NCIA Regional Noise Management Plan (RNMP)

Annual Report (covering the 2016 Calendar Year)

Prepared for the

Albert Energy Regulator (AER)

And

The Alberta Utilities Commission (AUC)

August 2017

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2017 (covering the calendar year 2016)

1 Executive Summary

NCIA completed field validation measurements for the Regional Noise Model (RNM) in 2016 (conducted by ACI Acoustical Consultants Inc.). These results are compared to the June 2015 Regional Noise Model (see Section 3).

Measured versus modeled results for the 2016 data are shown in Table 5 and Figure 2. Figure 3 and Figure 4 split the data into the two time periods representing the 2012 RNM and the 2015 RNM to make it easier to see the comparisons of the measured data to the predicted ranges of the 2012 RNM and the 2015 RNM. A discussion of the most recent results is presented in Section 4 of this report.

Figure 5 shows trend analysis that was completed for any location that had at least 4 years or more of data. It is evident from this Figure that there are no significant trends (either up or down) in the sound levels of the measured data over time when one considers the variability created by the meteorological conditions. These are best identified by the upper and lower ranges found in Figures 2 to 4.

2 AER Audits of NCIA Member Facilities

- No Audits by AER were conducted in 2016.

3 Regional Noise Model Update

- The next update to the Regional Noise Model is planned for 2018.
- Tables 1 to 3 are reproduced from the last annual report and show the current state of the site level models that make up the 2015 NCIA Regional Noise Model.

Table 1
Site Noise Models in Regional Noise Model Prepared by SLR

Company	Plant / Unit	Model Date
Agrium	Redwater Fertilizer Operations Plant	December 7, 2001 & January 21, 2008
Air Liquide	Cogeneration Unit	June, 1998
Cenovus	Bruderheim Operations	March, 2010
Dow Chemical Canada	Ethylene; Fractionator; Polyethylene I, II & III; Ethylene Oxide / Ethylene Glycol; Ethane Storage; Power & Utilities; Cogeneration plants	December 15, 2014
Maxim Power Corp. (non NCIA member)	Deerland Peaking Station	July, 2008
North West Redwater Partnership	Sturgeon Refinery (3 units)	November 22, 2007
Pembina Pipeline	Redwater Fractionation & Storage Facility	January 17, 2003
Shell Canada	Refinery; Upgrader (base plant and expansion plant); Cogen	September, 2014
Shell Chemicals	Styrene; MEG	March 19, 2009
<u>Sherritt Fort Saskatchewan Integrated Site:</u>		
Agrium	Nitrogen production	January 17, 2003
Corefco	Metal production	February 13, 2006 *****
Sherritt International	Metal production	February 13, 2006
Oerlikon-Metco	Chemical preparation	February 13, 2006
Umicore	Metal products	February 13, 2006 *****
Smith & Nephew	Surgical appliances	February 13, 2006 *****
Keyera Fort Saskatchewan	Fractionation and storage	March, 2014
Plains Midstream	Fractionation and storage	March, 2014

***** integrated into Sherritt model

Table 2

Site Noise Models in Regional Noise Model Prepared by Others

Company	Plant / Unit	Acoustical Consultant	Model Date
Access Pipelines	Sturgeon Terminal	FFA	July 21, 2010
Value Creation	Oilsands Upgrader	RWDI	May, 2004
Suncor (formerly Petro Canada)	Fort Hills Sturgeon Upgrader	RWDI	September 3, 2008
Pembina Pipeline	Expansion	Stantec	June 27, 2013
Sasol	Gas to Liquids Plant	Stantec / RWDI	May, 2013

Table 3
Heartland Plants where Basic Noise Models were Built

Plant / Unit	Process	Data Provided	Model Data
NCIA MEMBER COMPANIES			
Aux Sable Canada *****	Off Gas Plant	Sound Power Levels	September 2, 2010
Aux Sable Canada *****	Extraction Plant	Sound Power Levels	September 2, 2010
Plains Midstream [1]	Fractionation and Storage Complex	Fence line Measurements	March 2, 2010
Evonik Canada Inc.	Hydrogen Peroxide Plant	Fenceline Measurements	June 11, 2010
Keyera Energy	Fractionation and Storage Complex	Fenceline Measurements	March 2, 2011
Chemtrade Logistics ******	Central Service Center	Diagnostic Measurements	September 21, 2010
Chemtrade Logistics ******	Sulfides Facility	Diagnostic Measurements	September 21, 2010
Praxair Canada Inc.	Air Separation Plant	Fence line Measurements	June 11, 2010
Praxair Canada Inc.	Carbon Dioxide Plant	Fence line Measurements	June 11, 2010
NON-MEMBER COMPANIES			
ATCO Midstream	Liquid Extraction Plant	Sound Power Levels	June 23 2011
Smith & Nephew	Pharmaceuticals	Sound Power Levels	June 23, 2011

* based on PWL's delivered by the facility's acoustical specialist
** became Chemtrade after 2012 assessment date
1 2012 database replaced with a detailed database in 2015 model update

4 2016 Monitoring results for Regional Noise Model

ACI Acoustical Consultants Inc. (ACI), of Edmonton AB, was retained by the Northeast Capital Industrial Association (NCIA) to conduct an environmental noise survey within Alberta's Industrial Heartland (AIH). The purpose of the study was to conduct noise monitoring for a single 48-hour period at eleven (11) pre-specified locations within the AIH. Additional noise monitoring, spanning two (2) 48-hour periods, was conducted at a 12th monitoring location (referred to as Location 12) as an independent control/reference point. The noise monitoring was conducted in support of the NCIA's Regional Noise Management Plan. In addition, the results from the noise monitoring survey will be used to validate the Regional Noise Level Assessment Model (the Regional Noise Model). All noise monitoring procedures and equipment used was in accordance with the requirements of the Alberta Energy Regulator (AER) Directive 038 on Noise Control. Site work was conducted by ACI in July and August, 2016 by P. Froment, B.Sc., P.L.(Eng.).

As part of the study, 48-hour noise monitoring was conducted at a total of thirteen (13) locations throughout the Alberta's Industrial Heartland. It was found that the isolated LeqNight sound levels (both broadband and 1/3 octave band), from at least one (1) over-night period, were similar to those from previous measurements.

The noise levels at most locations consisted of low frequency components with occasional mid/high frequency components that could be attributed to the nearest facility relative to each individual noise monitoring location. Despite the noise being relatively low in frequency, none of the sites indicated any low frequency tonal components. As in previous years, the noise from train passages were again prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles. Though the train passages were not as often subjectively observed during the site visits in comparison to previous years, the isolation analysis indicated a similar number of rail passages when compared to 2015.

Measured versus modeled results are shown in Table 5 and Figures 2-4 below. Focusing on the 2016 results (previous years' results were discussed in previous annual reports available on the NCIA website), there is reasonably good agreement between the measured sound pressure levels and the predicted range of sound pressure levels from the 2015 RNM at locations 2, 3a, 4b, 8c, 9, 11 and 13. For locations 1a, 5 and 10 the model is over predicting the sound pressure levels. For location 6 the model is under predicting the sound pressure levels.

With respect to locations 1a and 10, we know that Sherritt International completed off-site noise monitoring in 2015 that suggested their off-site noise impact may be less than their site model suggests. Additional work is expected to happen in 2017 on this file that may lead to a site noise model update in the future.

For location 4b, we now know that the Shell Scotford model is over predicting noise levels somewhat (based on new on-site measurements for the site model) and that will be corrected in the 2018 Regional Noise Model update.

For location 5, Pembina has made a number of changes on their site and are currently working to update their site noise model. We expect that this discrepancy will decrease once the 2018 RNM update is completed.

For location 6, as we have seen in previous years, the model is under predicting the noise level in this area. The Agrium Redwater site noise model has now been updated and will be incorporated into the 2018 RNM update. We believe that will address the discrepancy at this location.

There are no obvious trends in the measured data to suggest that noise levels in the area are either increasing or decreasing due to industrial operations over time (see Figure 5 below).

Table 4
Monitoring Location Details

Location No.	UTM Coordinates (approximate)		Description
	Easting (m)	Northing (m)	
1a	355040	5954162	2 m north of 100 Ave, and 520 m northwest of Highway 15 near Mel Martin's Transfer Facility and approximately 550 m southwest of the Agrium Fort Saskatchewan Facility.
2	358261	5957223	90 m southeast of 125 Street and 1 km north of Highway 15 Near bend in River Road where it becomes 125 Street, between Dow and Keyera facilities.
3a	358353	5959156	6 m east of 125 Street and 220 m north of Petrogas facility. This location was changed from the 2012 noise monitoring location in an effort to better quantify the contributions of the facilities north of the Dow facility.
4b	361665	5960870	1.2 km south of the south fence line of the Shell Scotford site and 1.6 km east of 130 Street; 490 m south of the entrance to the electrical substation to the northwest.
5	361777	5964711	200 m north of Township Road 560A and 5 m east of Range Road 215, at 300 m north of the north fence line of the Shell Scotford facility.
6	364322	5967894	1.0 km north of Township Road 562 and 3 m east of Range Road 213A, 1.6 km East of Agrium Redwater facility.
7			Not measured in 2016 due to construction activities on North West Redwater Partnership site.
8c	358880	5965456	1.6 km south of highway 643 (eastbound) and 365 m east of Range Road 221, 30 m north of the northern fence line for the Pembina/InterPipeline facility.
9	355872	5957574	5 m southwest of the intersection of Lamoureux Drive & Godbout Avenue, 1.3 km northwest of the Dow facility and 1.4 km west of the Keyera facility.
10	355925	5955818	30 m west of 119 Street and 12 m north of the access road to Agrium Fort Saskatchewan, 750 m northeast of the Agrium facility and 180 m west of the Dow fence line.
11	358430	5963804	3 m northwest of Intersection of Range Road 221 and Township Road 560, 1.7 km southwest of Pembina/Williams facility.
12a	368223	5963070	Independent control/reference point. It was located 15 m east of Range Road 211 and 450 m south of Township Road 560. Approximately 1.6 km west of Highway 830 and 2.7 km north of Highway 15.
13	358667	5970180	3 m east of Range Road 221 and 100 m south of Township Road 564. This location was for background purposes.

The complete report is included as Appendix 1 of this report.

Figure 1: NCIA Regional Noise Monitoring Locations (as per Table 4)

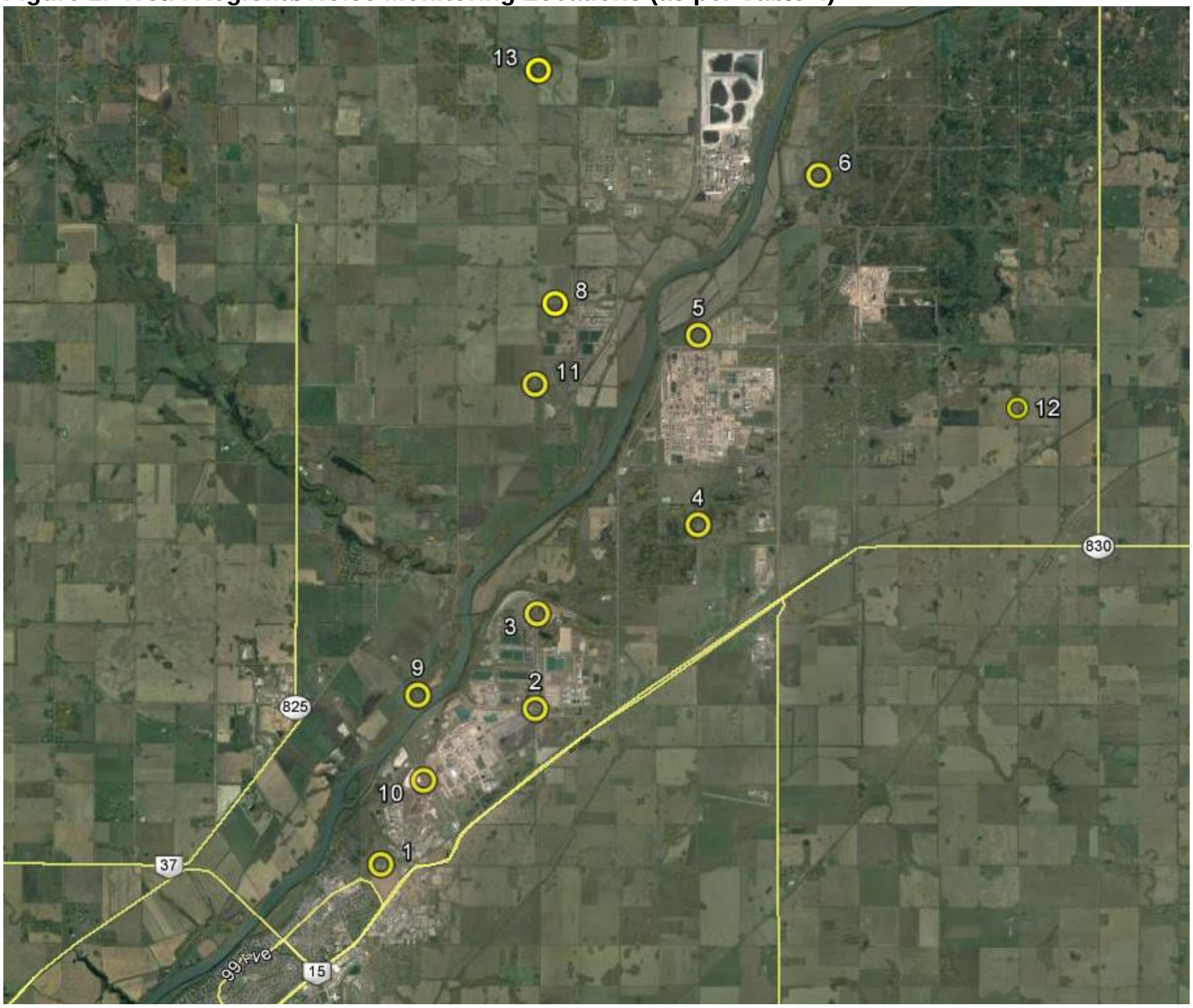


Table 5
Comparison of Measured versus Modelled results

Location	Predicted Sound Level (RNM 2016)		Measured Sound Level (2016)	
	Temperature Lapse Condition	Temperature Inversion Condition	First Night	Second Night
1a	50	54.8	45.0	46.2
2	49.3	55.3	47.2	49.8
3a	44.5	51.4	49.2	46.9
4b	45	52.1	42.2	46.2
5	55.2	59.8	53.5	50.2
6	34.5	42.3	46.3	45.9
8c	45.8	52.3	48.3	42.1
9	39.6	48.2	45.6	38.4
10	52.3	59.0	51.2	49.9
11	39.5	47.2	41.5	40.2
13	25.7	34.7	32.8	30.9

Figure 2: Predicted Range versus Measured Sound Levels (2016)

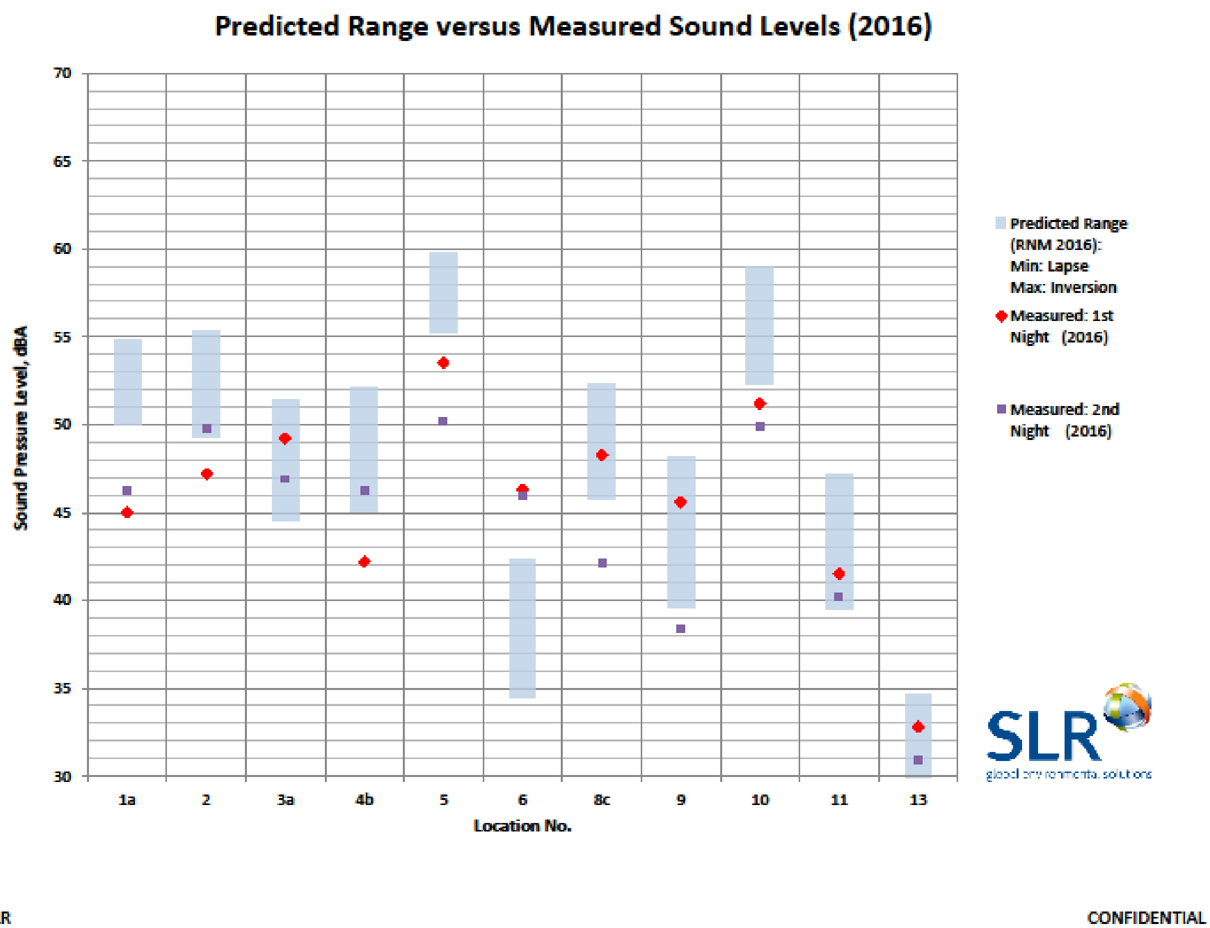


Figure 3: 2011 to 2013 Measured Data compared to 2012 RNM

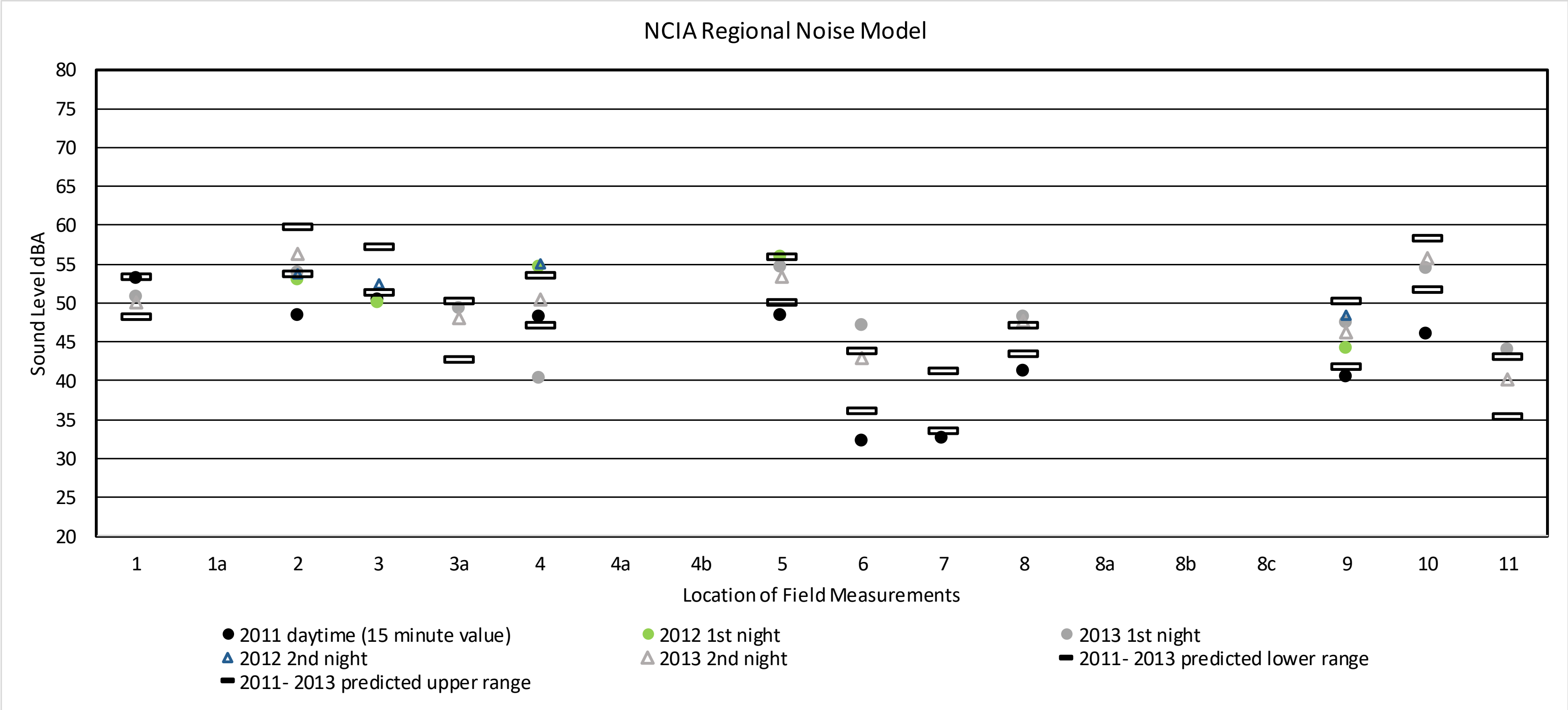


Figure 4: 2014 to 2016 Measured Data compared to 2015 RNM

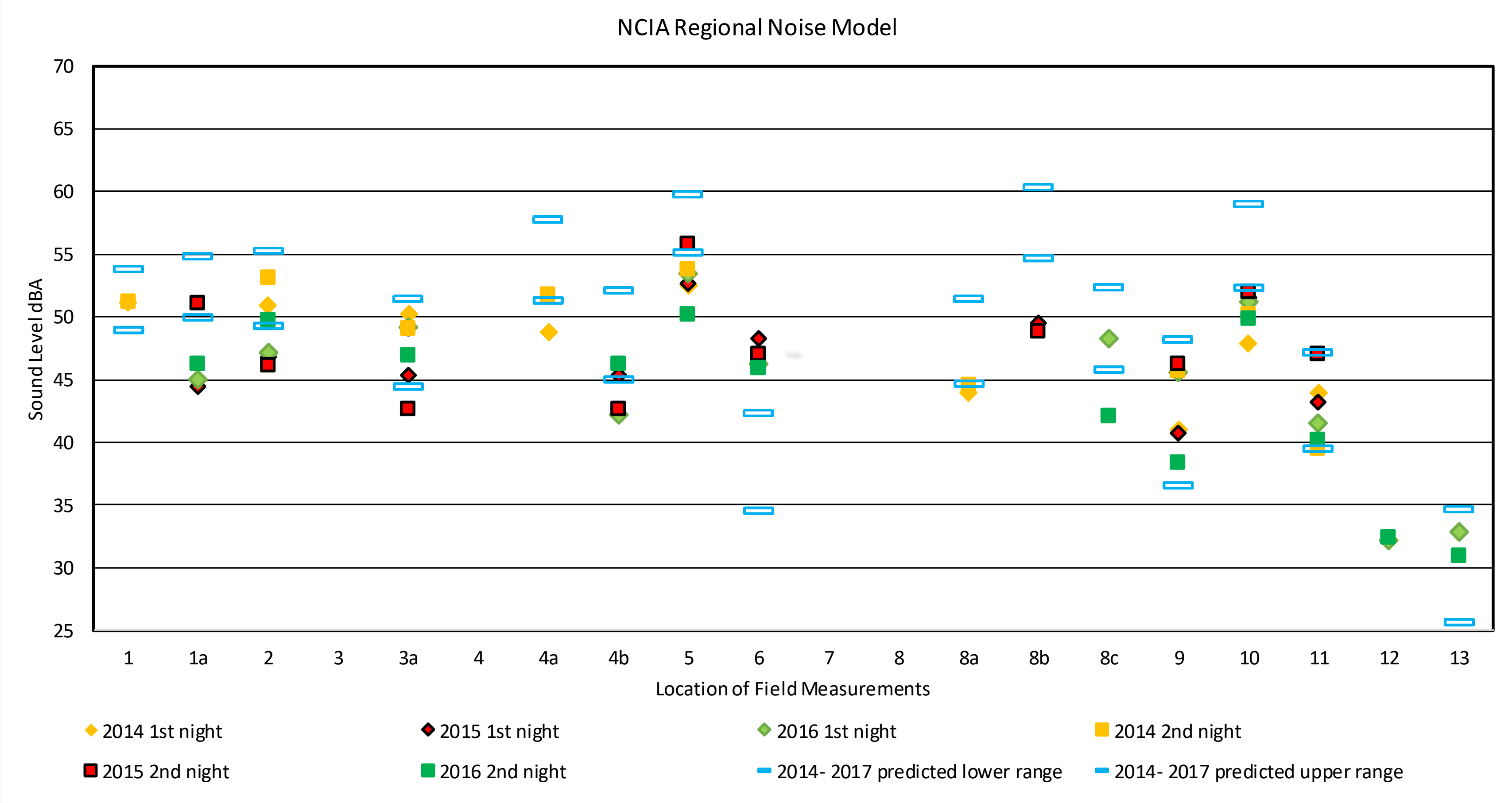
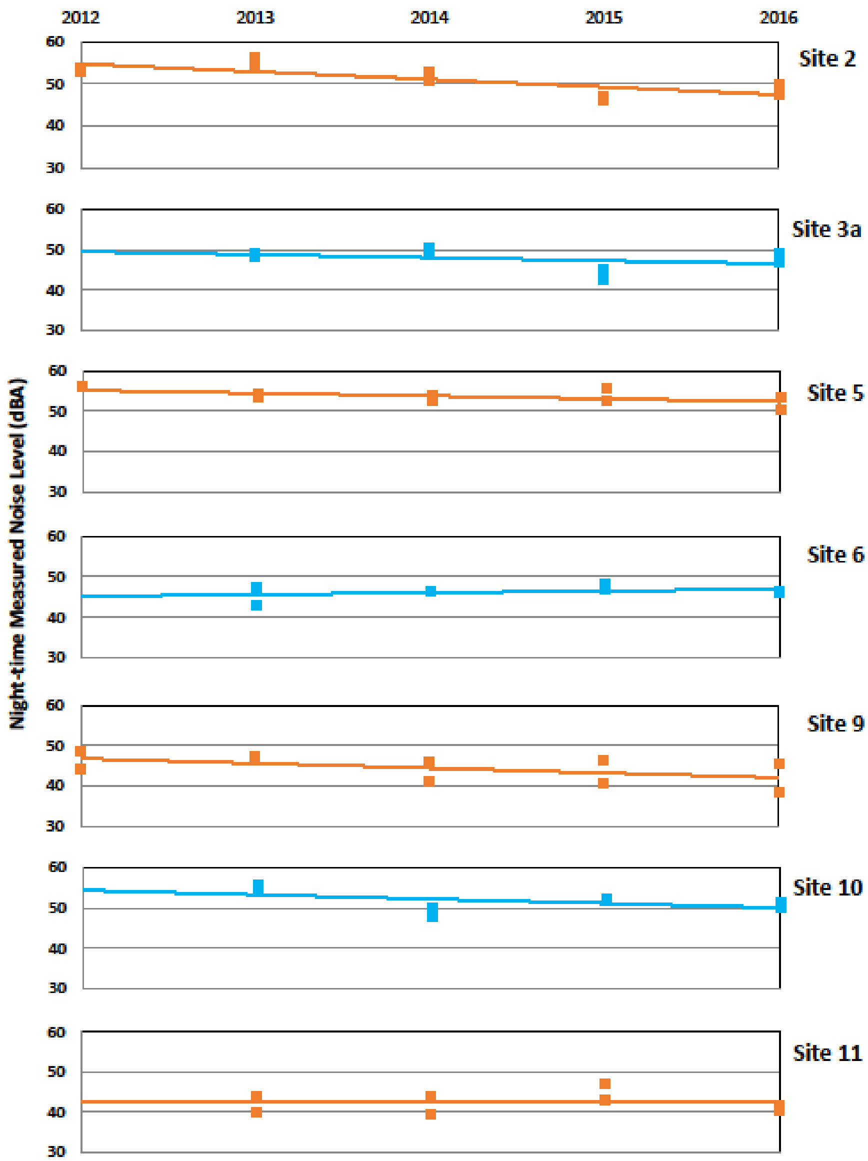


Figure 5: Trend Analysis of Measured Data (2012 to 2016)



5 NCIA Member Compliance

Table 6 summarizes the compliance requirements for NCIA member and non-member companies' vis-a-vis the NCIA RNMP.

Table 6
Compliance Requirements for NCIA Member Companies

NCIA Member	AER Regulated	RNMP Participant	Compliance Vehicle
Yes	Yes	Yes	NCIA - RNMP
No	Yes	No	AER to Determine
Yes	No	No	Municipality/AEP
Yes	No	Yes	NCIA - RNMP
No	No	Yes	Potential NCIA-RNMP
No	No	No	Other Regulatory Jurisdictions

As of this date, Table 7 summarizes the NCIA member companies and their status with respect to Table 5 above.

Table 7
Summary of NCIA Member Company Information for RNMP

NCIA Member[1]	AER Regulated Status for Noise Control Directive 038	Filed an Annual Update with NCIA for 2016 (Appendix 2)	Developed a Site Noise Management Plan
Access Pipeline	AER regulated under Noise Control Directive 038.	Yes	Not Yet
Agrium Fort Saskatchewan	Not regulated	Yes	Yes
Agrium Redwater	Not regulated	Yes	Yes
Air Liquide Canada	Not regulated	Yes	Partly
ATCO Power	Heartland facility <u>not operational</u>.	Yes	Yes
Aux Sable Canada	Regulated under Section 11 of the OSCA and therefore D-038.	Yes	Yes

NCIA Member[1]	AER Regulated Status for Noise Control Directive 038	Filed an Annual Update with NCIA for 2016 (Appendix 2)	Developed a Site Noise Management Plan
Cenovus	Not regulated	Yes	Not Yet
Chemtrade West	Not regulated	Yes	Yes
Dow Chemical Canada	Regulated under D-038 Operator No. 0F05	Yes	Yes
Enbridge Pipelines	Is regulated	Yes	Yes
Evonik	Not regulated	Yes	Partly
Fort Hills Energy Partnership	Not operational but will be regulated Operator No. 0XP9	No	Not Yet
Keyera Corp.	Regulated under D-038 Operator No. A5W1 LSD - 02-14-055-22W4 Facility No. F-12695	Yes	Yes
MEG Energy	Is Regulated	Yes	Yes
MEGlobal	Not regulated	Included with Dow's submission	Yes
North West Redwater Partnership	Not operational but will be regulated. LSD - E1/2-18-56-21-W4M	Yes	Yes
Oerlikon Metco (Canada)	Not regulated	Yes	Yes
Pembina NGL Corporation	Regulated under D-038	Yes	Yes
Plains Midstream Canada	Regulated under D-038 Operator No. 60 LSD - 14-55-22 W4M Facility No. 12699	Yes	Yes
Praxair Canada	Not regulated	No	Partly
Shell Chemicals	Not regulated	Yes	Yes
Shell Refinery	Regulated under Section 11 of the OSCA and therefore Noise Control Directive 038. AER Approval No. 11640.	Yes	Yes
Shell Upgrader	AER Approval No. 8522 regulated under D-038.	Yes	Yes
Sherritt International	Not regulated	Yes	Yes

NCIA Member[1]	AER Regulated Status for Noise Control Directive 038	Filed an Annual Update with NCIA for 2016 (Appendix 2)	Developed a Site Noise Management Plan
Umicore Canada	Not Regulated	Yes	Yes
Value Creation	Not operational, but will be regulated.	Yes	Not Yet

[1] **Bold** type in the above table signifies that these members have operational assets on the ground within Alberta's Industrial Heartland. Non-bold type means these companies are members, but do not have operational assets, at this time, in the region and were therefore not required to complete the annual input form, although some did provide updates on their projects.

6 Regional Noise Model

6.1 Improvements/Corrective Actions implemented in 2016 (Appendix 2)

1. Agrium - Agrium Redwater hired SLR Consulting to complete a Noise Model Update to address discrepancies in the existing NCIA Regional Noise Model. Approximately 50 of the 400 noise sources in the model were measured and updated. The most significant changes resulted from noise from open building doors where the previous site model assumed the doors to be closed. Further sources were added, namely the Phos 30# steam vents. See the detailed reports on this in Appendix 2. Agrium Redwater is planning to install silencers on the Phos 30# steam vents during the September 2017 turnaround.
2. Pembina NGL Corporation – Two projects have been approved for construction and will become operational in 2017 (RFS III Fractionation Plant and South Rail Yard Expansion project). Pembina is working with SLR Consulting to update the site noise model which will be incorporated into the 2018 RNM update.
3. Plains Midstream Canada - Construction activities will continue in 2017 with Phase 1, 2 & 3 expansion plans. These planned activities may result in changes that require the facility to update the Regional Noise Model again and this will be evaluated as the expansion proceeds.
4. Shell – Shell Scotford amalgamated the Refinery, Chemicals and Upgrader noise management plans into one document (see Appendix 2). The site model for Quest and for the Chemicals plant were updated in 2016. These will be captured in the 2018 RNM update. The debottlenecking project will also require an update to the site model. It is expected this will happen in 2018 and be captured by the 2018 RNM update.

6.2 Other Items for Follow-up Based on 2016 Field Measurements

1. Discrepancy between measured versus predicted sound levels at monitoring location #4, #6 and #8. It should be noted that we now understand that the Shell Scotford model is over

predicting the noise levels from the site (based on new site level noise measurements) which have resulted in a change in the site model. This change will be captured in the next Regional Noise Model update in 2018.

2. With respect to location 6, this will be addressed by Agrium Redwater as part of their site model update which will be captured in the 2018 RNM update.
3. With respect to location 5 and 8, this may be due to activities at the Pembina site or at the North West Redwater Partnership site. The Pembina part of this will be addressed as part of the 2018 RNM update.

6.3 Next Steps for 2017/2018

1. Agrium - Agrium Redwater is in the process of planning and purchasing silencers for the Phos 30 # Steam Vents. These silencers will be installed during the September turnaround in 2017.
2. It is our understanding that site level noise models have or will be updated for Aux Sable Canada, Agrium Redwater, Keyera, Pembina NGL Corporation, and Shell Scotford. These site level model updates will be incorporated into the 2018 RNM update.
3. Sherritt International completed off-site noise monitoring in 2015 that suggested their off-site noise impact may be less than their site model suggests. Additional work is expected to happen in 2017 on this file that may lead to a site noise model update in the future.
4. Gather information from members to begin the 2018 RNM update.

APPENDIX 1

2016 Field Validation Monitoring Report

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2016 Environmental Noise Survey

For The

Regional Noise Model Annual Field Validation Monitoring

Prepared for:

Northeast Capital Industrial Association

Prepared by:
P. Froment, B.Sc., B.Ed., P.L.(Eng.)
aci Acoustical Consultants Inc.
Edmonton, Alberta
APEGA Permit to Practice #P7735

aci Project #: 16-030
February 3, 2017

Executive Summary

aci Acoustical Consultants Inc., of Edmonton AB, was retained by the Northeast Capital Industrial Association (NCIA) to conduct an environmental noise survey within Alberta's Industrial Heartland (AIH). The purpose of the study was to conduct a single 48-hour noise monitoring at eleven (11) pre-specified locations within the AIH. An additional noise monitoring, spanning two (2) 48-hour periods, was conducted at an 12th monitoring location (referred to as Location 12) as an independent control/reference point. The noise monitoring was conducted in support of the NCIA's Regional Noise Management Plan. In addition, the results from these noise monitoring will be used to validate the Regional Noise Level Assessment Model (the Regional Noise Model). All noise monitoring procedures and equipment used was in accordance with the requirements of the Alberta Energy Regulator (AER) Directive 038 on Noise Control. Site work was conducted for aci in July and August, 2016 by P. Froment, B.Sc., P.L.(Eng.).

As part of the study, a total of thirteen (13) 48-hour noise monitorings were conducted throughout the Alberta's Industrial Heartland. It was found that the isolated L_{eq}Night[1] broadband and 1/3 octave band L_{eq} sound levels, from at least one (1) over-night period, were similar to those from previous measurements.

The noise levels at most locations consisted of low frequency components with occasional mid/high frequency components that could be attributed to the nearest facility relative to each individual noise monitoring location. Despite the noise being relatively low in frequency, none of the sites indicated any low frequency tonal components. The noise from train passages were again prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles. Though the train passages were not as often subjectively observed during the site visits in comparison to previous years, the isolation analysis indicated a similar number of rail passages when compared to 2015.

[1] The term L_{eq} represents the energy equivalent sound level. This is a measure of the equivalent sound level for a specified period of time accounting for fluctuations.

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1.0 Introduction

aci Acoustical Consultants Inc., of Edmonton AB, was retained by the Northeast Capital Industrial Association (NCIA) to conduct an environmental noise survey within Alberta's Industrial Heartland (AIH). The purpose of the study was to conduct a single 48-hour noise monitoring at eleven (11) pre-specified locations within the AIH. An additional noise monitoring, spanning two (2) 48-hour periods, was conducted at an 12th monitoring location (referred to as Location 12) as an independent control/reference point. The noise monitoring was conducted in support of the NCIA's Regional Noise Management Plan. In addition, the results from these noise monitoring will be used to validate the Regional Noise Level Assessment Model (the Regional Noise Model). All noise monitoring procedures and equipment used was in accordance with the requirements of the Alberta Energy Regulator (AER) Directive 038 on Noise Control. Site work was conducted for aci in July and August, 2016 by P. Froment, B.Sc., P.L.(Eng.).

2.0 Location Description

Alberta's Industrial Heartland (AIH) is located northeast of Edmonton, AB and extends into five different municipalities as indicated in Figure 1. This includes 533 km^2 within the City of Fort Saskatchewan and the Counties of Lamont, Strathcona and Sturgeon, in addition to 49 km^2 in the City of Edmonton's "Edmonton Energy and Technology Park". The area has 40+ companies in various sectors that include producing and processing oil, gas and petrochemicals in addition to advanced manufacturing.

Topographically, the AIH does have some varying elevation changes however in general it can be considered relatively flat with no substantial hills. Areas with more significant changes in elevation are found adjacent to the North Saskatchewan River (the River) which divides the AIH from the southwest to the northeast (excluding the AIH area within the City of Edmonton's limits). The vegetation varies from open grain fields to thick dense vegetation. Due to the relative distance from the noise monitoring locations to the nearby facilities (with the exception of Noise Monitor Location 12) and the relatively low frequency nature of the industrial noise, the level of vegetative sound absorption is considered negligible to low.

3.0 Measurement Methods

As part of the study, a total of thirteen (13) 48-hour noise monitorings were conducted at 12 locations[1] throughout the AIH, as indicated in Figure 2.

Similarly to the 2015 Noise Survey[2], a noise monitoring was **not** conducted at Noise Monitor Location 7 due to the current construction activities at the Northwest Redwater Partnership (NWR) refinery. As discussed with the NCIA Regional Noise Management Plan Steering Committee on March 31, 2016, Noise Monitor Location 7 will no longer be used as a noise monitoring location due to the NWR refinery. A new location (Noise Monitor Location 13) was selected to represent this area of the AIH. Therefore, in future reports Noise Monitor Location 7 will not be discussed in great detail. Noise Monitor Location 13 will be discussed in Section 4.0.

All noise monitoring locations were identical to those conducted during the 2015 Noise Survey with the exception of Noise Monitor Location 8. This noise monitor was relocated due to construction and vehicle traffic found at its 2015 location. The new location was selected based on its sight lines to the facilities to the south and east is a more representative of its initial location from 2013 & 2014. It is anticipated that this new location for Noise Monitor 8 will be used in future studies.

The noise monitorings were conducted collecting broadband A-weighted and C-weighted as well as 1/3 octave band sound levels and were conducted during "typical" operations at all facilities[3]. In particular, the chosen noise monitoring periods avoided any major shut-downs or outages that could adversely affect the "typical" noise levels (either louder or quieter) from a given facility. In addition, the monitorings were conducted in summer conditions (i.e. no snow cover) with little or no precipitation and, if possible, low wind-speeds. Each noise monitoring was accompanied by a 48-hour digital audio recording for more detailed post process analysis. Three (3) local weather monitoring stations were also used for the two (2) 48-hour time monitoring periods. The weather monitors obtained the wind speed, wind direction, temperature, relative humidity, barometric pressure and rain fall data in 15-second sampling periods. Lastly, it should be noted that all measurements were performed in accordance with the methods described in the AER Directive 038 on Noise Control.

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[1] Once again, it should be noted that two (2) 48-hour monitoring were conducted at Monitoring Location 12.
[2] This refers to the report, "2015 *Environmental Noise Survey for the Regional Noise Model Annual Field Validation Monitoring*" prepared for the NCIA by aci Acoustical Consultants Inc. on November 23, 2015.
[3] This was verified by all of the various company representatives.

4.0 Noise Monitoring Location Description

In addition to Table 1, which provides the UTM coordinates and the start and end times for each noise monitoring, a brief discussion of each noise monitoring location can be found below. All noise measurement instrumentation was calibrated at the start of the measurements and then checked afterwards to ensure that there had been no significant calibration drift over the duration of the measurements. Refer to Appendix I for a detailed description of the measurement equipment used and for all calibration records.

Table 1. Noise Monitoring Locations with Start and End Times

Monitoring Location	UTM Coordinates (Approximate)[1]		Start Time	End Time
	Easting (m)	Northing (m)		
1	355040	5954162	6/27/16 11:40	6/29/16 11:40
2	358261	5957223	6/27/16 11:10	6/29/16 11:10
3	358353	5959156	8/02/16 09:00	8/04/16 09:00
4	361665	5960870	6/27/16 10:10	6/29/16 10:10
5	361777	5964711	6/27/16 10:00	6/29/16 10:00
6	364322	5967894	6/27/16 09:30	6/29/16 09:30
7	N/A			
8	358880	5965456	8/02/16 13:00	8/04/16 13:00
9	355872	5957574	8/02/16 14:00	8/04/16 14:00
10	355925	5955818	6/27/16 11:00	6/29/16 11:00
11	358430	5963804	8/02/16 13:10	8/04/16 13:10
12a	368223	5963070	6/27/16 11:00	6/29/16 11:00
12b			8/02/16 12:00	8/04/16 12:00
13	358667	5970180	8/02/16 12:10	8/04/16 12:10

4.1. Noise Monitor Location 1

The noise monitor at Location 1 was located approximately 2 m north of 100 Avenue, 350 m west of 114 Street and approximately 520 m northwest of Highway 15 as indicated in Figure 2 and Figure 3. This put the noise monitor approximately 550 m southwest of the Sherritt International Corporation facility. This is the southernmost noise monitoring location found within the AIH. At this location, there was direct line-of-sight to 100 Avenue, Mel Martin's Transfer Facility and the Sherritt International Corporation facility. There was no significant vegetation between the noise monitor and the facilities to the northeast.

[1] The UTM Coordinates have been updated to reflect the modified 2016 noise monitor locations.

4.2. Noise Monitor Location 2

The noise monitor at Location 2 was located approximately 90 m southeast of 125 Street and approximately 1.0 km north of Highway 15 as indicated in Figure 2 and Figure 4. This put the noise monitor approximately 120 m west of the Dow yard, 170 m north of the Dow rail yard and approximately 850 m east-southeast of the Keyera Facility. At this location, there was direct line-of-sight to Dow's main site to the east and to the rail yard to the south. There was no significant vegetation between the noise monitor and the aforementioned facilities.

4.3. Noise Monitor Location 3

The noise monitor at Location 3 was located approximately 6 m east of 125 Street and approximately 220 m north of the entrance to the Petrogas entrance as indicated in Figure 2 and Figure 5. This put the noise monitor approximately 270 m northwest of the Petrogas facility and approximately 120 m southeast of the entrance to the Plains Midstream Facility. At this location, there was direct line-of-sight to equipment found on the Petrogas site. This equipment was not visible during the 2015 Noise Survey due to a relatively significant earth berm. Since the 2015 Noise Survey this berm has been removed. In addition, relative to the 2015 Noise Survey it was subjectively observed that there was a higher volume traffic along 125 Street due to activity at the Plains Midstream facility. There was no significant vegetation between the noise monitor and the aforementioned facilities.

4.4. Noise Monitor Location 4

The noise monitor at Location 4 was located approximately 1.2 km south of the south fence line of the Shell Scotford site and approximately 1.6 km east of Range Road 220 (130 Street) as indicated in Figure 2 and Figure 6. This put the noise monitor at 490 m south of the entrance to the electrical substation to the northwest. At this location, there was direct line-of-sight to the Shell Scotford site but not to the electrical substation to the northwest. There was no significant vegetation between the noise monitor and the Shell Scotford facility.

4.5. Noise Monitor Location 5

The noise monitor at Location 5 was located approximately 200 m north of Township Road 560A and 5 m east of Range Road 215 as indicated in Figure 1 and Figure 7. This put the noise monitor approximately 300 m north of the north fence line for the Shell Scotford facility and approximately 135 m west of an industrial yard to the east. At this location, there was direct line-of-sight to the Shell Scotford site but not the industrial yard (due to the topography of the area). There was no significant vegetation between the noise monitor and the Shell Scotford facility.

4.6. Noise Monitor Location 6

The noise monitor at Location 6 was located approximately 1.0 km north of Township Road 562 and 3 m east of Range Road 213A as indicated in Figure 1 and Figure 8. This put the noise monitor approximately 1.6 km east of the Agrium Redwater facility. Due to favorable topography between the noise monitor and Agrium there was direct line-of-sight to the Agrium site through a small row of deciduous trees across the road. There was no significant vegetation between the noise monitor and the Agrium facility. Note also that a weather monitor was placed at this location, adjacent to the noise monitor for the July 27 – 29, 2016 noise monitoring period.

4.7. Noise Monitor Location 7

As previously mentioned this noise monitoring location is no longer used.

4.8. Noise Monitor Location 8

The noise monitor at Location 8 was located approximately 1.6 km south of Highway 643 (eastbound) and 365 m east of Range Road 221 as indicated in Figure 2 and Figure 9. This put the noise monitor approximately 30 m north of the northern fence line for the Pembina/Williams facility. At this location, there was direct line-of-sight to the Pembina/Williams site through a thin row of deciduous trees. There was no significant vegetation between the noise monitor and the aforementioned facilities.

4.9. Noise Monitor Location 9

The noise monitor at Location 9 was located approximately 5 m southwest of the intersection of Lamoureux Drive and Godbout Avenue as indicated in Figure 2 and Figure 10. This put the noise monitor approximately 1.3 km northwest of the major structures at the Dow facility and approximately 1.4 km west of the Keyera facility. Due to favorable topography, there was direct line-of-sight to the facilities across the River through a thin row of deciduous trees[1]. Despite the thin row of trees there was no significant vegetation between the noise monitor and the aforementioned facilities.

4.10. Noise Monitor Location 10

The noise monitor at Location 10 was located approximately 30 m west of 119 Street and 12 m north of the access road to the Agrium Fort Saskatchewan facility as indicated in Figure 2 and Figure 11. This put the noise monitor approximately 750 northeast of the major structures at the Agrium facility and approximately 180 m west of the west fence-line of the Dow facility. There was direct line-of-sight to the

[1] This was particularly observable during the night-time period.

Dow facility but not to the Agrium facility (due to the topography of the area). There was no significant vegetation between the noise monitor and the aforementioned facilities. Note also that a weather monitor was placed at this location, adjacent to the noise monitor for the July 27 – 29, 2016 noise monitoring period.

4.11. Noise Monitor Location 11

The noise monitor at Location 11 was located approximately 3 m northwest of the intersection of Range Road 221 and Township Road 560 as indicated in Figure 2 and Figure 12. This put the noise monitor approximately 1.7 km southwest of the major structures at the Pembina/Williams facility and approximately 330 m west of the Pembina/Williams rail yard. At this location, there was direct line-of-sight to the Pembina/Williams facility but not to the rail yard (due to the topography of the area). There was no significant vegetation between the noise monitor and the aforementioned facilities. Note also that a weather monitor was placed near this location for the August 2 – 4, 2016 noise monitoring period.

4.12. Noise Monitor Location 12

The noise monitor at Location 12 was the independent control/reference point. It was located approximately 15 m east of Range Road 211 and 450 m south of Township Road 560 as indicated in Figure 2 and Figure 13. This placed the noise monitor approximately 1.6 km west of Highway 830 and approximately 2.7 km north of Highway 15. At this location, there was direct line-of-sight to the west of the AIH region. The noise monitor was bordered on all sides by a combination of open grassy fields. Due to the distance from the noise monitor to the existing major facilities within the AIH, the vegetative absorption between the noise monitor and these facilities would be considered significant. Note also that a weather monitor was placed at this location, adjacent to the noise monitor for the July 27 – 29 & August 2 – 4, 2016 noise monitoring periods.

4.13. Noise Monitor Location 13

The noise monitor at Location 13 was located approximately 3 m east of Range Road 221 and 100 m south of Township Road 564 as indicated in Figure 2 and Figure 14. This put the noise monitor approximately 1.1 km northwest of the lay down yard for the NWR facility and is the north easternmost noise monitoring location found within the AIH. At this location, there was no direct line-of-sight to any facilities. There was moderate vegetation between the noise monitor and the aforementioned facilities. Note also that a weather monitor was placed near this location for the August 2 – 4, 2016 noise monitoring period.

5.0 Equivalent Sound Level & Statistical Descriptors

Environmental noise levels from industry are commonly described in terms of equivalent sound levels or L_{eq}. This is the level of a steady sound having the same acoustic energy, over a given time period, as the fluctuating sound. The concept is that the same amount of annoyance occurs from a sound having a high level for a short period of time as from a sound at a lower level for a longer period of time. In addition, this energy averaged sound level is often A-weighted to account for the reduced sensitivity of average human hearing to low frequency sounds and/or C-weighted to allow for more low frequency noise to be considered. These L_{eq} in dBA/dBC, which are the most common environmental noise measure, are often given for day-time (07:00 to 22:00) L_{eq}Day and night-time (22:00 to 07:00) L_{eq}Night while other criteria use the entire 24-hour period as L_{eq}24.

Another method of conveying long term noise levels utilizes statistical descriptors. These are calculated from a cumulative distribution of the sound levels over the entire measurement duration and then determining the sound level at xx % of the time. These descriptors can be used to provide a more detailed analysis of the varying noise climate.

For purposes of this study, the following equivalent sound levels and statistical descriptors will be presented and discussed:

L_{eq}Day - Measured over the day-time (07:00 – 22:00)

L_{eq}Night - Measured over the night-time (22:00 – 07:00)

L_{10} - Sound level that was exceeded only 10% of the time.
- Good measure of intermittent or intrusive noise

L_{50} - Sound level that was exceeded 50% of the time (arithmetic average)
- Good to compare to L_{eq} to determine steadiness of noise

L_{90} - sound level that was exceeded 90% of the time
- Good indicator of typical "ambient" noise levels

For further information, refer to Appendix II for a description of the acoustical terminology and Appendix III for a list of common noise sources and their associated noise levels.

6.0 Results and Discussion

6.1. Environmental Noise Monitorings

The results of the thirteen (13) 48-hour noise monitorings can be found in Table 2[1] and are presented in Figures 15 – 118. The figures include the 15-second broadband dBA and dBC L_{eq} sound levels[2], 1-hour dBA and dBC, L_{90}, L_{50}, L_{10} sound levels[3] and the 1/3 octave band L_{eq} sound levels[3] for each noise monitoring location. Table 2 provides results of each of the three daytime periods in addition to the isolated and non-isolated values for the two night-time periods. The isolation analysis for the night-time periods was performed in accordance with Section 4.3.2 of the AER Directive 038. A list of all non-typical noise events removed from each of the thirteen noise monitorings can be found in Appendix IV. Each event that was removed has been dated with its corresponding time period as well as the rationale for its removal. A detailed discussion of the results for each monitoring location can be found below.

Table 2. L_{eq} 24-Hour Results

Noise Monitoring Location	1st Daytime Period	1st Night-time Period (Non-Isolated)	1st Night-time Period (Isolated)	2nd Daytime Period	2nd Night-time Period (Non-isolated)	2nd Night-time Period (Isolated)	3rd Daytime Period
	L_{eq}Day (dBA)	L_{eq}Night (dBA)		L_{eq}Day (dBA)	L_{eq}Night (dBA)		L_{eq}Day (dBA)
1	61.7	58.3	45.0	62.7	58.6	46.2	59.5
2	49.0	61.7	47.2	56.5	54.0	49.8	60.0
3	54.6	52.3	49.2	55.7	52.4	46.9	62.2
4	41.0	44.1	42.2	45.3	46.7	46.2	46.2
5	57.0	53.7	53.5	56.3	50.7	50.2	49.5
6	52.7	47.4	46.3	55.5	47.6	45.9	60.2
7	N/A						
8	46.4	48.7	48.3	47.0	43.0	42.1	48.8
9	50.9	49.1	45.6	49.9	47.6	38.4	50.1
10	58.1	56.4	51.2	58.4	55.5	49.9	59.1
11	56.9	53.7	41.5	60.3	53.5	40.2	56.1
12 (Period 1)	50.4	47.3	32.2	51.8	47.8	33.5	49.7
12 (Period 2)	47.8	44.5	31.3	48.9	46.1	32.4	52.0
13	42.7	42.3	32.8	44.2	42.3	30.9	43.0

[1] The results of each location will be discussed individually.
[2] The data provided in the 15-second L_{eq} traces shows the 24-hour time period with the isolated night-time results, after removal of non-typical noise levels. This was done to indicate the relative steadiness of the noise levels and to make it easier to view the night-time data.
[3] Isolated and Non-isolated values are presented.

6.1.1. Noise Monitoring Location 1

The results of the noise monitoring conducted at Location 1 are provided in Table 2 and in Figures 15 - 21 The isolated L_{eq}Night values from Table 2 and the traces found in Figures 15 – 18 indicate relatively consistent noise levels for the two night-time periods[1]. The slightly elevated noise levels during the June 28 - 29, 2016 night-time period were subjectively apparent during the site visit and are consistent with the weather conditions during each of the two night-time periods.

The 1/3 octave band L_{eq} sound levels found in Figures 21 - 22 are relatively broadband with a decrease in the higher frequencies (1.25 kHz and above) and an elevated peak in the 25 Hz band, which is consistent with the 2015 Noise Survey.

Based on the results and subjective observations from previous years and when considering the weather conditions, the isolated values are representative of the typical noise climate of this area.

6.1.2. Noise Monitoring Location 2

The results of the noise monitoring conducted at Location 2 are provided in Table 2 and in Figures 23 - 30. The isolated L_{eq}Night traces found in Figures 23 – 24 indicate that a significant amount of data was isolated from the measured (i.e. raw) data[2]. As noted in Appendix IV, the majority of removed "non-typical" incidents were from time periods in which noise from the rail line to the south was the dominant source. The removal of data due to the rail yard is consistent with previous years, however the number of events is relatively higher than in previous years. This is further reinforced by Figures 25 - 28 which indicate a large variance between the measured and isolated data, particularly during the June 27 – 28, 2016 night-time period.

The isolated 1/3 octave figures indicate relatively broadband noise levels, particularly in the mid-frequency bands, with elevated noise levels in the lower (below 100 Hz) frequency bands. This is consistent with the 2015 Noise Survey.

Due to the varying contributions from the rail yard (from day to day and from year to year), a representative average noise level for Location 2 is more difficult to determine in comparison to other locations.

[1] Data was completely removed between 04:34 – 07:00 on June 28, and between 04:34 – 07:00 on June 29, due to the number of vehicle passages (several per minute) and birds chirping during that time period.
[2] Data was completely removed between 05:13 – 07:00 on June 28, and between 05:03 – 07:00 on June 29, due primarily to birds chirping during that time period.

6.1.3. Noise Monitoring Location 3

The results of the noise monitoring conducted at Location 3 are provided in Table 2 and in Figures 31 - 38. The isolated L_{eq}Night values and the traces found in Figures 31 – 34 indicate relatively consistent noise levels throughout both night-time periods[1], particularly from 23:00 – 06:00. Similarly to the 2015 results, as indicated in Appendix IV, there was high amount of "non-typical" events throughout both noise monitoring periods. The majority of the "non-typical" events were from; vehicle pass-by's, particularly between 05:30 and 07:00 each morning and from rail activity to the north. When considering the "typical" noise climate of the area, the isolated L_{50} and L_{90} values (shown in Figures 35 - 36) indicate very little fluctuation in the noise levels.

The 1/3 octave band spectral data is consistent between all noise monitoring periods and indicates elevated noise levels in the lower frequency bands that gradually decrease as the frequency increases. These are again consistent with the results from the 2015 Noise Survey.

Based on the results and subjective observations from previous years and when considering the weather conditions, the isolated values are representative of the typical noise climate of this area.

6.1.4. Noise Monitoring Location 4

The results of the noise monitoring conducted at Location 4 are provided in Table 2 and in Figures 39 - 46. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 39 – 42 indicate varying noise levels for both night-time periods. In reviewing the weather conditions, found in Appendix V[2], there were no parameters (wind speed, wind direction, etc.) that would account for the variance in noise levels between the two nights. However, it should be noted that this variation in noise level has occurred in previous measurements at this location. In addition, subjective observations made in previous years have indicated that this location is highly influenced by small variations in meteorological conditions. Therefore, it is possible, that the variation can be attributed to small fluctuations in the weather conditions between the two nights.

As illustrated in Figure 40, the noise climate for the June 28 – 29, 2016 overnight period has less variations in the noise levels. This is also consistent with subjective observations made on-site during this night-

[1] It should be noted that the data was completely removed between 05:16 – 07:00 on August 4 due to the number of vehicle passages (several per minute) and birds chirping during that time period.
[2] It should be noted however, that the nearest weather station for this noise monitoring period was found approximately 7.5 km northeast of this location.

time period. The 1/3 octave band spectral data is consistent between both noise monitoring periods with slightly lower levels for the June 27 – 28, 2016 overnight period. Based on the results and subjective observations from previous years and when considering the weather conditions, the isolated values are representative of the typical noise climate of this area.

6.1.5. Noise Monitoring Location 5

The results of the noise monitoring conducted at Location 5 are provided in Table 2 and in Figures 47 - 54. Figures 47 – 50 indicate relatively consistent isolated 15-second L_{eq} traces throughout both night-time periods. This is further confirmed in Figures 51 – 52 where there are minimal differences between the L_{10}, L_{50} and L_{90} values which indicates that noise levels were relatively steady and are reflective of typical noise levels. Despite, the consistency of the traces there is still a variance of 3 dBA between the two night-time periods. Similarly to Noise Monitoring Location 4, there were no specific weather parameters (wind speed, wind direction, etc.), found in Appendix V[1], that would account for the variance in noise levels between the two nights. When considering the location of Monitor Location 5 and Monitor Location 4, relative to the nearest facility (north and south, respectively), it is anticipated that the variance in noise levels between the two night-time periods can be attributed to the weather conditions.

The 1/3 octave band spectral data is consistent between both noise monitoring periods with slightly lower levels for the June 28 – 29, 2016 overnight period. In reviewing the weather conditions, found in Appendix V, there were no parameters (wind speed, wind direction, etc.) that would account for the variance in noise levels between the two nights (approximately 3 dBA). Based on comparisons between these results and those the 2015 Noise Survey, the isolated values from the June 27 – 28, 2016 overnight period are representative of the typical noise climate of this area.

6.1.6. Noise Monitoring Location 6

The results of the noise monitoring conducted at Location 6 are provided in Table 2 and in Figures 55 - 62. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 55 – 58 indicate relatively consistent noise levels throughout both night-time periods. The isolated L_{eq}Night values are consistent with those from the 2015 Noise Survey in addition to the 2014 Noise Survey in which both night-time periods resulted in L_{eq}Night noise levels of 46.3 dBA.

[1] It should be noted however, that the nearest weather station for this noise monitoring period was found approximately 4.0 km northeast of this location.

The noise was subjectively broadband across all frequencies which is consistent with the 1/3 octave band L_{eq} traces and with the results from the 2015 Noise Survey.

6.1.7. Noise Monitoring Location 7

As previously mentioned this noise monitoring location will no longer be used as a noise monitoring location due to the NWR refinery.

6.1.8. Noise Monitoring Location 8

The results of the noise monitoring conducted at Location 8 are provided in Table 2 and in Figures 63 - 70. The isolated L_{eq}Night values and the traces found in Figures 63 – 66 indicate varying noise levels between the two night-time periods. Specifically, there is a difference of 6.2 dBA between the two night-time periods. The variance in noise level can be attributed to the weather conditions between the two nights. In particular, the wind during the August 3 – 4, 2016 night-time period was from the north-northwest for a majority of the monitoring period, thus causing upwind conditions from the noise monitor to the facility to the southeast. This relatively large reduction in noise level between nights was also observed for Noise Monitor 9.

The 1/3 octave band spectral data is consistent between both noise monitoring periods with lower levels for the August 3 – 4, 2016 overnight period. Based on comparisons between these results and those from the 2014 Noise Survey[1], the isolated values from the August 2 – 3, 2016 overnight period are more representative of the typical noise climate of this area.

6.1.9. Noise Monitoring Location 9

The results of the noise monitoring conducted at Location 9 are provided in Table 2 and in Figures 71 - 78. The isolated L_{eq}Night values and the traces found in Figures 71 – 74 indicate varying noise levels between the two night-time periods. Specifically, there is a difference of 7.2 dBA between the two night-time periods. The variance in noise level can be attributed to the weather conditions between the two nights. In particular, the wind during the August 3 – 4, 2016 night-time period was from the north-northwest for a majority of the monitoring period, thus causing upwind conditions from the noise monitor to the facilities

[1] As previously mentioned, this location was moved back to an area consistent with the 2014 Noise Survey. As such, a comparison to the 2014 Noise Survey is more appropriate.

to the east-southeast. This relatively large reduction in noise level between nights was also observed for Noise Monitor 8.

The 1/3 octave band spectral data is consistent between both noise monitoring periods with lower levels for the August 3 – 4, 2016 overnight period. Based on comparisons between these results and those from the 2015 Noise Survey, the isolated values from the August 2 – 3, 2016 overnight period are more representative of the typical noise climate of this area.

6.1.10. Noise Monitoring Location 10

The results of the noise monitoring conducted at Location 10 are provided in Table 2 and in Figures 79 - 86. The isolated L_{eq}Night values and the traces found in Figures 79 – 82 indicate relatively consistent noise levels, particularly for the June 28 – 29, 2016 night-time period[1]. The consistency of the noise climate at this location is further confirmed in Figures 83 – 84 where there is very little difference between the isolated L_{10}, L_{50} and L_{90} values which indicates that noise levels were relatively steady and are reflective of typical noise levels.

Similarly to previous years, it was noted that not one site dominated the noise climate of the area. Instead noise was distinctly audible from each the various surrounding facilities and was more prominent when any particular facility was upwind from the noise monitoring location. The 1/3 octave band L_{eq} sound levels indicate elevated noise levels in the lower frequency bands that gradually decrease as the frequency increases with a significant reduction beyond the 5 kHz.

Based on the results and subjective observations from previous years and when considering the weather conditions, the isolated values of both night-time periods are representative of the typical noise climate of this area.

6.1.11. Noise Monitoring Location 11

The results of the noise monitoring conducted at Location 11 are provided in Table 2 and in Figures 87 - 94. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 87 - 90 indicate varying noise levels for both night-time periods[2]. In particular, there is a relatively significant decrease in

[1] Data was completely removed between 05:30 – 07:00 on June 28, and between 05:37 – 07:00 on June 29, due to the number of vehicle passages (several per minute during that time period.

[2] Data was completely removed between 06:04 – 07:00 on August 3, 2016 due to the number of vehicle passages (several per minute during that time period.

the noise levels from approximately 03:00 – 07:00 during the August 2 – 3, 2016 night-time period. In reviewing the weather conditions, found in Appendix V, the decrease in noise level (approximately 10 dBA) can be attributed to the shift in wind direction from east-northeast to north and northwest. This resulted in the noise monitor shifting from being in a downwind location to an upwind location relative to the facilities to the northeast and east. These wind conditions occurred again during the August 3 – 4, 2016 night-time period and again resulted in lower than anticipated isolated L_{eq}Night values.

Subjectively, the noise arriving at this monitoring location (when excluding rail activity) was relatively broadband with the mid/high frequencies coming from the northeast and east. The 1/3 octave band L_{eq} sound levels indicate elevated noise levels in the lower frequency bands that gradually decrease as the frequency increases. The contribution of the train and the 1/3 octave band L_{eq} sound levels are consistent with the 2015 Noise Survey.

6.1.12. Noise Monitoring Location 12

The results of the noise monitoring conducted at Location 12 are provided in Table 2 and in Figures 95 - 110. As previously mentioned, this location was the independent control/reference point. Therefore, the results from this location span two (2) 48-hour monitoring periods[1].

For all night-time periods there is a significant difference between the non-isolated L_{eq}Night noise levels in comparison to the isolated L_{eq}Night noise levels for all night-time periods. This can be attributed to this location being relatively far any major facility[2], therefore most instances of vehicular traffic on Range Road 211 or rail activity along the nearby CP rail line dominate the noise climate. This was similar for all night-time periods and is consistent with the results from the 2015 Noise Survey.

In the absence of the vehicular or rail activity the 1/3 octave band L_{eq} sound levels indicate a similar trace to the other monitoring locations with elevated noise levels in the lower frequency bands (20 Hz – 80 Hz) that gradually decrease as the frequency increases.

[1] Data was completely removed between 05:25 – 07:00 on June 28, 05:28 – 07:00 on June 29, 05:03 – 07:00 on August 3 and from 05:10 – 07:00 on August 4 due to the number of vehicle passages (several per minute during that time period) and due to the morning chorus.

[2] This location is approximately 2.3 km northeast of the ATCO Natural Gas Salt Cavern Storage Site.

6.1.13. Noise Monitoring Location 13

The results of the noise monitoring conducted at Location 13 are provided in Table 2 and in Figures 111 - 118. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 111 – 114 indicate varying noise levels for both night-time periods. The variance in noise level can be attributed to the weather conditions between the two nights. In particular, the wind during the August 3 – 4, 2016 night-time period was from the north-northwest for a majority of the time, thus causing upwind conditions from the noise monitor to the facilities to the east-southeast.

The 1/3 octave band spectral data is consistent between both noise monitoring periods with lower levels for the August 3 – 4, 2016 overnight period. In addition, the 1/3 octave band L_{eq} sound levels indicate a similar trace to the other monitoring locations with elevated noise levels in the lower frequency bands (20 Hz – 80 Hz) that gradually decrease as the frequency increases.

6.2. 2016 General Subjective Observations from Site Visits and Data Analysis

- Due to the varying contributions from the rail yard (from day to day and from year to year), a representative average noise level for Noise Monitor Location 2 is more difficult to determine in comparison to other locations.
- The trace of the 1/3 octave band L_{eq} sound levels for all noise monitoring locations were similar to those measured in previous years.
- The noise arriving at most monitor locations consisted primarily of low frequency components that gradually decreased in noise level as the frequency increased.
- Despite the noise being relatively low in frequency, none of the sites indicated any specific low frequency tonal components.
- The noise from train passages was prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles. Though the train passages were not subjectively observed during the site visits in comparison to previous years, the isolation analysis indicated a similar number of rail passages when compared to 2015.
- Data obtained from the August 2 – 4, 2016 noise monitoring periods illustrated the potential acoustical consequence of noise propagation due to meteorological conditions. Specifically, the shift from a receiving point upwind condition to a downwind condition.

6.3. Night-time Weather Conditions

As previously mentioned, 3 local weather monitoring stations were used throughout all noise monitoring periods to obtain the wind speed, wind direction, temperature, relative humidity, barometric pressure and rain fall data in 1-minute sampling periods. All weather data are presented in Appendix V[1]. A brief discussion of each night-time period can be found below. The wind speeds during certain night-time periods were in excess of the limits of AER Directive 038. However, through the use of the audio files and the 1/3 octave band L_{eq} sound levels, all instances of high wind speeds that influenced the noise monitoring results were isolated (i.e. removed). Therefore, the results found within Table 2 are considered in compliance with AER Directive 038.

6.3.1. June 27 – 28, 2016

Weather Monitor near Noise Monitor Location 6

The wind conditions during the night-time period were considered calm (primarily below 5 km/hr) and predominantly from the east to south directions. The temperature ranged from 13°C to 21°C and the relative humidity ranged from approximately 51% - 89%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 10

The wind conditions during the night-time period were considered moderate (primarily below 10 km/hr) and from the south-southeast. The temperature ranged from 12°C to 23°C and the relative humidity ranged from approximately 50% - 82%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night-time period were considered calm (primarily below 5 km/hr for a majority of the night-time period). The wind shifted from the north, at the beginning of the night-time period, to the south by the end. The temperature ranged from 12°C to 18°C and the relative humidity ranged from approximately 68% - 92%. The barometric pressure was consistent and relatively flat at approximately 95kPa. Lastly, there was no precipitation.

[1] Rainfall was only presented for the night-time period (for all noise monitoring periods) as only the night-time period was isolated.

6.3.2. June 28 – 29, 2016

Weather Monitor near Noise Monitor Location 6

The wind conditions during the night-time period were considered calm (primarily below 5 km/hr) and predominantly from the east to south directions. The temperature ranged from 10°C to 19°C and the relative humidity ranged from approximately 68% - 94%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 10

The wind conditions during the night-time period were considered moderate (primarily below 10 km/hr). The wind was initially from the north, shifting to the southwest before gradually shifting to the south. The temperature ranged from 13°C to 20°C and the relative humidity ranged from approximately 59% - 90%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night-time period were considered moderate (below 10 km/hr the entire night-time period). The wind was initially from the north-northeast before shifting to the southwest for the majority of the night-time period. The temperature ranged from 10°C to 18°C and the relative humidity ranged from approximately 74% - 92%. The barometric pressure was consistent and relatively flat at approximately 95kPa. Lastly, there was no precipitation.

6.3.3. August 2 – 3, 2016

Weather Monitor near Noise Monitor Location 11

The wind conditions during the start of night-time period were considered moderate (primarily between 5 - 12 km/hr) and from the east. The wind calmed (at or below 5 km/hr) after approximately 02:00 and then shifted to the west-northwest for the remainder of the night-time period. The temperature ranged from 12°C to 20°C and the relative humidity ranged from approximately 55% - 89%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 13

The wind was relatively calm (primarily below 5 km/hr) from varying directions[1] throughout the entire night-time period. The temperature ranged from 10°C to 17°C and the relative humidity ranged from approximately 78% - 92%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night-time period were considered calm (primarily below 5 km/hr for a majority of the night-time period). The wind shifted from the southeast to northeast, at the beginning of the night-time period, to the south-southwest by the end. The temperature ranged from 12°C to 18°C and the relative humidity ranged from approximately 76% - 91%. The barometric pressure was consistent and relatively flat at approximately 95kPa. Lastly, there was no precipitation.

[1] The wind direction fluctuates more greatly when wind speeds are below 5 km/hr and are essentially calm. In these instances, the wind direction has a minimal influence of the propagation of the sound.

6.3.4. August 3 – 4, 2016

Weather Monitor near Noise Monitor Location 11

The wind conditions were considered moderate (primarily between 5 - 10 km/hr) and predominantly from the west-northwest for the night-time period. The temperature ranged from 12°C to 17°C and the relative humidity ranged from approximately 77% - 90%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 13

The wind was relatively calm (primarily below 5 km/hr) from varying directions[1] throughout the entire night-time period. The temperature ranged from 12°C to 15°C and the relative humidity ranged from approximately 85% - 94%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions were considered moderate (primarily between 5 - 10 km/hr) and predominantly from the southwest for the night-time period. The temperature ranged from 11°C to 16°C and the relative humidity ranged from approximately 75% - 92%. The barometric pressure was consistent and relatively flat at approximately 94kPa. Lastly, there was no precipitation.

[1] The wind direction fluctuates more greatly when wind speeds are below 5 km/hr and are essentially calm. In these instances, the wind direction has a minimal influence of the propagation of the sound.

7.0 Conclusion

As part of the study, a total of thirteen (13) 48-hour noise monitorings were conducted throughout the Alberta's Industrial Heartland. It was found that the isolated L_{eq}Night broadband and 1/3 octave band L_{eq} sound levels, from at least one (1) over-night period, were similar to those from previous measurements.

The noise levels at most locations consisted of low frequency components with occasional mid/high frequency components that could be attributed to the nearest facility relative to each individual noise monitoring location. Despite the noise being relatively low in frequency, none of the sites indicated any low frequency tonal components. The noise from train passages were again prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles. Though the train passages were not as often subjectively observed during the site visits in comparison to previous years, the isolation analysis indicated a similar number of rail passages when compared to 2015.

8.0 References

- *Environmental Noise Survey for the Regional Noise Model Annual Field Validation Monitoring,* prepared for the NCIA by aci Acoustical Consultants Inc., December 3, 2015.
- Alberta Energy Regulator (AER), *Directive 038 on Noise Control, 2007*, Calgary, Alberta
- International Organization for Standardization (ISO), *Standard 1996-1, Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures, 2003*, Geneva Switzerland.
- International Organization for Standardization (ISO), *Standard 9613-1, Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of absorption of sound by the atmosphere, 1993*, Geneva Switzerland.
- International Organization for Standardization (ISO), *Standard 9613-2, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, 1996*, Geneva Switzerland.

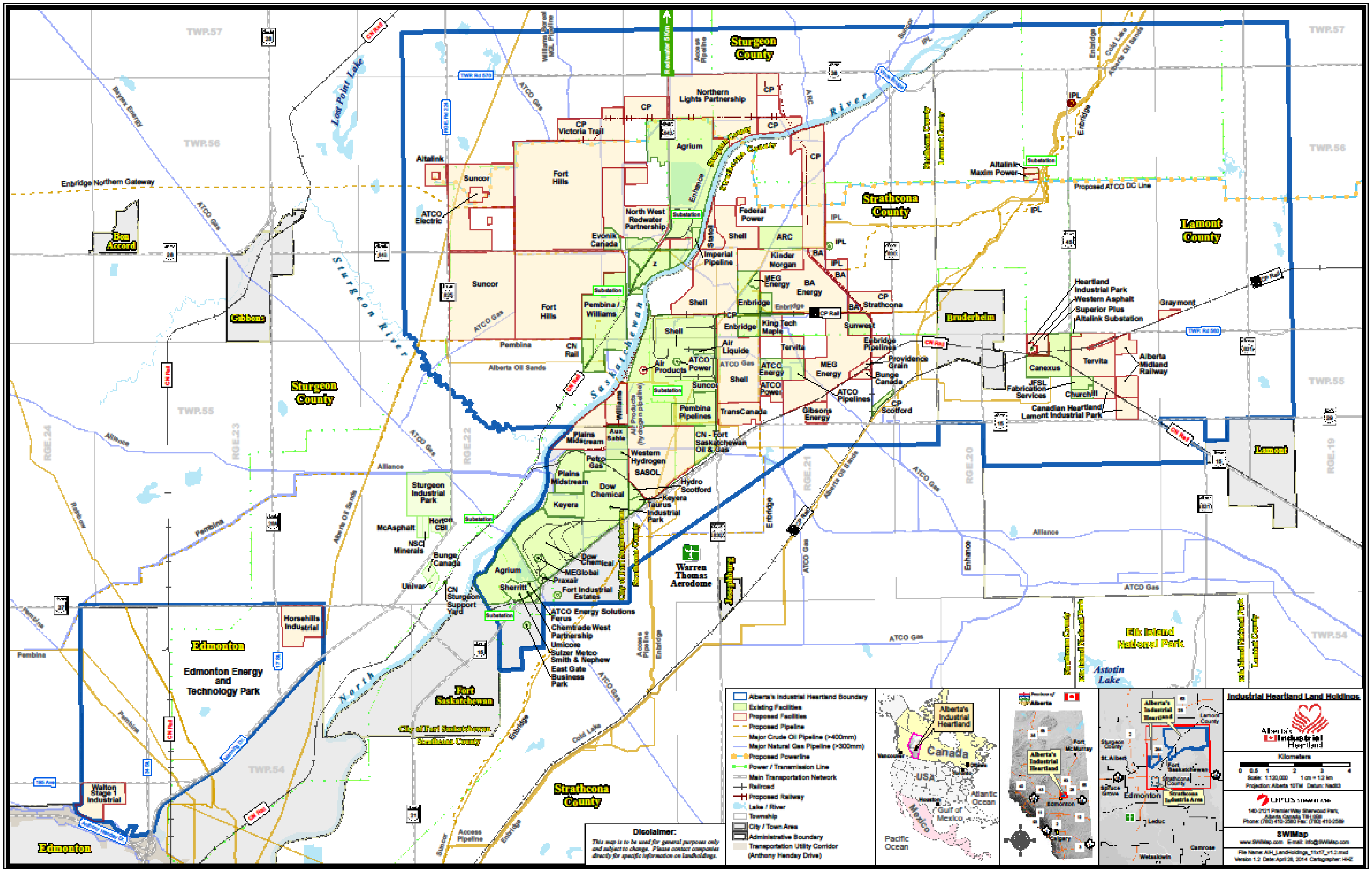

Figure 1. Study Area

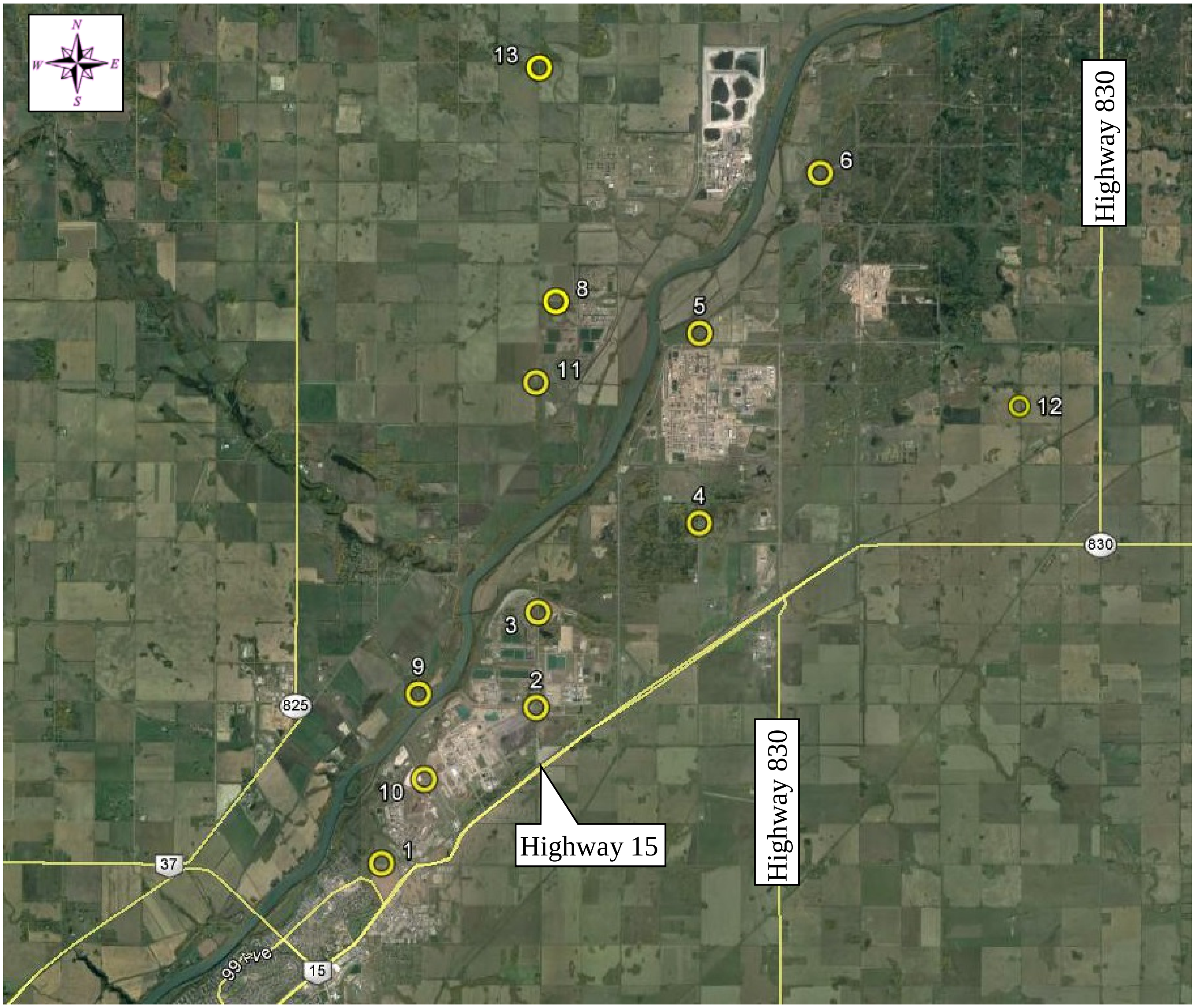

Figure 2. 2015 Study Area (With Noise Monitoring Locations)

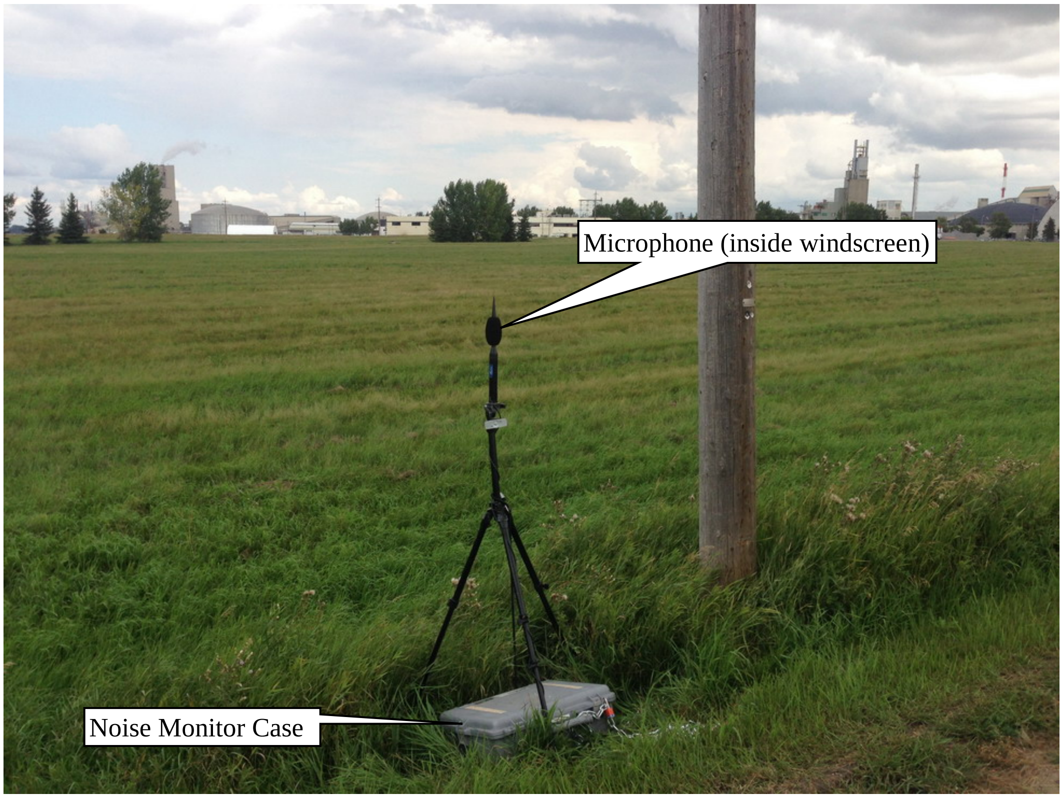

Figure 3. Noise Monitor #1

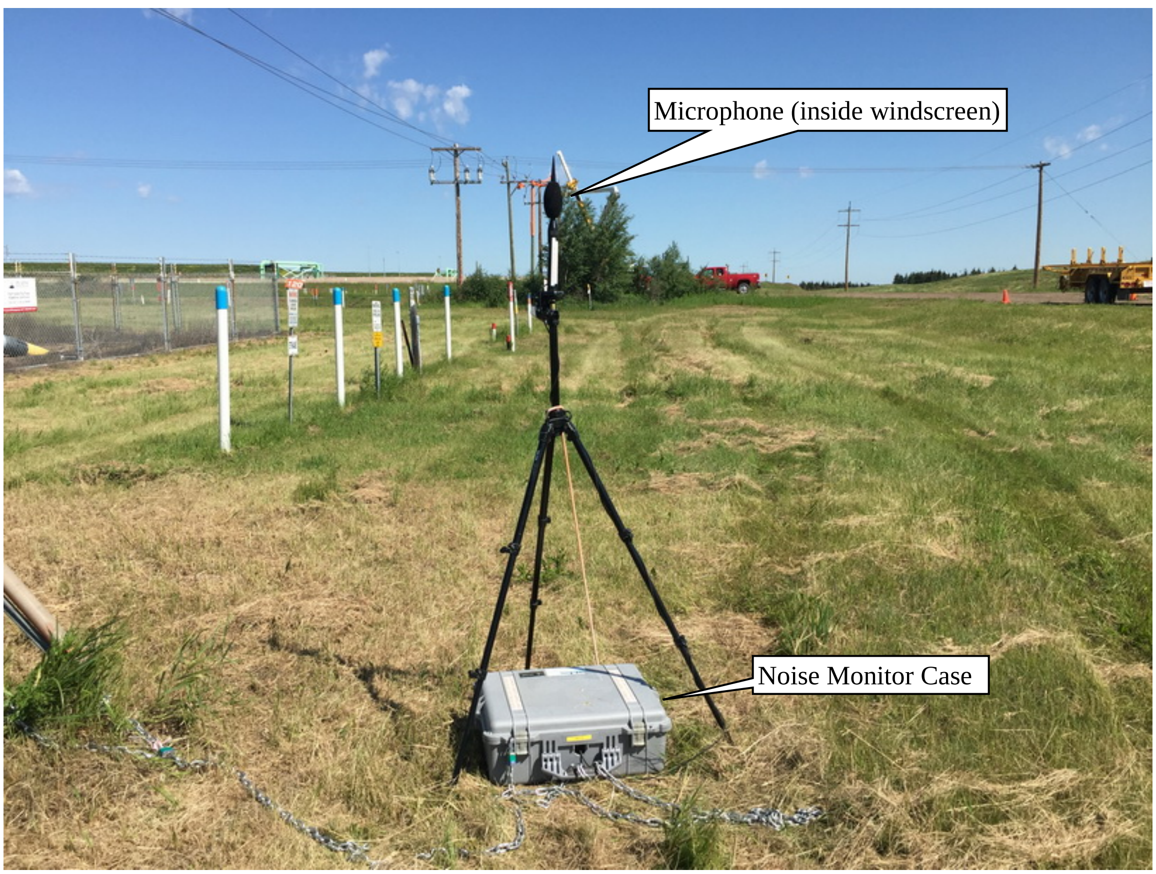

Figure 4. Noise Monitor #2

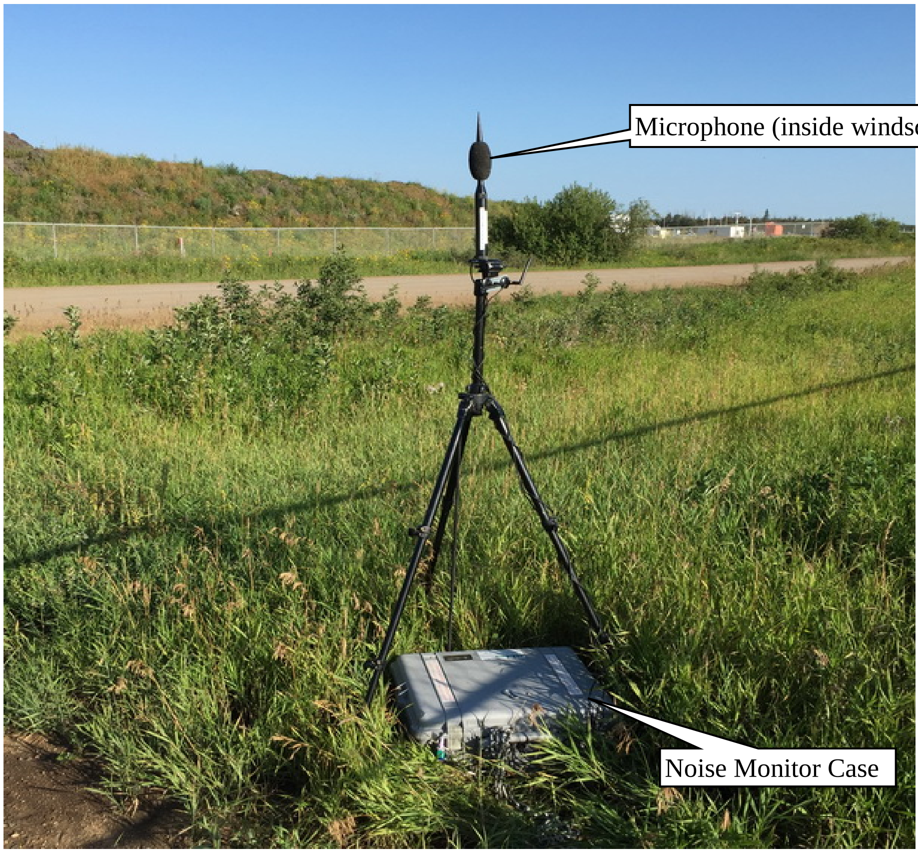

Figure 5. Noise Monitor #3

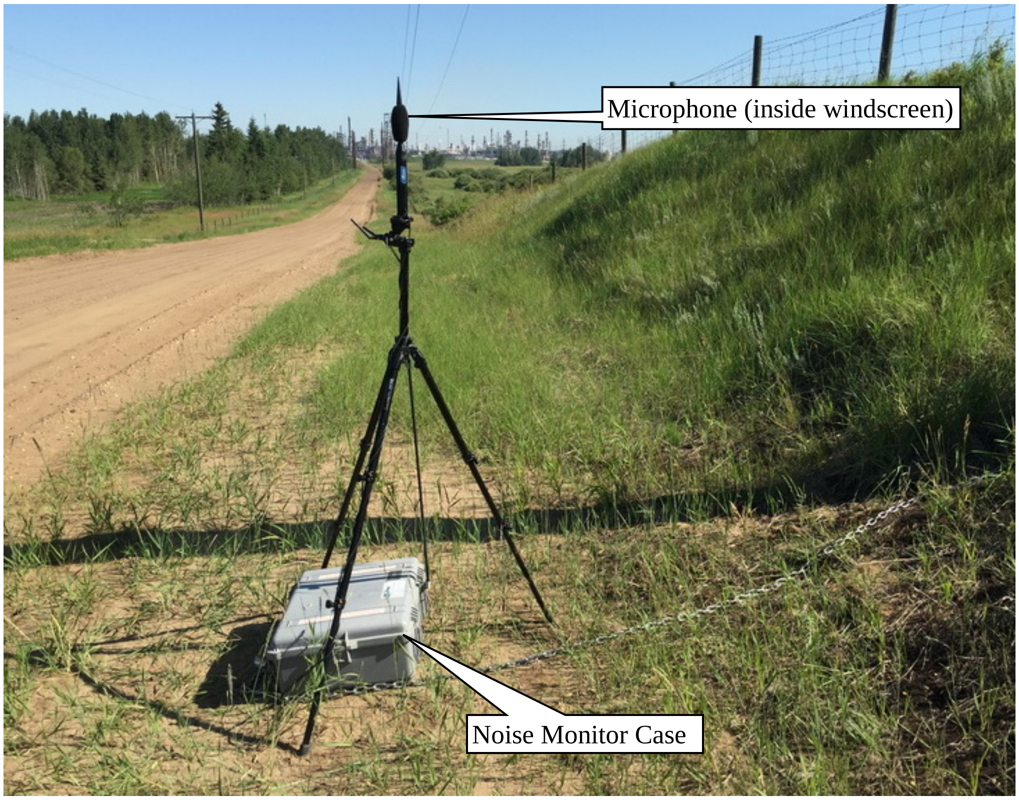

Figure 6. Noise Monitor #4

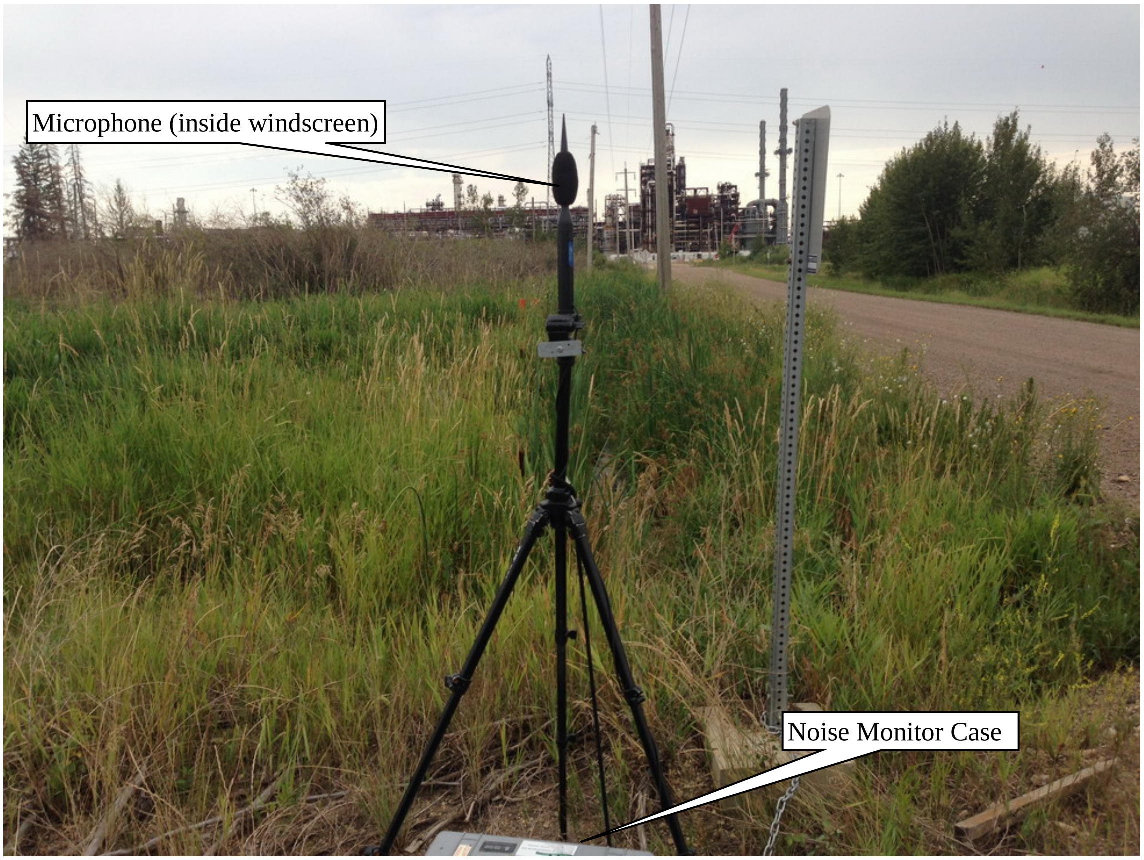

Figure 7. Noise Monitor #5

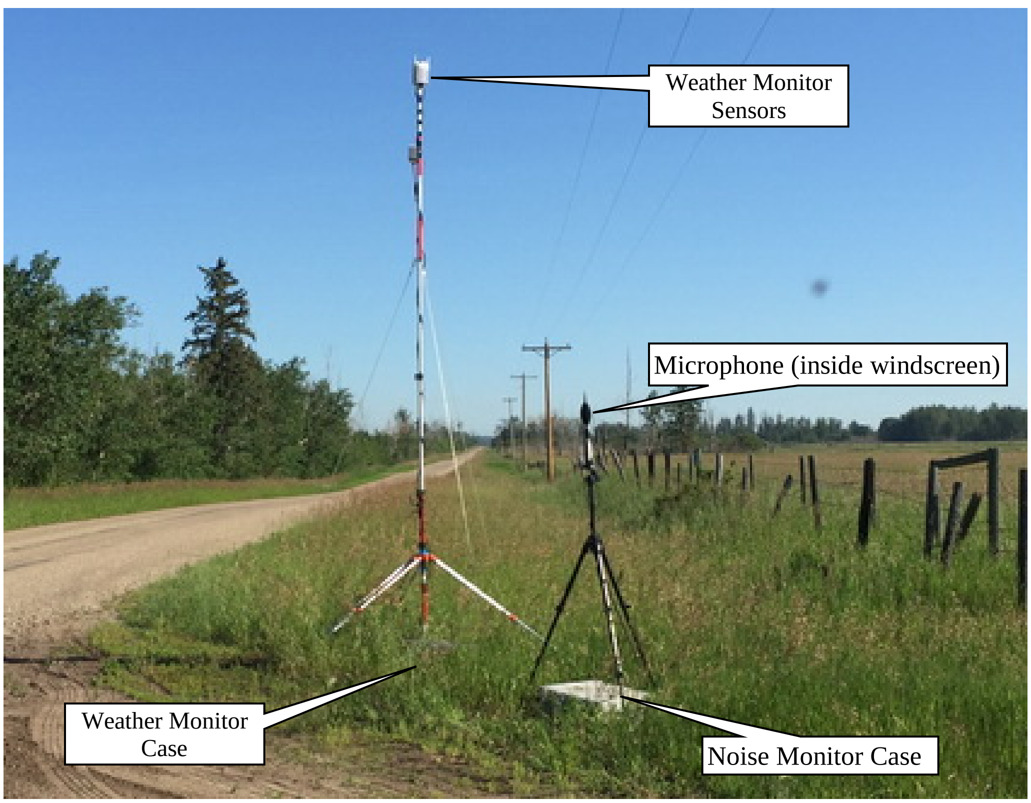

Figure 8. Noise Monitor #6 (With Weather Monitor)

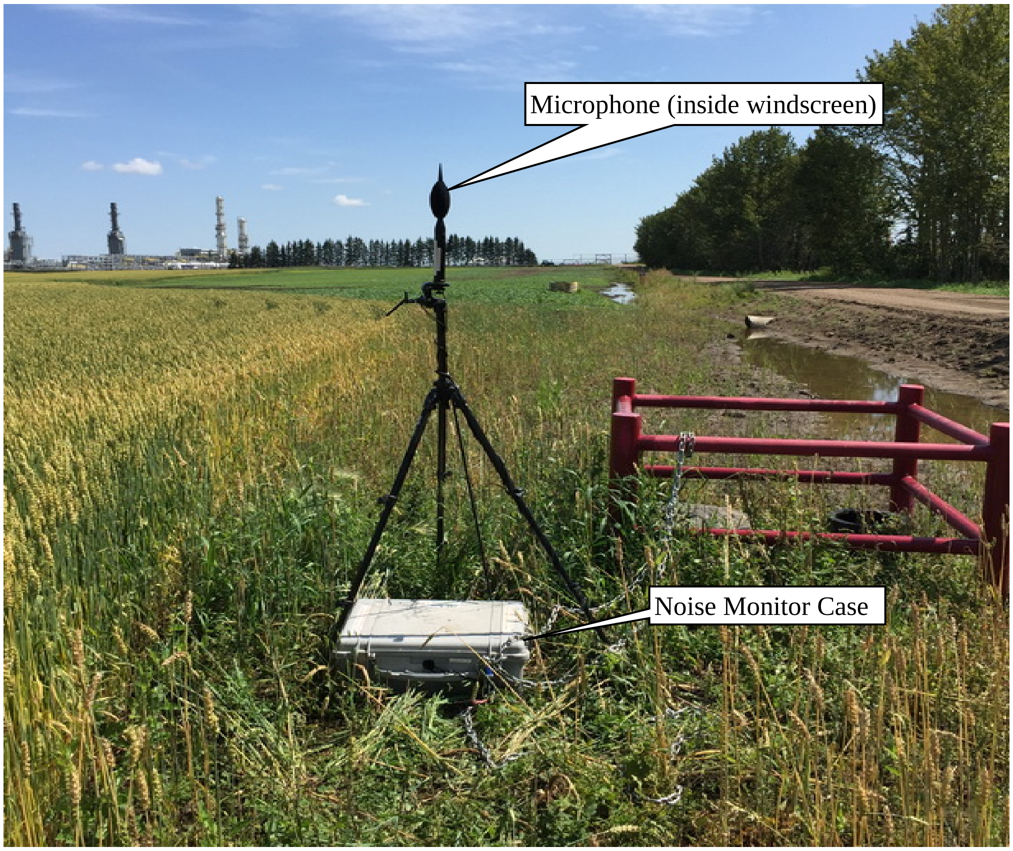

Figure 9. Noise Monitor #8

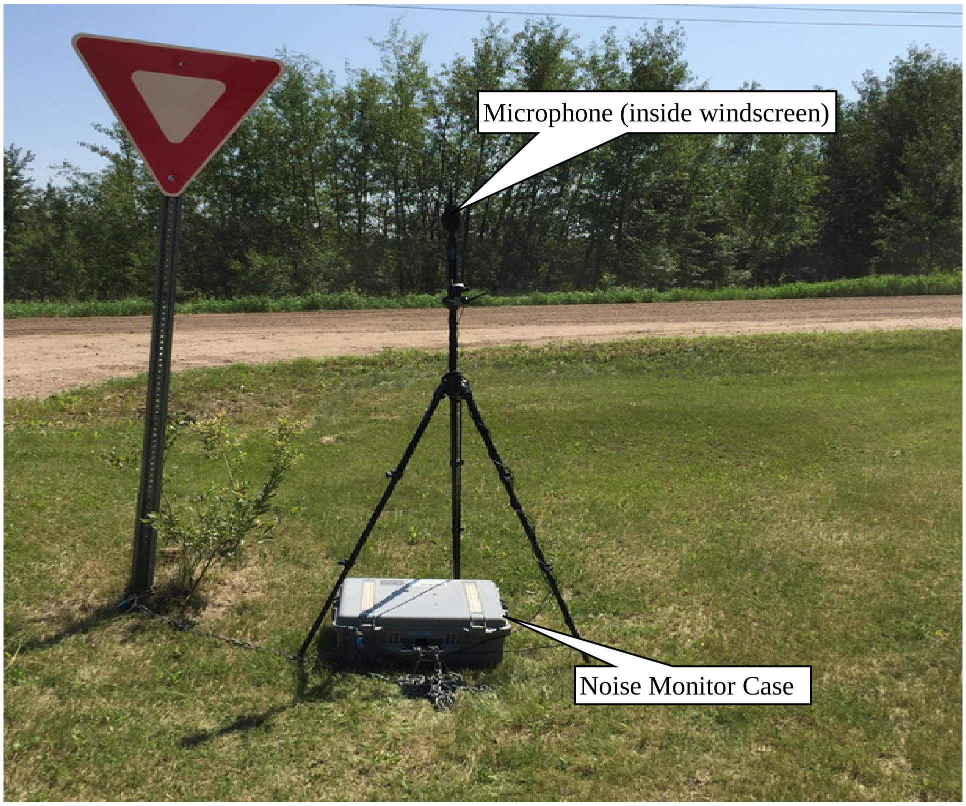

Figure 10. Noise Monitor #9

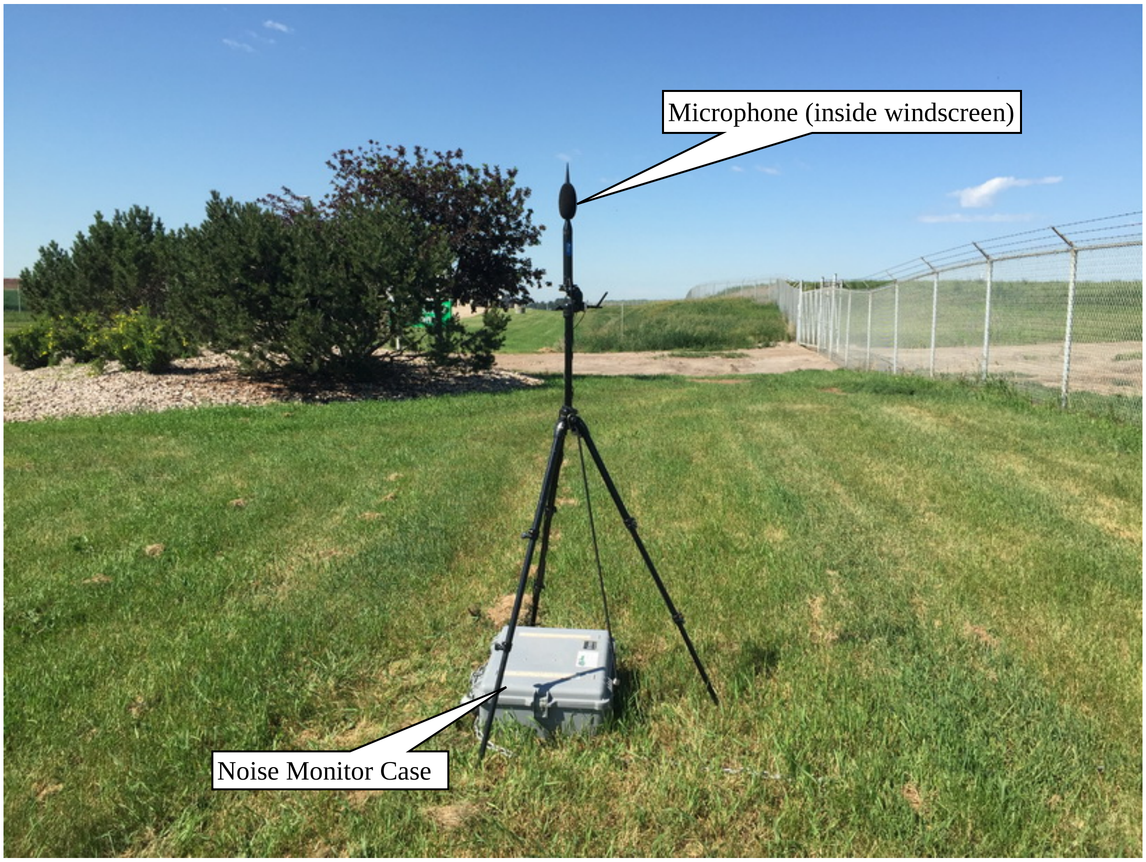

Figure 11. Noise Monitor #10

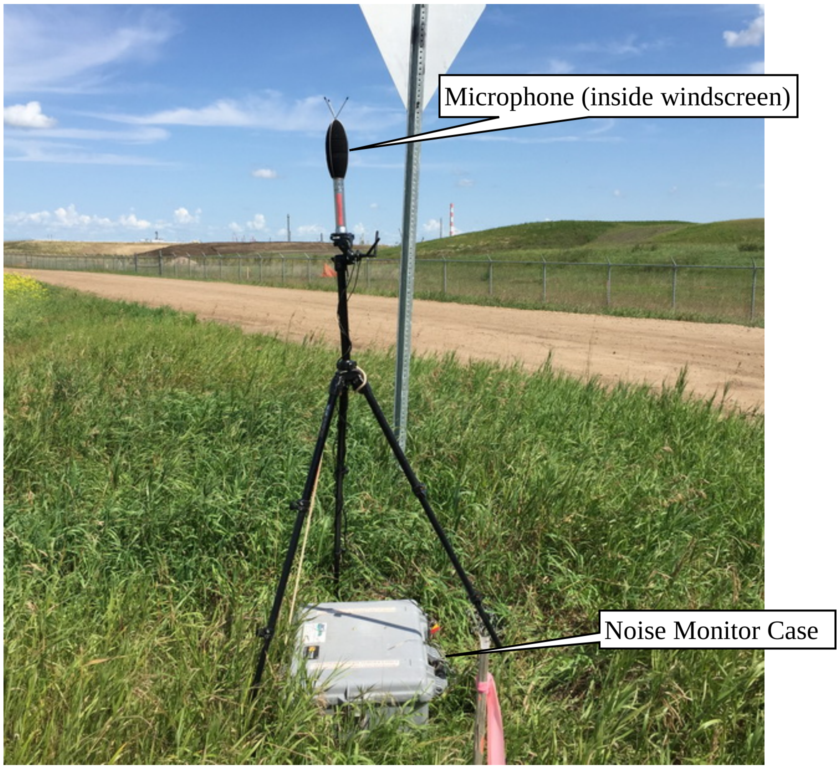

Figure 12. Noise Monitor #11

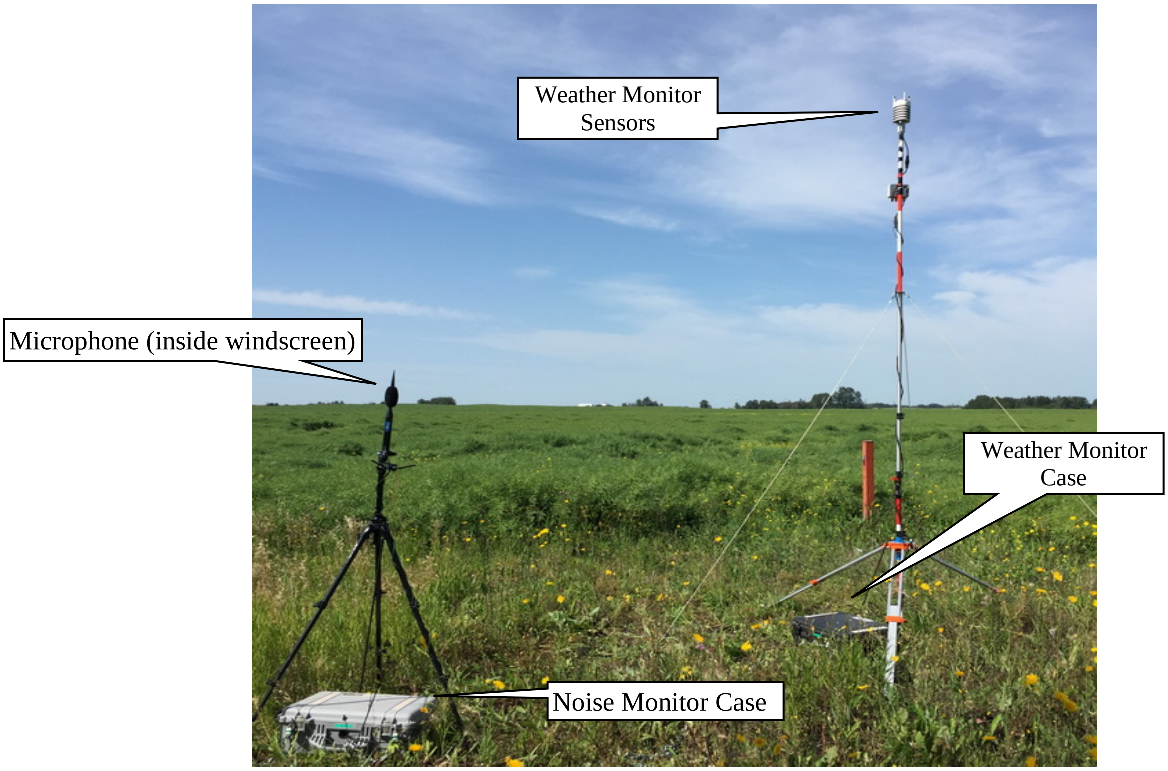

Figure 13. Noise Monitor #12 (With Weather Monitor)

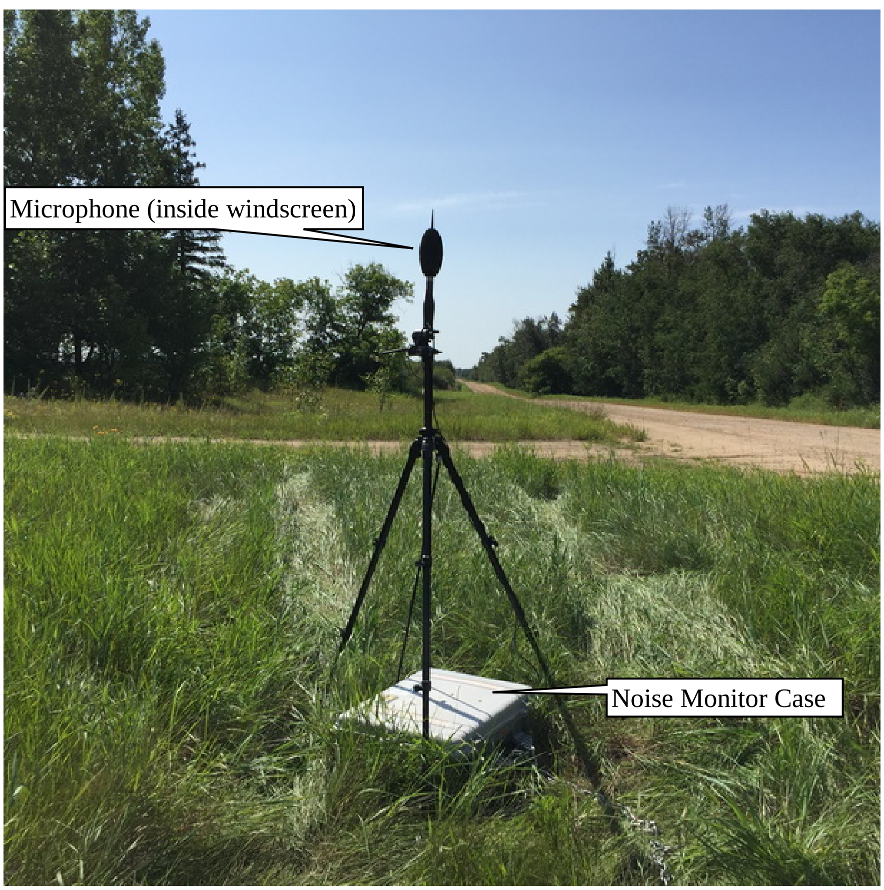

Figure 14. Noise Monitor #13

Noise Monitor #1

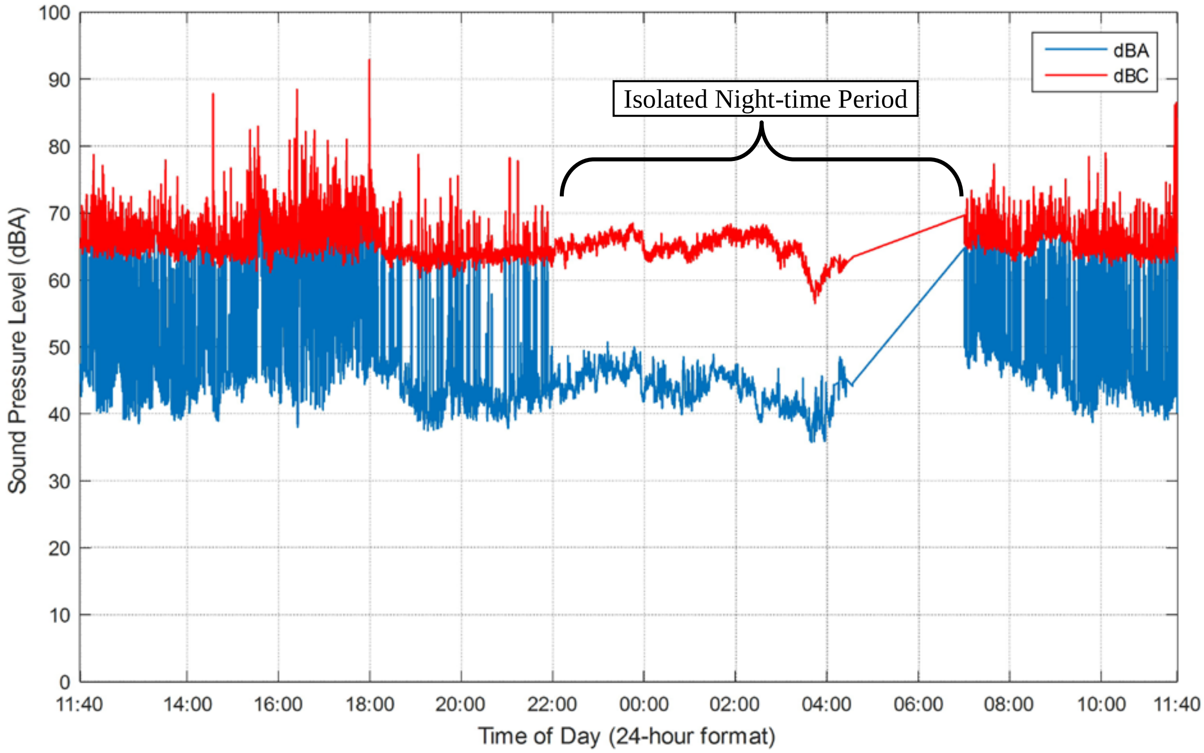

Figure 15. Noise Monitor #1, 15-Second L_{eq} Sound Levels (June 27 - 28, 2016)

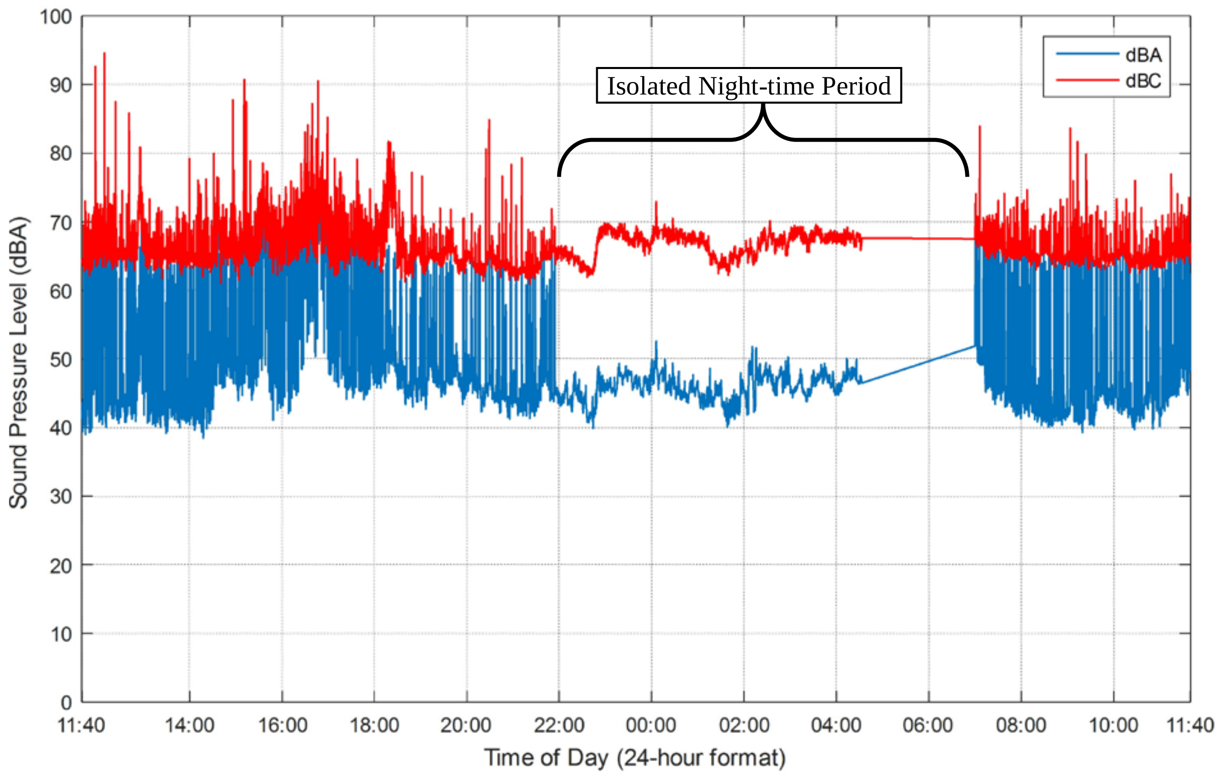

Figure 16. Noise Monitor #1, 15-Second L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #1

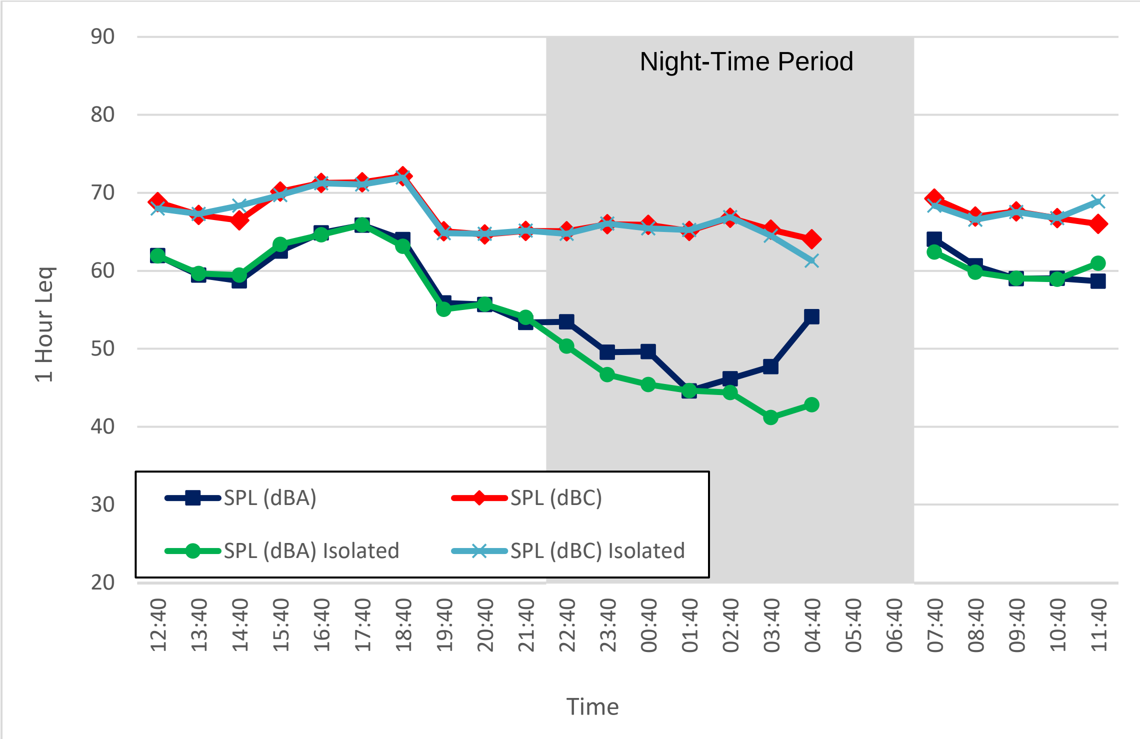

Figure 17. Noise Monitor #1, 1-Hour L_{eq} Sound Levels (June 27 - 28, 2016)[1]

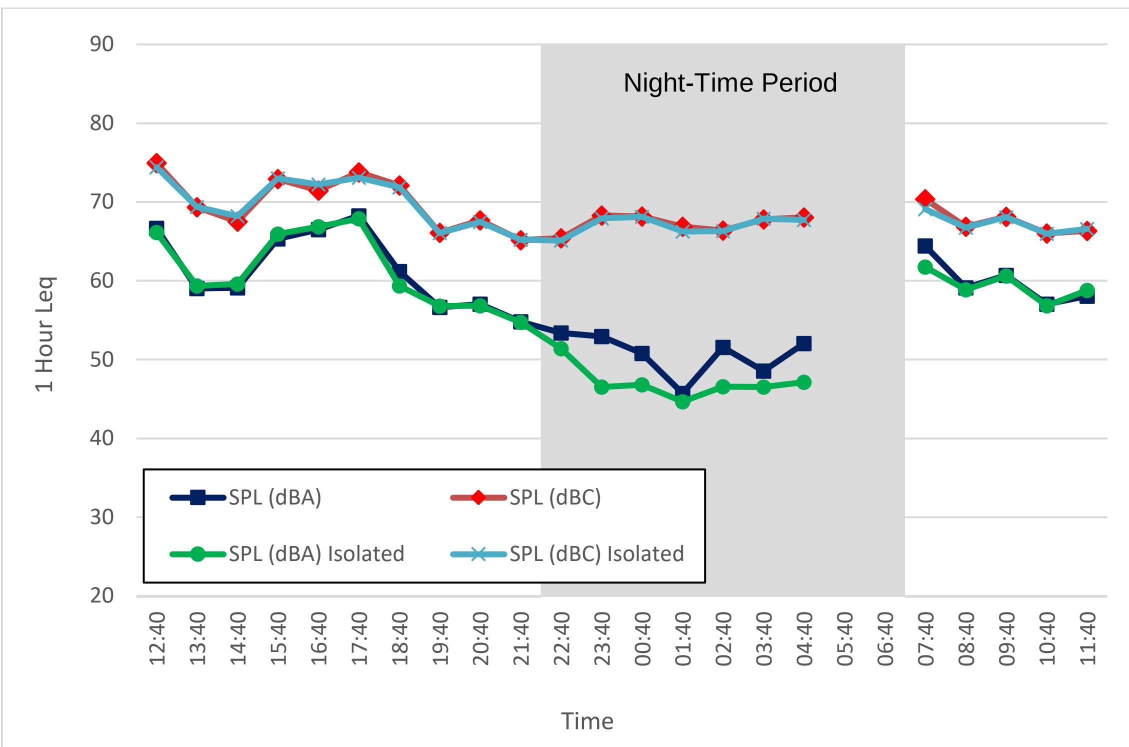

Figure 18. Noise Monitor #1, 1-Hour L_{eq} Sound Levels (June 28 - 29, 2016)[1]

[1] Again, it should be noted that data from 04:34 to 07:00 was entirely removed due to traffic along the adjacent road.

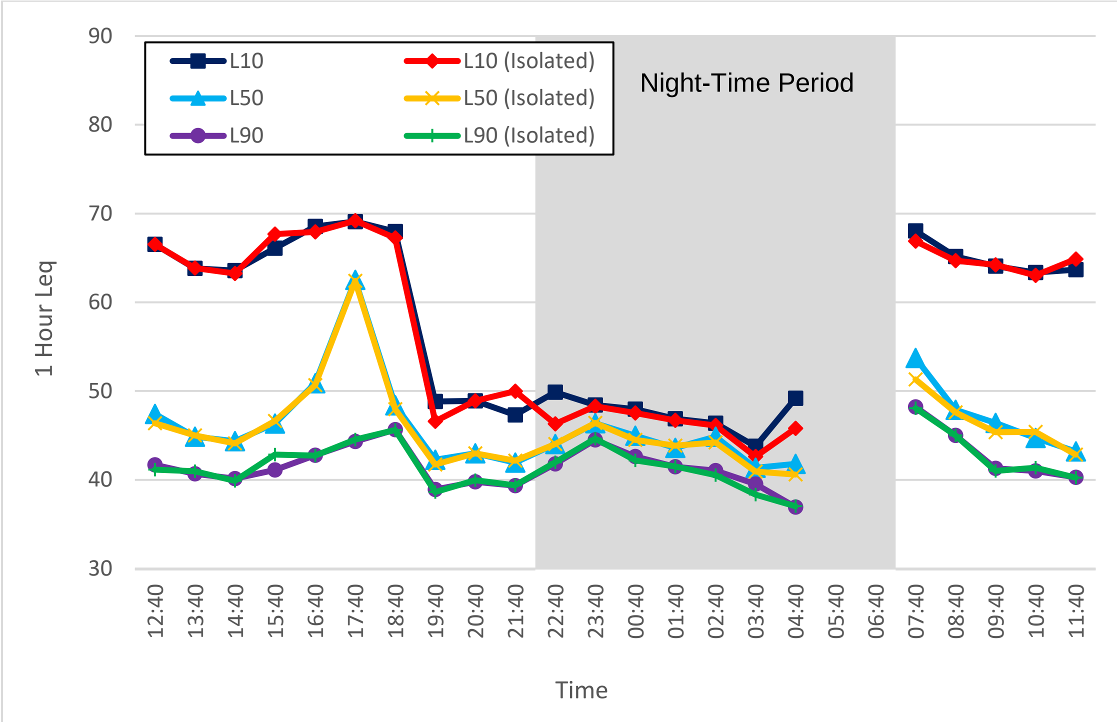

Figure 19. Noise Monitor #1, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 27 - 28, 2016)[1]

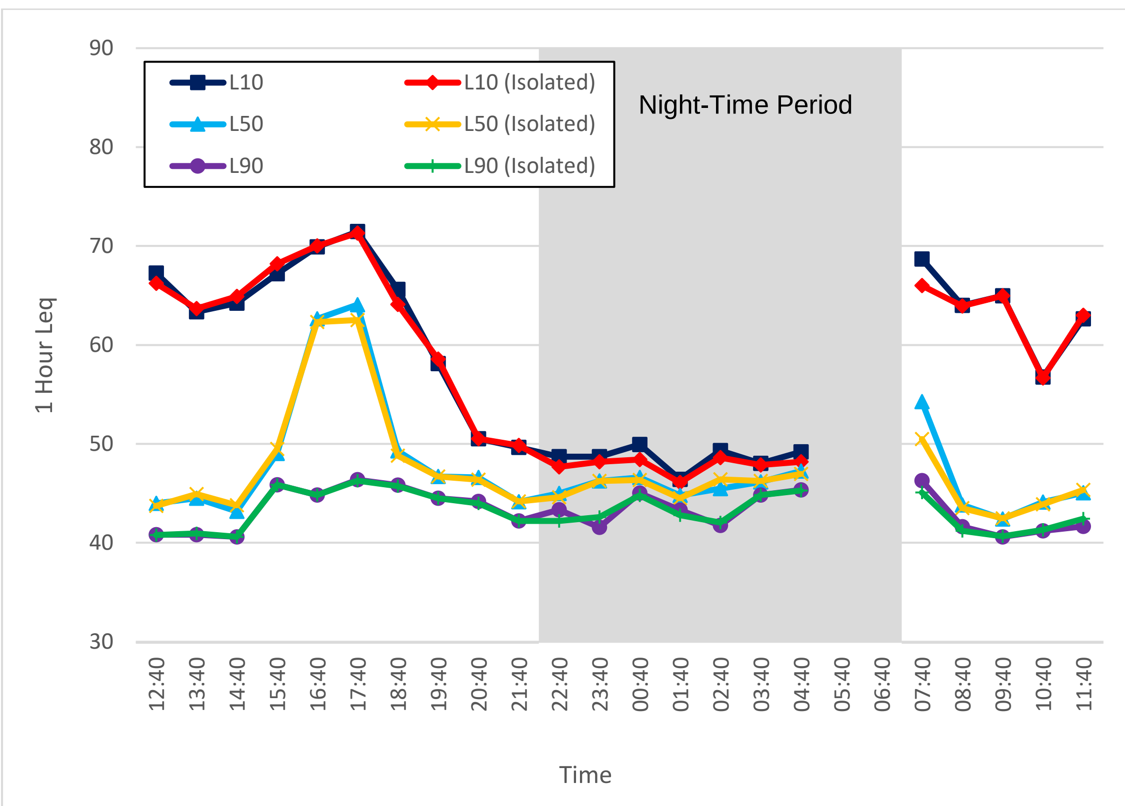

Figure 20. Noise Monitor #1, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 28 - 29, 2016)[1]

[1] Again, it should be noted that data from 04:34 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #1

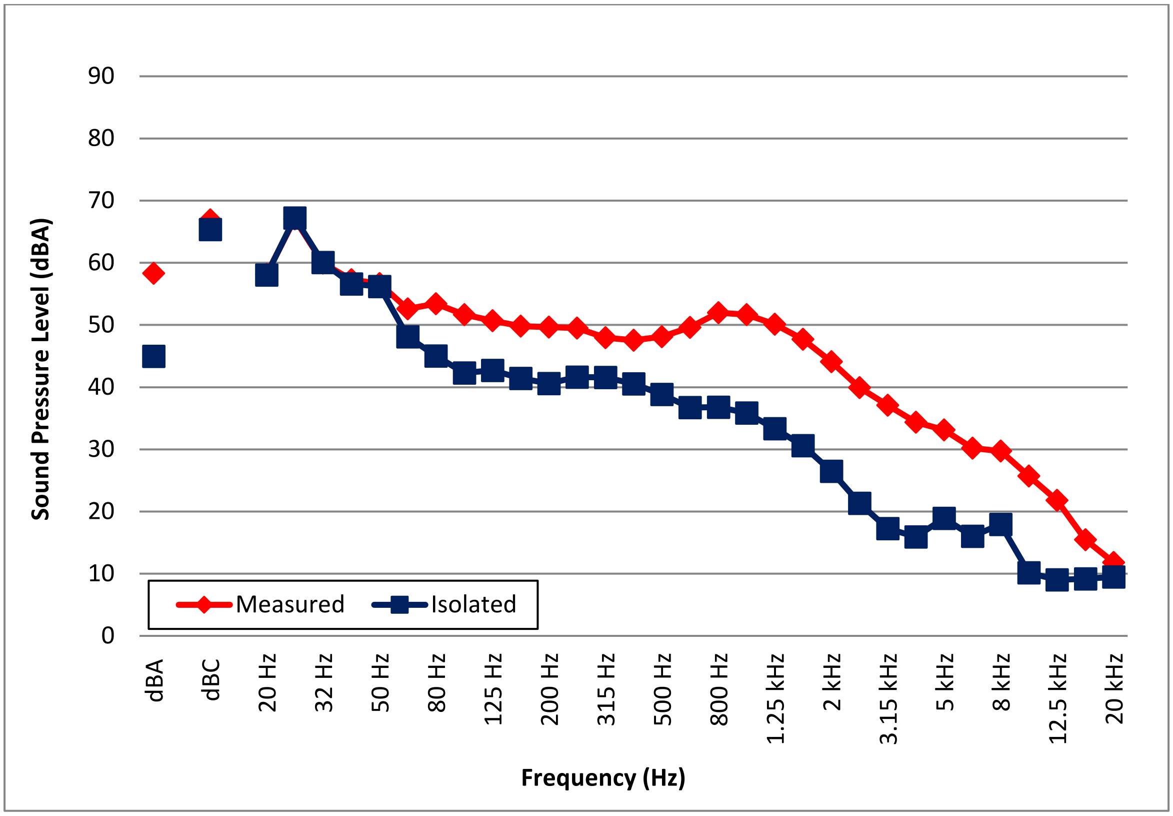

Figure 21. Noise Monitor #1, 1/3 Octave L_{eq} Sound Levels (June 27 - 28, 2016)

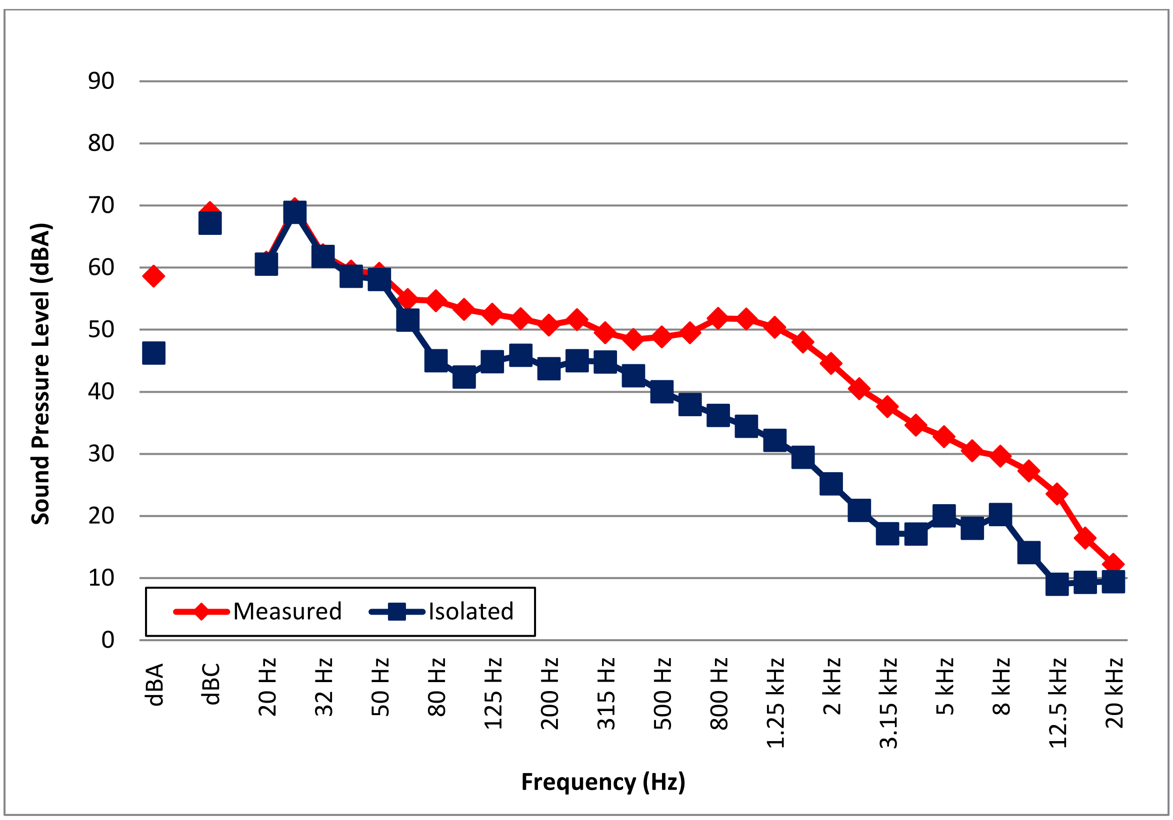

Figure 22. Noise Monitor #1, 1/3 Octave L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #2

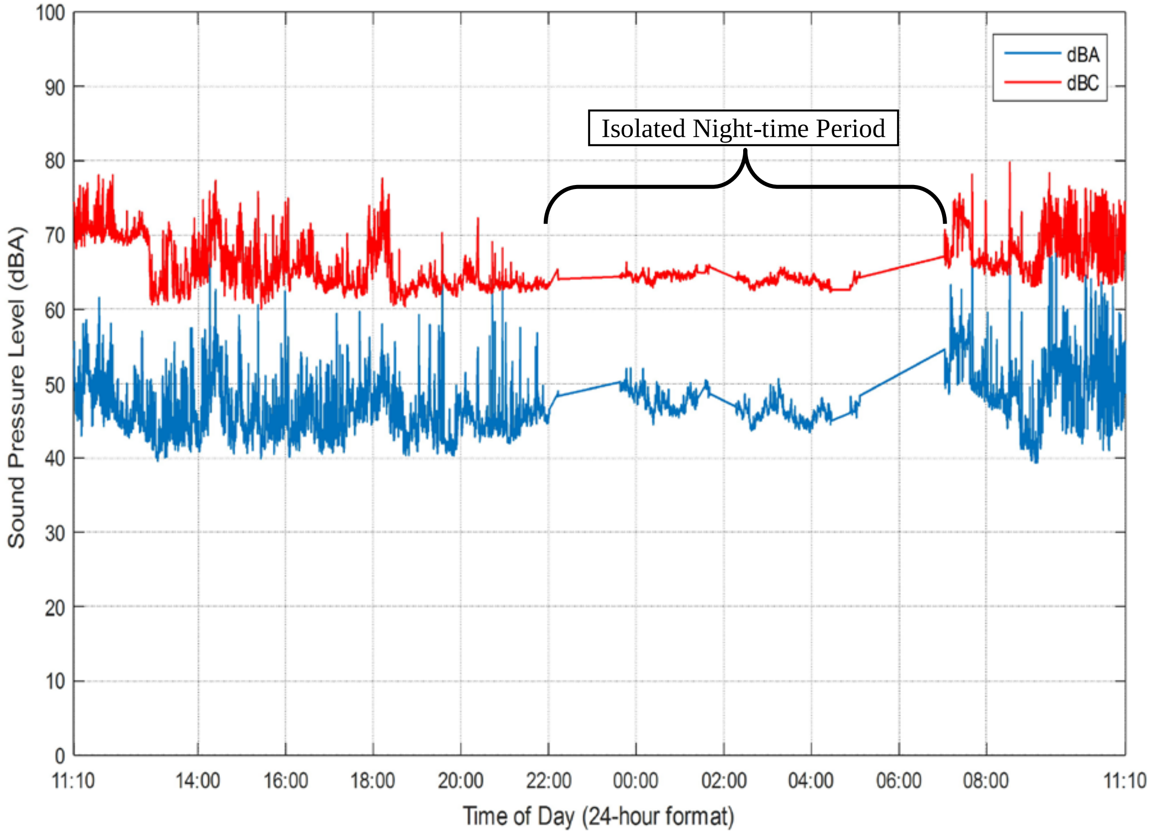

Figure 23. Noise Monitor #2, 15-Second L_{eq} Sound Levels (June 27 - 28, 2016)

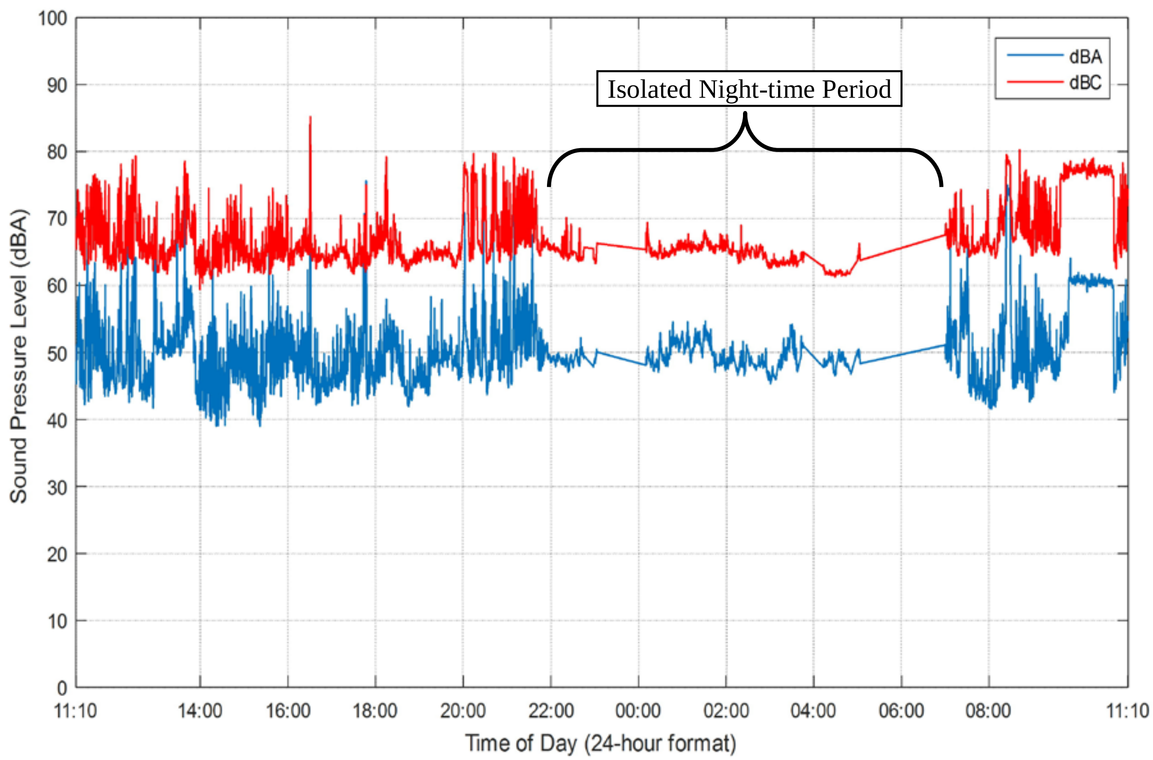

Figure 24. Noise Monitor #2, 15-Second L_{eq} Sound Levels (June 28 – 29, 2016)

Noise Monitor #2

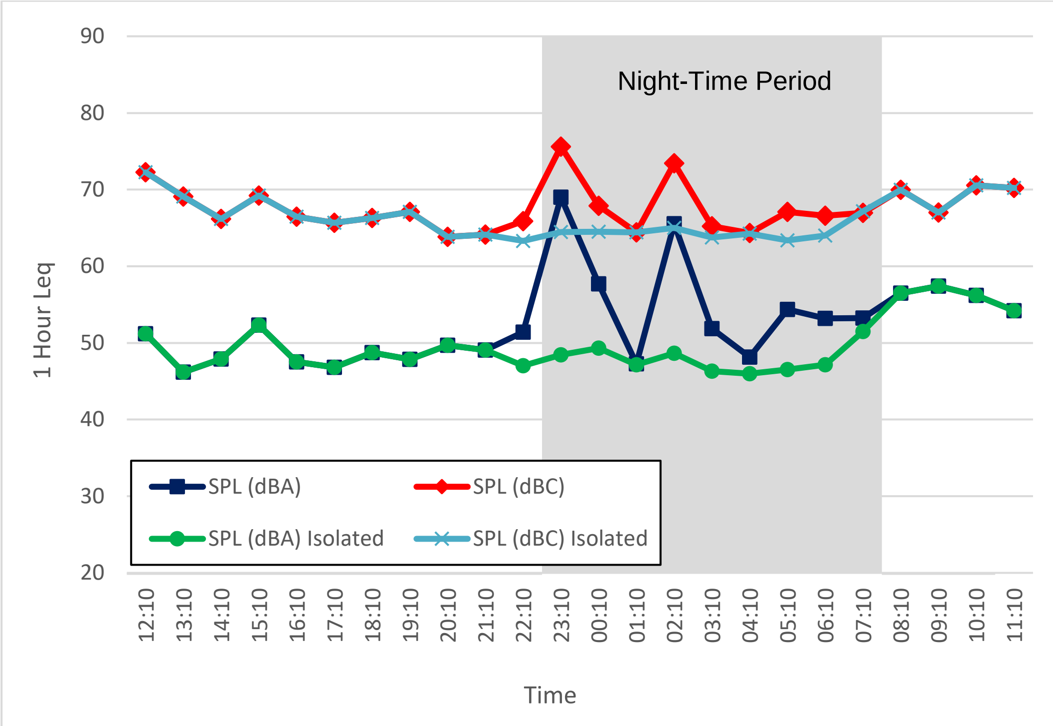

Figure 25. Noise Monitor #2, 1-Hour L_{eq} Sound Levels (June 27 - 28, 2016) [1]

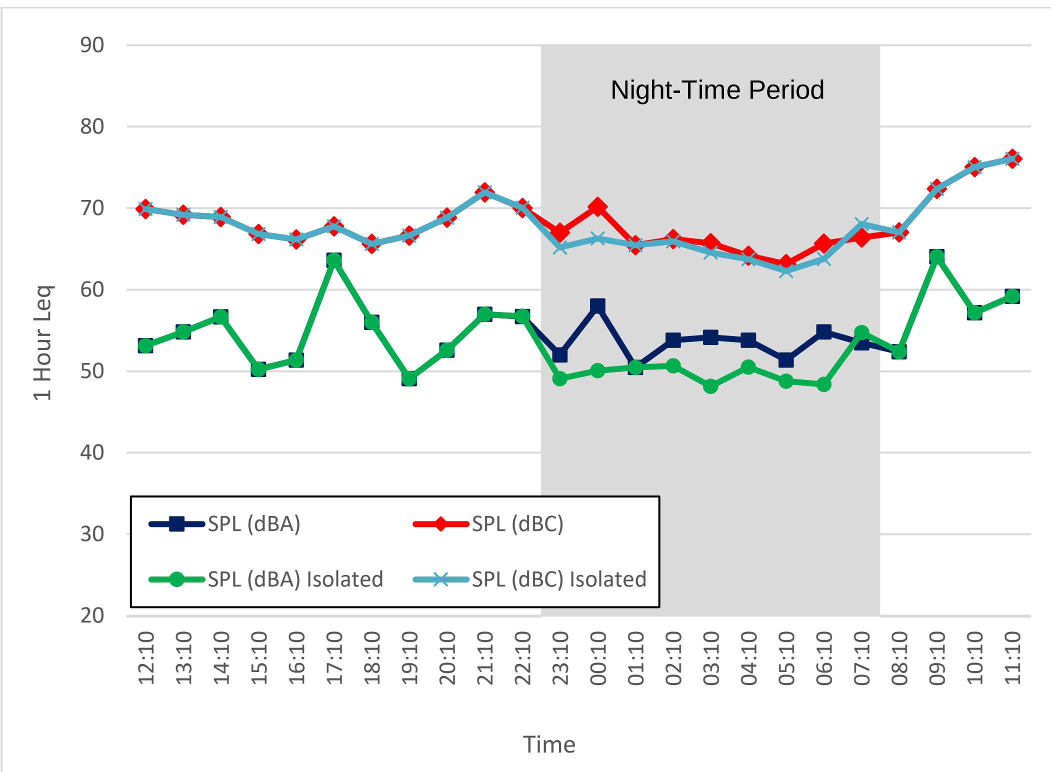

Figure 26. Noise Monitor #2, 1-Hour L_{eq} Sound Levels (June 28 - 29, 2016) [2]

[1] Data from 05:13 to 07:00 was entirely removed due to traffic along the adjacent road.
[2] Data from 05:03 to 07:00 was entirely removed due to traffic along the adjacent road.

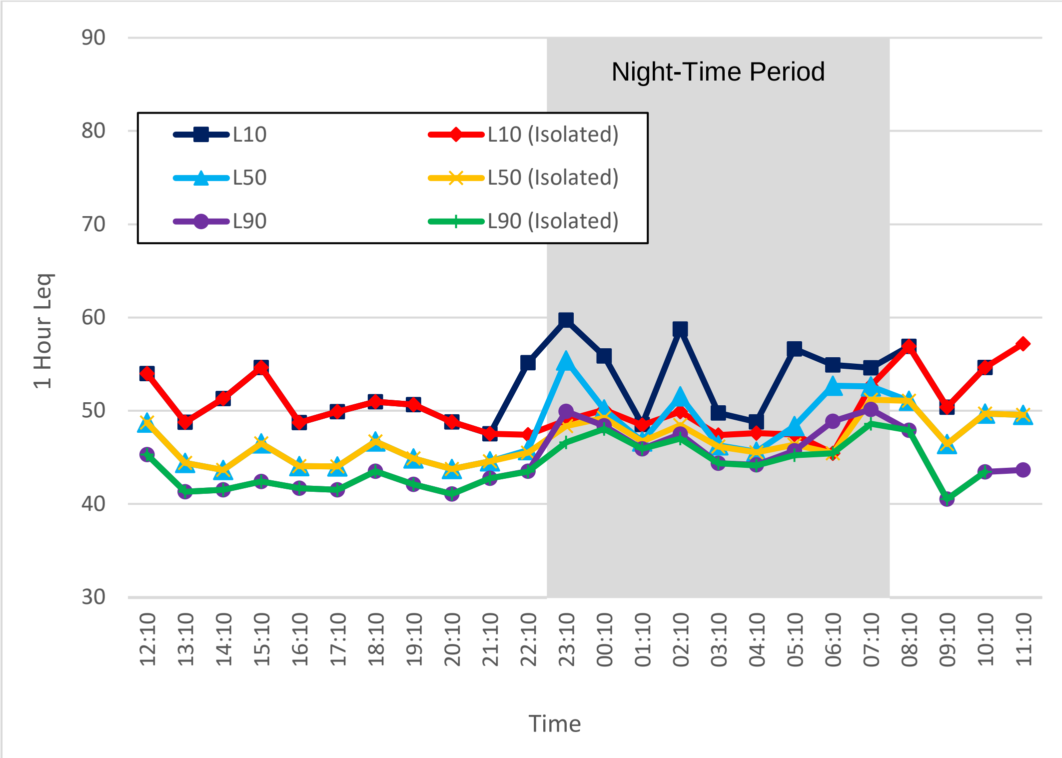

Figure 27. Noise Monitor #2, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 27 - 28, 2016) [1]

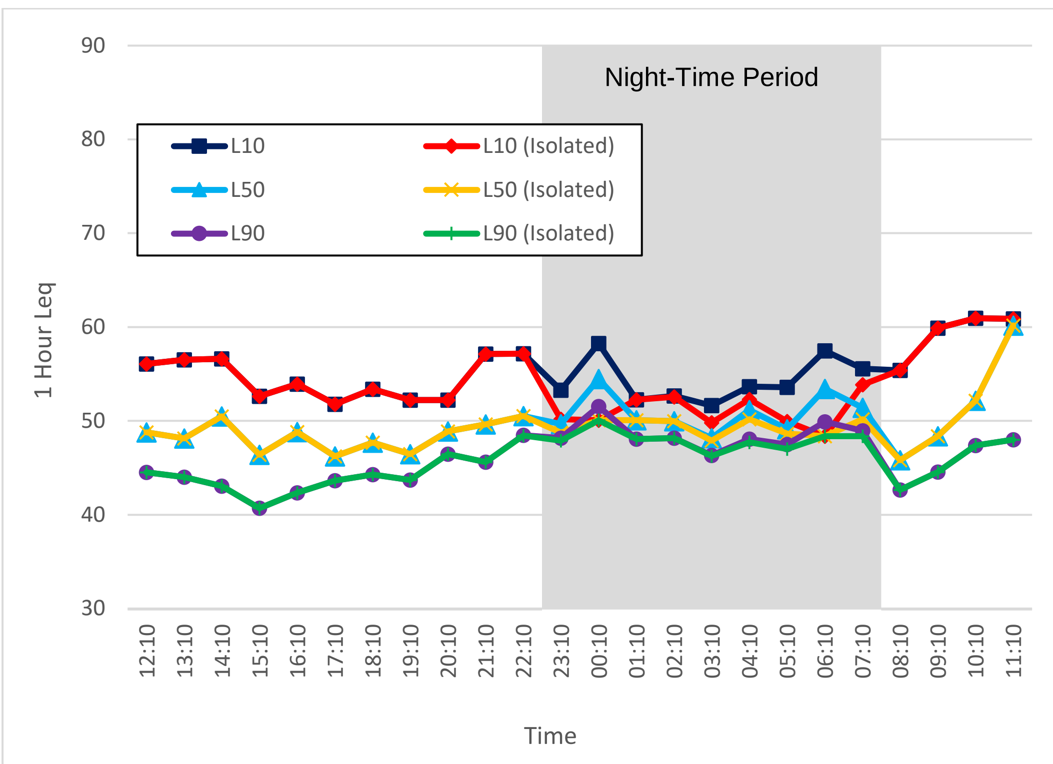

Figure 28. Noise Monitor #2, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 28 - 29, 2016) [2]

[1] Data from 05:13 to 07:00 was entirely removed due to traffic along the adjacent road.
[2] Data from 05:03 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #2

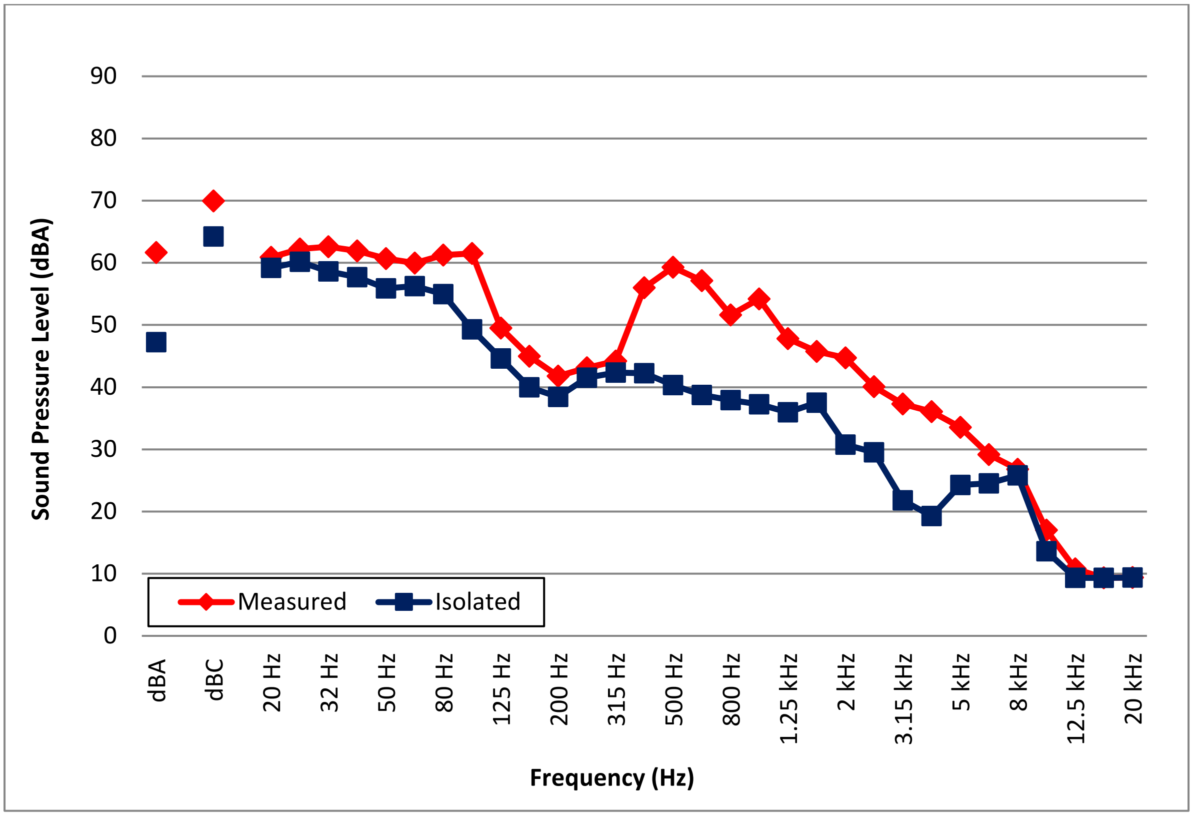

Figure 29. Noise Monitor #2, 1/3 Octave L_{eq} Sound Levels (June 27 - 28, 2016)

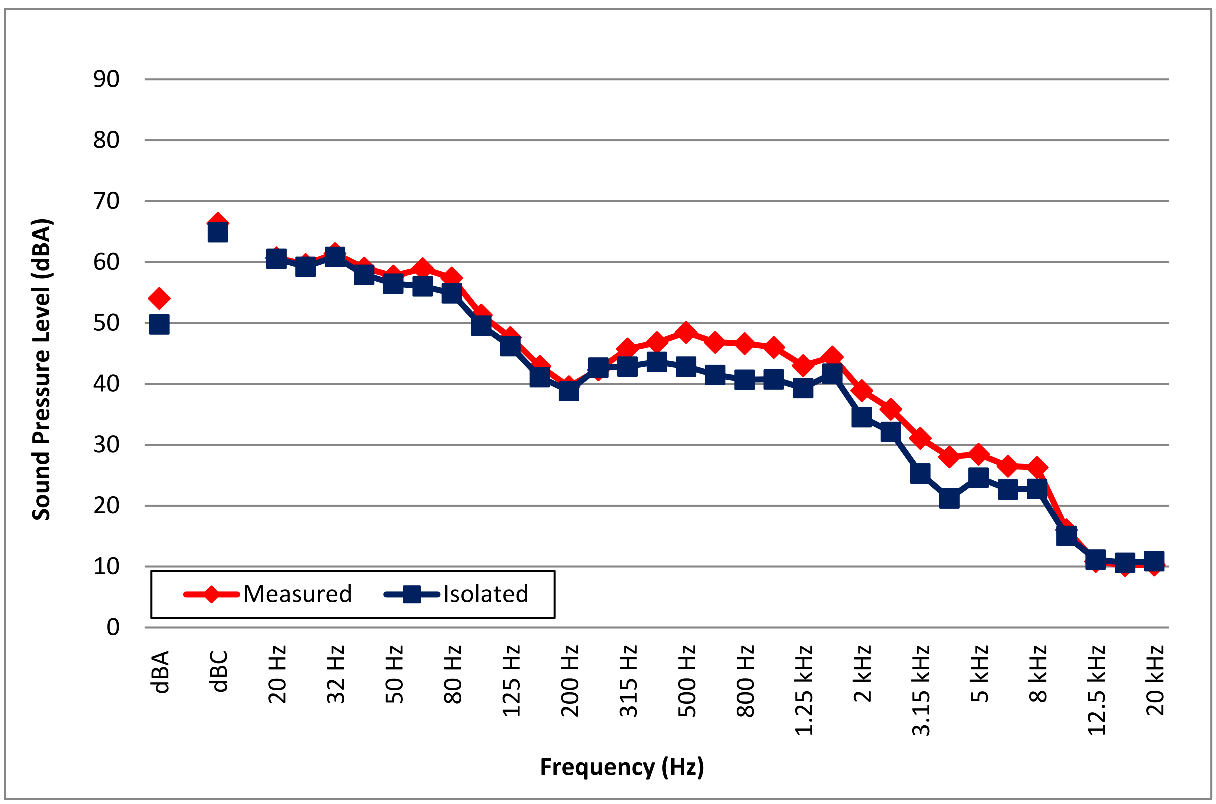

Figure 30. Noise Monitor #2, 1/3 Octave L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #3

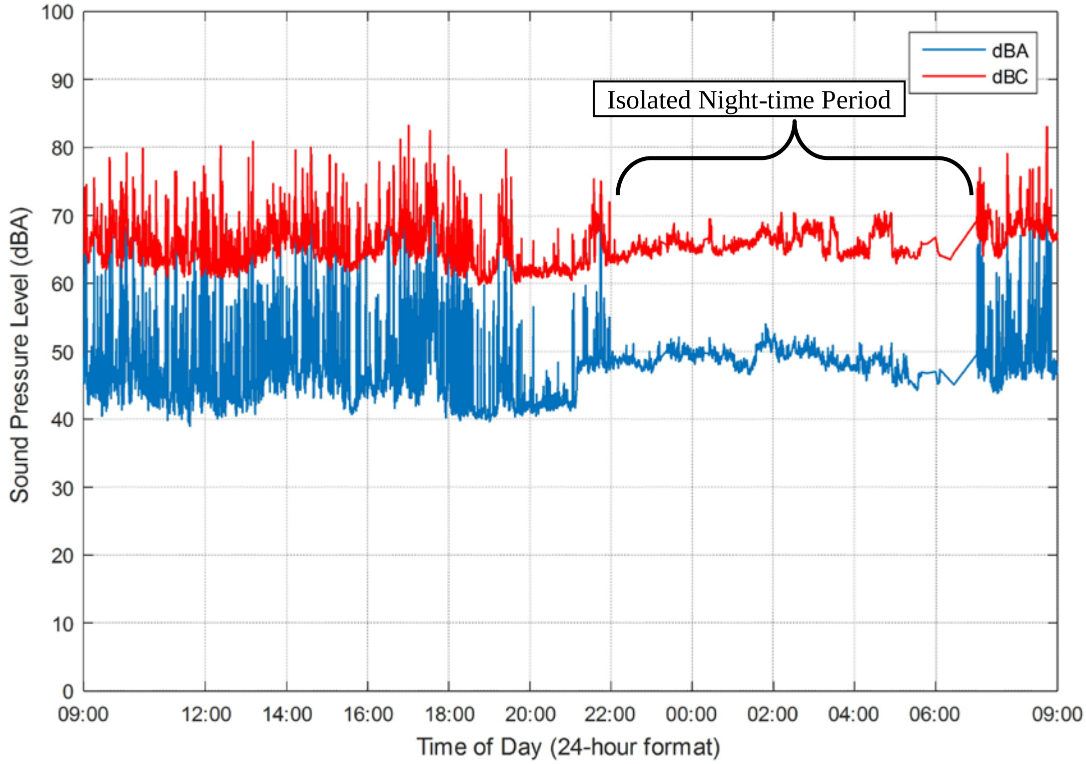

Figure 31. Noise Monitor #3, 15-Second L_{eq} Sound Levels (August 2 - 3, 2016)

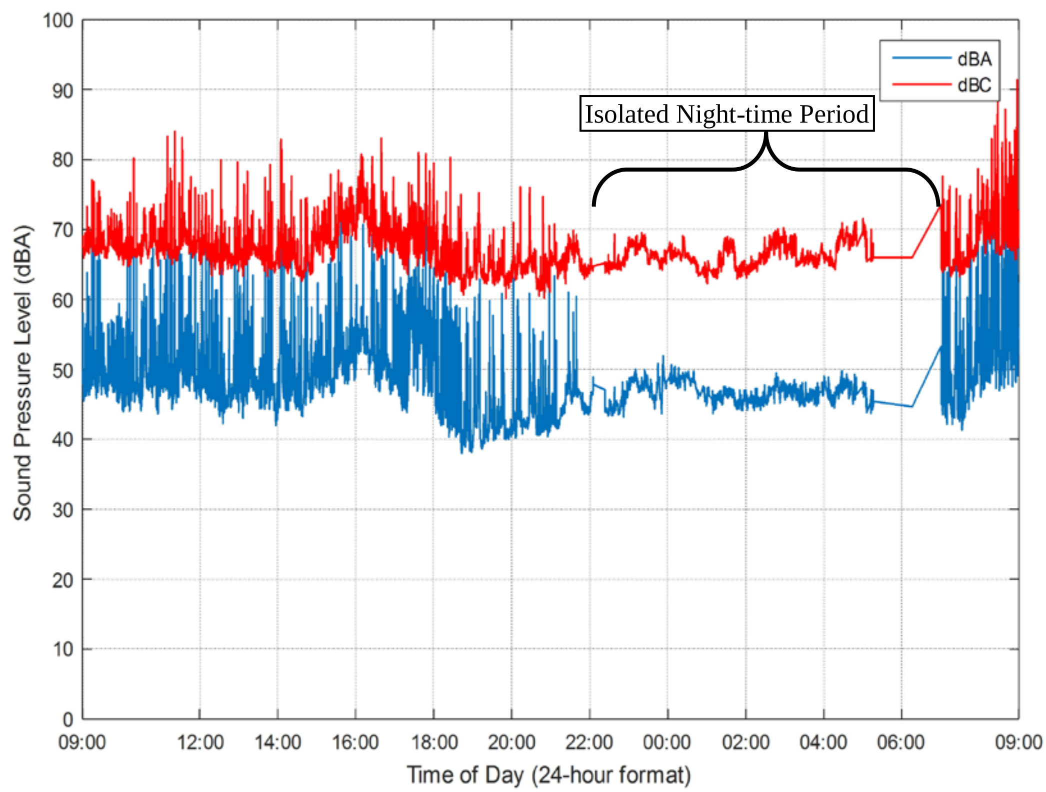

Figure 32. Noise Monitor #3, 15-Second L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #3

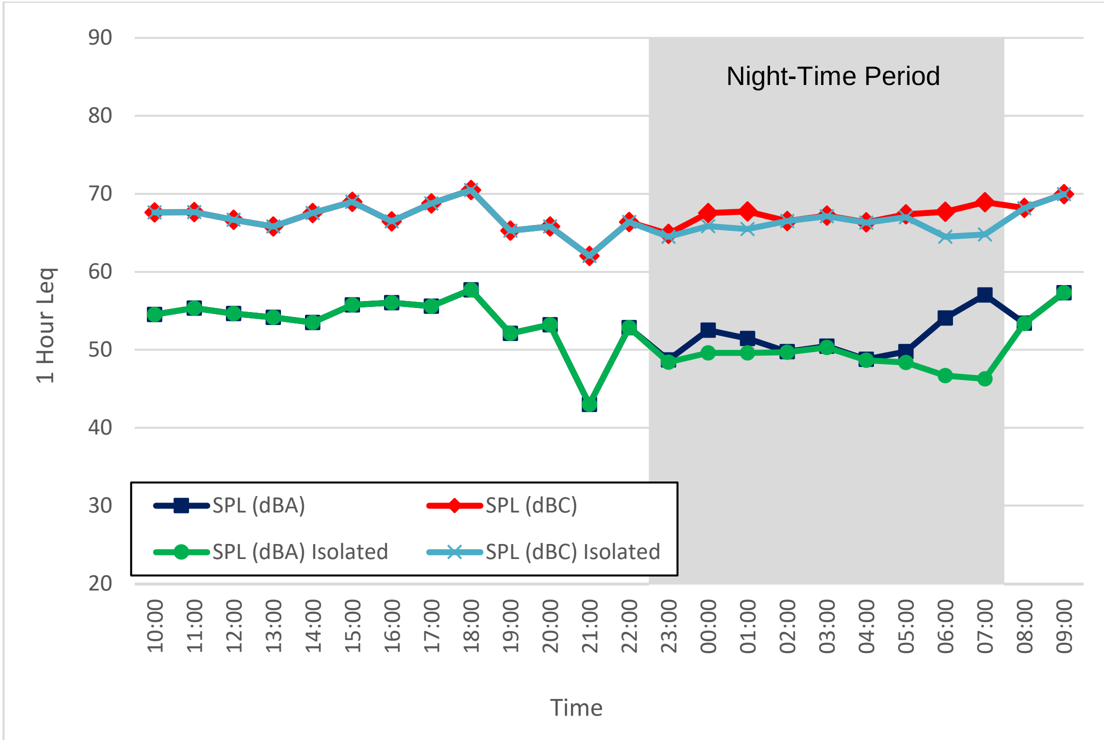

Figure 33. Noise Monitor #3, 1-Hour L_{eq} Sound Levels (August 2 - 3, 2016)

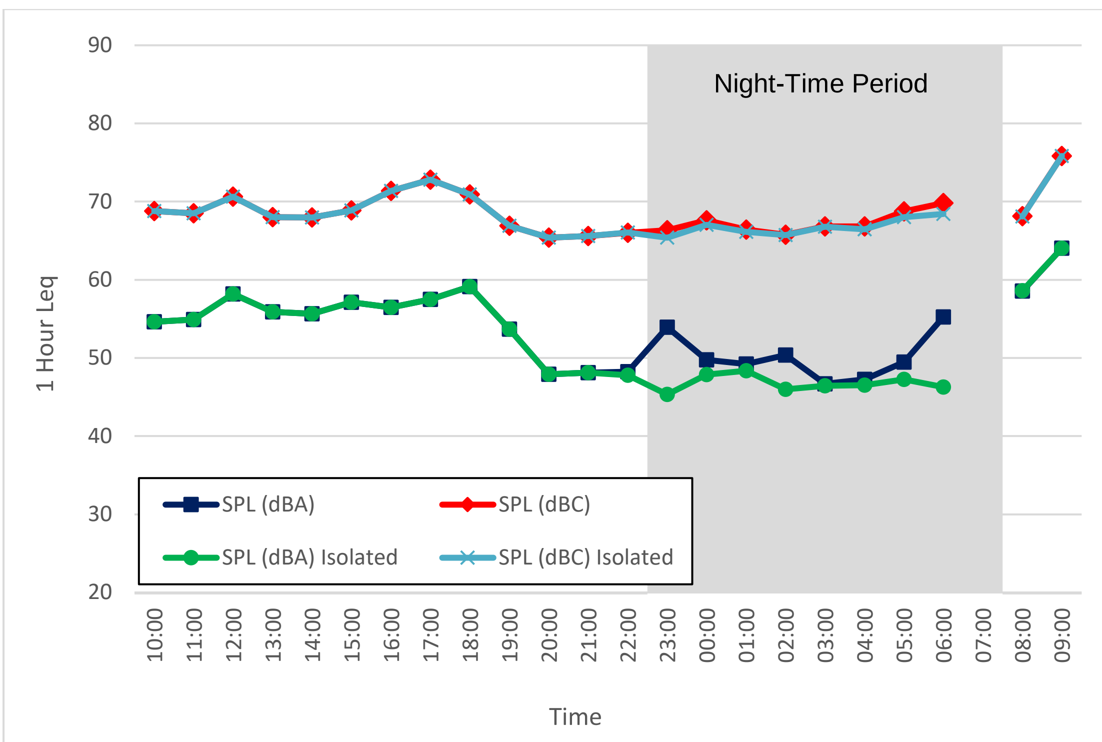

Figure 34. Noise Monitor #3, 1-Hour L_{eq} Sound Levels (August 3 - 4, 2016) [1]

[1] Again, it should be noted that data from 05:16 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #3

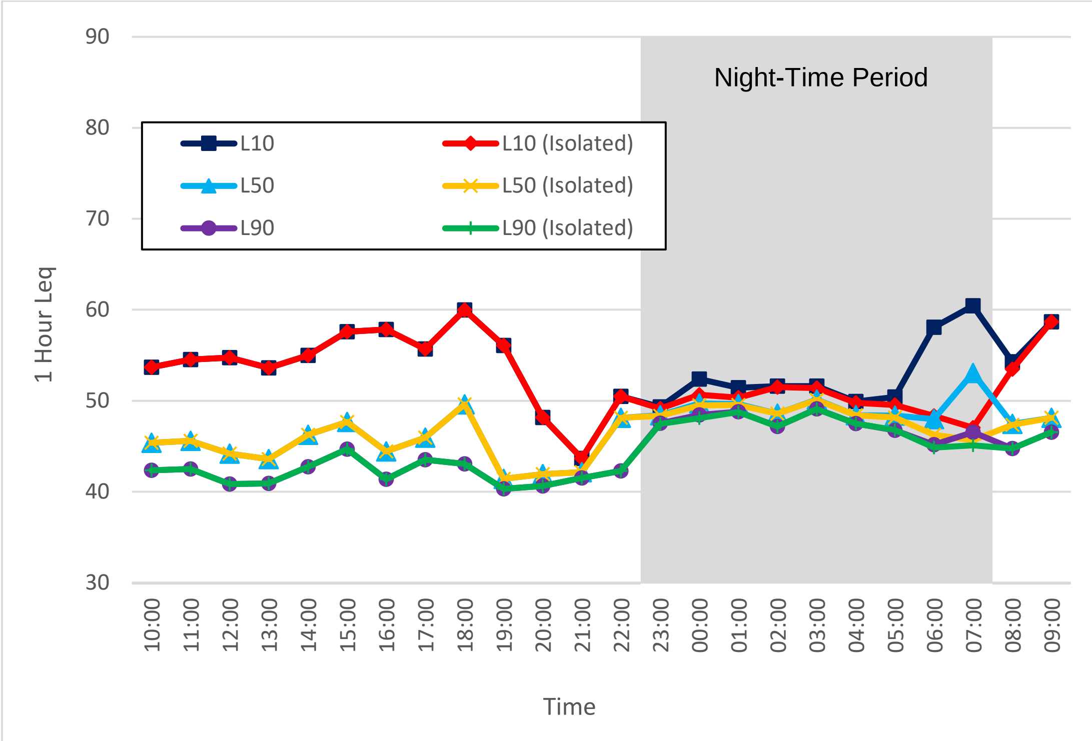

Figure 35. Noise Monitor #3, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 2 - 3, 2016)

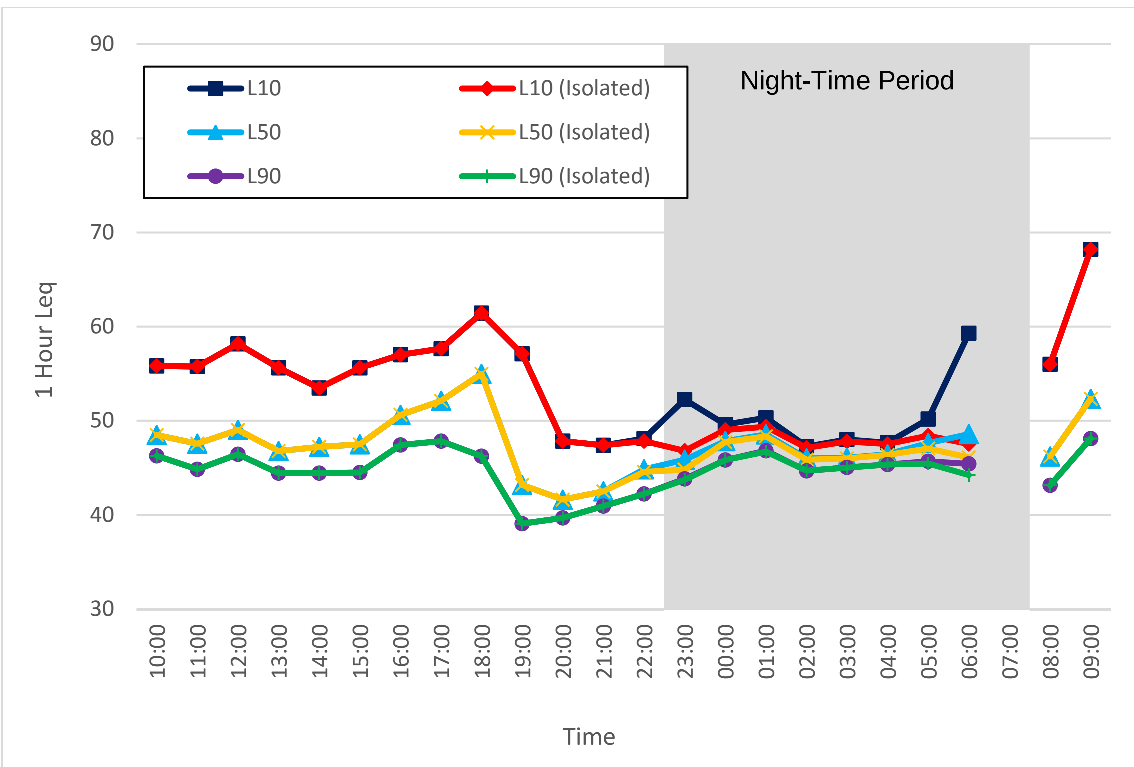

Figure 36. Noise Monitor #3, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 3 - 4, 2016) [1]

[1] Data from 05:16 to 07:00 was entirely removed due to traffic along the adjacent road.

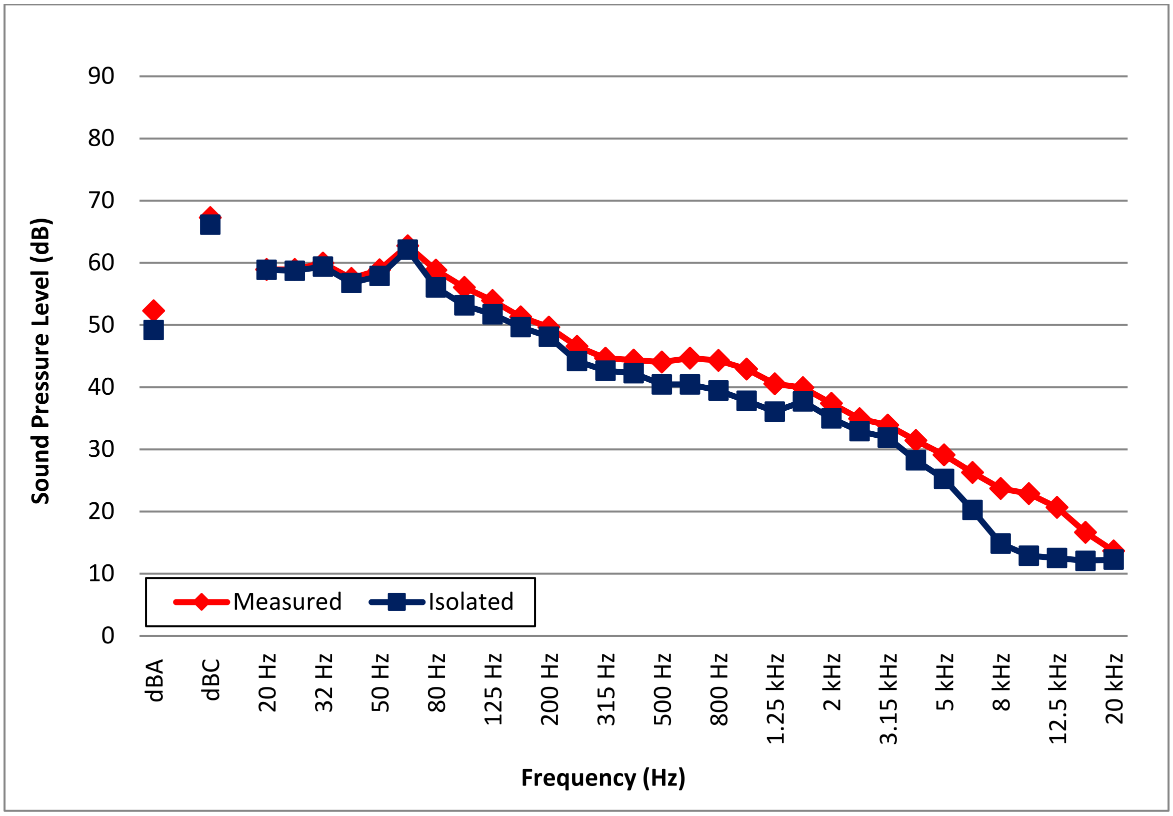

Figure 37. Noise Monitor #3, 1/3 Octave L_{eq} Sound Levels (August 2 - 3, 2016)

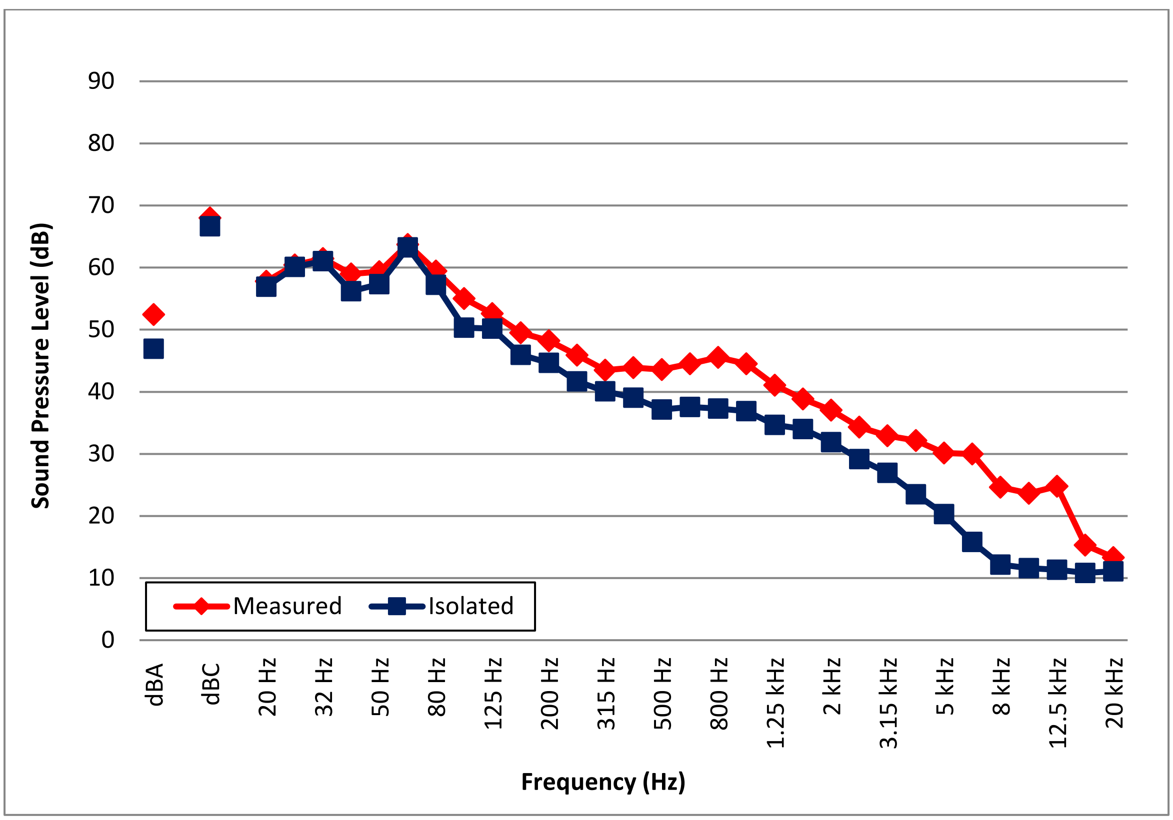

Figure 38. Noise Monitor #3, 1/3 Octave L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #4

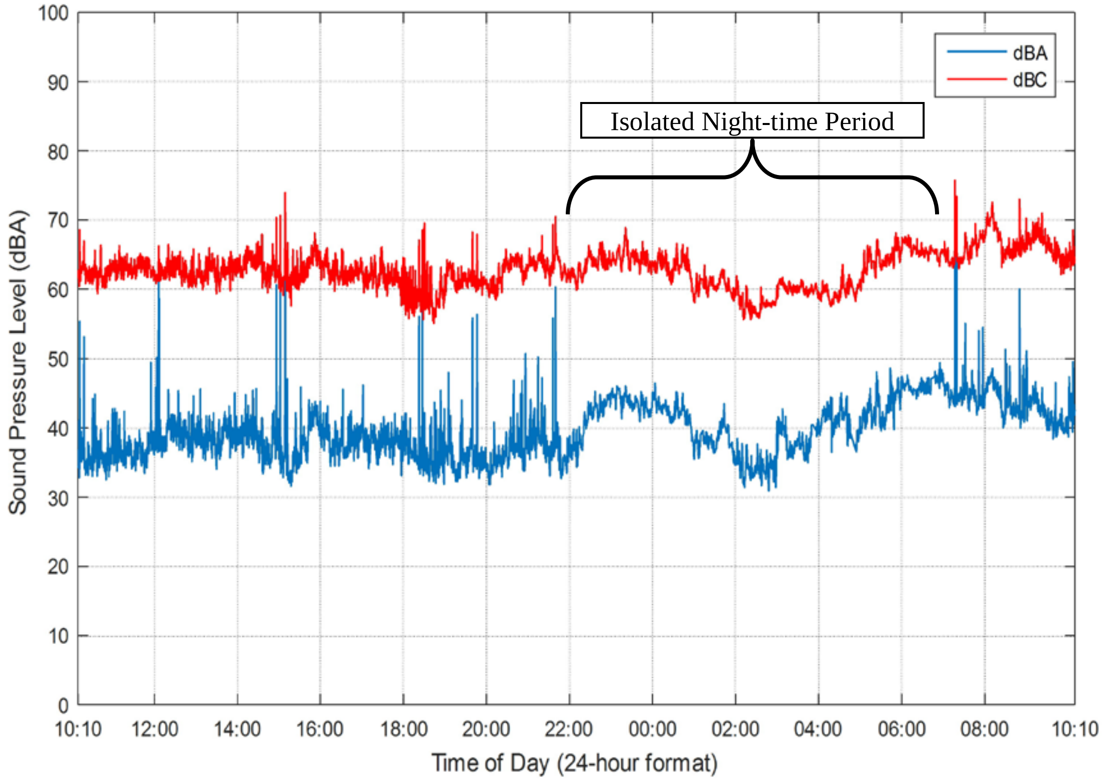

Figure 39. Noise Monitor #4, 15-Second L_{eq} Sound Levels (June 27 - 28, 2016)

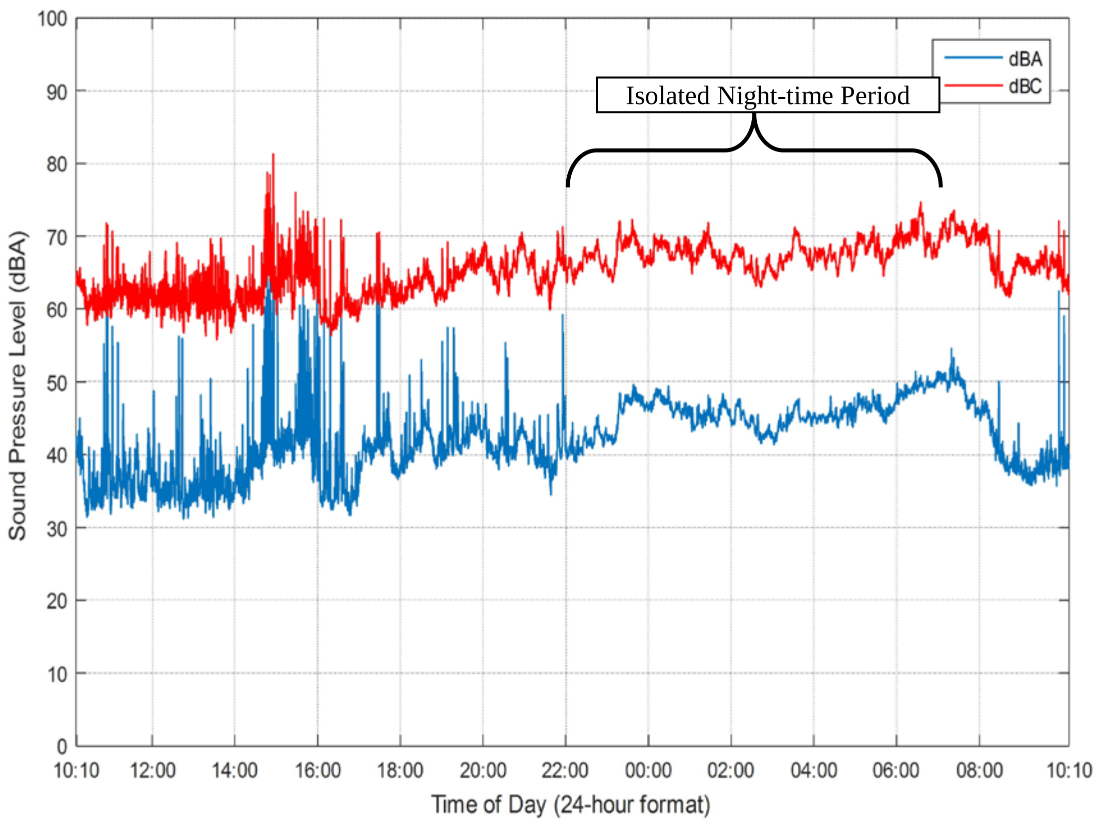

Figure 40. Noise Monitor #4, 15-Second L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #4

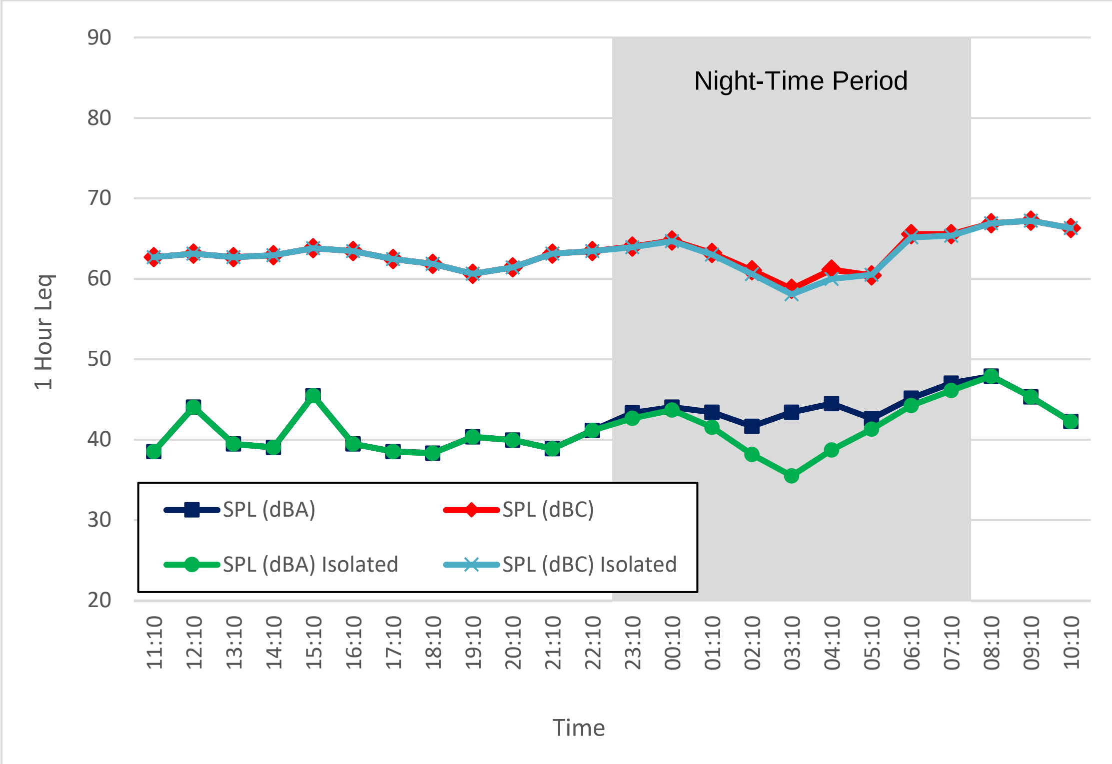

Figure 41. Noise Monitor #4, 1-Hour L_{eq} Sound Levels (June 27 - 28, 2016)

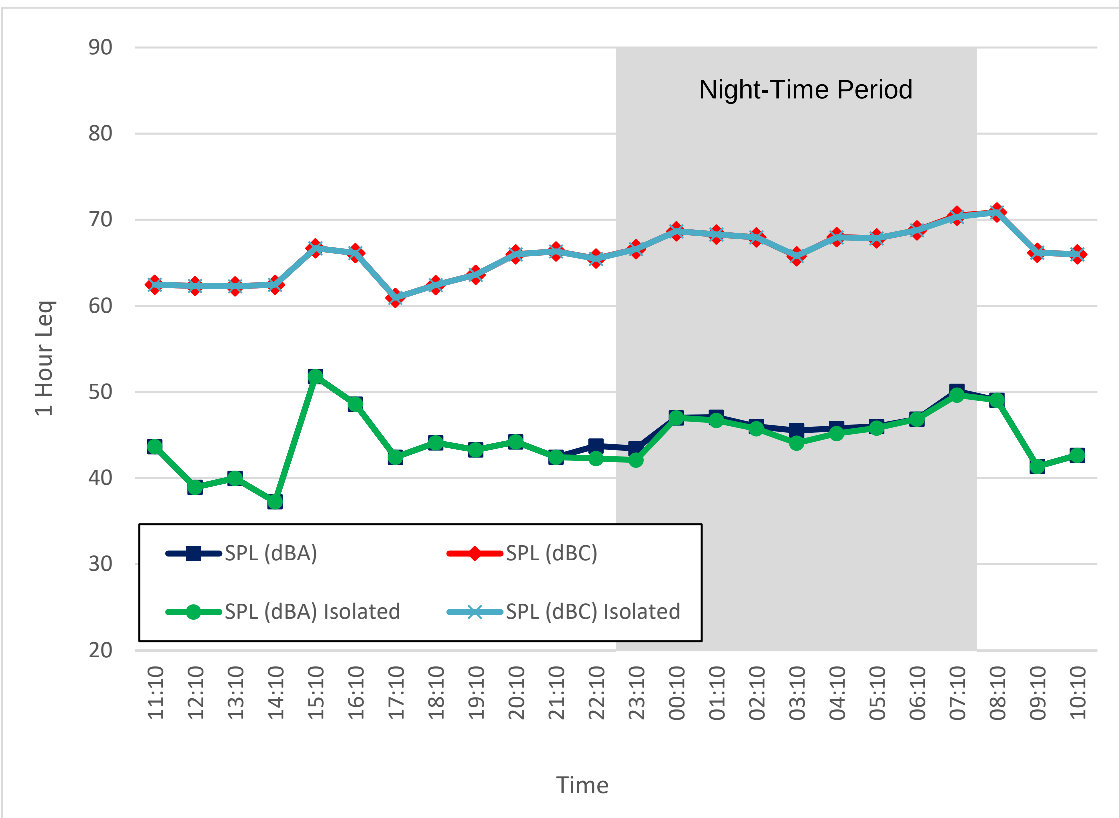

Figure 42. Noise Monitor #4, 1-Hour L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #4

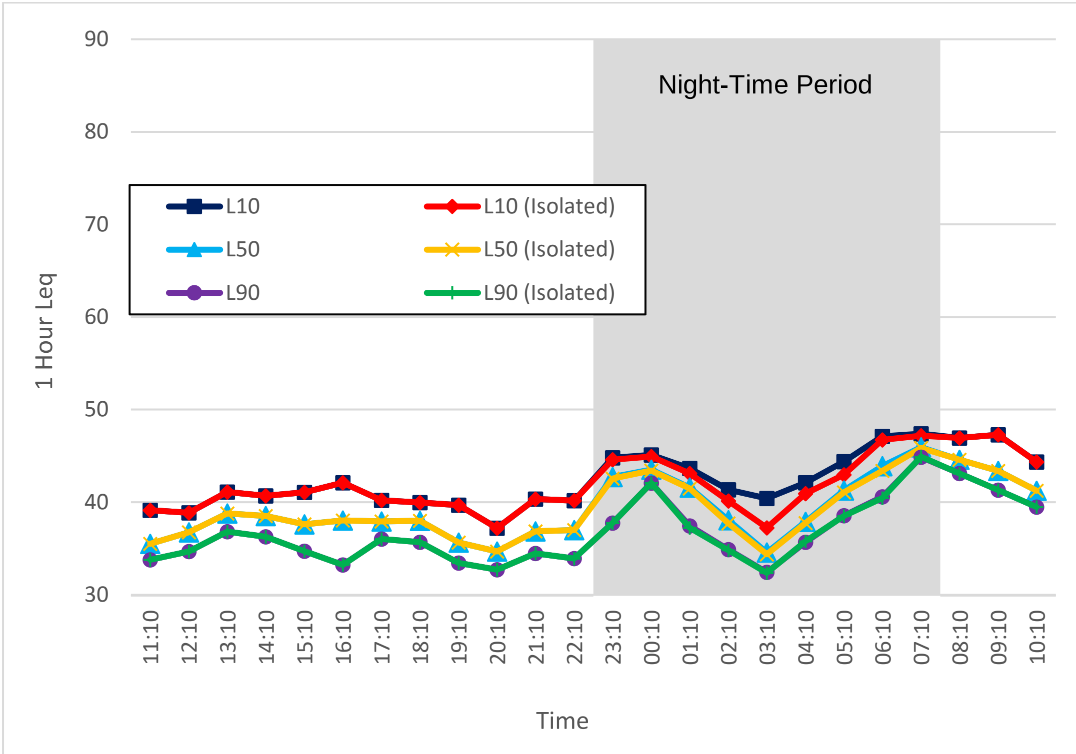

Figure 43. Noise Monitor #4, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 27 - 28, 2016)

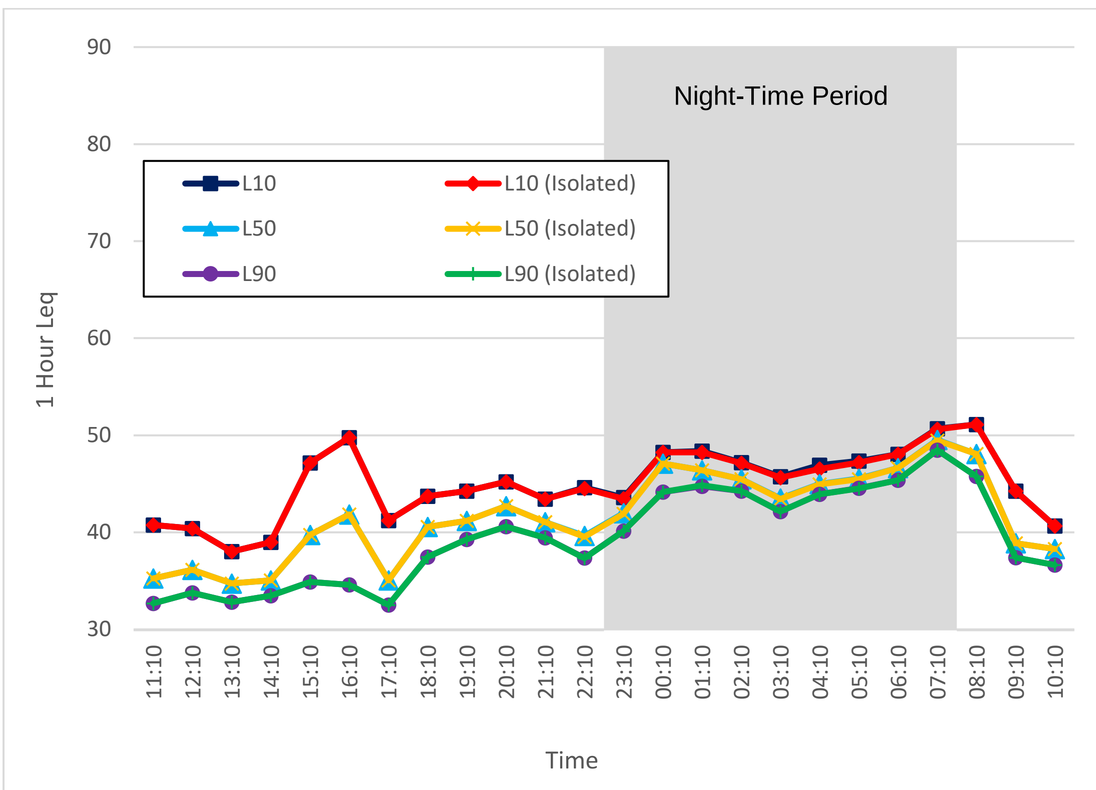

Figure 44. Noise Monitor #4, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #4

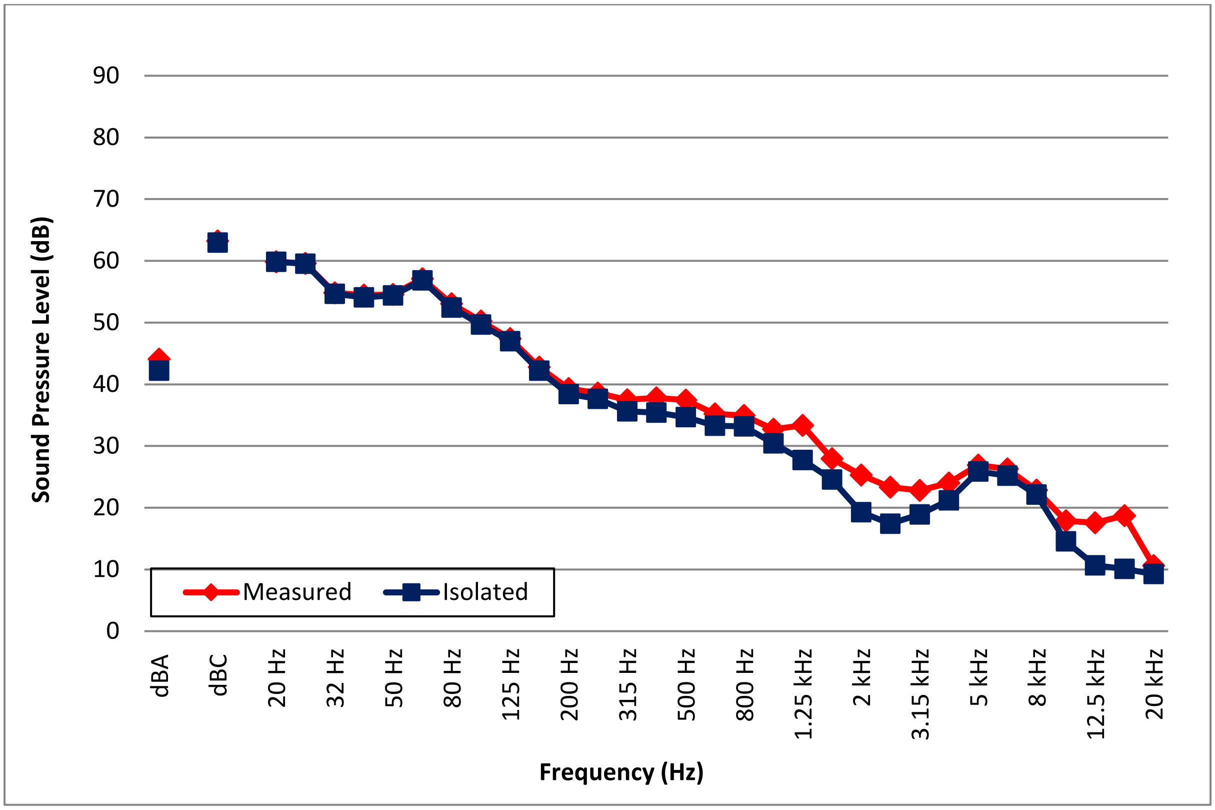

Figure 45. Noise Monitor #4, 1/3 Octave L_{eq} Sound Levels (June 27 - 28, 2016)

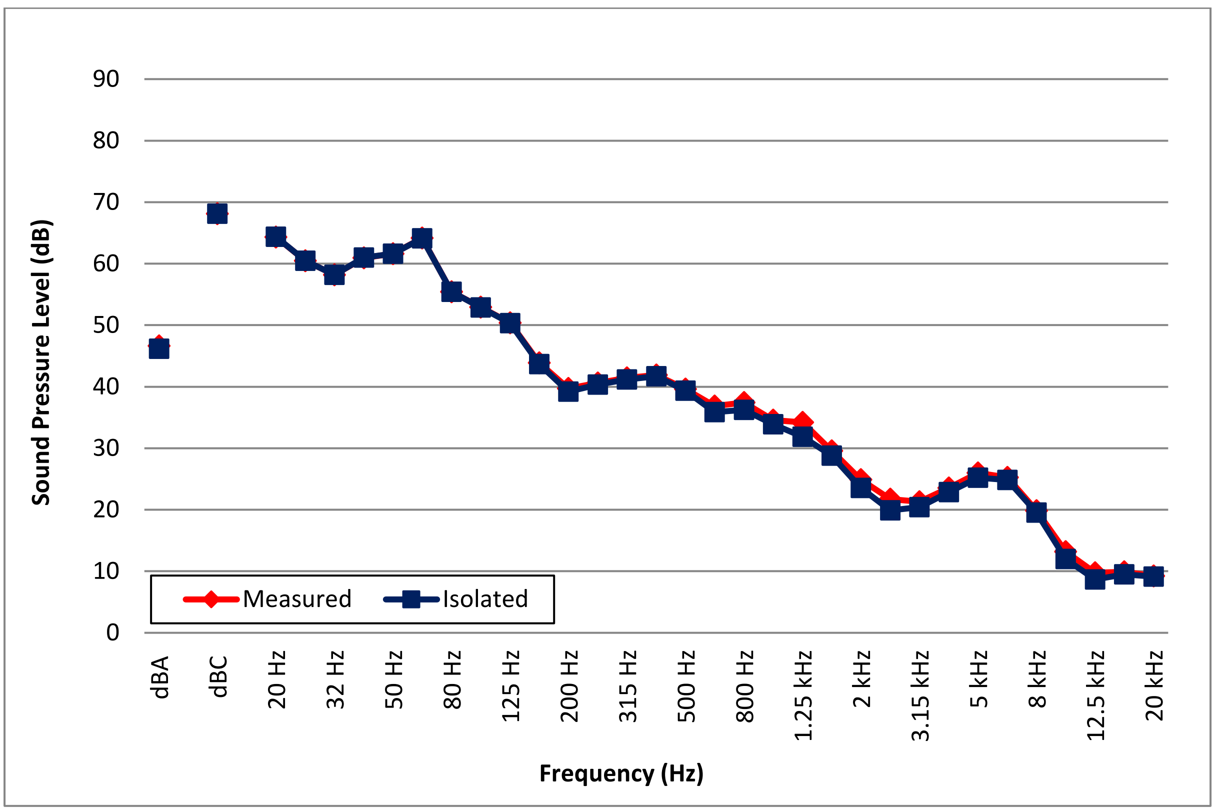

Figure 46. Noise Monitor #4, 1/3 Octave L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #5

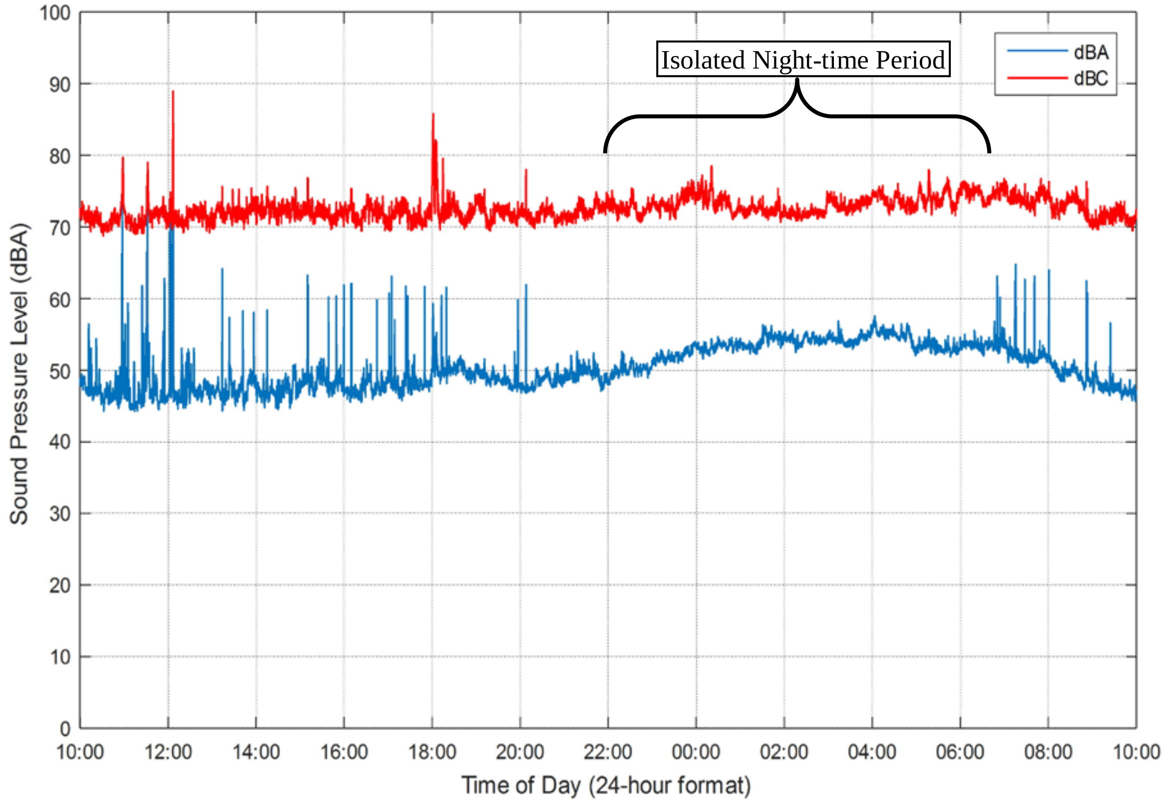

Figure 47. Noise Monitor #5, 15-Second L_{eq} Sound Levels (June 27 - 28, 2016)

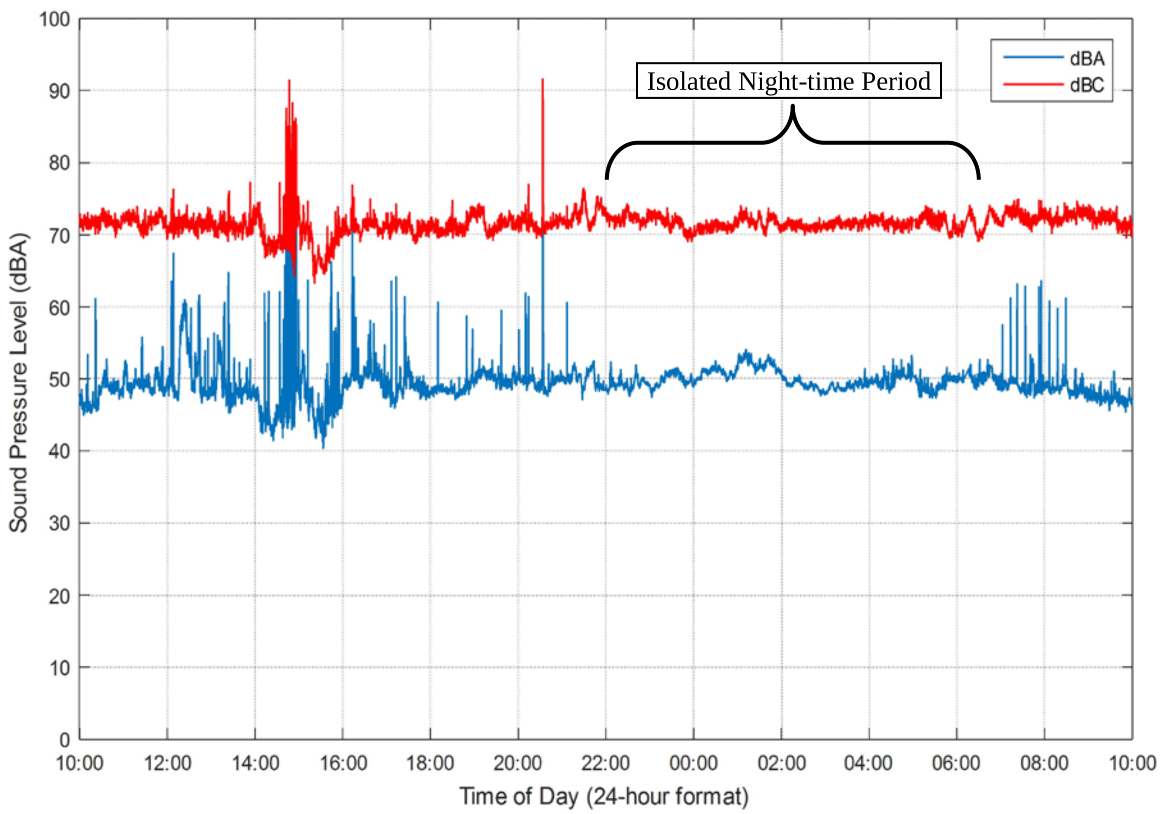

Figure 48. Noise Monitor #5, 15-Second L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #5

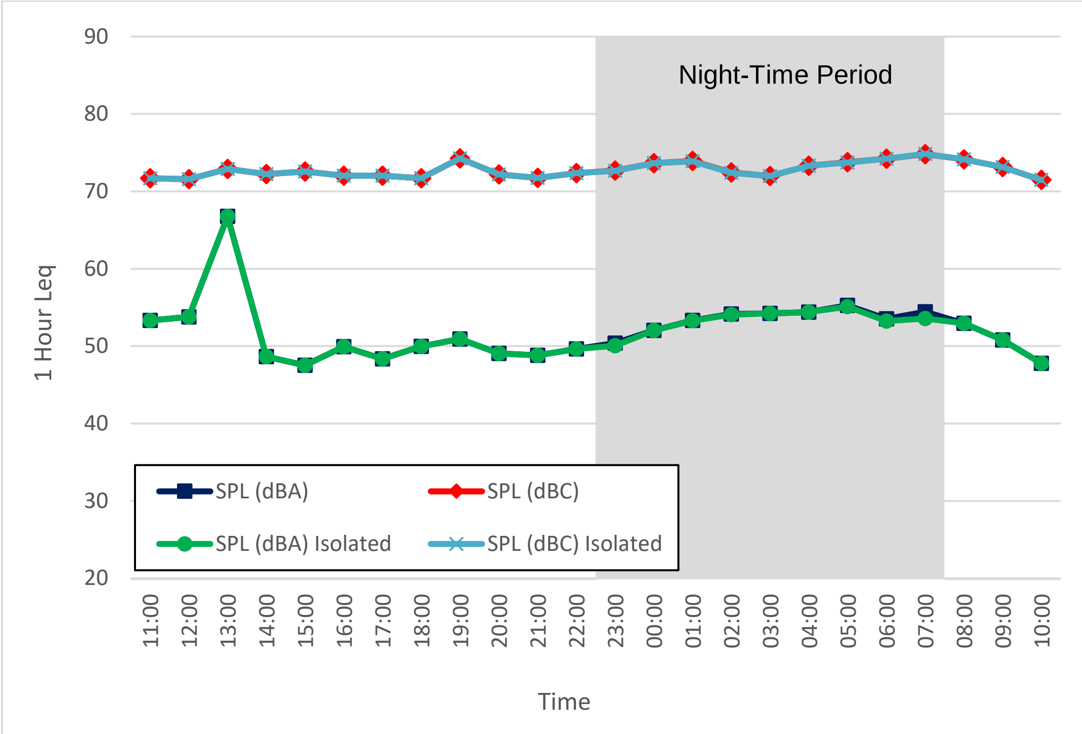

Figure 49. Noise Monitor #5, 1-Hour L_{eq} Sound Levels (June 27 - 28, 2016)

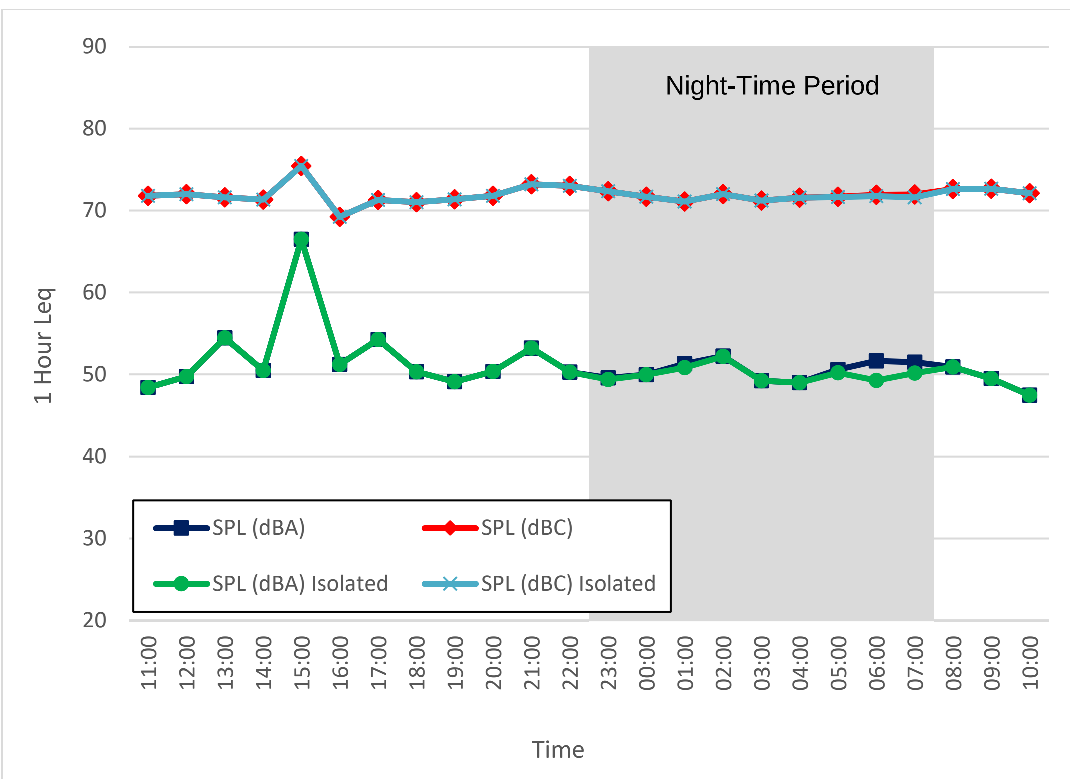

Figure 50. Noise Monitor #5, 1-Hour L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #5

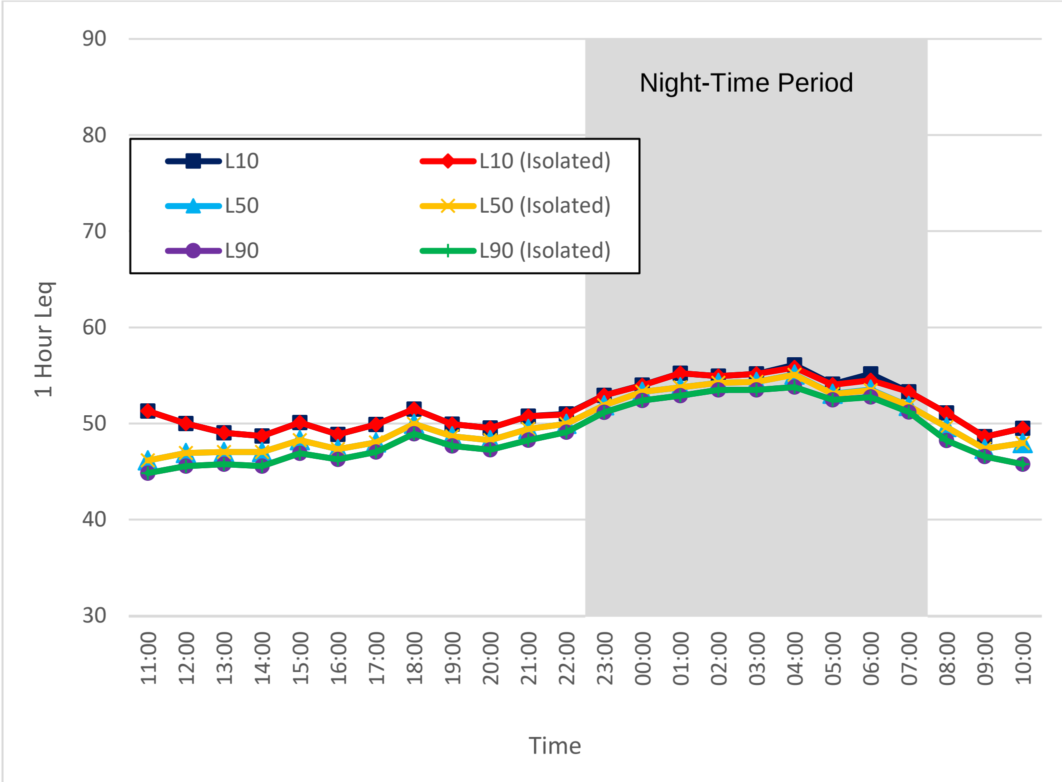

Figure 51. Noise Monitor #5, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 27 - 28, 2016)

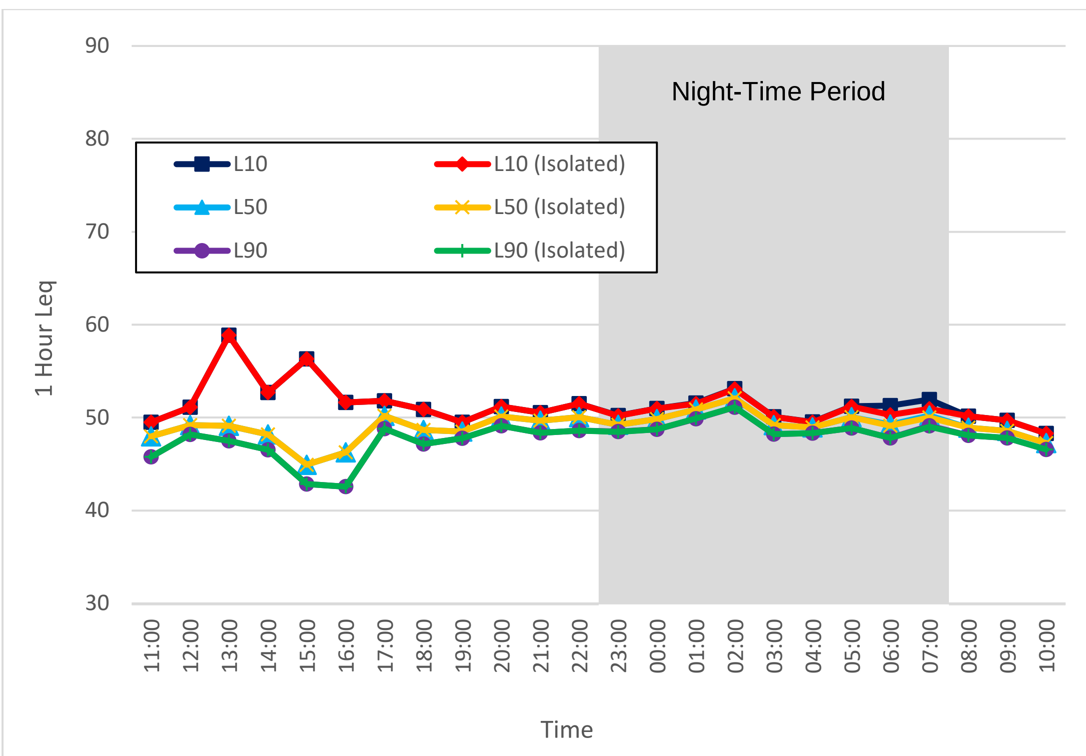

Figure 52. Noise Monitor #5, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 28 - 29, 2016)

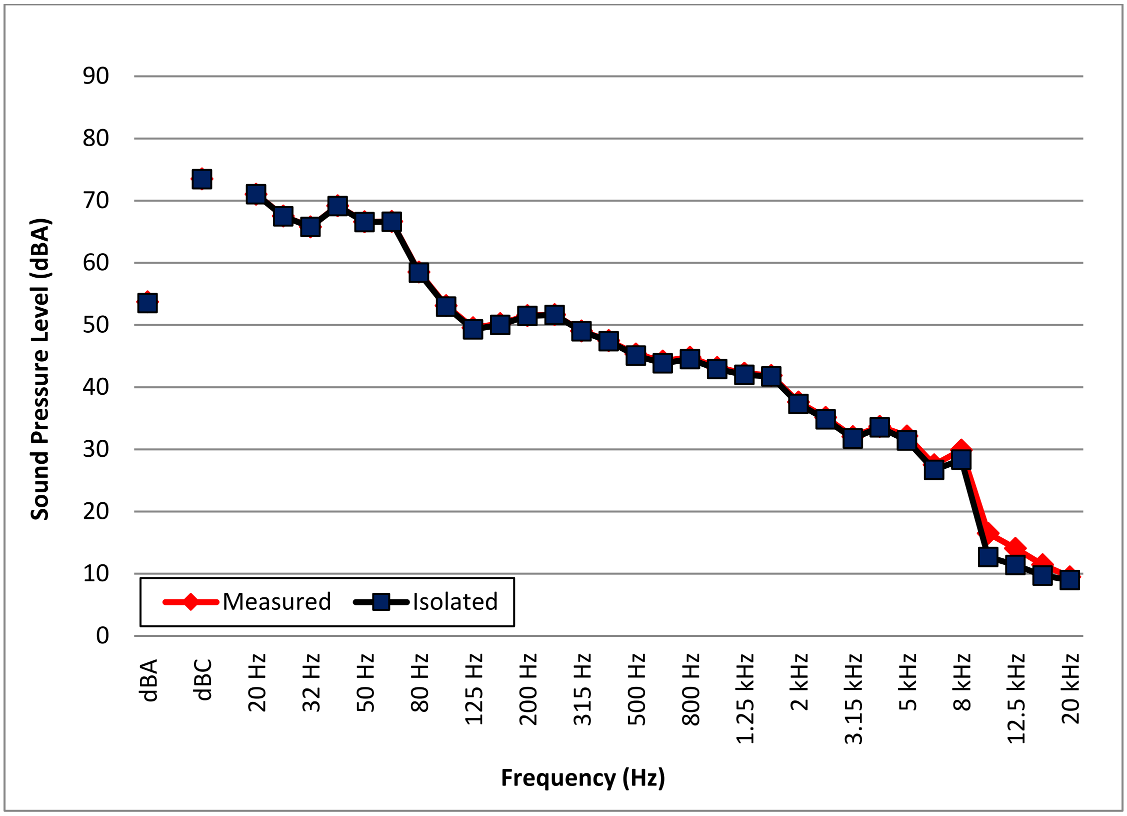

Figure 53. Noise Monitor #5, 1/3 Octave L_{eq} Sound Levels (June 27 - 28, 2016)

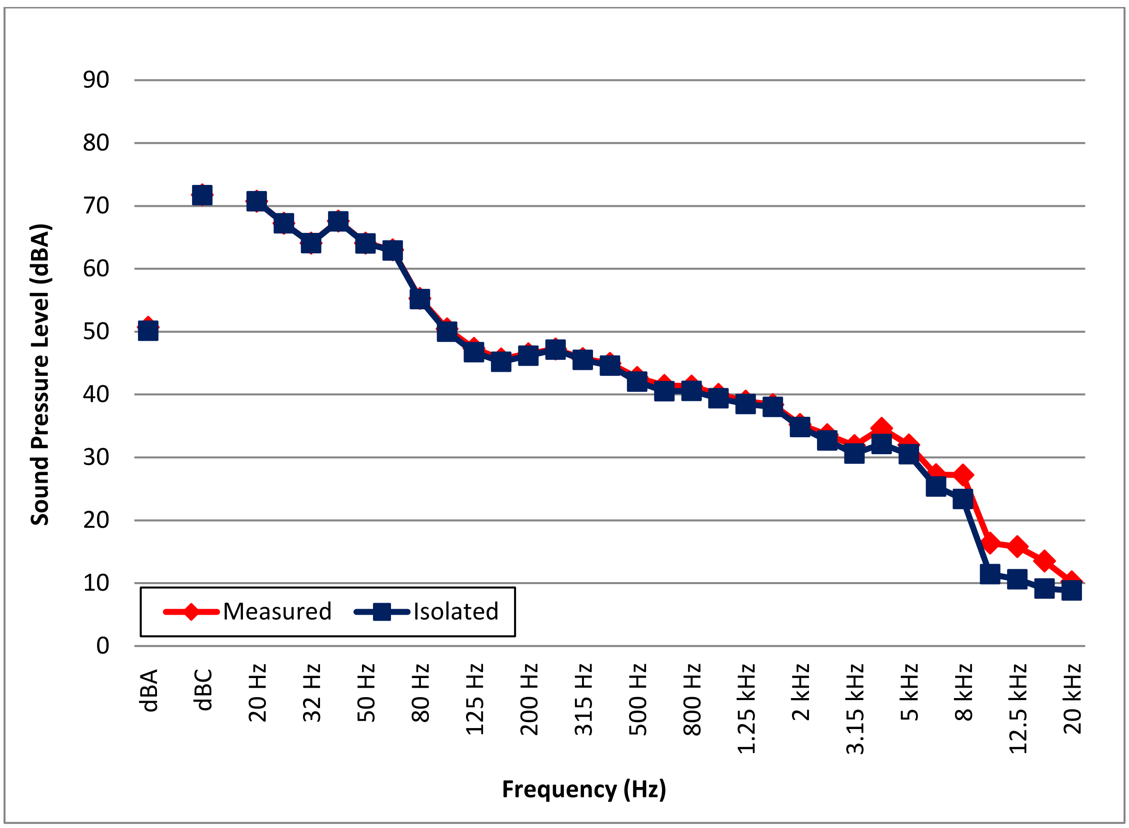

Figure 54. Noise Monitor #5, 1/3 Octave L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #6

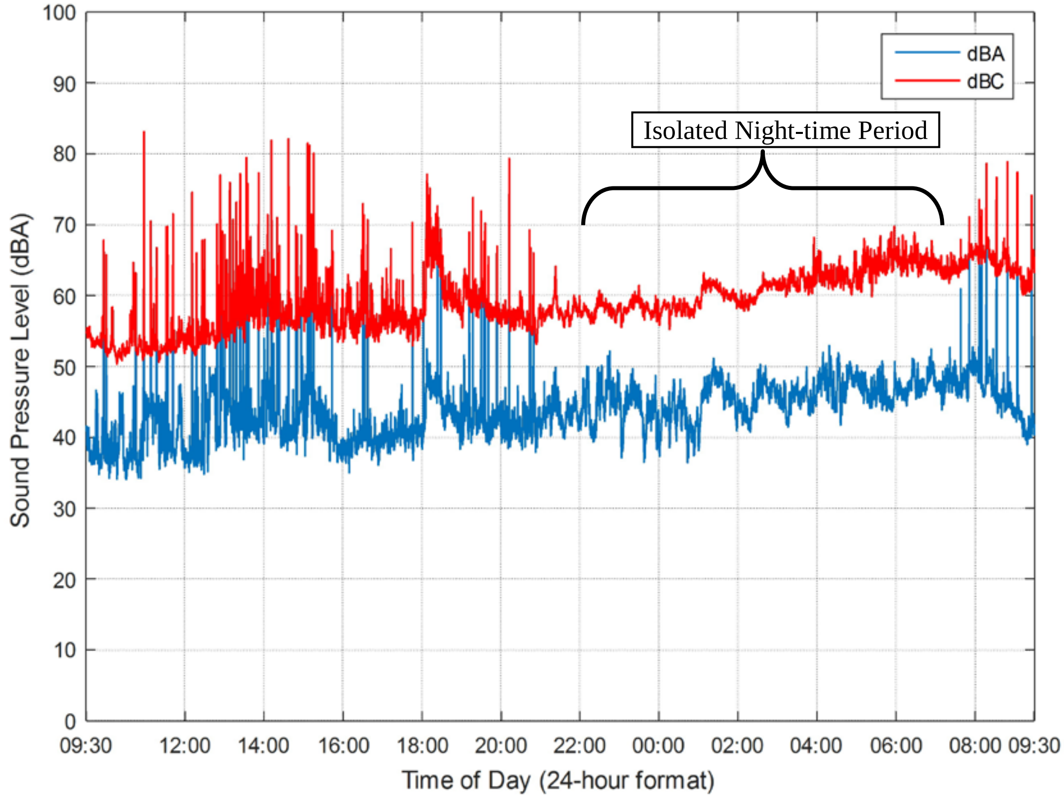

Figure 55. Noise Monitor #6, 15-Second L_{eq} Sound Levels (June 27 - 28, 2016)

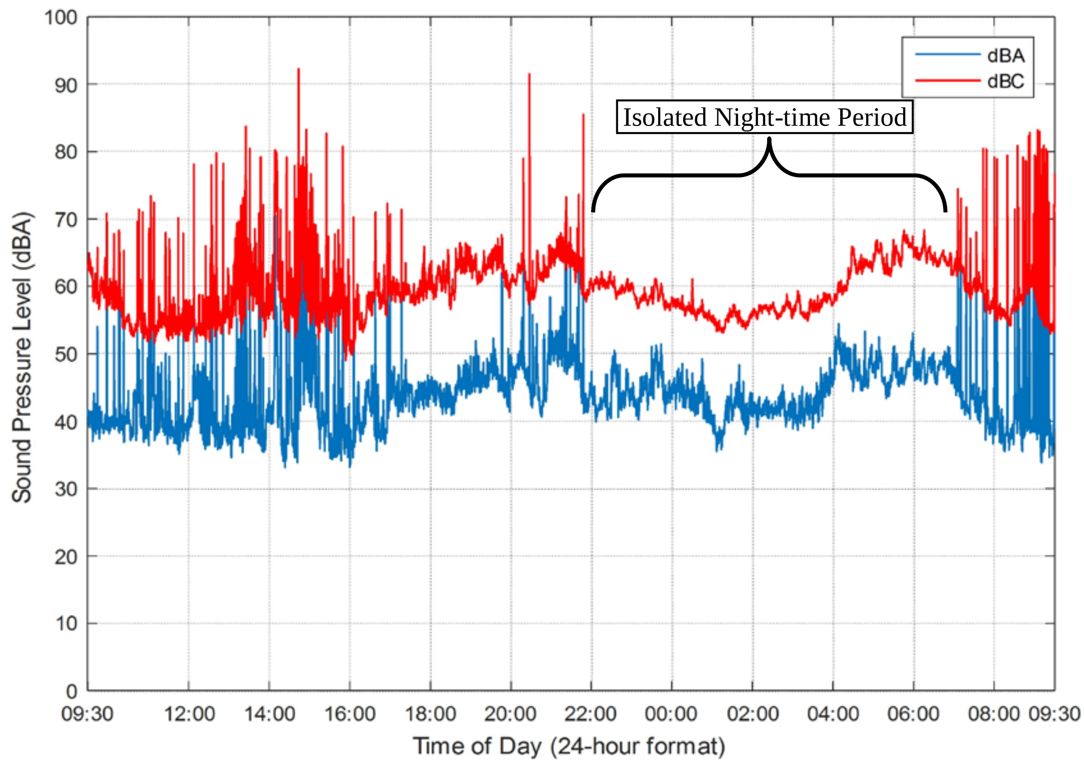

Figure 56. Noise Monitor #6, 15-Second L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #6

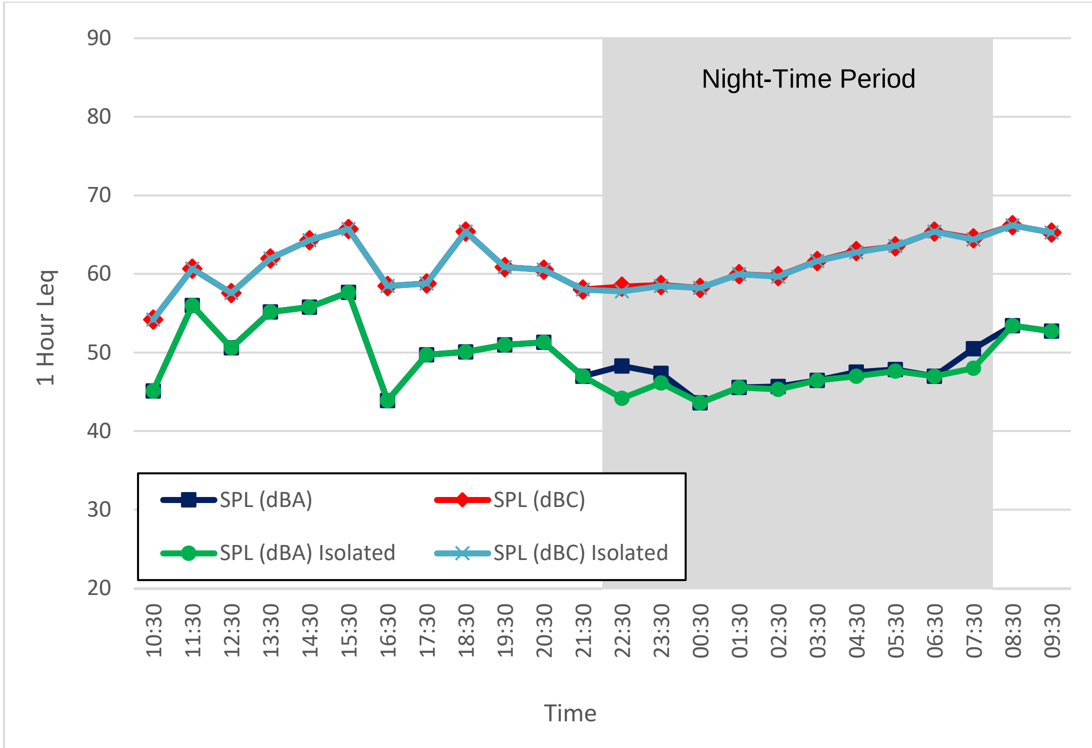

Figure 57. Noise Monitor #6, 1-Hour L_{eq} Sound Levels (June 27 - 28, 2016)

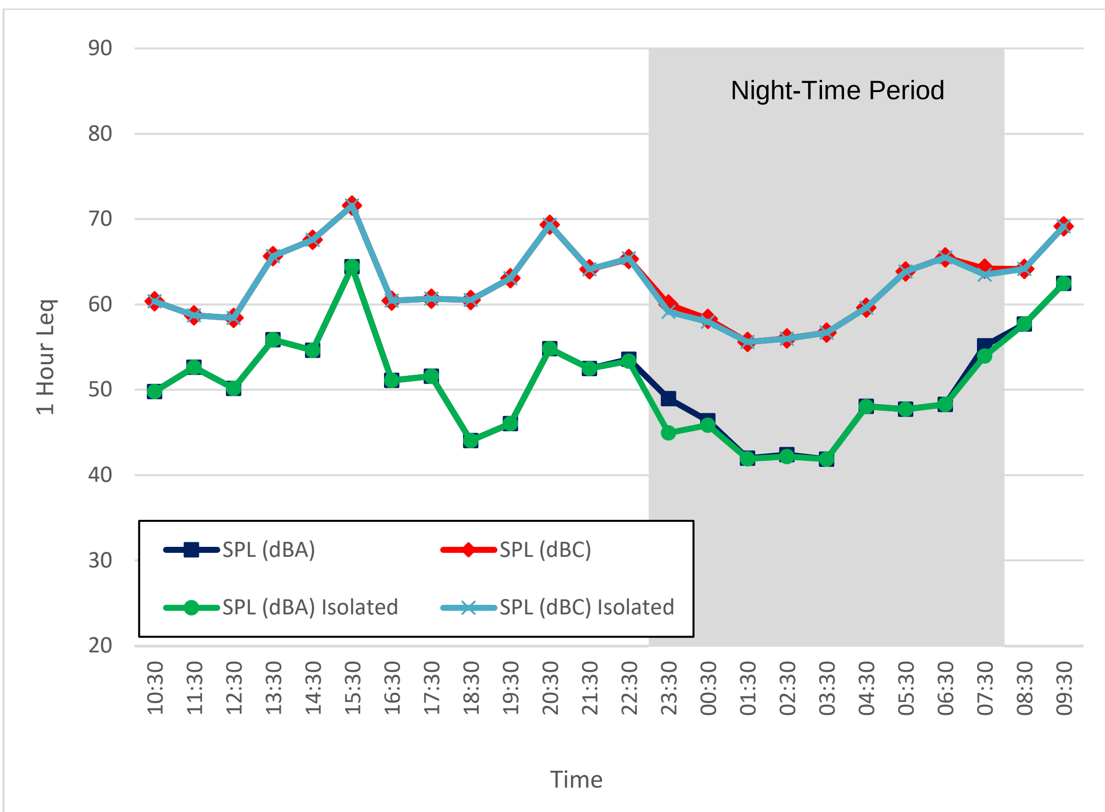

Figure 58. Noise Monitor #6, 1-Hour L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #6

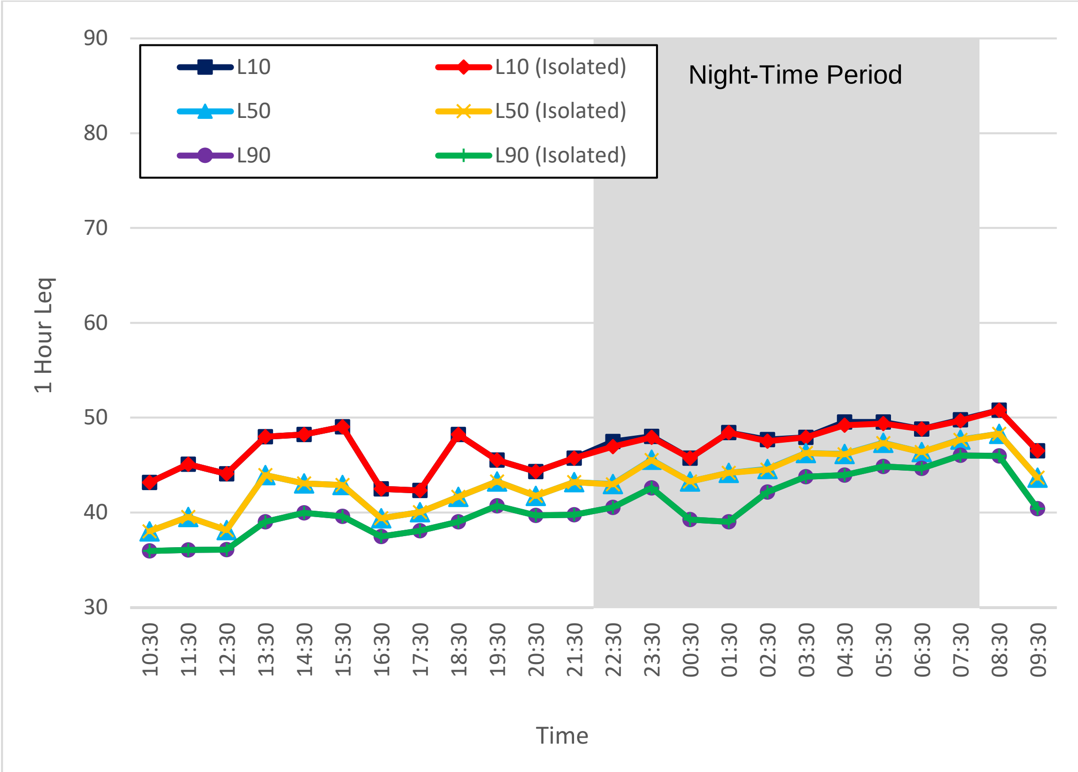

Figure 59. Noise Monitor #6, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 27 - 28, 2016)

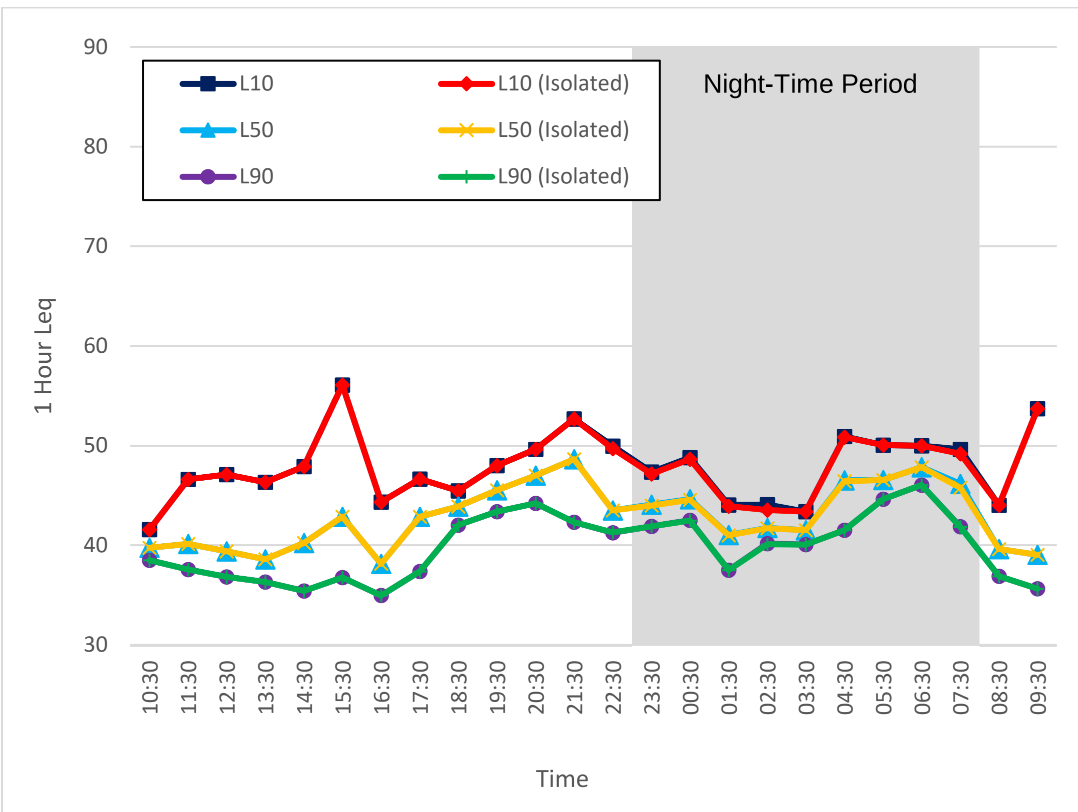

Figure 60. Noise Monitor #6, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 28 - 29, 2016)

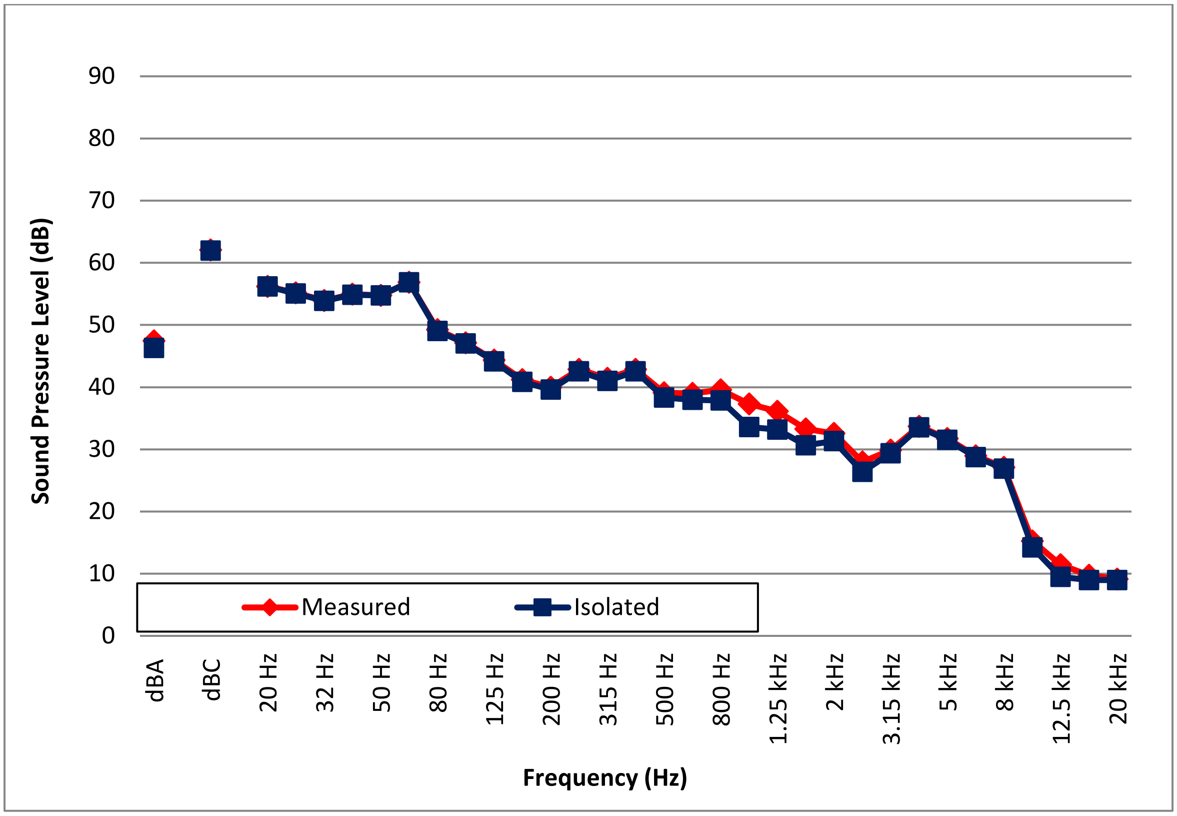

Figure 61. Noise Monitor #6, 1/3 Octave L_{eq} Sound Levels (June 27 - 28, 2016)

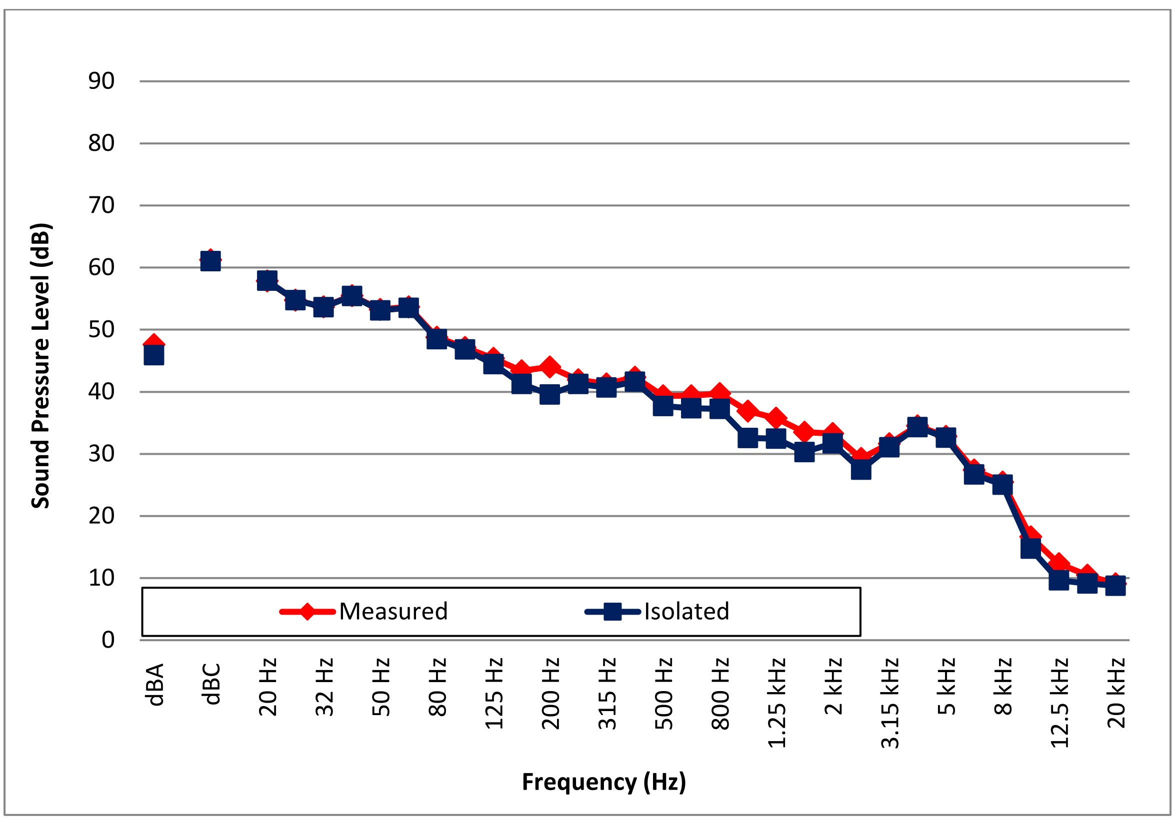

Figure 62. Noise Monitor #6, 1/3 Octave L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #8

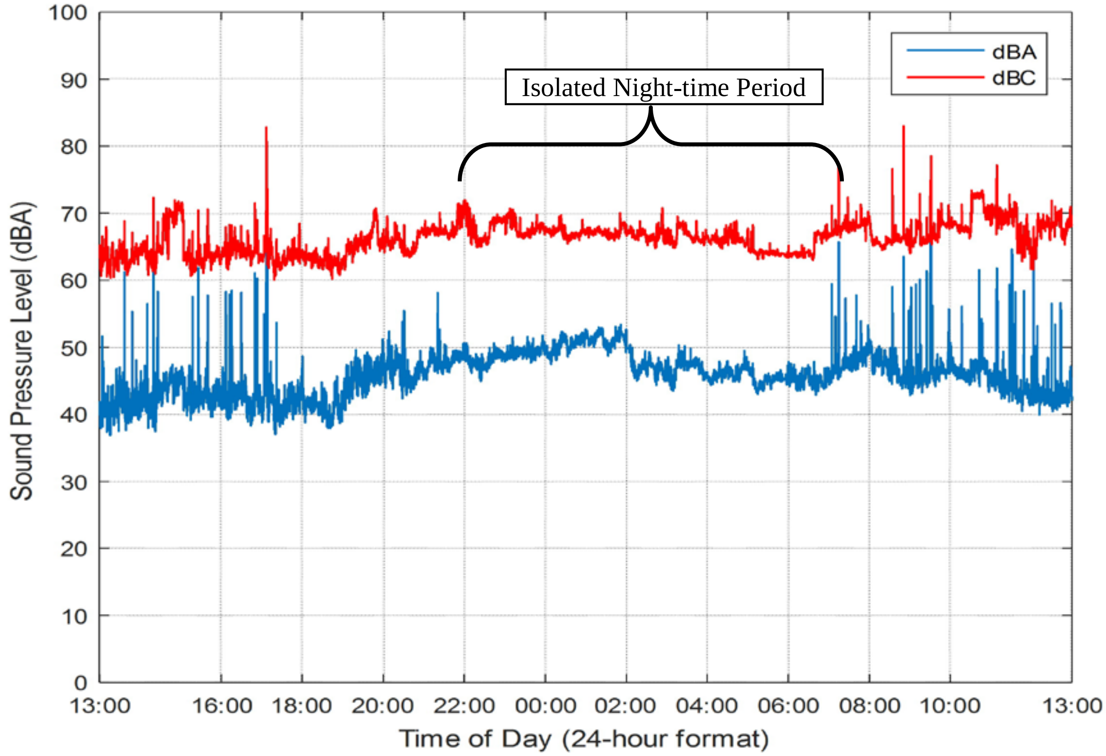

Figure 63. Noise Monitor #8, 15-Second L_{eq} Sound Levels (August 2 - 3, 2016)

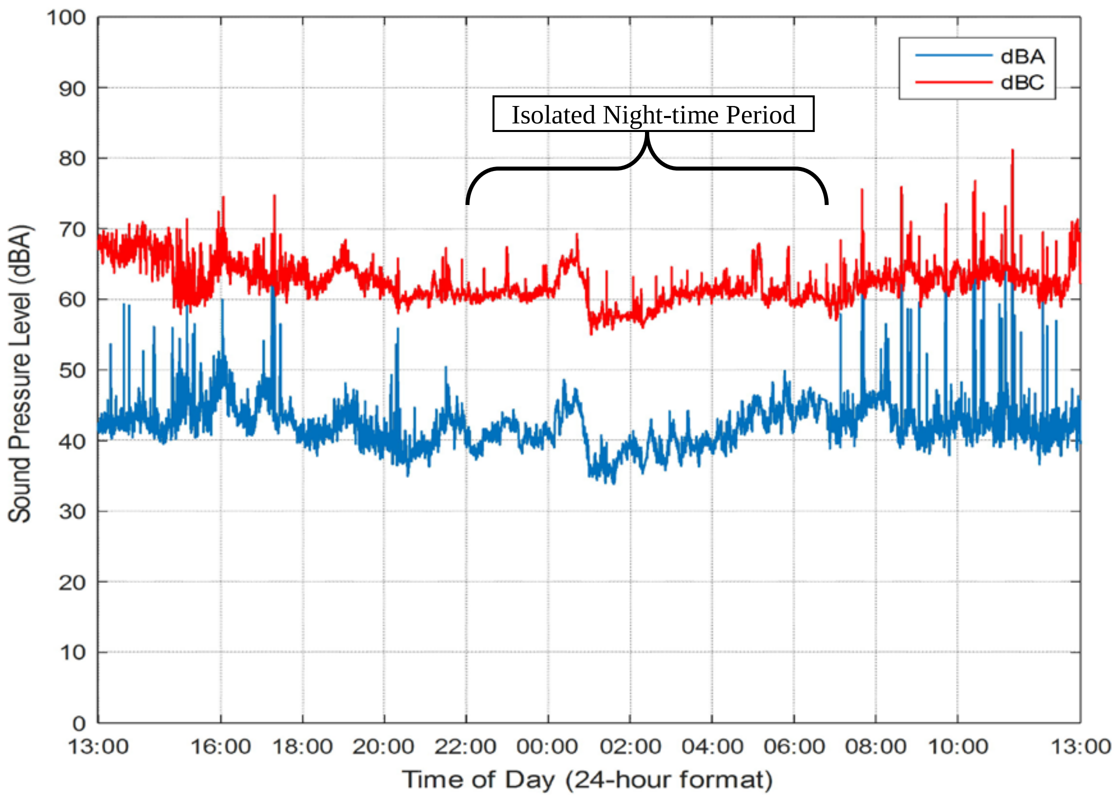

Figure 64. Noise Monitor #8, 15-Second L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #8

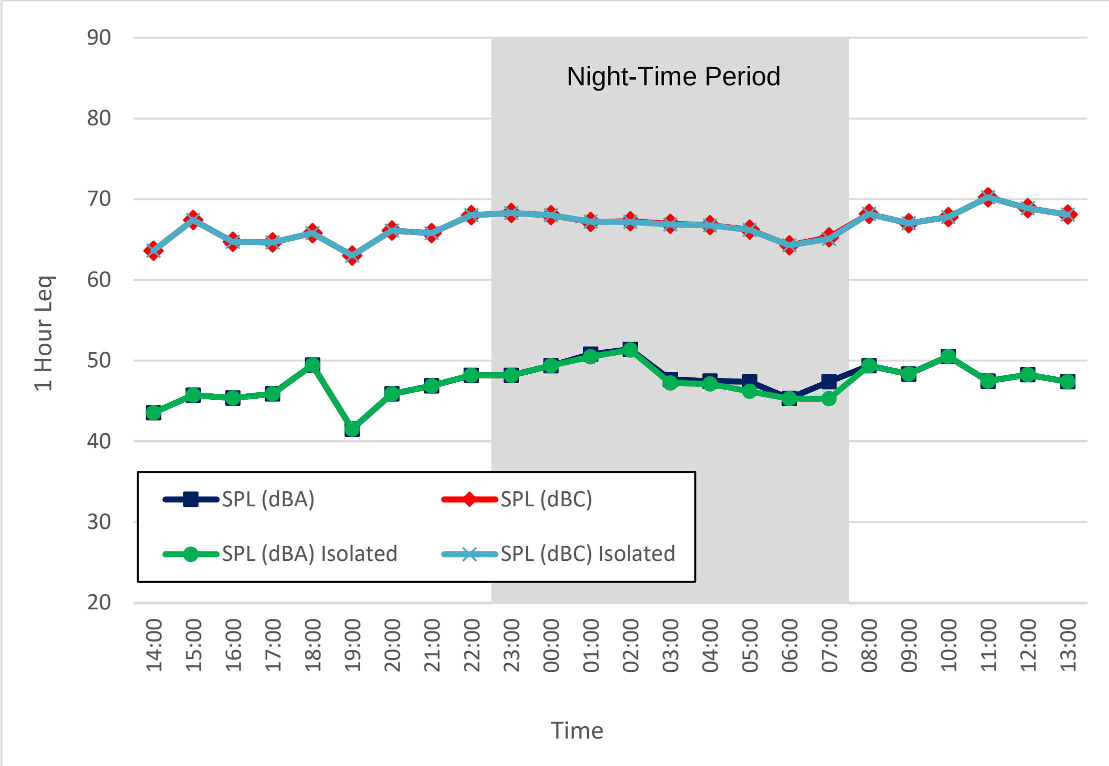

Figure 65. Noise Monitor #8, 1-Hour L_{eq} Sound Levels (August 2 - 3, 2016)

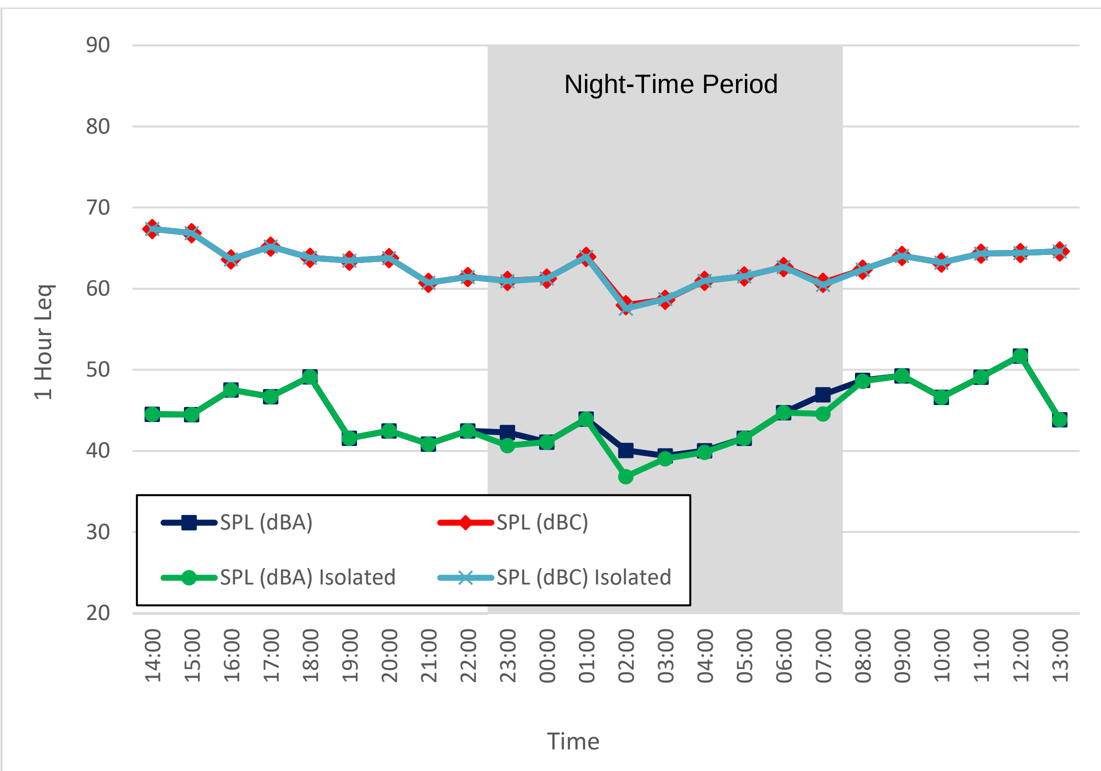

Figure 66. Noise Monitor #8, 1-Hour L_{eq} Sound Levels (August 3 - 4, 2016)

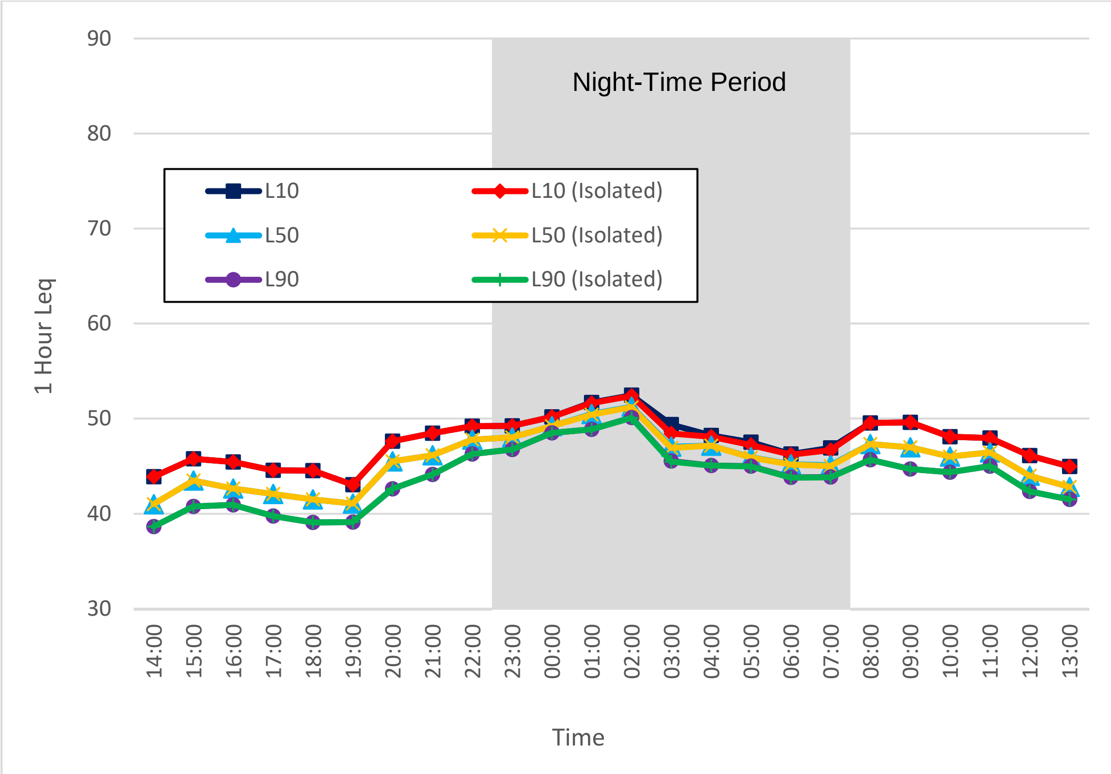

Figure 67. Noise Monitor #8, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 2 - 3, 2016)

Noise Monitor #8

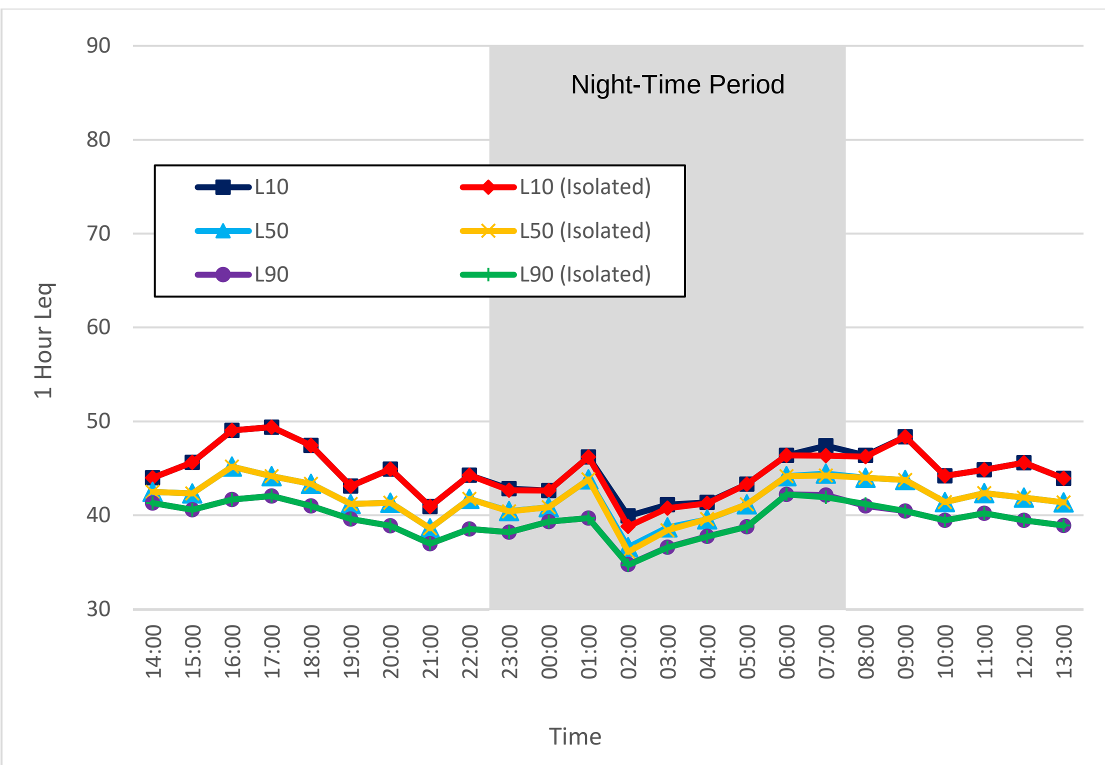

Figure 68. Noise Monitor #8, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 3 - 4, 2016)

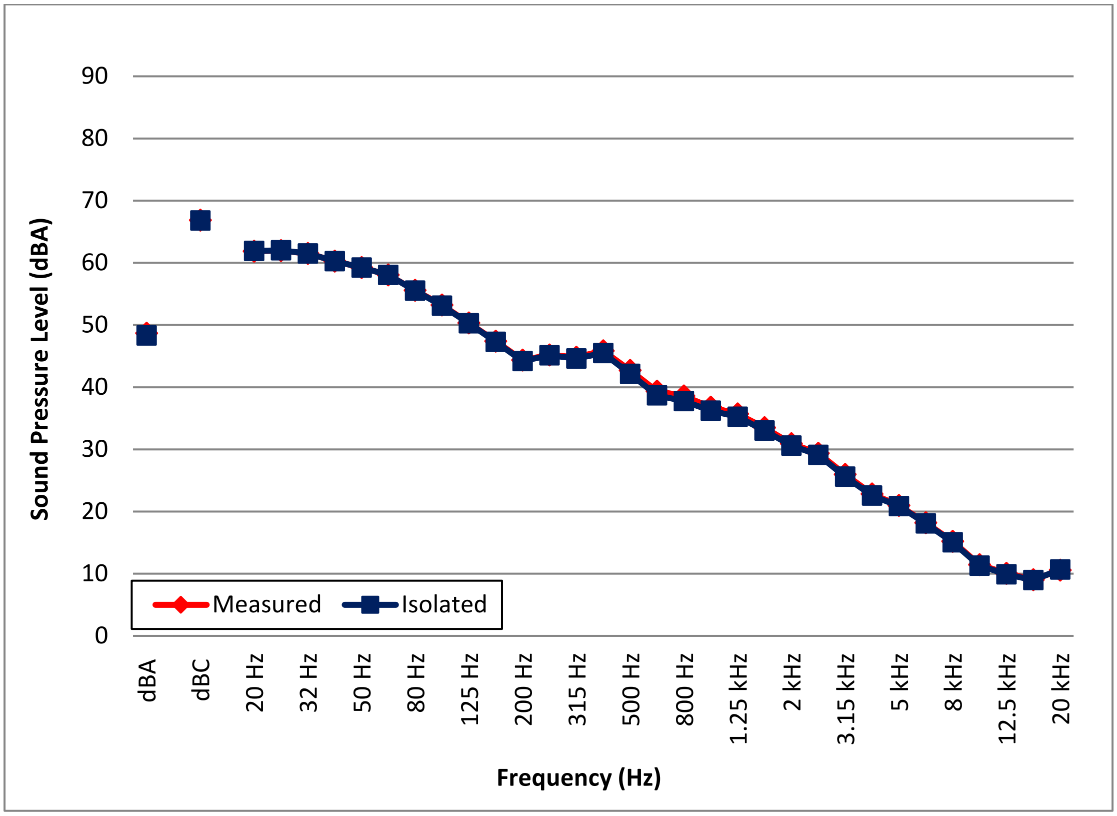

Figure 69. Noise Monitor #8, 1/3 Octave L_{eq} Sound Levels (August 2 - 3, 2016)

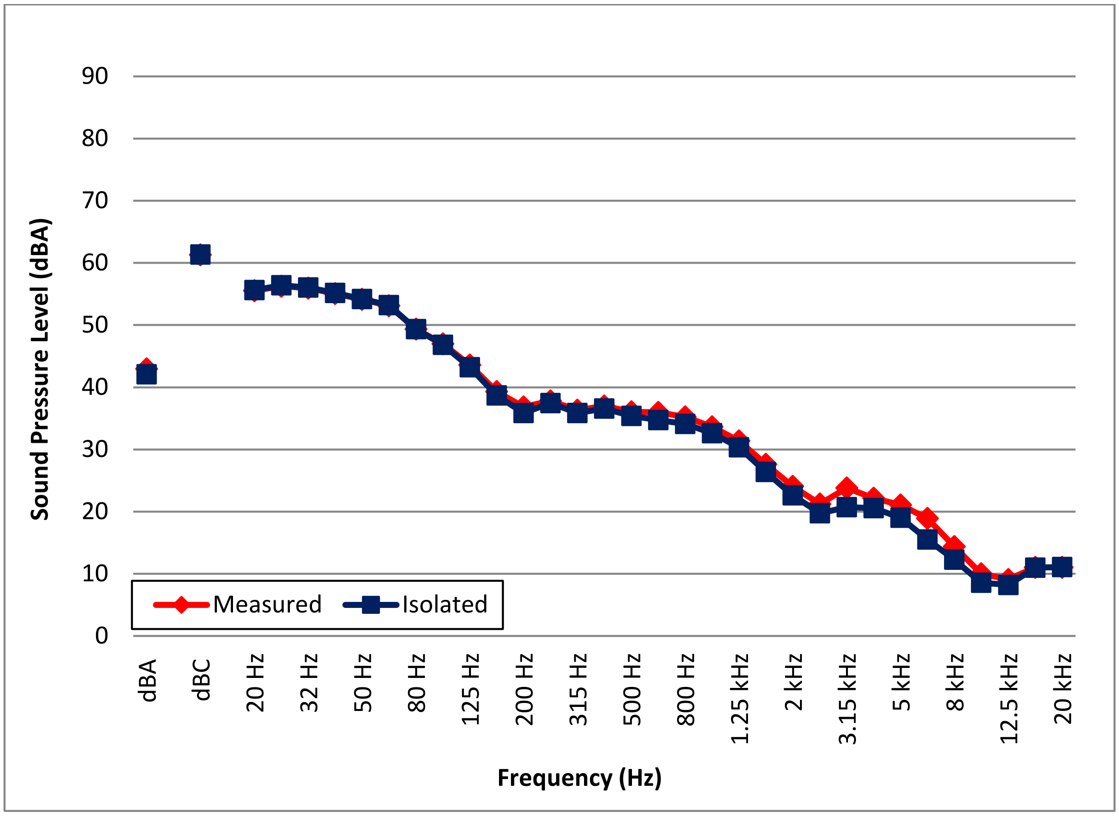

Figure 70. Noise Monitor #8, 1/3 Octave L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #9

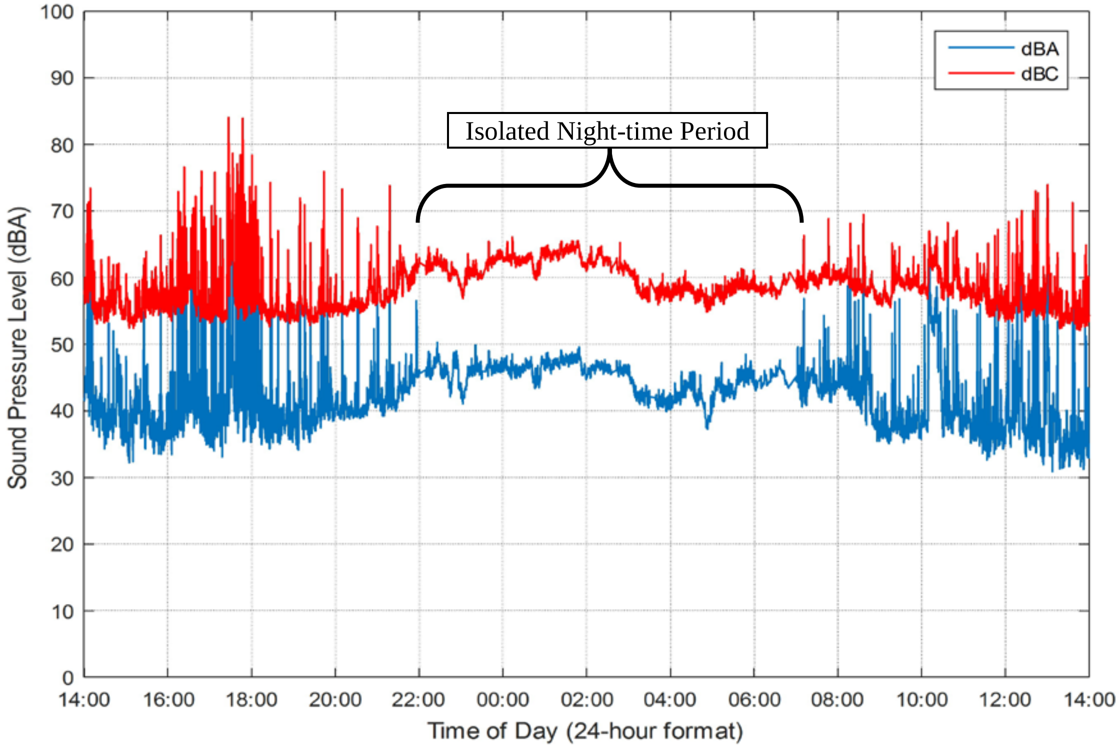

Figure 71. Noise Monitor #9, 15-Second L_{eq} Sound Levels (August 2 - 3, 2016)

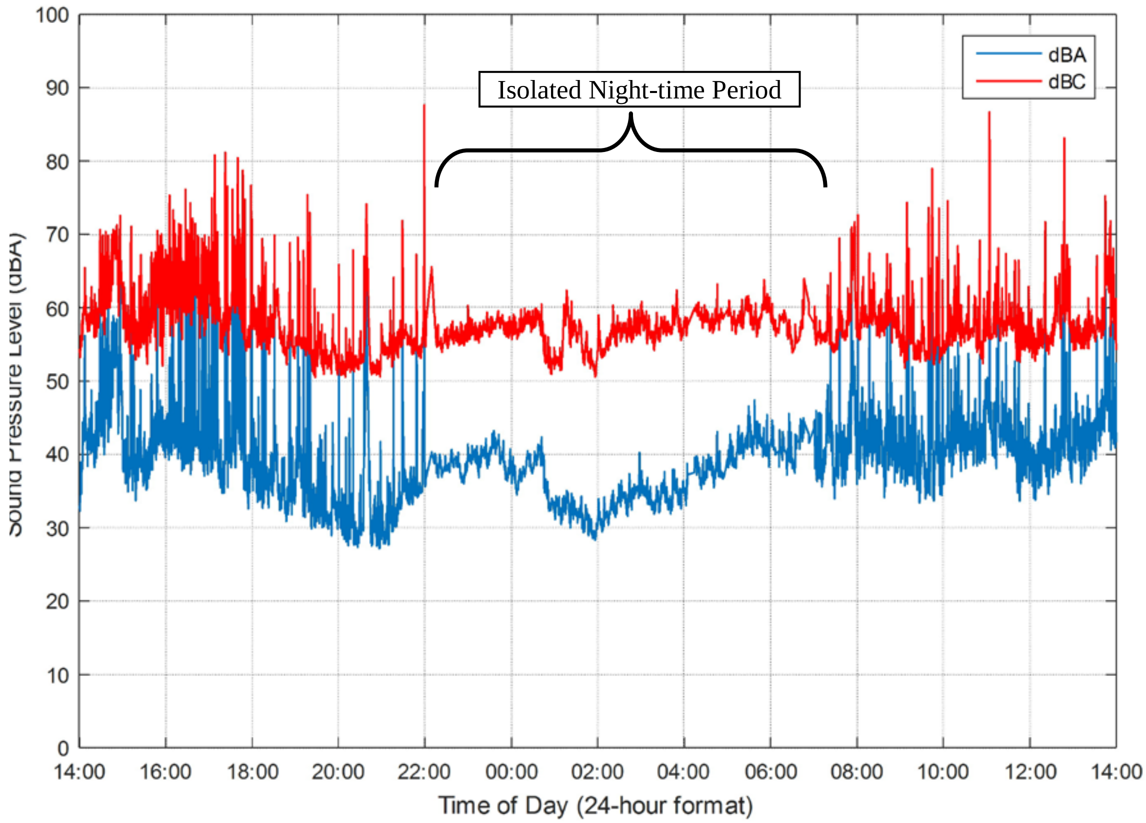

Figure 72. Noise Monitor #9, 15-Second L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #9

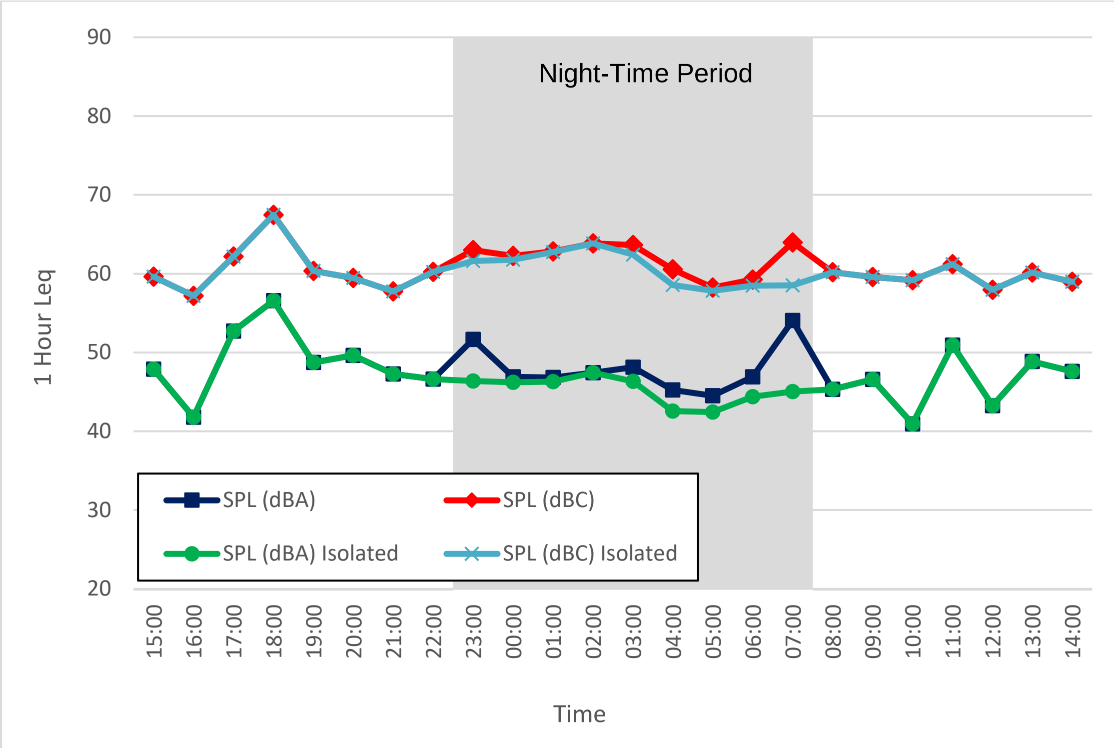

Figure 73. Noise Monitor #9, 1-Hour L_{eq} Sound Levels (August 2 - 3, 2016)

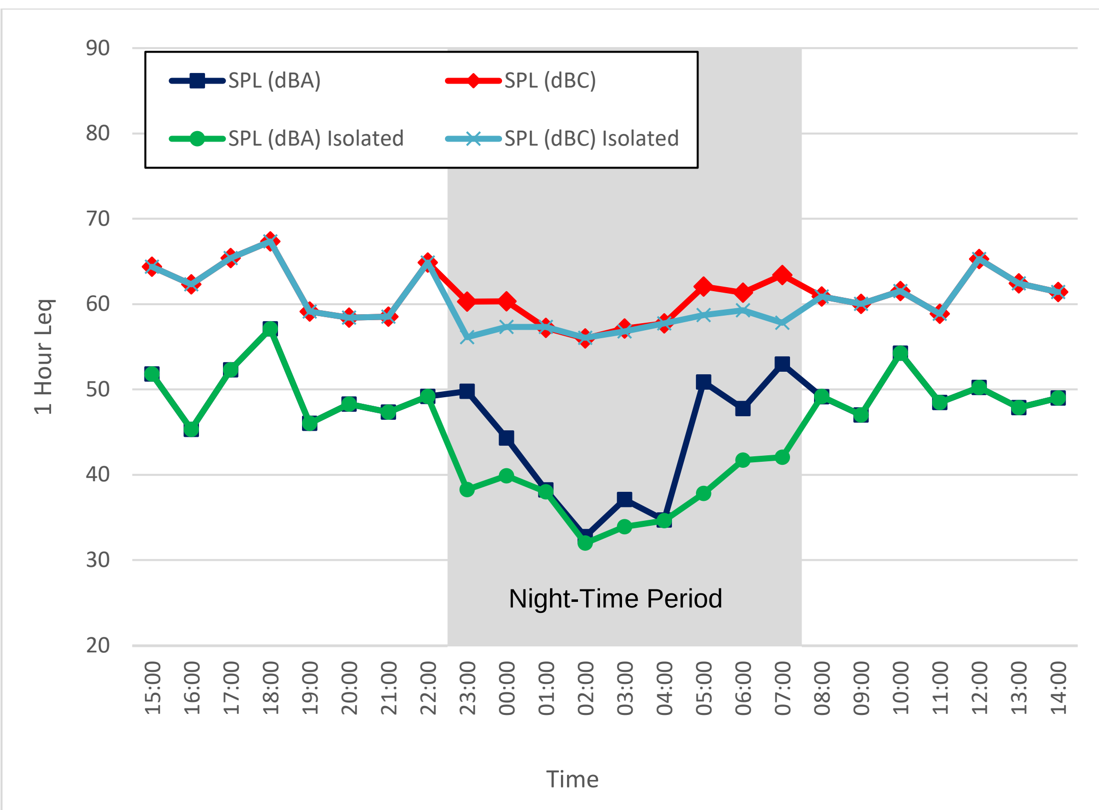

Figure 74. Noise Monitor #9, 1-Hour L_{eq} Sound Levels (August 3 - 4, 2016)

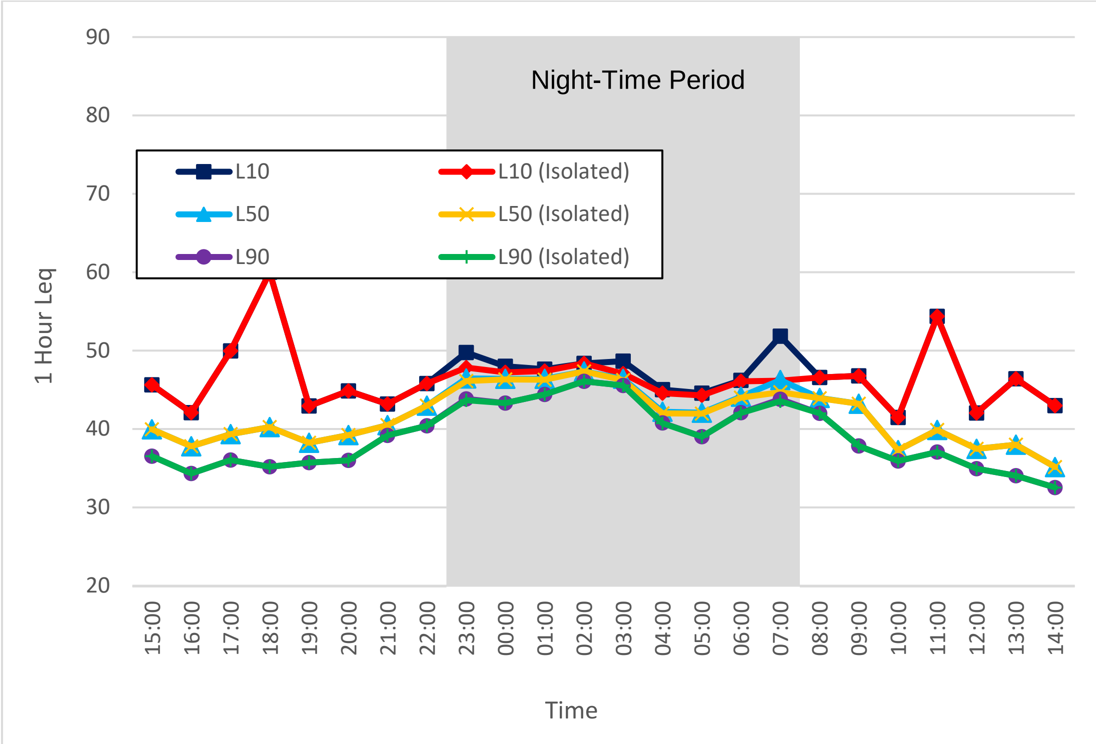

Figure 75. Noise Monitor #9, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 2 - 3, 2016)

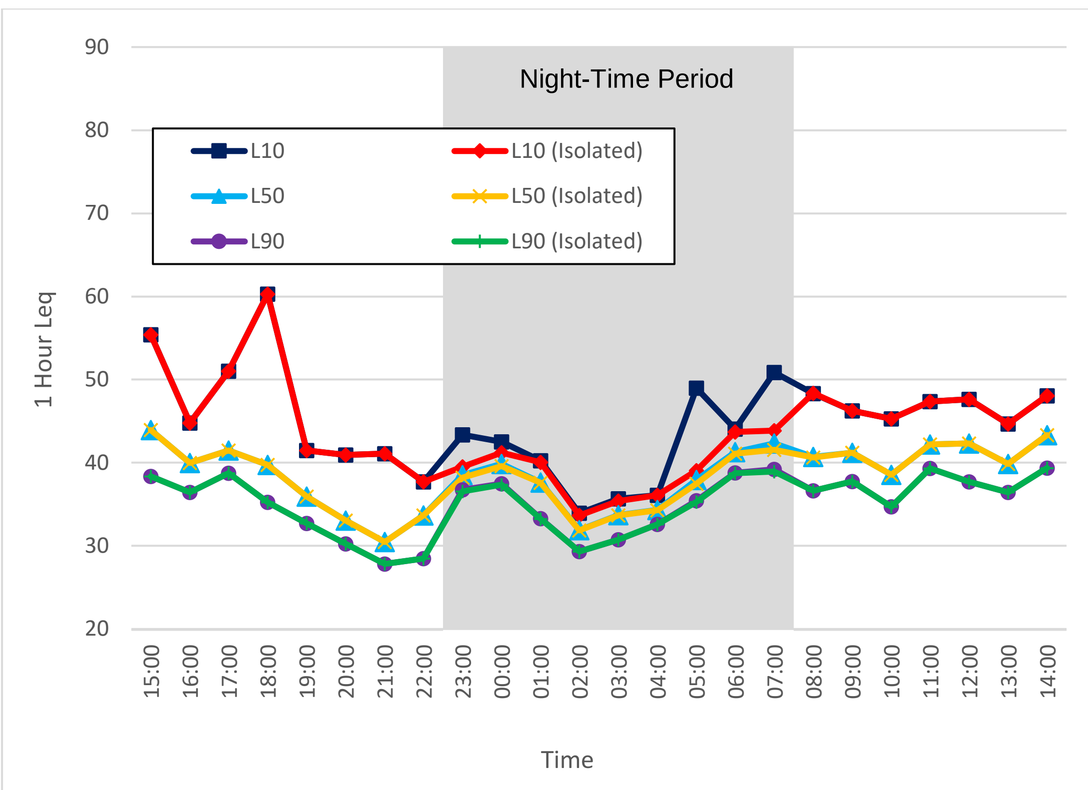

Figure 76. Noise Monitor #9, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #9

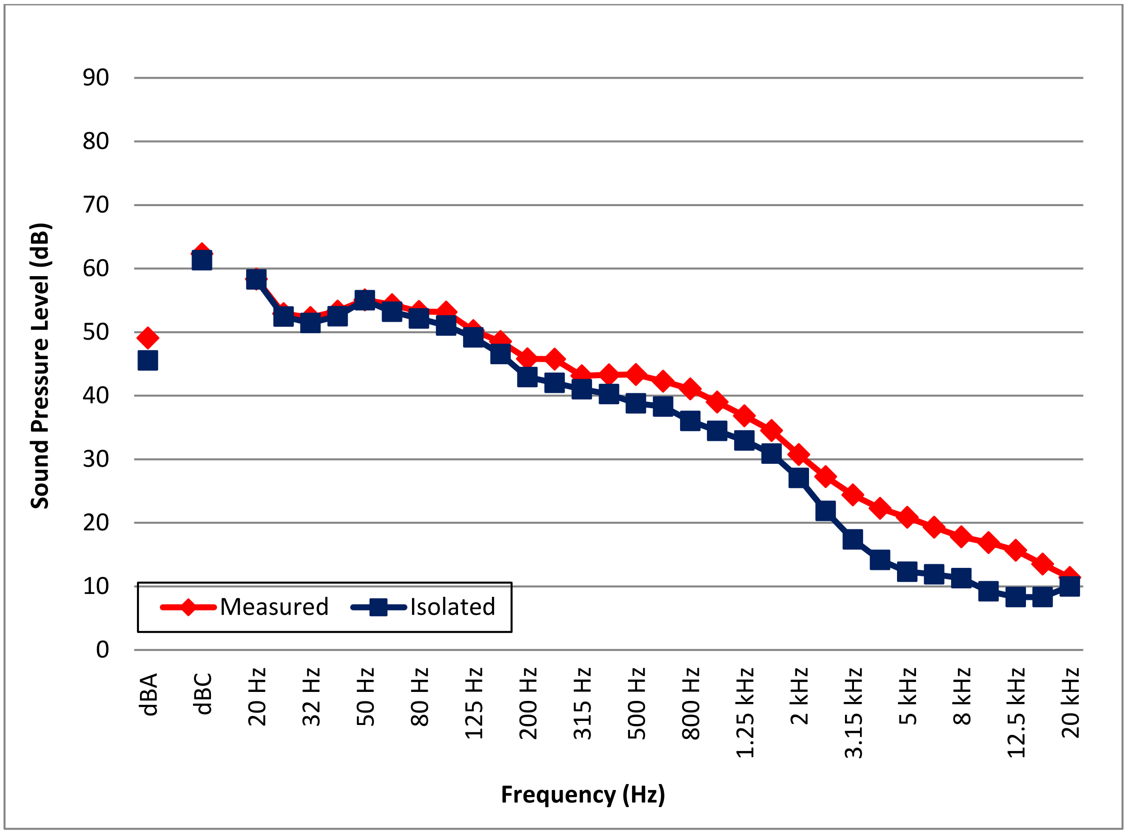

Figure 77. Noise Monitor #9, 1/3 Octave L_{eq} Sound Levels (August 2 - 3, 2016)

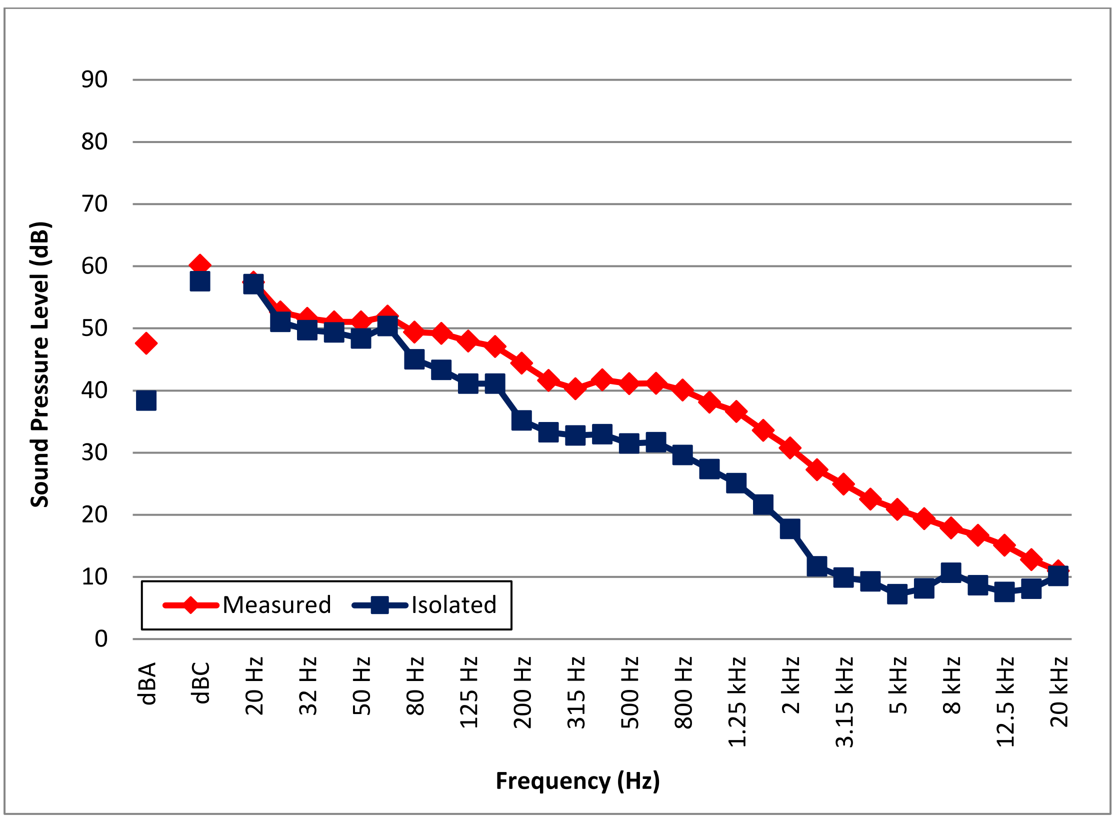

Figure 78. Noise Monitor #9, 1/3 Octave L_{eq} Sound Levels (August 3 - 4, 2016)

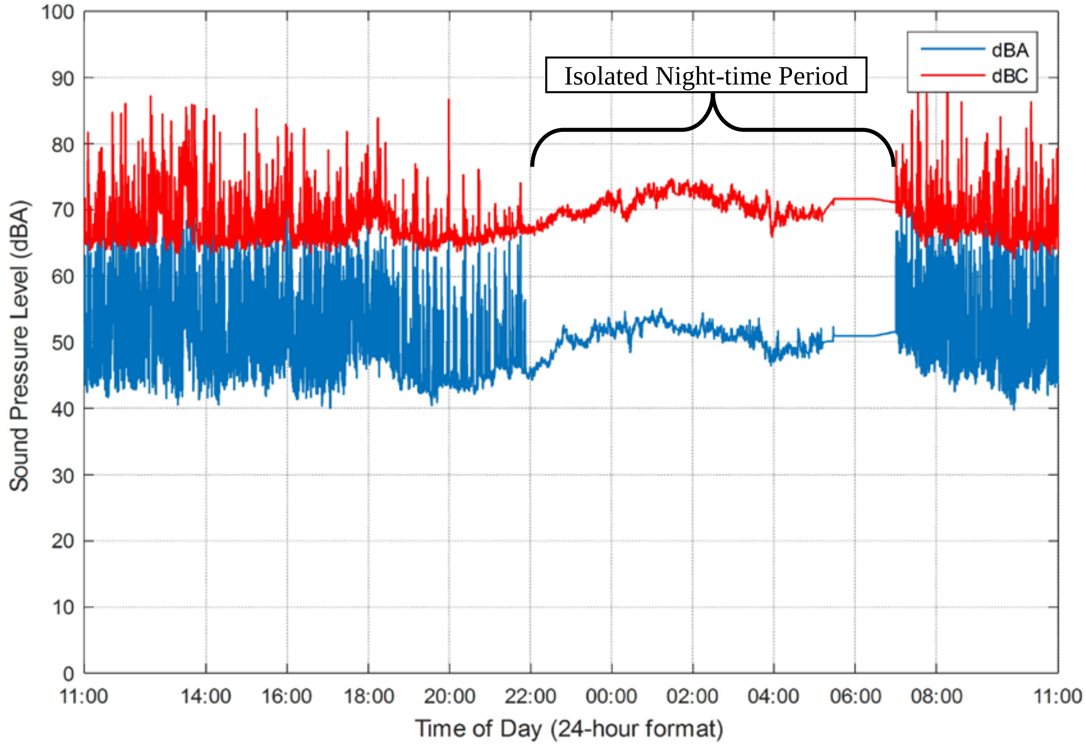

Figure 79. Noise Monitor #10, 15-Second L_{eq} Sound Levels (June 27 - 28, 2016)

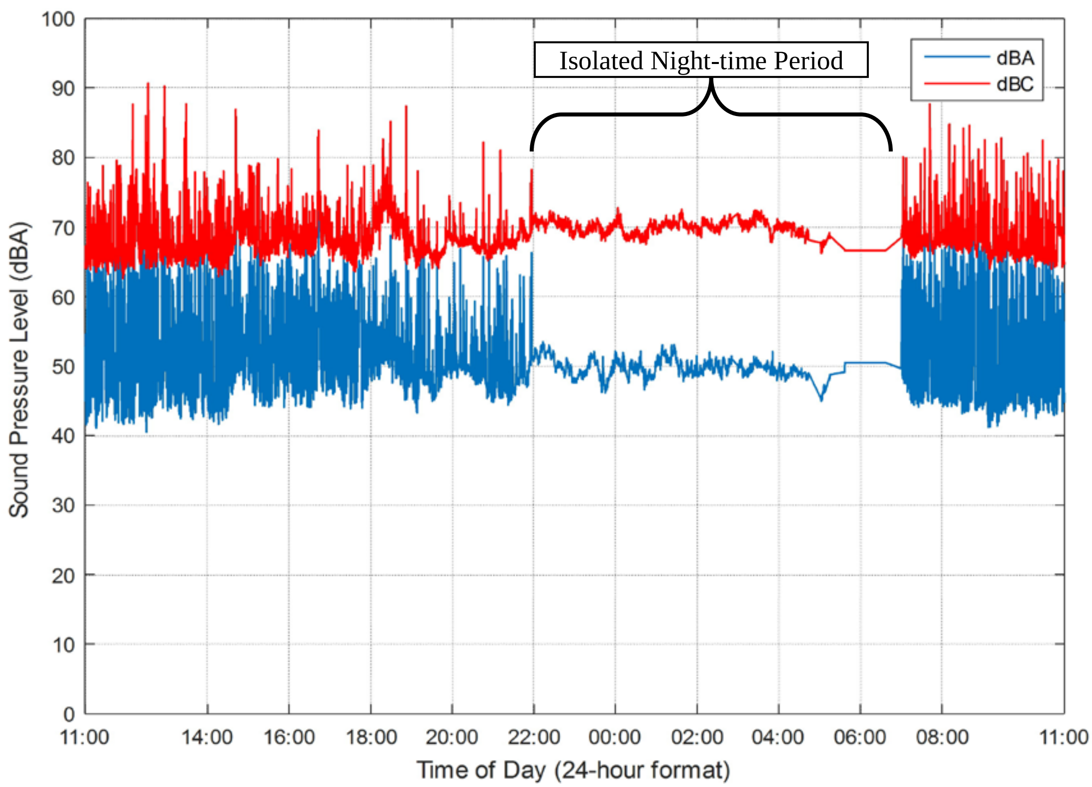

Figure 80. Noise Monitor #10, 15-Second L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #10

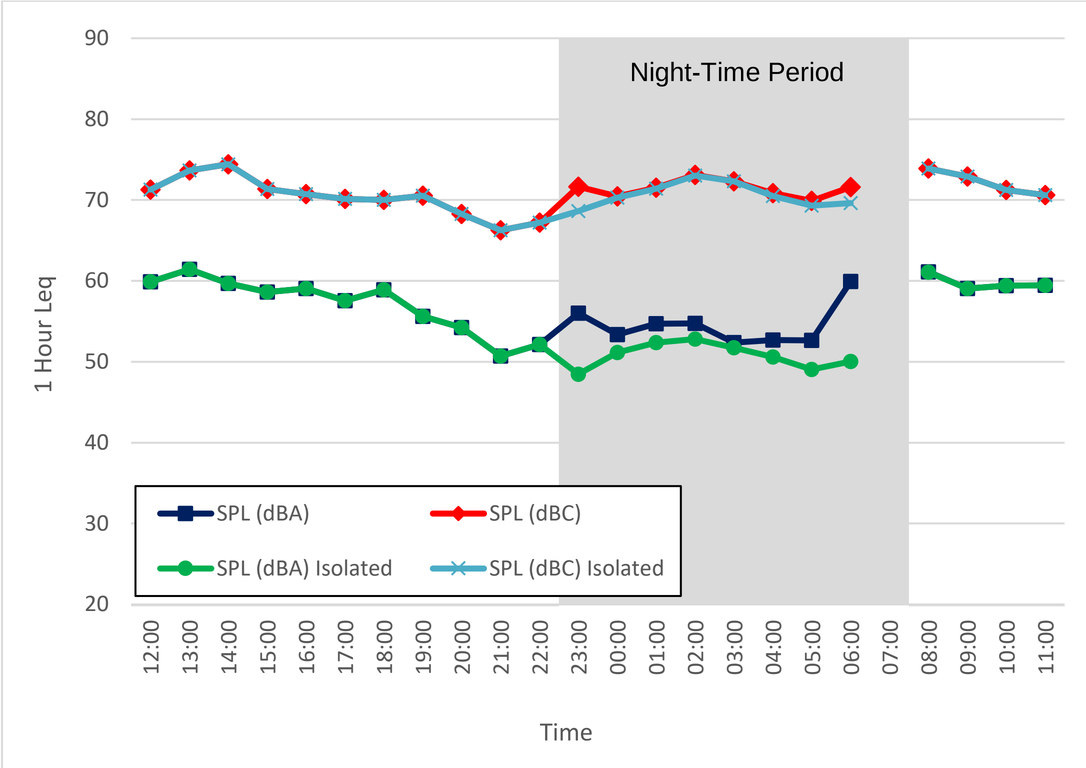

Figure 81. Noise Monitor #10, 1-Hour L_{eq} Sound Levels (June 27 - 28, 2016) [1]

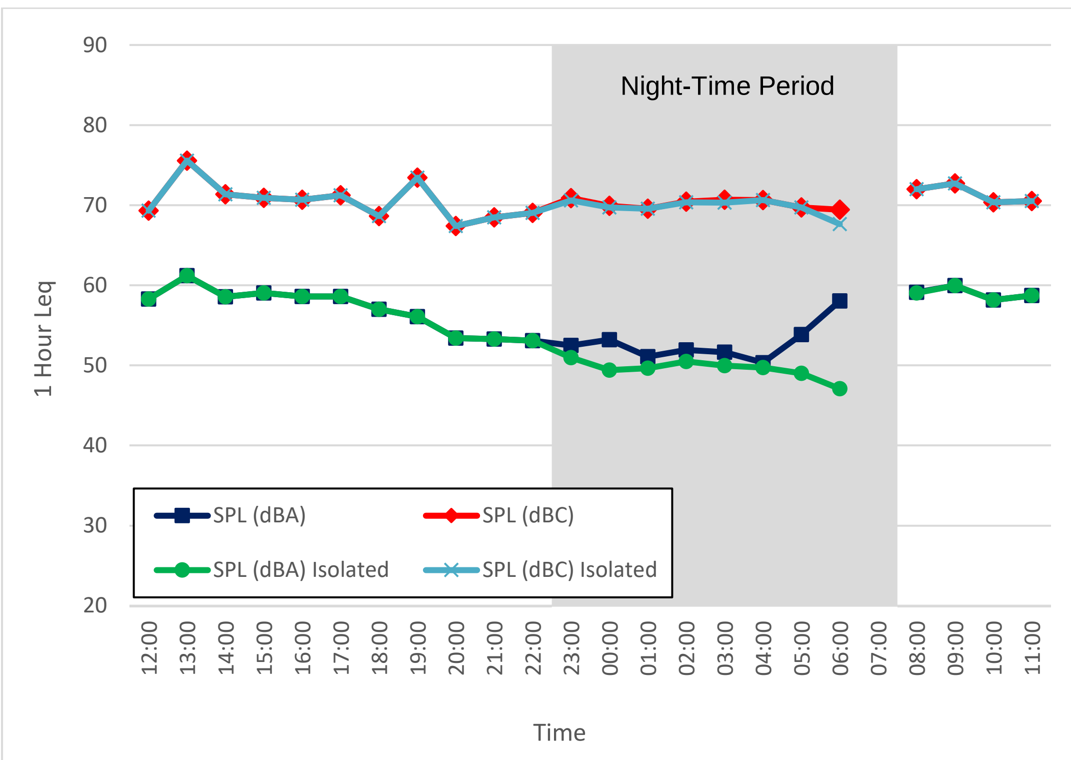

Figure 82. Noise Monitor #10, 1-Hour L_{eq} Sound Levels (June 28 - 29, 2016) [2]

[1] Data from 05:30 to 07:00 was entirely removed due to traffic along the adjacent road.
[2] Data from 05:37 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #10

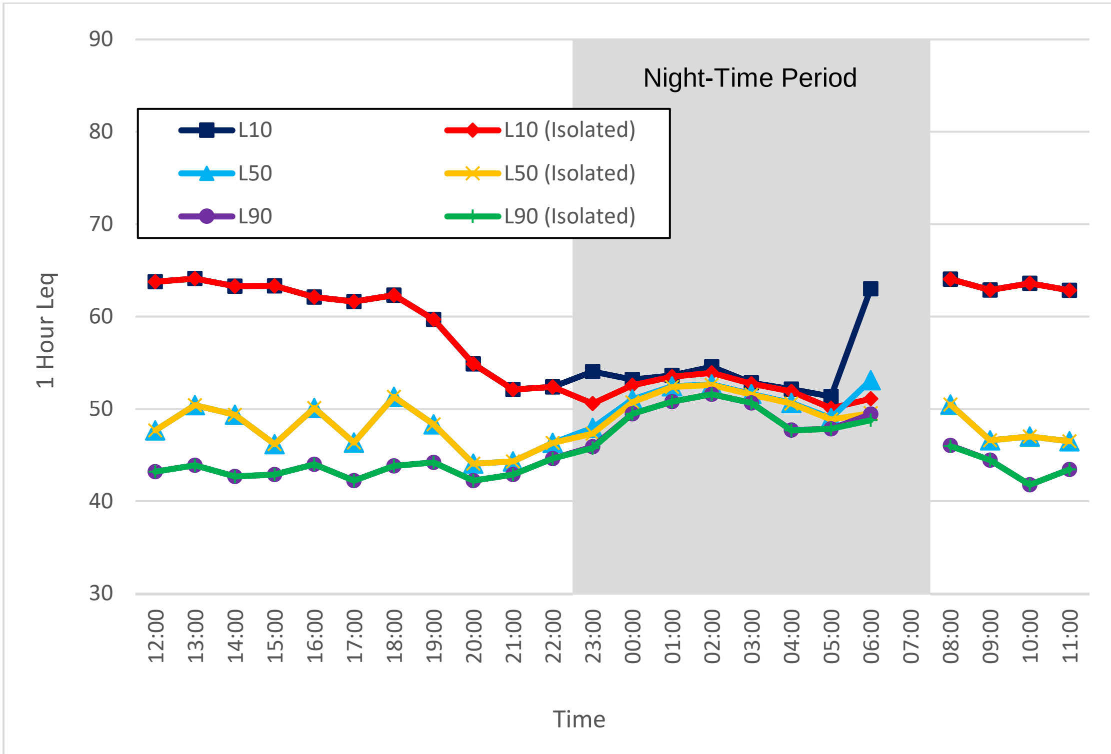

Figure 83. Noise Monitor #10, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 27 - 28, 2016) [1]

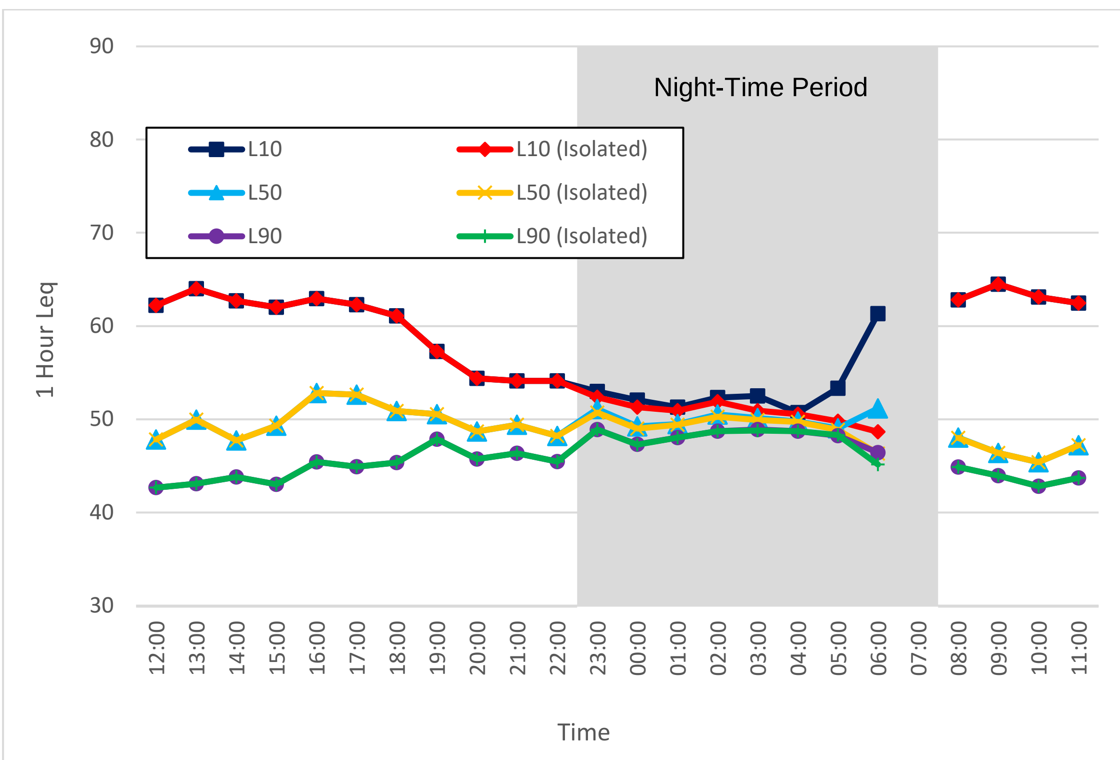

Figure 84. Noise Monitor #10, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 28 - 29, 2016) [2]

[1] Data from 05:30 to 07:00 was entirely removed due to traffic along the adjacent road.
[2] Data from 05:37 to 07:00 was entirely removed due to traffic along the adjacent road.

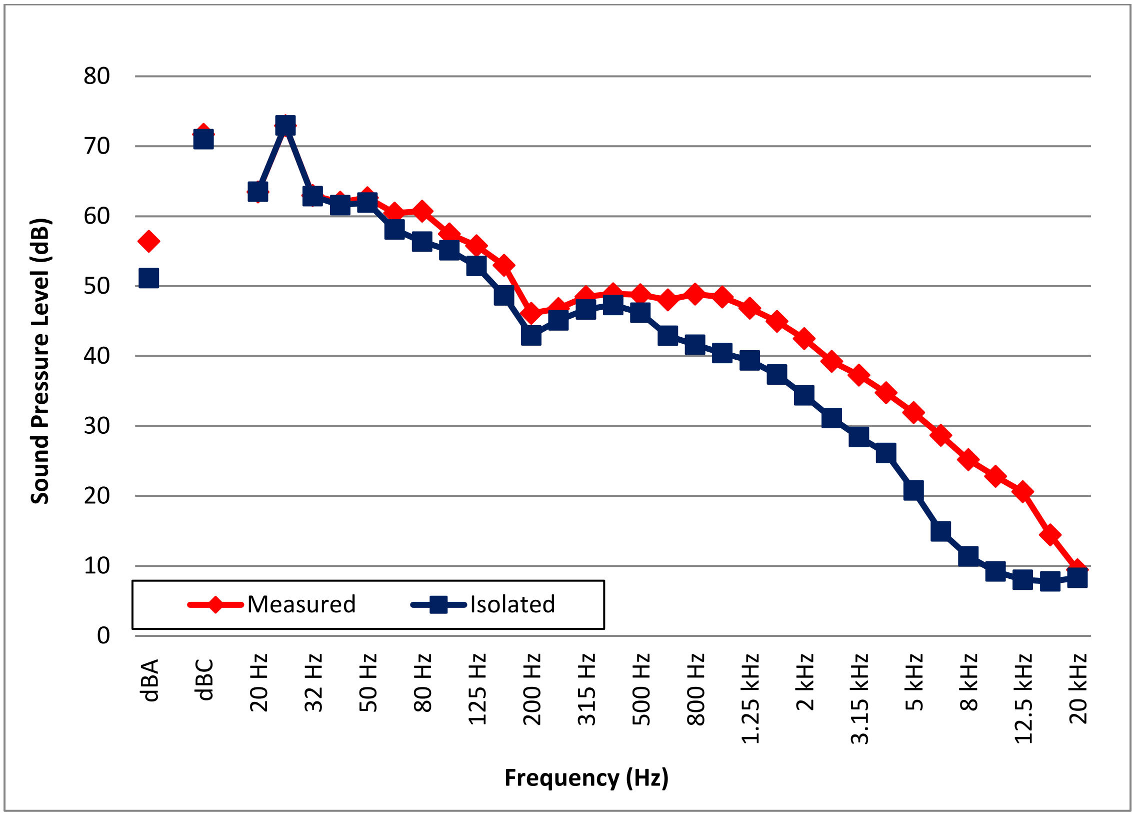

Figure 85. Noise Monitor #10, 1/3 Octave L_{eq} Sound Levels (June 27 - 28, 2016)

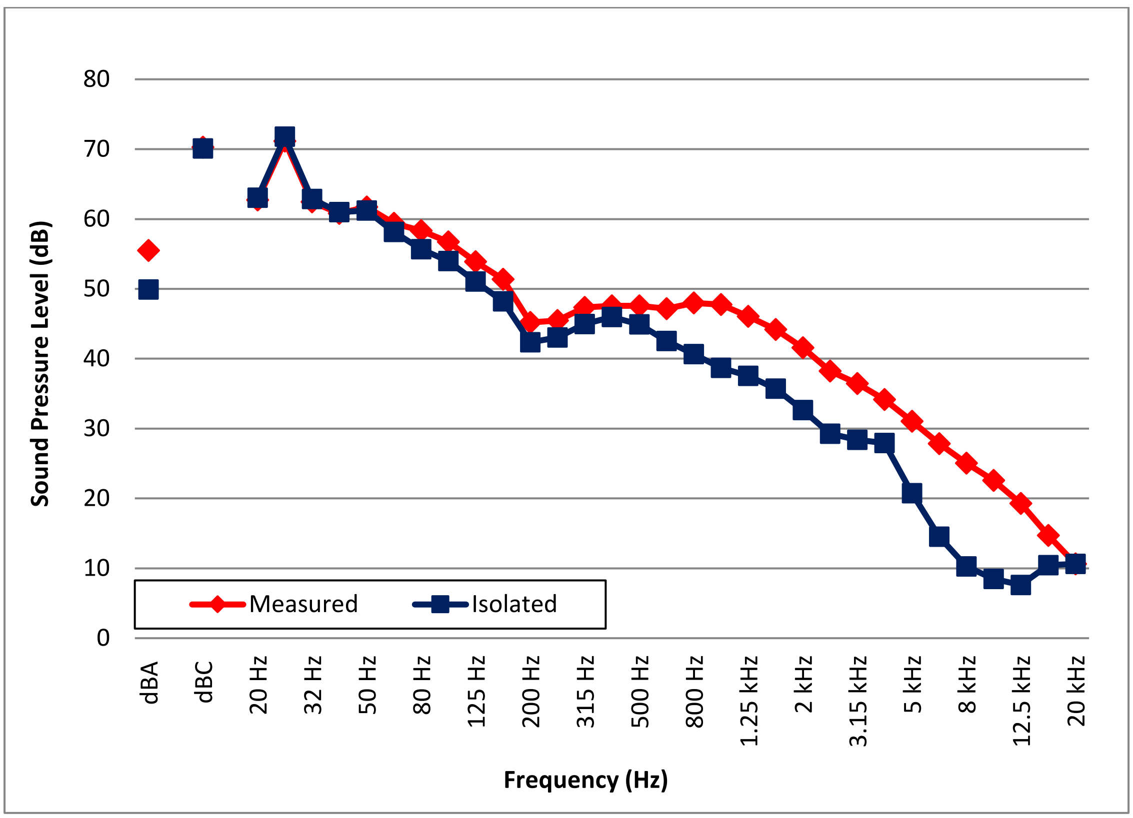

Figure 86. Noise Monitor #10, 1/3 Octave L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #11

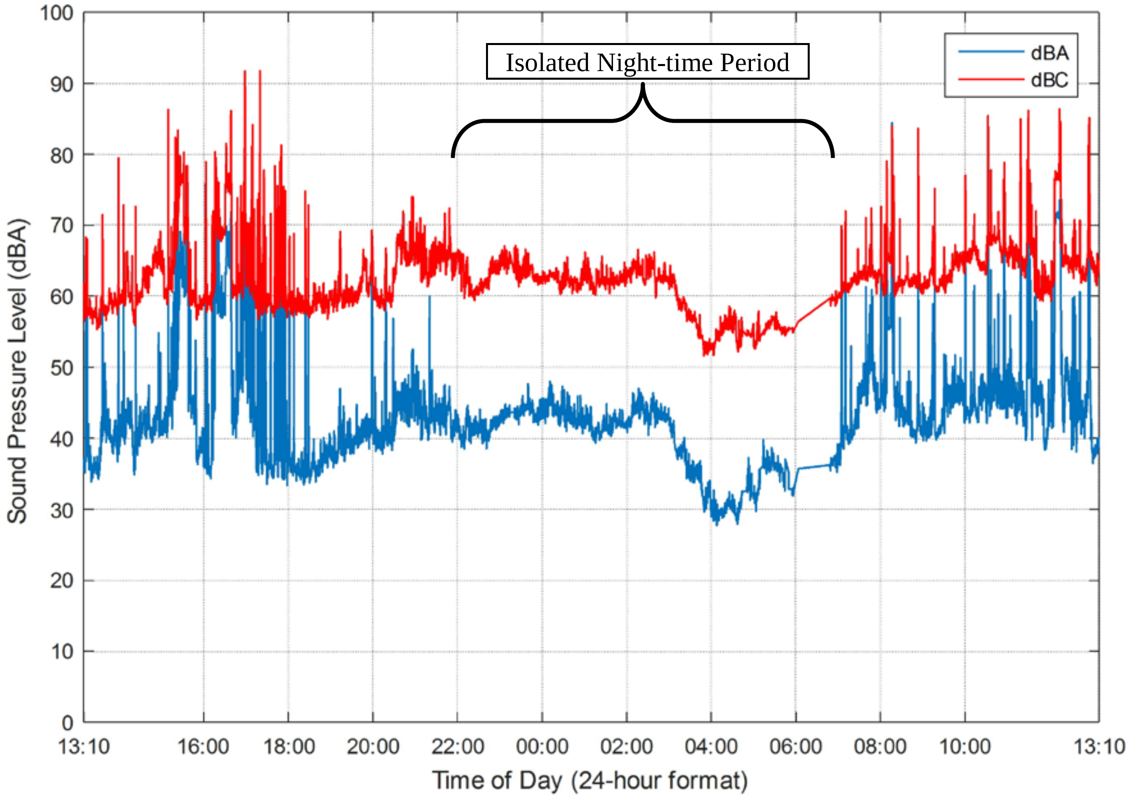

Figure 87. Noise Monitor #11, 15-Second L_{eq} Sound Levels (August 2 - 3, 2016)

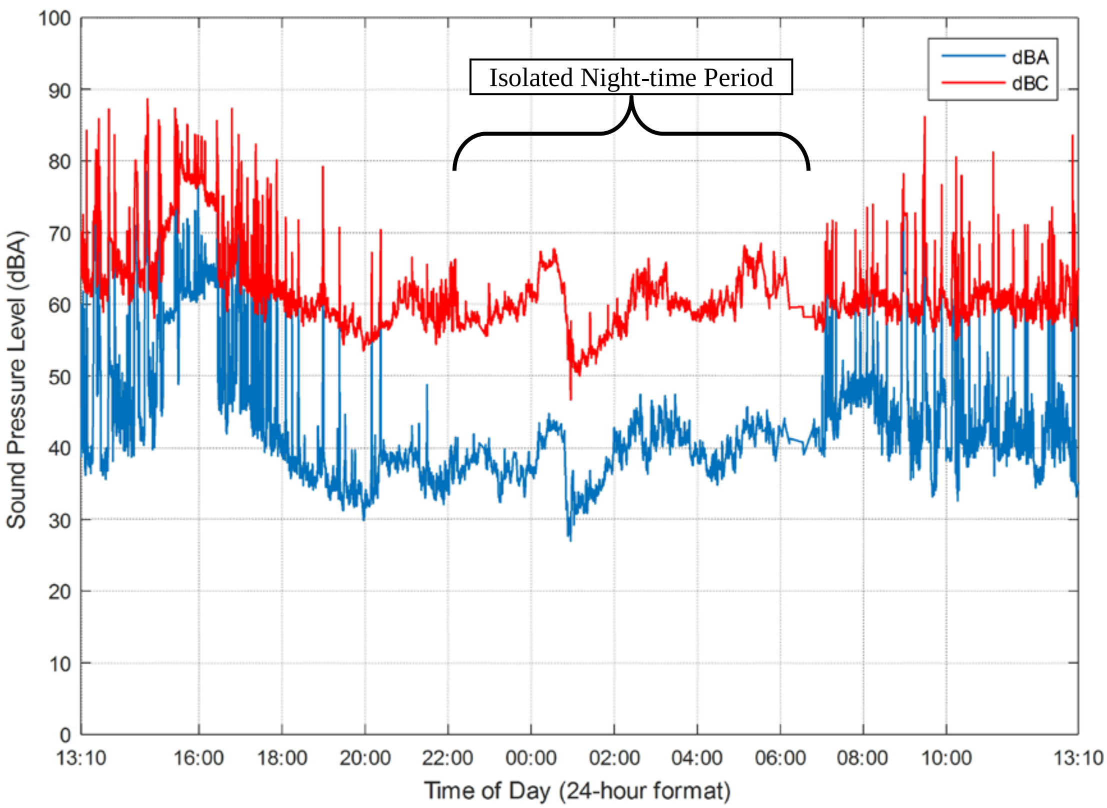

Figure 88. Noise Monitor #11, 15-Second L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #11

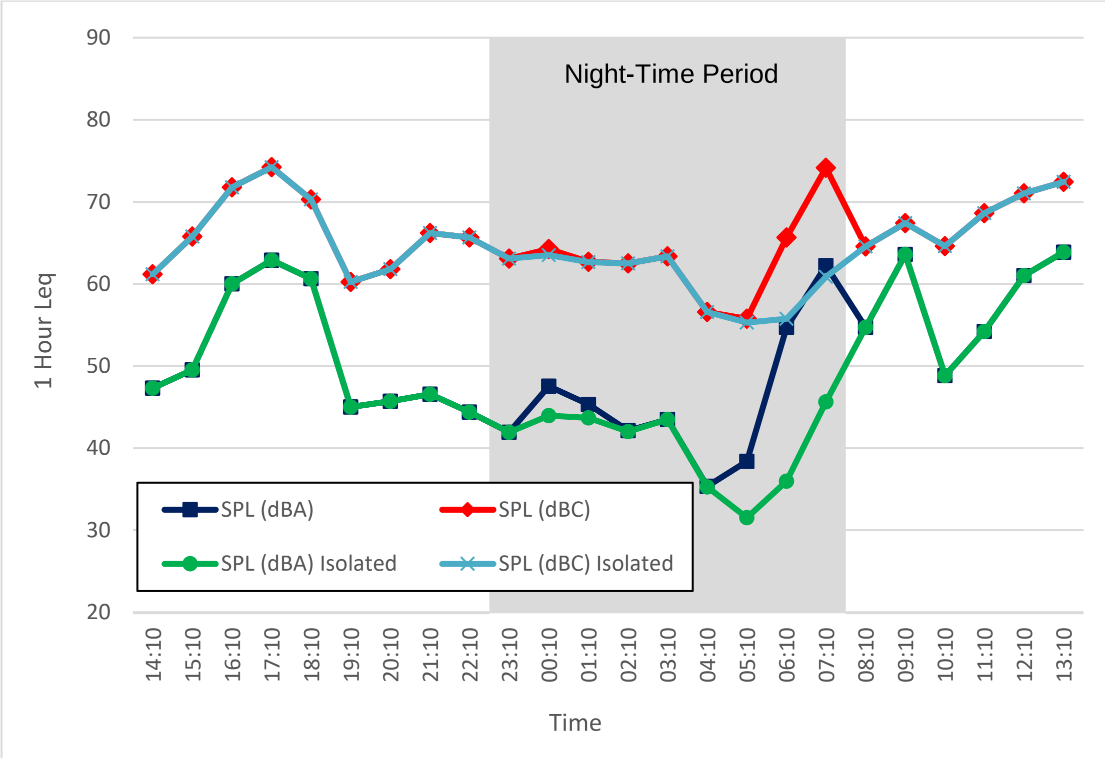

Figure 89. Noise Monitor #11, 1-Hour L_{eq} Sound Levels (August 2 - 3, 2016) [1]

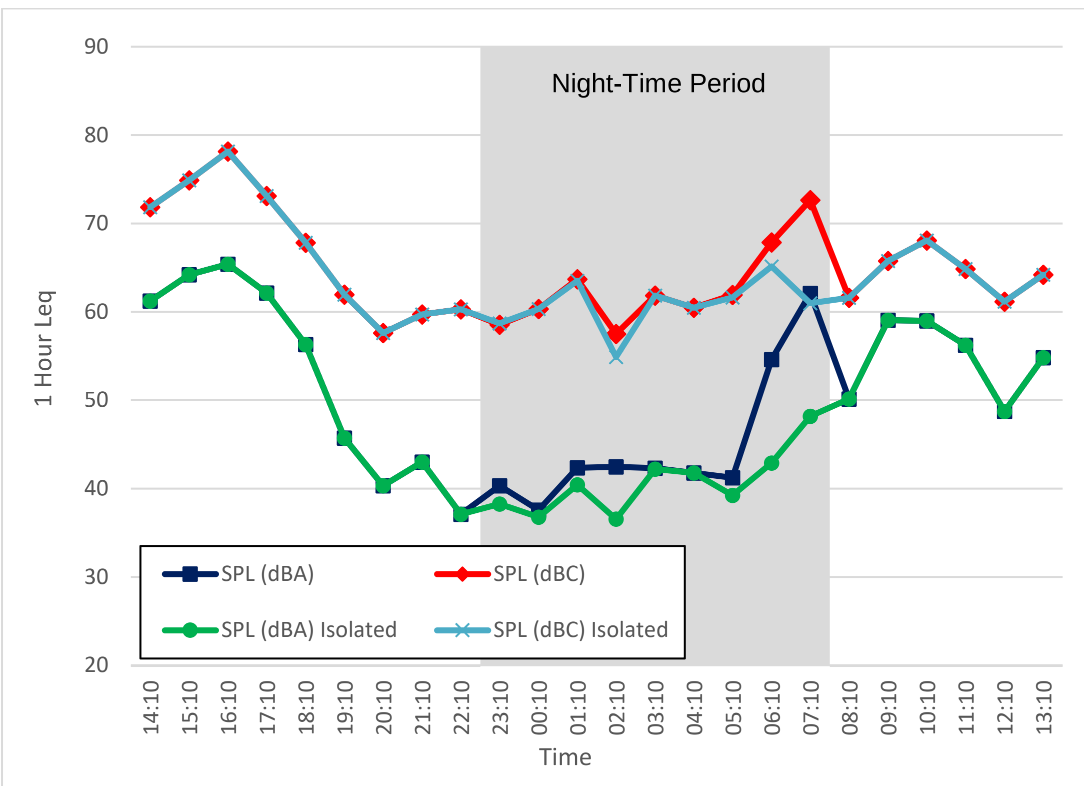

Figure 90. Noise Monitor #11, 1-Hour L_{eq} Sound Levels (August 3 - 4, 2016)

[1] Data from 06:04 to 07:00 was entirely removed due to traffic along the adjacent road.

Monitor #11

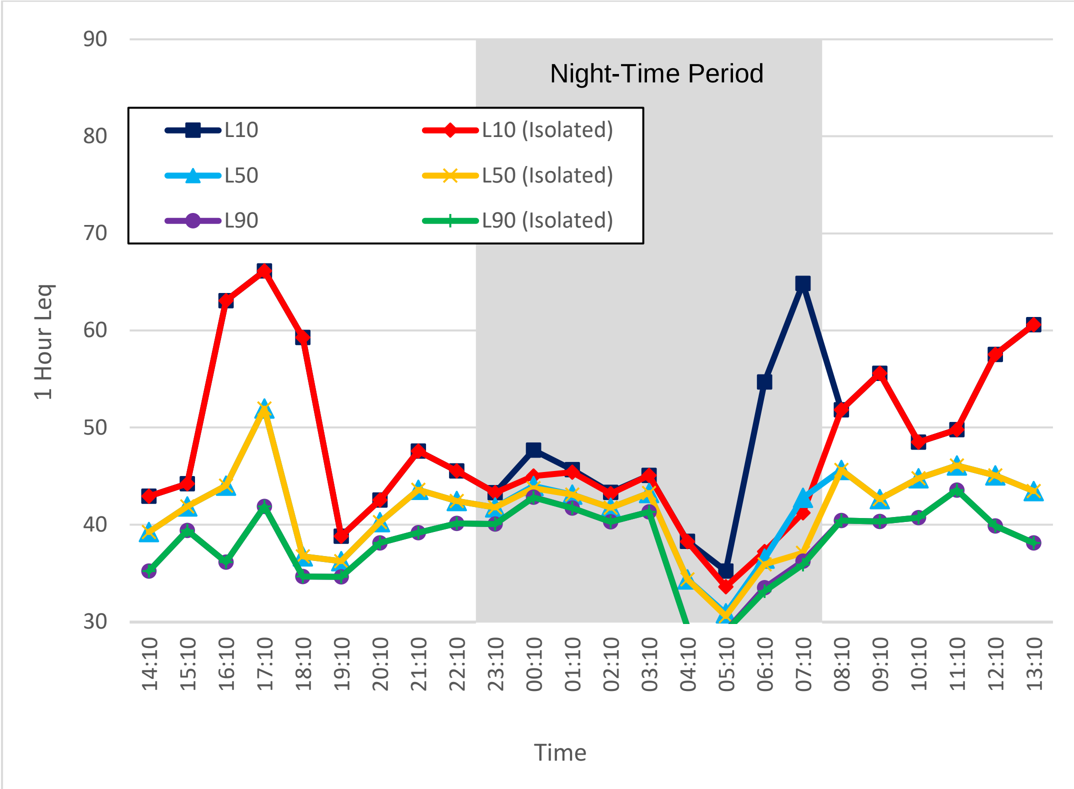

Figure 91. Noise Monitor #11, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 2 - 3, 2016) [1]

Noise

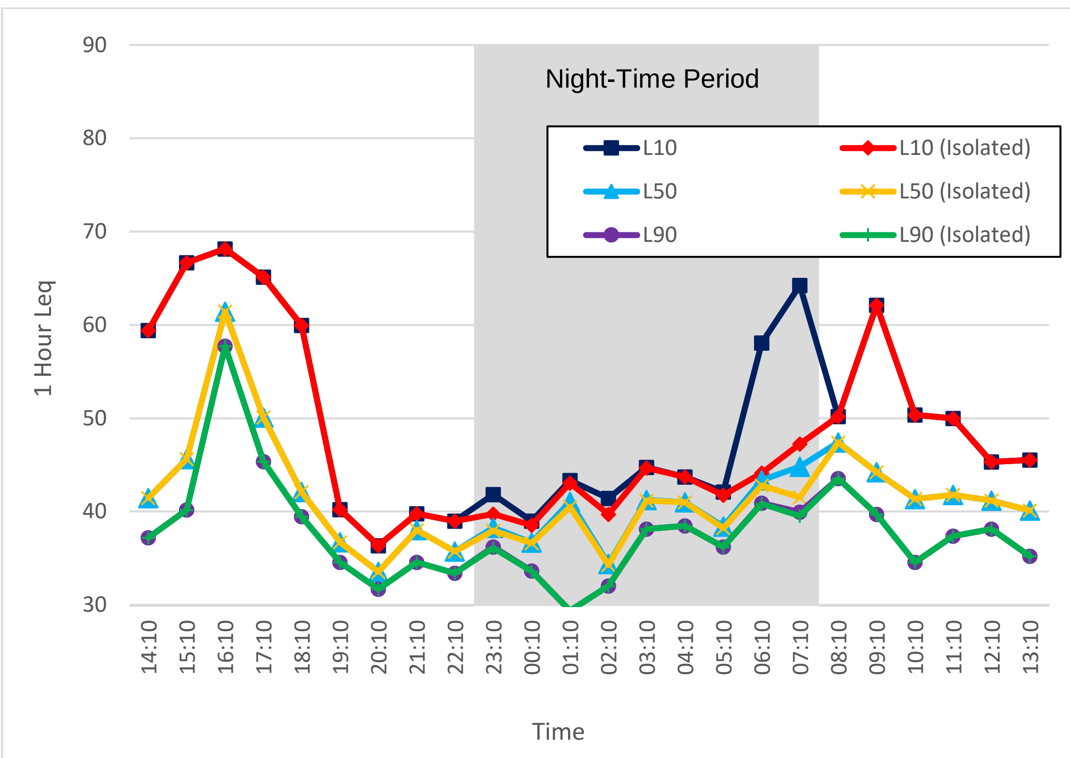

Figure 92. Noise Monitor #11, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 3 - 4, 2016)

[1] Data from 06:04 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #11

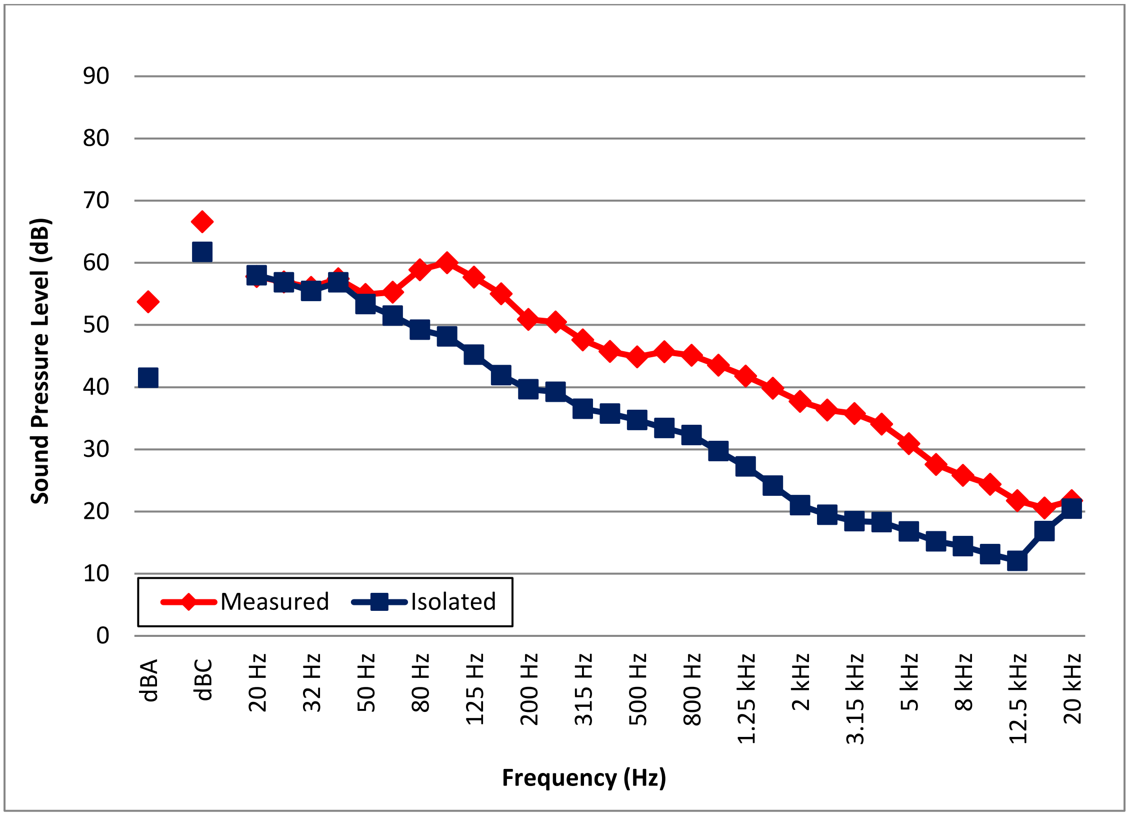

Figure 93. Noise Monitor #11, 1/3 Octave L_{eq} Sound Levels (August 2 - 3, 2016)

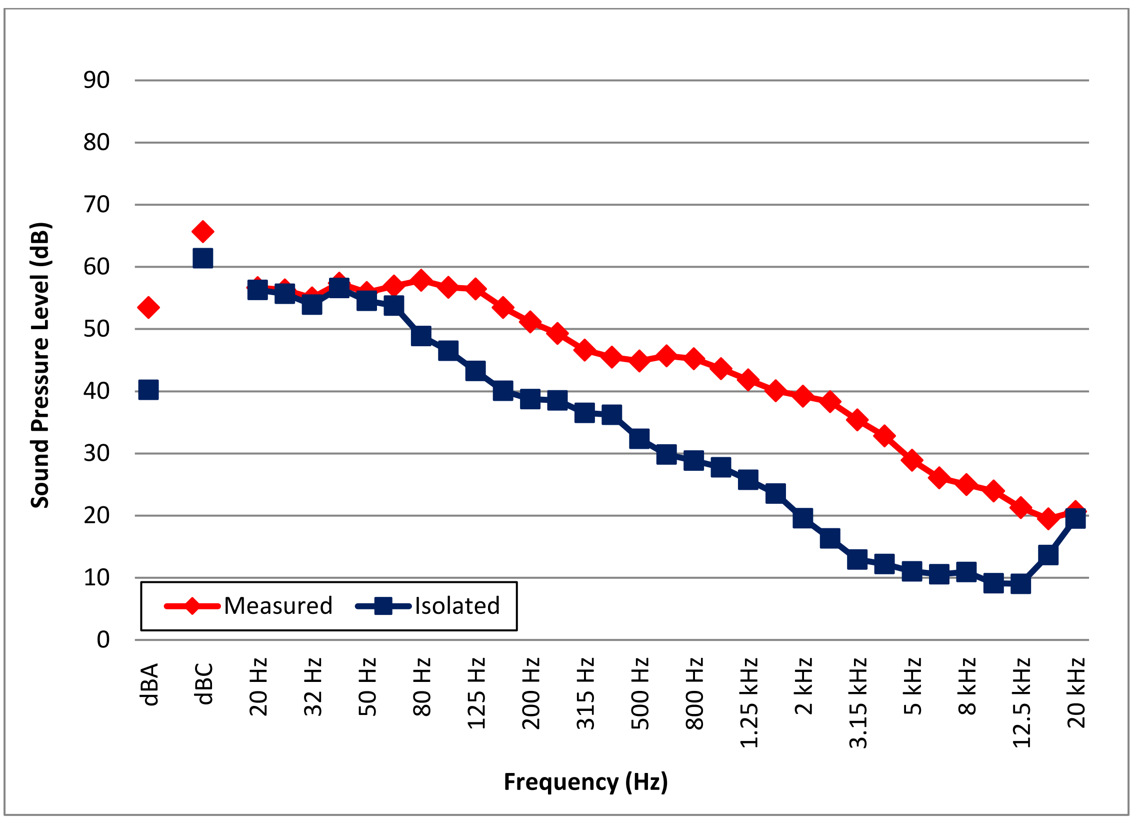

Figure 94. Noise Monitor #11, 1/3 Octave L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #12 - Period 1

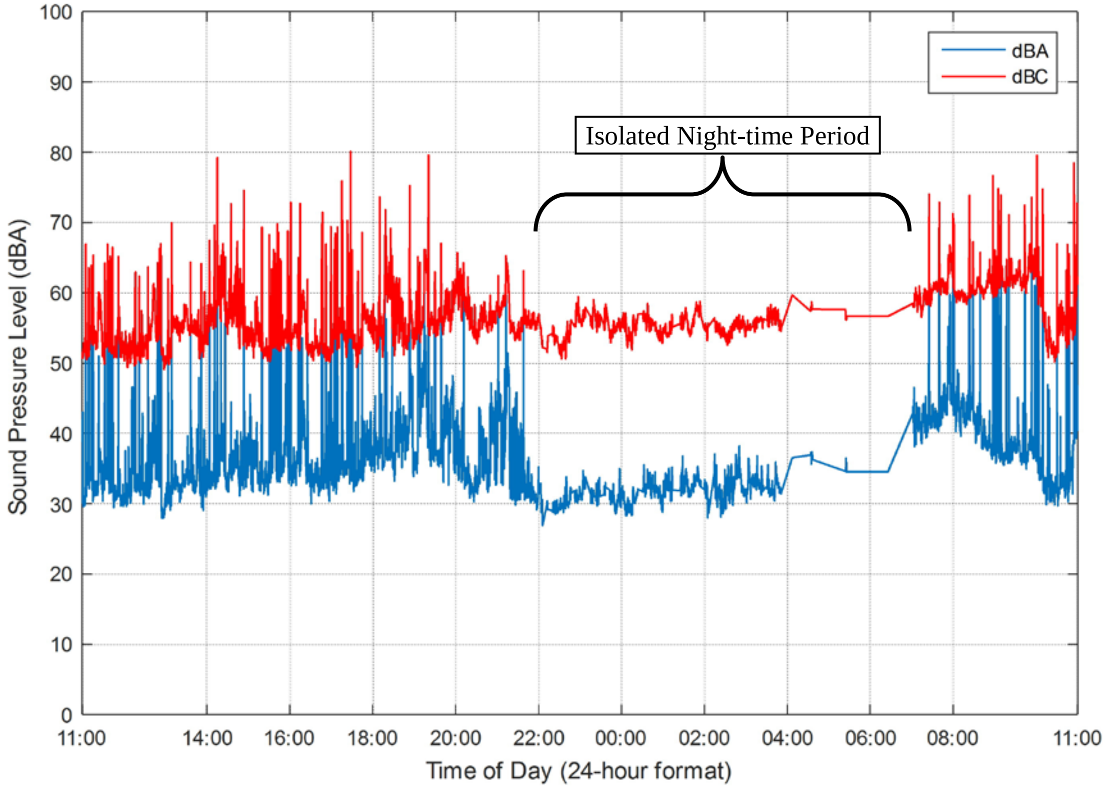

Figure 95. Noise Monitor #12, 15-Second L_{eq} Sound Levels (June 27 - 28, 2016)

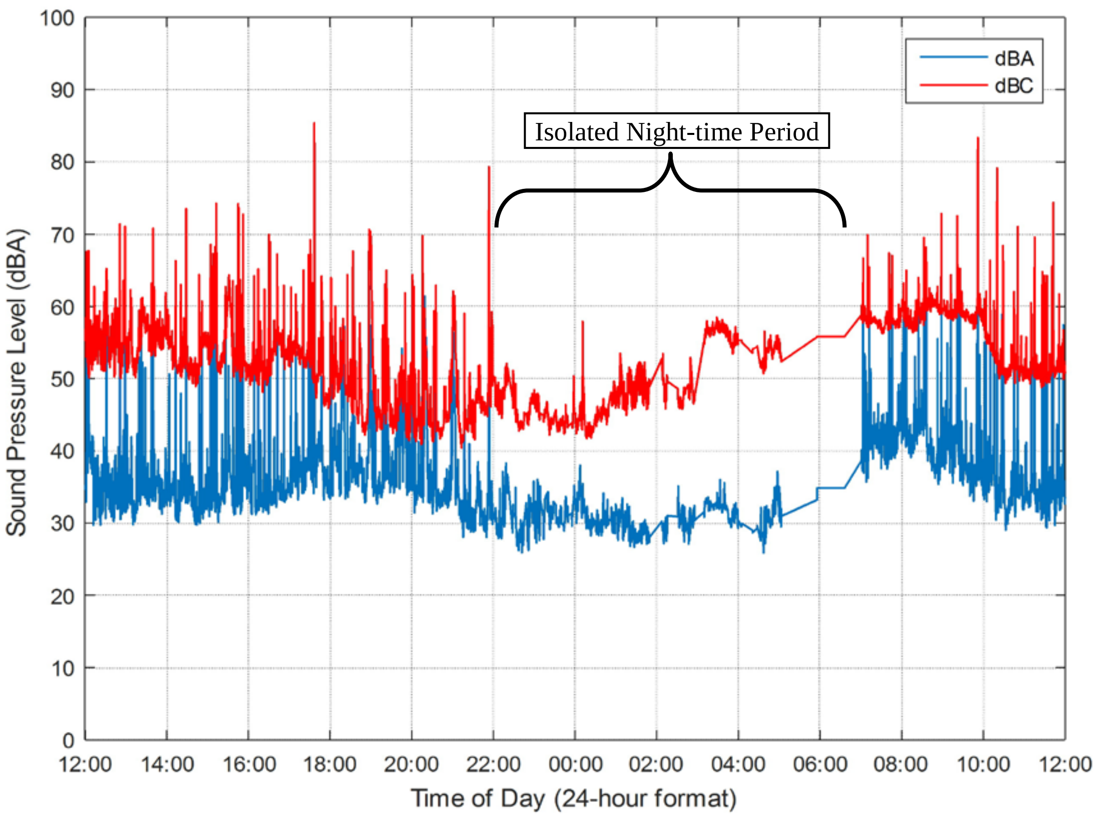

Figure 96. Noise Monitor #12, 15-Second L_{eq} Sound Levels (June 28 - 29, 2016)

Noise Monitor #12 - Period 1

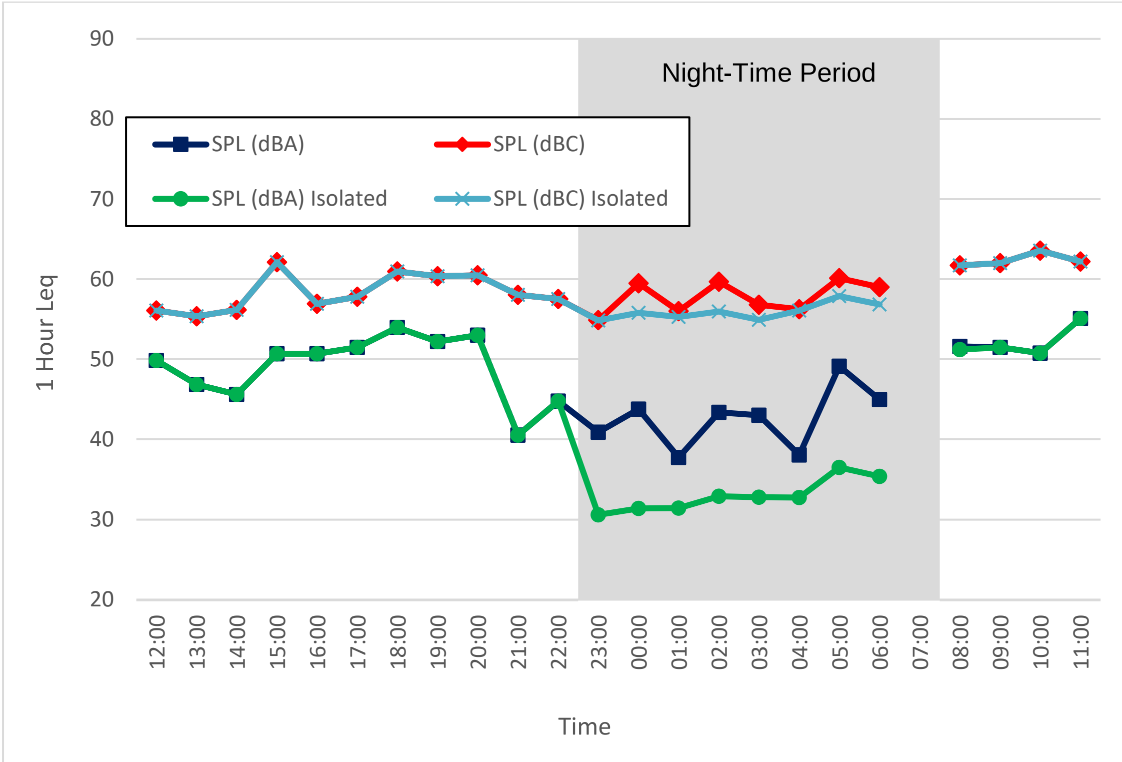

Figure 97. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (June 27 - 28, 2016) [1]

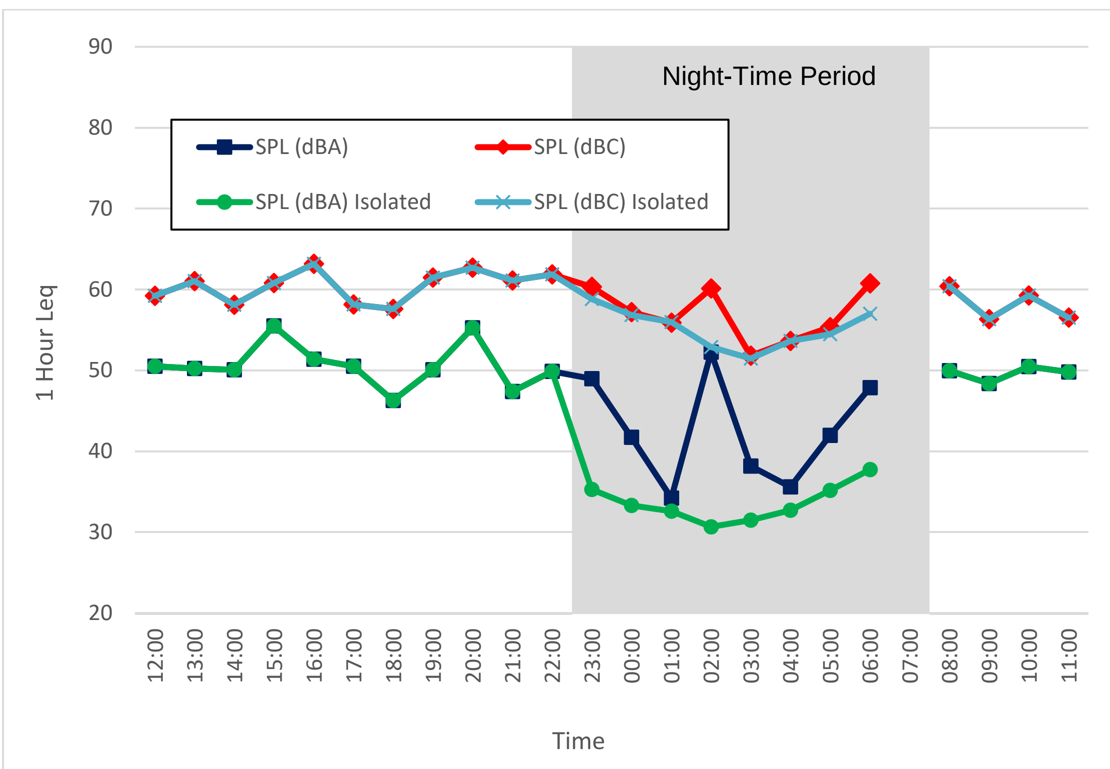

Figure 98. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (June 28 - 29, 2016) [2]

[1] Data from 05:25 to 07:00 was entirely removed due to traffic along the adjacent road.
[2] Data from 05:28 to 07:00 was entirely removed due to traffic along the adjacent road.

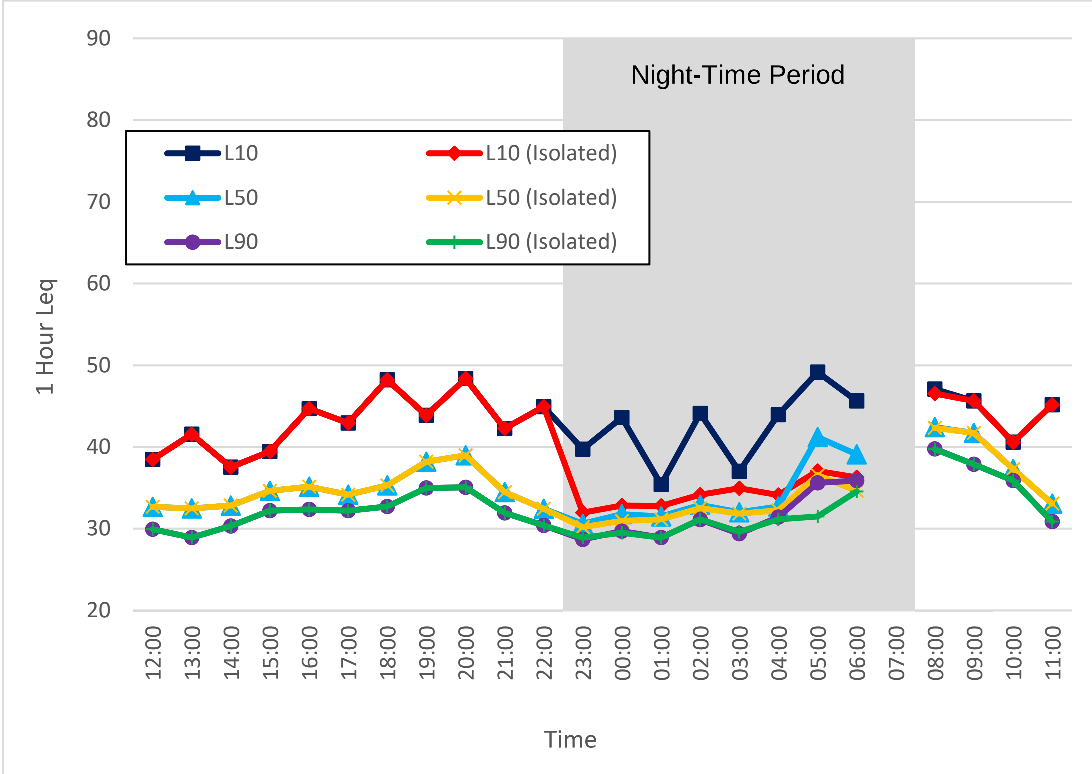

Figure 99. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 27 - 28, 2016) [1]

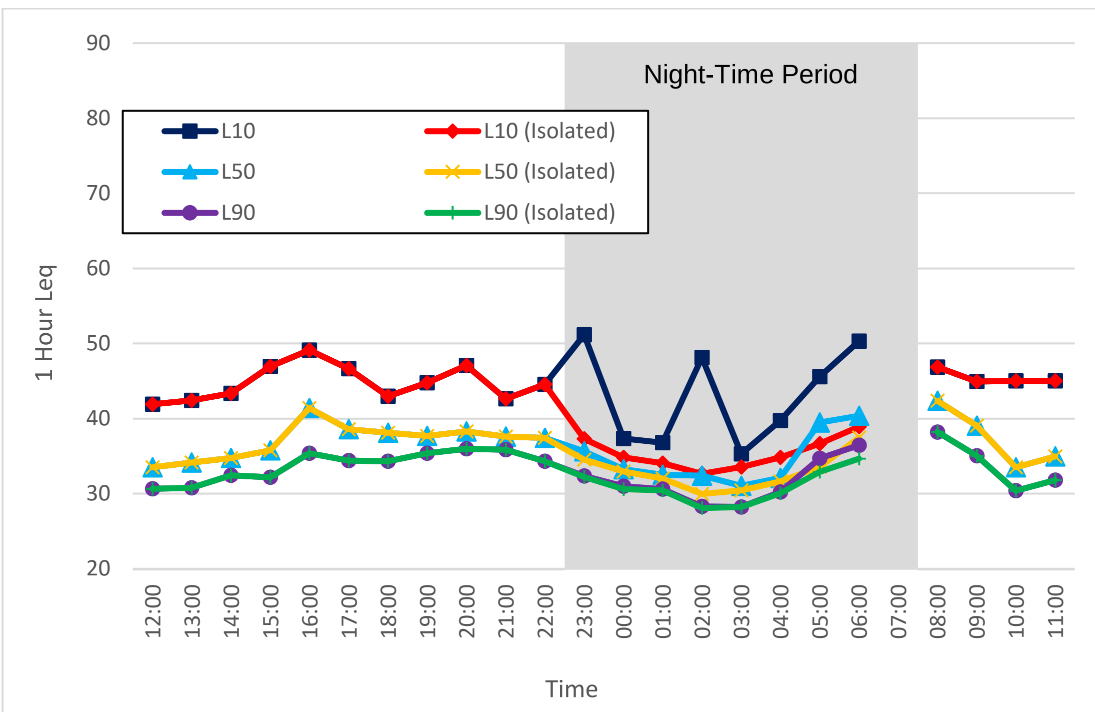

Figure 100. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 28 - 29, 2016) [2]

[1] Data from 05:25 to 07:00 was entirely removed due to traffic along the adjacent road.
[2] Data from 05:28 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #12 - Period 1

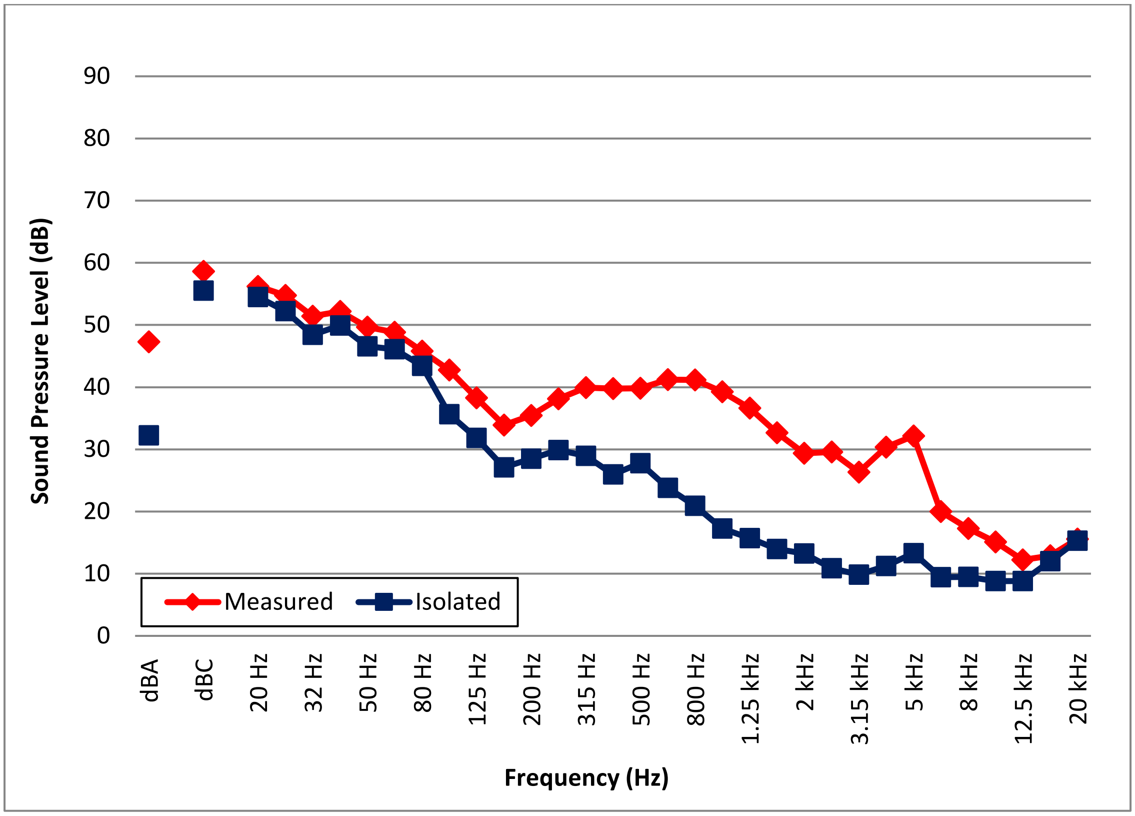

Figure 101. Noise Monitor #12, 1/3 Octave L_{eq} Sound Levels (June 27 - 28, 2016)

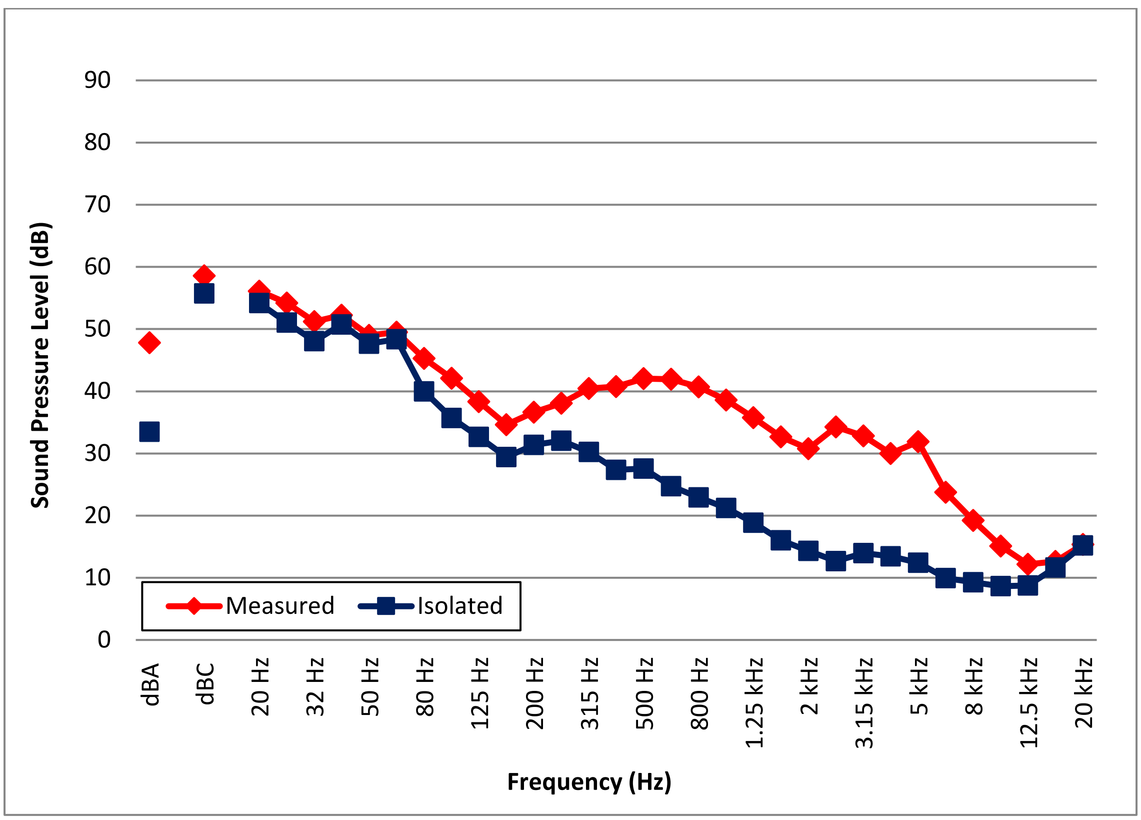

Figure 102. Noise Monitor #12, 1/3 Octave L_{eq} Sound Levels (June 27 - 28, 2016)

Noise Monitor #12 - Period 2

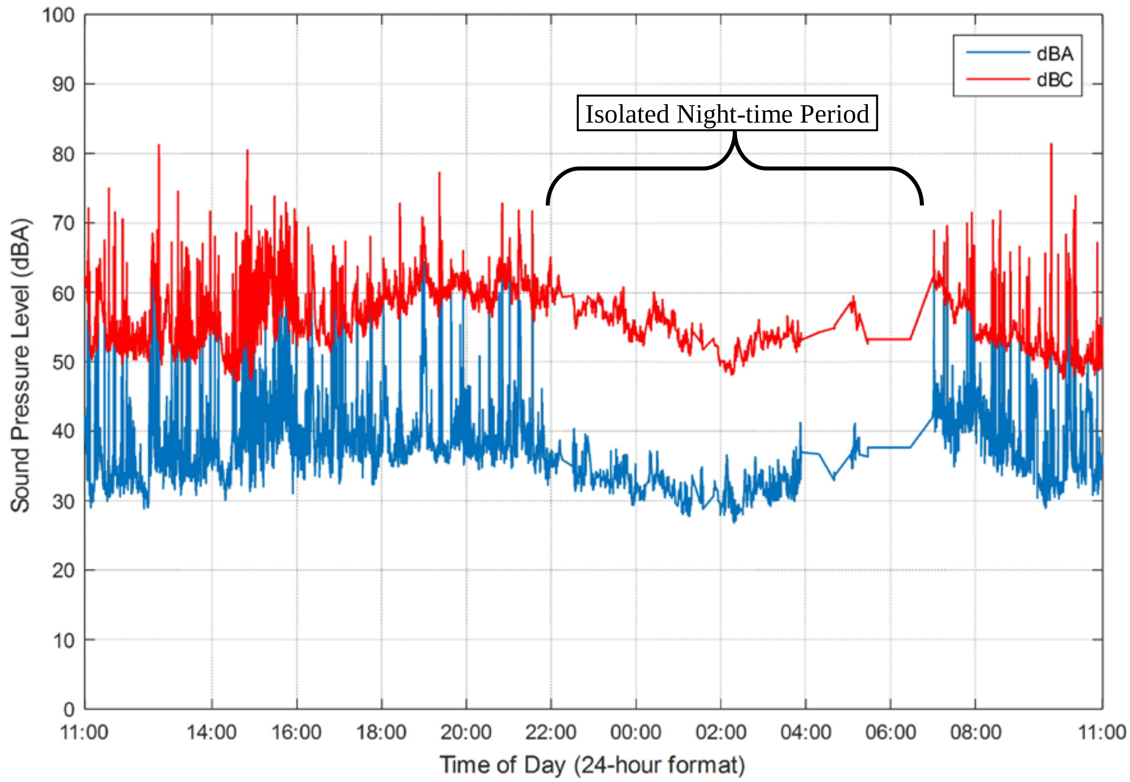

Figure 103. Noise Monitor #12, 15-Second L_{eq} Sound Levels (August 2 - 3, 2016)

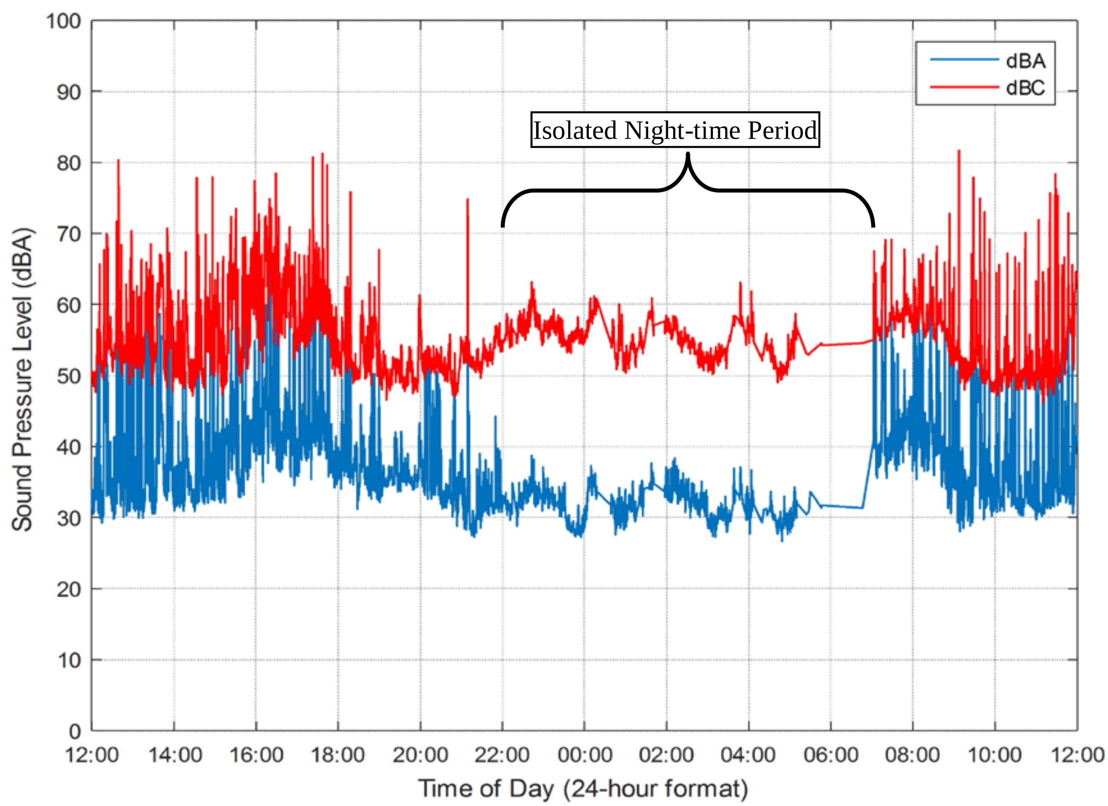

Figure 104. Noise Monitor #12, 15-Second L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #12 - Period 2

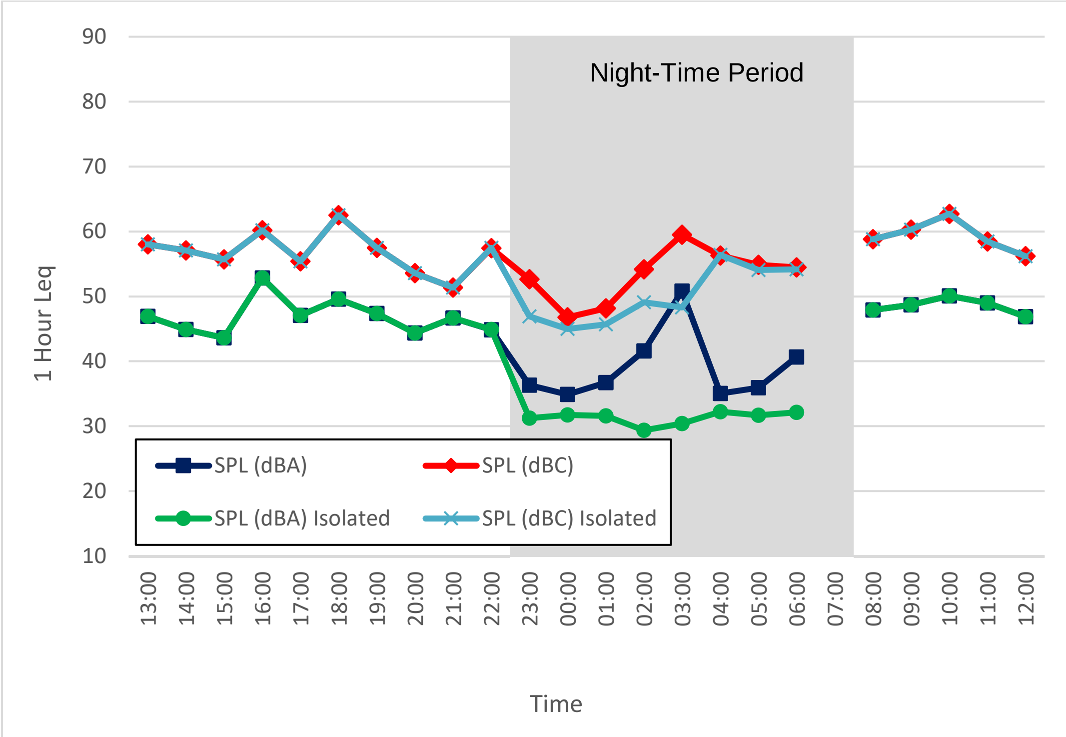

Figure 105. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (August 2 - 3, 2016) [1]

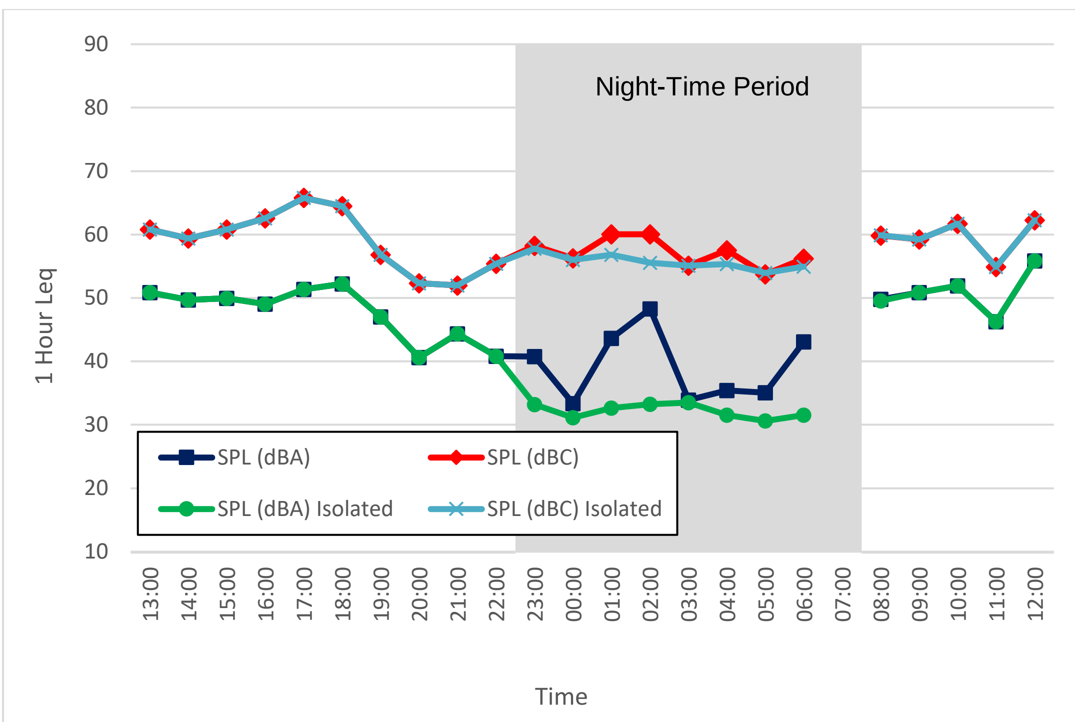

Figure 106. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (August 3 - 4, 2016) [2]

[1] Data from 05:03 to 07:00 was entirely removed due to traffic along the adjacent road.
[2] Data from 05:10 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #12 - Period 2

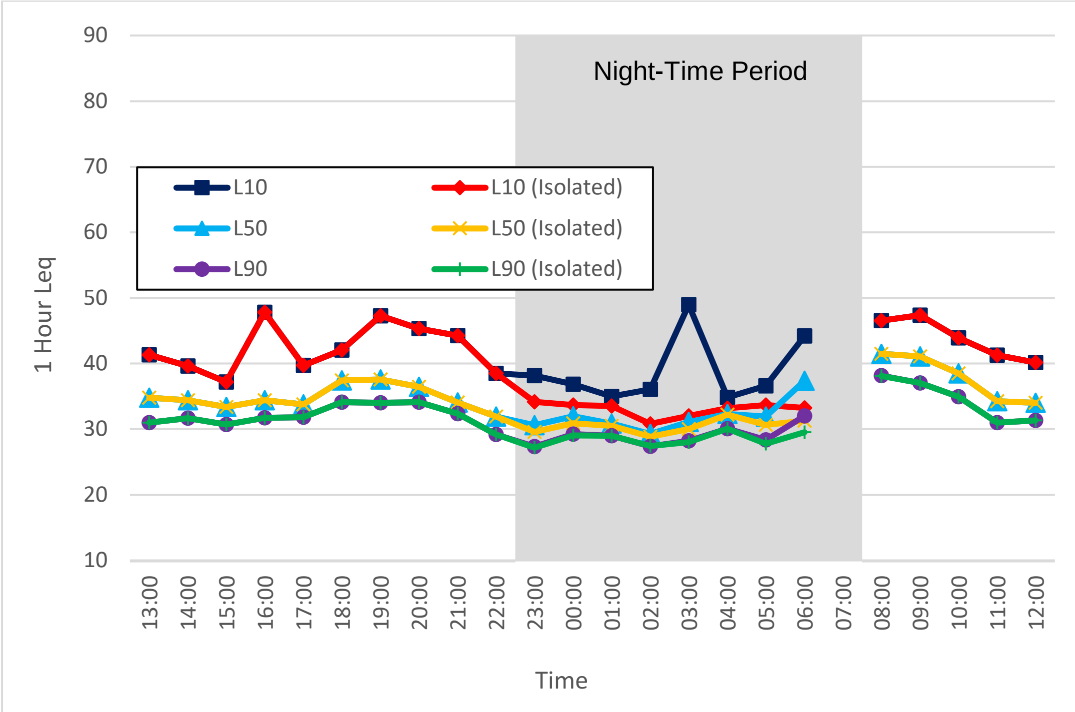

Figure 107. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 2 - 3, 2016) [1]

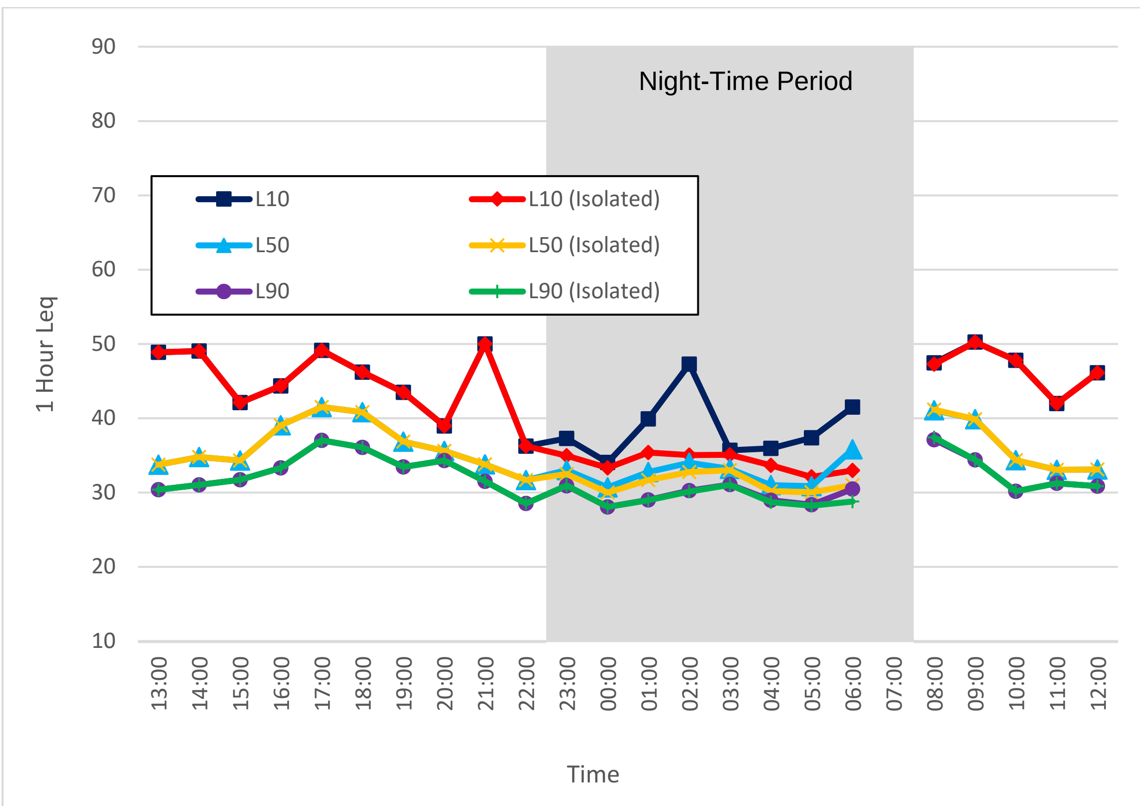

Figure 108. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 3 - 4, 2016) [2]

[1] Data from 05:03 to 07:00 was entirely removed due to traffic along the adjacent road.
[2] Data from 05:10 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #12 - Period 2

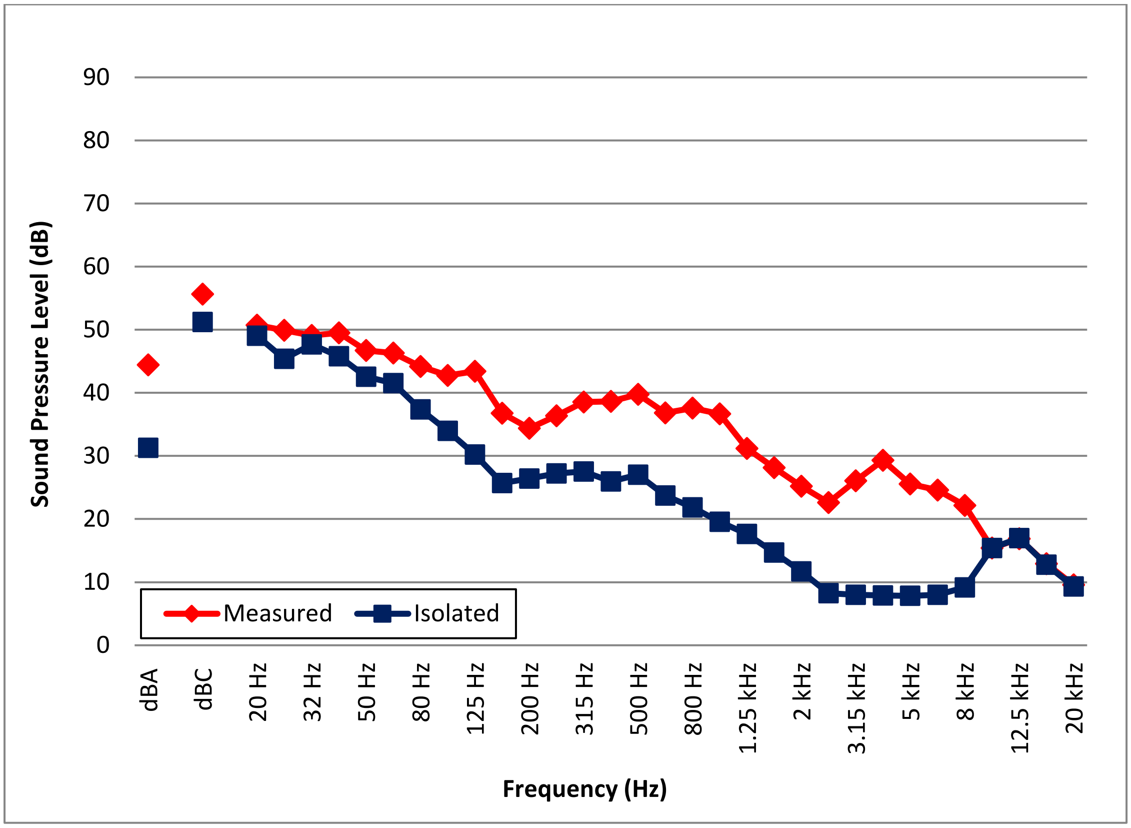

Figure 109. Noise Monitor #12, 1/3 Octave L_{eq} Sound Levels (August 2 - 3, 2016)

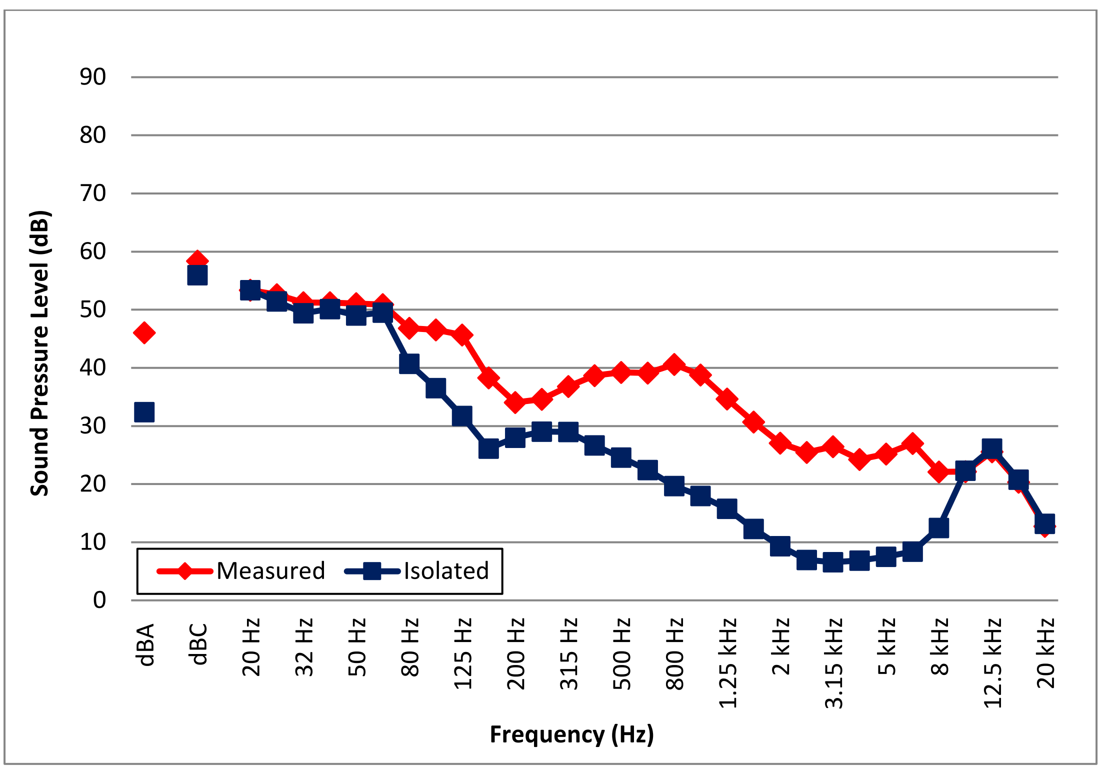

Figure 110. Noise Monitor #12, 1/3 Octave L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #13

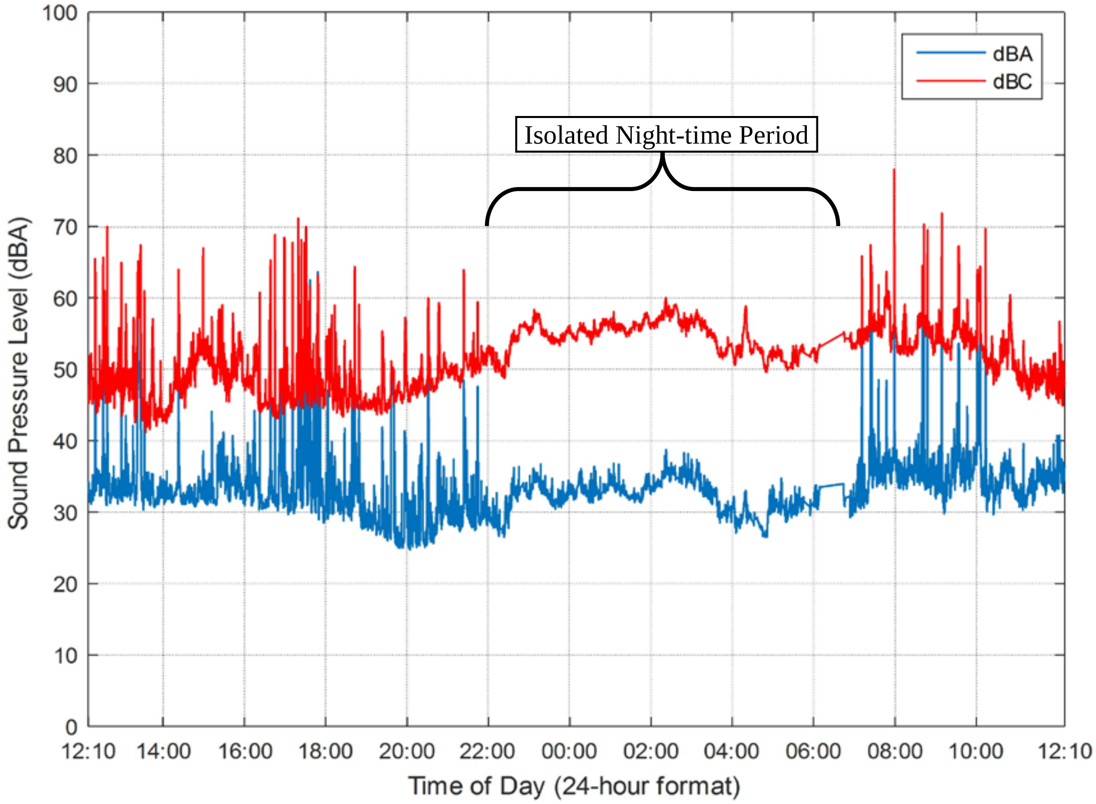

Figure 111. Noise Monitor #13, 15-Second L_{eq} Sound Levels (August 2 - 3, 2016)

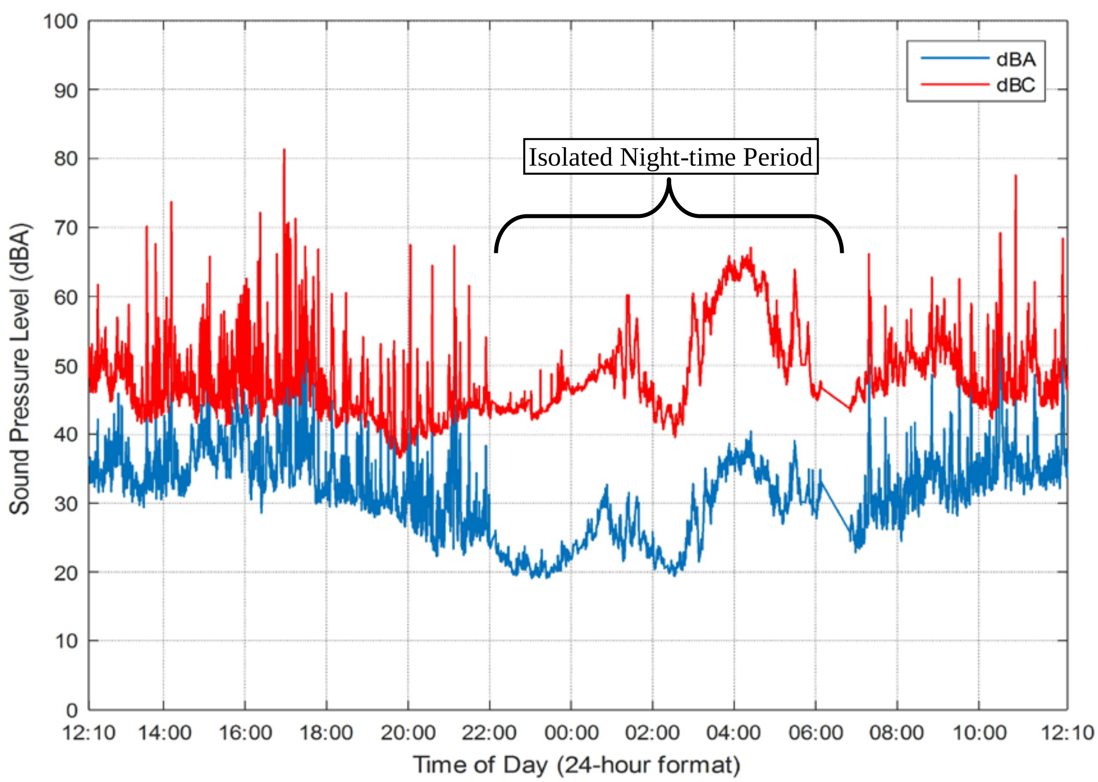

Figure 112. Noise Monitor #13, 15-Second L_{eq} Sound Levels (August 3 - 4, 2016)

Noise Monitor #13

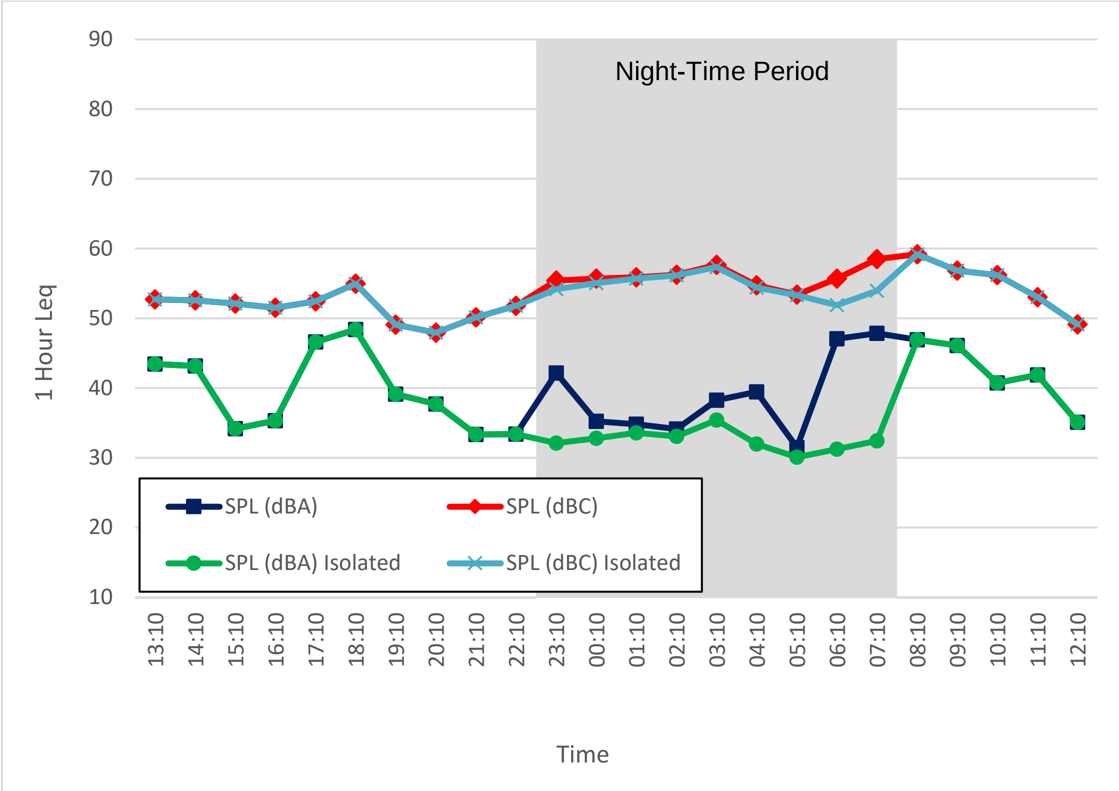

Figure 113. Noise Monitor #13, 1-Hour L_{eq} Sound Levels (August 2 - 3, 2016)

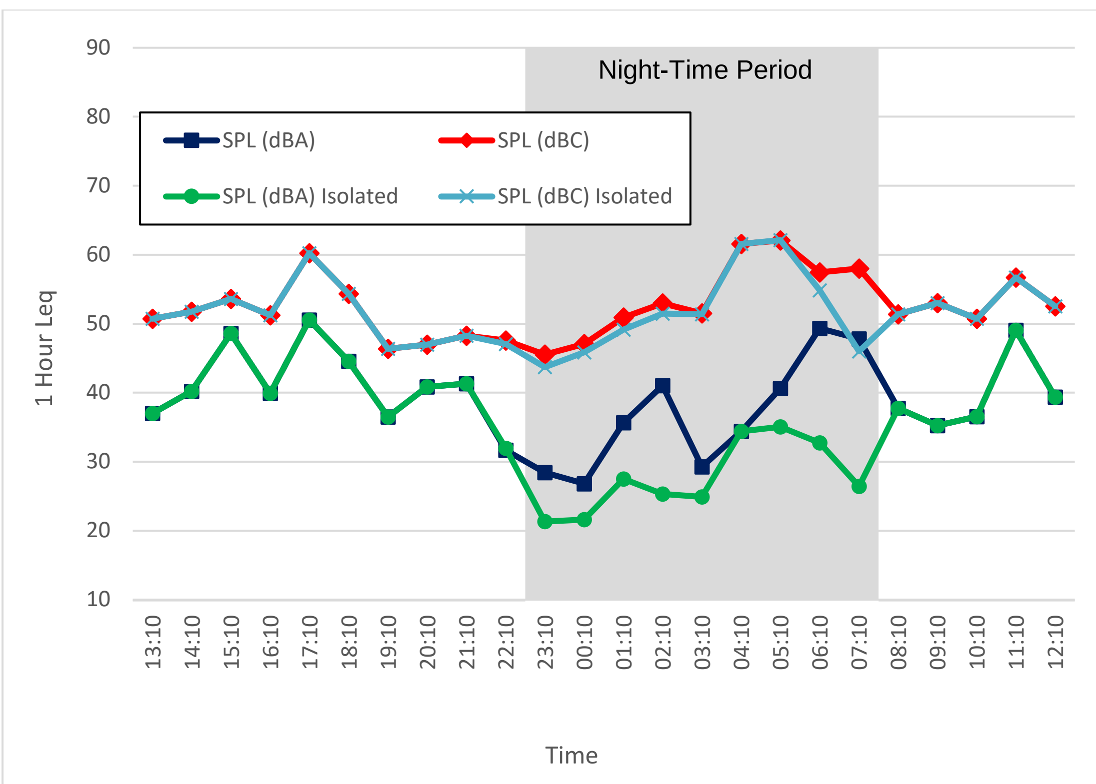

Figure 114. Noise Monitor #13, 1-Hour L_{eq} Sound Levels (August 3 - 4, 2016)

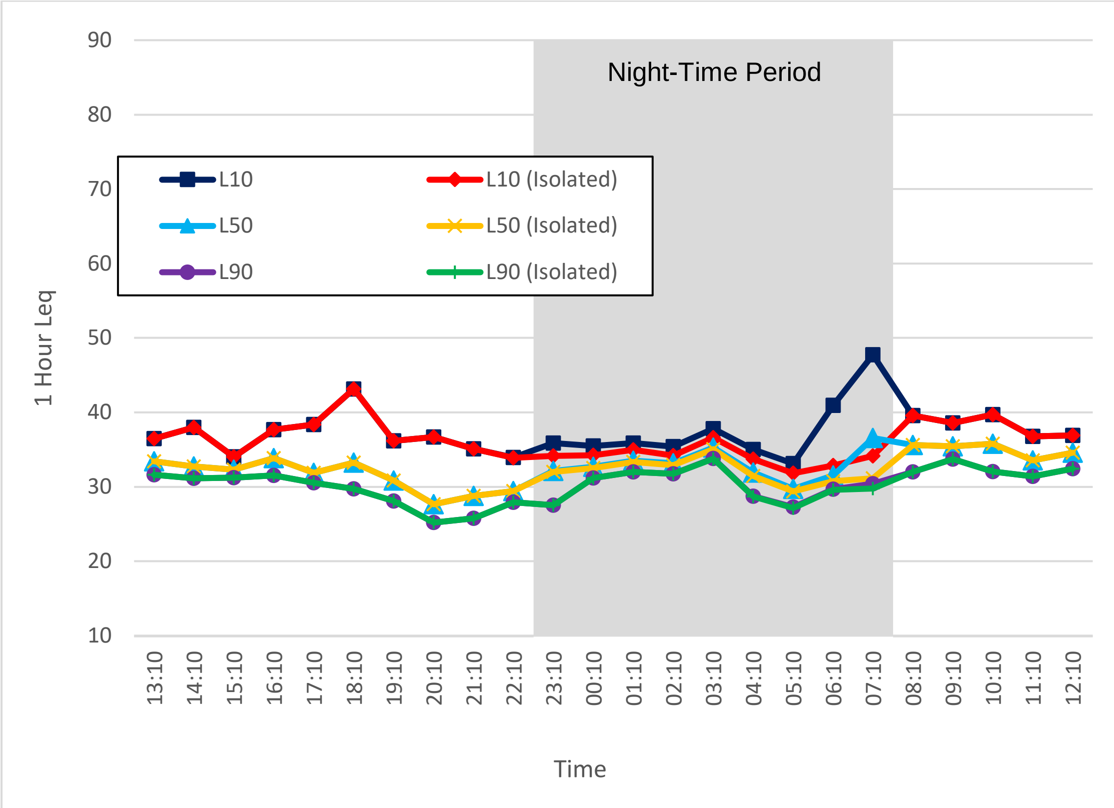

Figure 115. Noise Monitor #13, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 2 - 3, 2016)

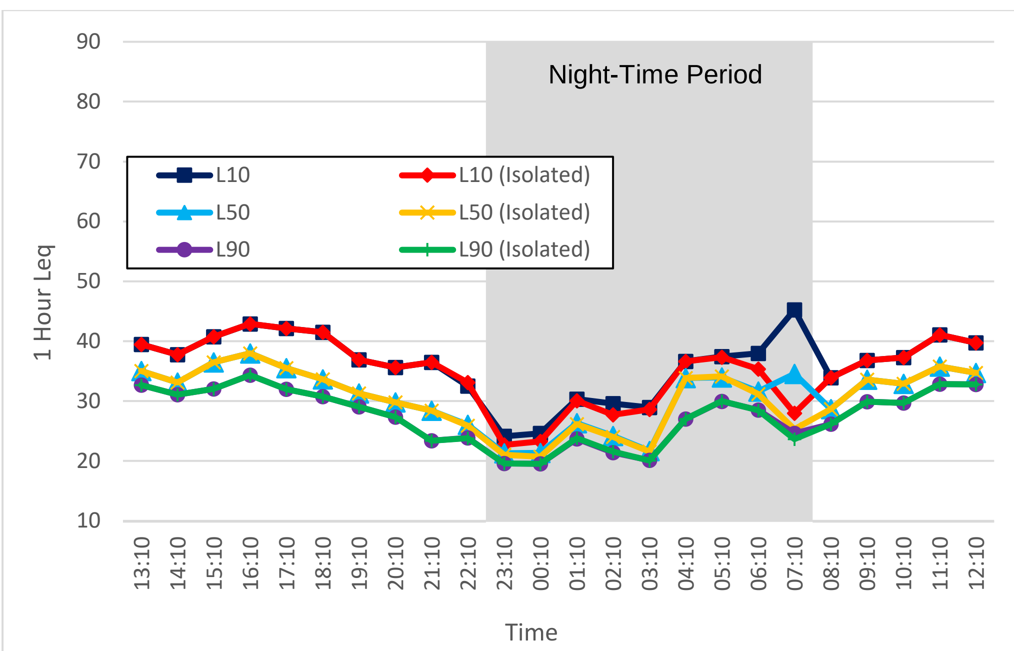

Figure 116. Noise Monitor #13, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (August 3 - 4, 2016)

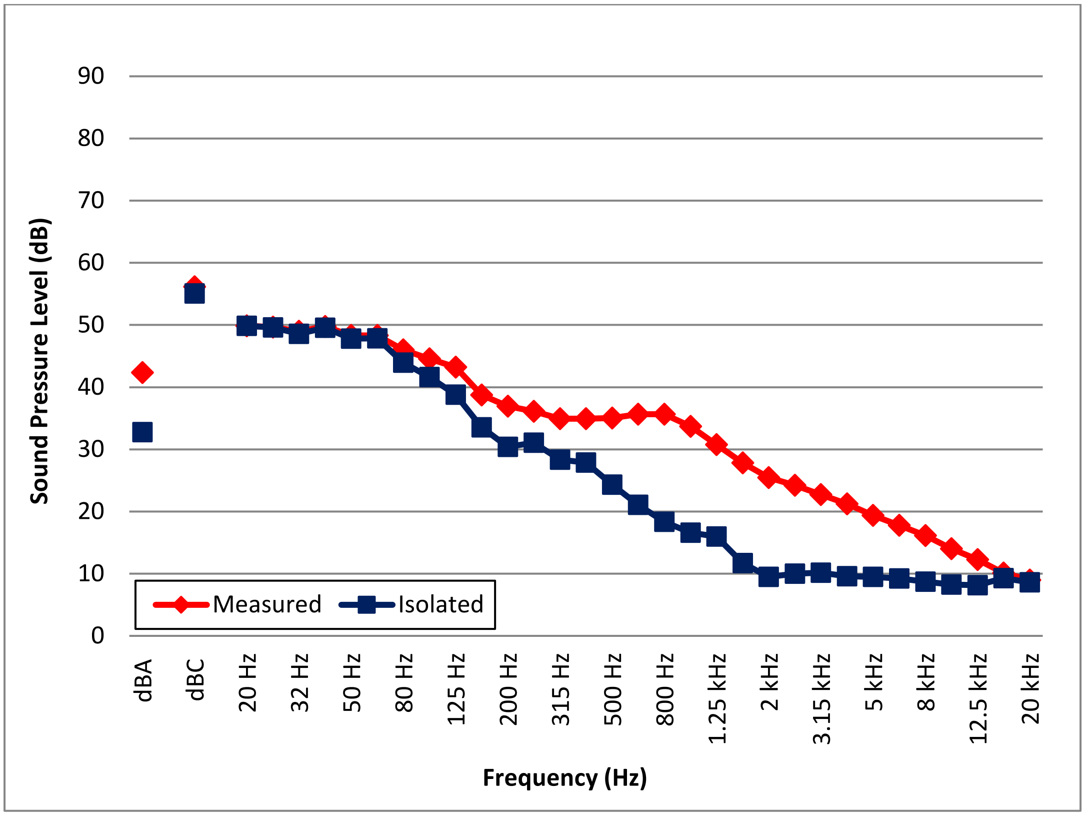

Figure 117. Noise Monitor #13, 1/3 Octave L_{eq} Sound Levels (August 2 - 3, 2016)

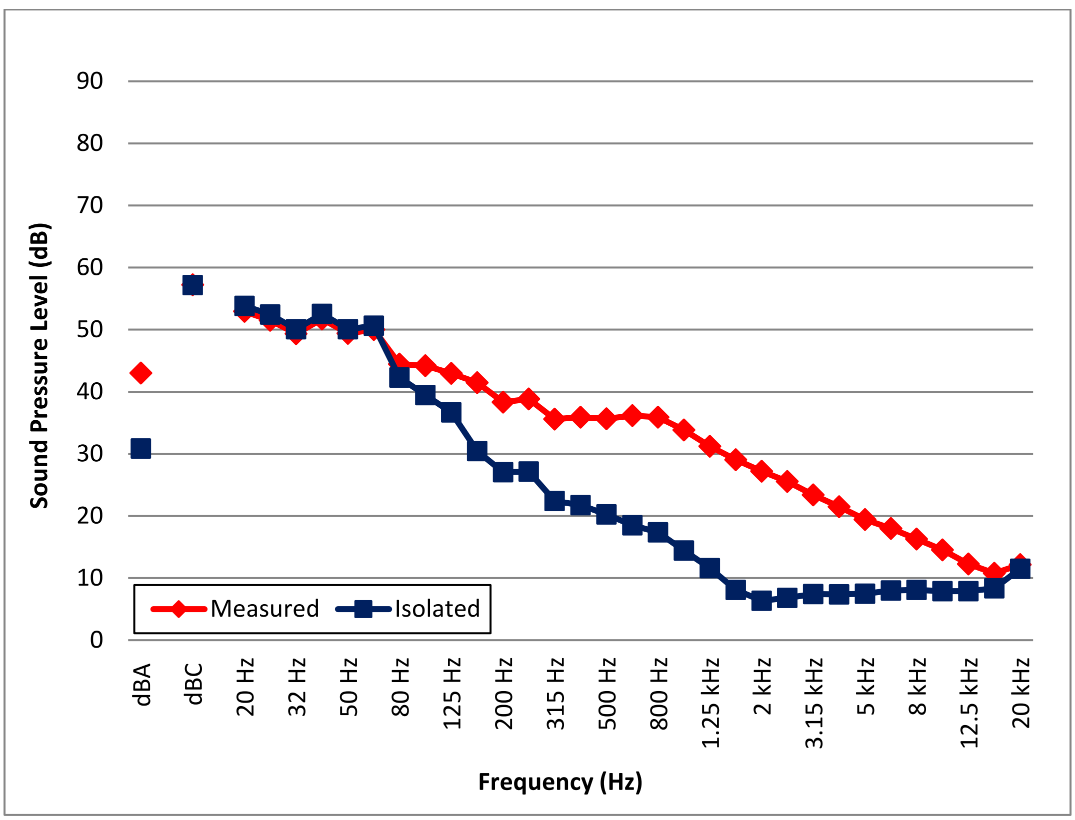

Figure 118. Noise Monitor #13, 1/3 Octave L_{eq} Sound Levels (August 3 - 4, 2016)

Appendix I MEASUREMENT EQUIPMENT USED

Noise Monitors

The environmental noise monitoring equipment used consisted of Brüel and Kjær Type 2250/2270 Precision Integrating Sound Level Meters enclosed in environmental cases with tripods, weather protective microphone hoods, and (in some cases) external batteries. The systems acquired data in 15-second L_{eq} samples using 1/3 octave band frequency analysis and overall A-weighted and C-weighted sound levels. The sound level meters conform to Type 1, ANSI S1.4, ANSI S1.43, IEC 61672-1, IEC 60651, IEC 60804 and DIN 45657. The 1/3 octave filters conform to S1.11 – Type 0-C, and IEC 61260 – Class 0. The calibrator conforms to IEC 942 and ANSI S1.40. The sound level meters, pre-amplifiers and microphones were certified on July 07, 2015 / December 15, 2014 / October 8, 2014 / October 8, 2014 / October 9, 2014 / October 9, 2014 / April 29, 2016 / April 30, 2015 and the calibrator (type B&K 4231) was certified on August 17, 2015 by a NIST NVLAP Accredited Calibration Laboratory for all requirements of ISO 17025: 1999 and relevant requirements of ISO 9002:1994, ISO 9001:2000 and ANSI/NCSL Z540: 1994 Part 1. All measurement methods and instrumentation conform to the requirements of the AER Directive 038. Simultaneous digital audio was recorded directly on the sound level meter using a 8 kHz sample rate for more detailed post-processing analysis. Refer to the next section in the Appendix for a detailed description of the various acoustical descriptive terms used.

Weather Monitors

Each weather monitoring system used for the study consisted of an Orion Weather Station 9510-A-1 with a WXT520 Self-Aspirating Radiation Shield Sensor Unit, a Weather MicroServer 9590 Data-logger, and a Lightning Arrestor. The Data-logger and batteries were located in a grounded, weather protective case. The Sensor Unit was mounted on a sturdy survey tripod (with supporting guy-wires) at approximately 5.0 m above ground. The system was set up to record data in 1-minute samples obtaining the wind-speed, peak wind-speed, and wind-direction in a rolling 2-minute average as well as the 1-minute temperature, relative humidity, barometric pressure, rain rate and total rain accumulation.

Record of Calibration Results

Description	Date	Time	Pre / Post	Calibration Level	Calibrator Model	Serial Number
Monitor #1	June 27, 2016	11:35	Pre	93.9 dBA	B&K 4231	2478139
Monitor #1	June 29, 2016	11:50	Post	93.8 dBA	B&K 4231	2478139
Monitor #2	June 27, 2016	11:10	Pre	93.9 dBA	B&K 4231	2478139
Monitor #2	June 29, 2016	11:30	Post	93.9 dBA	B&K 4231	2478139
Monitor #3	August 2, 2016	08:45	Pre	93.9 dBA	B&K 4231	2478139
Monitor #3	August 4, 2016	14:40	Post	93.9 dBA	B&K 4231	2478139
Monitor #4	June 27, 2016	10:05	Pre	93.9 dBA	B&K 4231	2478139
Monitor #4	June 29, 2016	10:30	Post	93.8 dBA	B&K 4231	2478139
Monitor #5	June 27, 2016	09:40	Pre	93.9 dBA	B&K 4231	2478139
Monitor #5	June 29, 2016	10:10	Post	93.8 dBA	B&K 4231	2478139
Monitor #6	June 27, 2016	09:15	Pre	93.9 dBA	B&K 4231	2478139
Monitor #6	June 29, 2016	09:45	Post	93.9 dBA	B&K 4231	2478139
Monitor #8	August 2, 2016	12:35	Pre	93.9 dBA	B&K 4231	2478139
Monitor #8	August 4, 2016	13:20	Post	93.9 dBA	B&K 4231	2478139
Monitor #9	August 2, 2016	13:40	Pre	93.9 dBA	B&K 4231	2478139
Monitor #9	August 4, 2016	14:05	Post	93.8 dBA	B&K 4231	2478139
Monitor #10	June 27, 2016	10:55	Pre	93.9 dBA	B&K 4231	2478139
Monitor #10	June 29, 2016	11:10	Post	93.8 dBA	B&K 4231	2478139
Monitor #11	August 2, 2016	13:05	Pre	93.9 dBA	B&K 4231	2478139
Monitor #11	August 4, 2016	13:30	Post	93.8 dBA	B&K 4231	2478139
Monitor #12a	June 27, 2016	08:35	Pre	93.9 dBA	B&K 4231	2478139
Monitor #12a	June 29, 2016	12:15	Post	93.8 dBA	B&K 4231	2478139
Monitor #12b	August 2, 2016	11:28	Pre	93.9 dBA	B&K 4231	2478139
Monitor #12b	August 4, 2016	15:20	Post	93.9 dBA	B&K 4231	2478139
Monitor #13	August 2, 2016	12:05	Pre	93.9 dBA	B&K 4231	2478139
Monitor #13	August 4, 2016	12:45	Post	93.8 dBA	B&K 4231	2478139

B&K 4231 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.34409

Instrument:	**Acoustical Calibrator**
Model:	**4231**
Manufacturer:	**Brüel and Kjær**
Serial number:	**2478139**
Class (IEC 60942):	**1**
Barometer type:	
Barometer s/n:	

Date Calibrated: **8/17/2015** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**
Address: **5031 - 210 Street, Edmonton, Alberta, Canada T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 1/16/2015

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 7, 2014	Scantek, Inc./ NVLAP	Oct 7, 2015
DS-360-SRS	Function Generator	33584	Sep 30, 2013	ACR Env./ A2LA	Sep 30, 2015
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 1, 2014	ACR Env. / A2LA	Oct 1, 2015
HM30-Thommen	Meteo Station	1040170/39633	Oct 3, 2014	ACR Env./ A2LA	Oct 3, 2015
8903-HP	Audio Analyzer	2514A05691	Dec 12, 2013	ACR Env. / A2LA	Dec 12, 2016
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4134-Brüel&Kjær	Microphone	906763	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015
1203-Norsonic	Preamplifier	14052	Aug 22, 2014	Scantek, Inc./ NVLAP	Aug 22, 2015

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	8/17/2015	Date	8/17/2015

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B&K 2250 Unit #1 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.34214

Instrument:	**Sound Level Meter**	*Date Calibrated:* **7/7/2015**	*Cal Due:*	
Model:	**2250**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X	X
Serial number:	**2488495**	*Out of tolerance:*		
Tested with:	**Microphone 4189 s/n 2471133**	*See comments:*		
	Preamplifier ZC0032 s/n 3271	*Contains non-accredited tests:* __Yes X No		
Type (class):	**1**	*Calibration service:* __ Basic X Standard		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:* **5031 - 210 Street**		
Tel/Fax:	**780-414-6373 / -6376**	**Edmonton, Alberta CANADA T6M 0A8**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2015	Scantek, Inc./ NVLAP	Jul 2, 2016
DS-360-SRS	Function Generator	61646	Nov 11, 2014	ACR Env./ A2LA	Nov11, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 11, 2014	ACR Env. / A2LA	Nov 11, 2015
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 18, 2014	ACR Env./ A2LA	Nov 18, 2016
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2014	Scantek, Inc./ NVLAP	Nov 10, 2015

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.1	100.41	42.3

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	7/07/2015	Date	7/7/2015

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B&K 2250 Unit #1 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.34215

Instrument:	**Microphone**	*Date Calibrated:* **7/7/2015**	*Cal Due:*	
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	X	X
Serial number:	**2471133**	*Out of tolerance:*		
Composed of:		*See comments:*		
		Contains non-accredited tests: __Yes _X_ No		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street Edmonton, Alberta CANADA T6M 0A8**	
Tel/Fax:	**780-414-6373 / -6376**			

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2015	Scantek, Inc./ NVLAP	Jul 2, 2016
DS-360-SRS	Function Generator	61646	Nov 11, 2014	ACR Env./ A2LA	Nov11, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 11, 2014	ACR Env. / A2LA	Nov 11, 2015
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 18, 2014	ACR Env./ A2LA	Nov 18, 2016
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2014	Scantek, Inc./ NVLAP	Nov 10, 2015
1203-Norsonic	Preamplifier	14059	Jan 5, 2015	Scantek, Inc./ NVLAP	Jan 5, 2016
4180-Brüel&Kjær	Microphone	2246115	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Valentin Buzduga	Authorized signatory:	Mariana Buzduga
Signature		Signature	
Date	7/07/2015	Date	7/7/2015

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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B&K 2270 Unit #2 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32877

Instrument:	**Sound Level Meter**	*Date Calibrated:* **12/15/2014** *Cal Due:*		
Model:	**2270**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X	X
Serial number:	**3002718**	*Out of tolerance:*		
Tested with:	**Microphone 4189 s/n 2850742** **Preamplifier ZC0032 s/n 18754**	*See comments:* *Contains non-accredited tests:* __Yes X No		
Type (class):	**1**	*Calibration service:* __ Basic X Standard		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:* **5031 - 210 Street**		
Tel/Fax:	**780-414-6373 / -6376**	**Edmonton, Alberta** **CANADA T6M 0A8**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 11, 2014	ACR Env./ A2LA	Nov11, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 11, 2014	ACR Env. / A2LA	Nov 11, 2015
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 18, 2014	ACR Env./ A2LA	Nov 18, 2016
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2014	Scantek, Inc./ NVLAP	Nov 10, 2015

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
24.0 °C	100.329 kPa	42.4 %RH

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	12/15/2014	Date	12/15/2014

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B&K 2270 Unit #2 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32878

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2850742**
Composed of:

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**

Date Calibrated: **12/13/2014** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Address: **5031 - 210 Street**
Edmonton, Alberta
CANADA T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 11/30/2010

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 11, 2014	ACR Env./ A2LA	Nov11, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 11, 2014	ACR Env. / A2LA	Nov 11, 2015
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 18, 2014	ACR Env./ A2LA	Nov 18, 2016
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2014	Scantek, Inc./ NVLAP	Nov 10, 2015
1203-Norsonic	Preamplifier	14059	Jan 2, 2014	Scantek, Inc./ NVLAP	Jan 2, 2015
4180-Brüel&Kjær	Microphone	2246115	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Valentin Buzduga	Authorized signatory:	Mariana Buzduga
Signature		Signature	
Date	12/13/2014	Date	12/13/2014

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B&K 2270 Unit #4 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32426

Instrument:	**Sound Level Meter**	*Date Calibrated:* **10/8/2014** *Cal Due:*		
Model:	**2270**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**2644639**	*Out of tolerance:*		
Tested with:	**Microphone 4189 s/n 2643219**	*See comments:*		
	Preamplifier ZC0032 s/n 8255	*Contains non-accredited tests:* __Yes **X** No		
Type (class):	**1**	*Calibration service:* __ Basic **X** Standard		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:* **5031 - 210 Street, Edmonton Alberta, CANADA T6M 0A8**		
Tel/Fax:	**780-414-6373 / -6376**			

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 22, 2013	ACR Env. / A2LA	Nov 22, 2014
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ A2LA	Nov 21, 2014
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1019 Norsonic	Calibration software	v.5.2	Validated Mar 2011	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 8, 2013	Scantek, Inc./ NVLAP	Nov 8, 2014

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
24.4 °C	100.009 kPa	54.1 %RH

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	10/08/2014	Date	10/9/2014

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B&K 2270 Unit #4 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32427

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2643219**
Composed of:

Date Calibrated: **10/3/2014** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ **No**

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**
Address: **5031 - 210 Street, Edmonton Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 11/30/2010

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 22, 2013	ACR Env. / A2LA	Nov 22, 2014
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ A2LA	Nov 21, 2014
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1017 Norsonic	Calibration software	v.6.1m	Validated July 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 8, 2013	Scantek, Inc./ NVLAP	Nov 8, 2014
1203-Norsonic	Preamplifier	14059	Jan 2, 2014	Scantek, Inc./ NVLAP	Jan 2, 2015
4180-Brüel&Kjær	Microphone	2246115	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	10/03/2014	Date	10/9/2014

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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B&K 2250 Unit #5 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32428

Instrument:	**Sound Level Meter**	*Date Calibrated:* **10/8/2014**	*Cal Due:*
Model:	**2250**	*Status:*	**Received** / **Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X / X
Serial number:	**2722894**	*Out of tolerance:*	
Tested with:	**Microphone 4189 s/n 2719777** **Preamplifier ZC0032 s/n 13895**	*See comments:*	
		Contains non-accredited tests: __Yes X No	
Type (class):	**1**	*Calibration service:* __ Basic X Standard	
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street, Edmonton Alberta, CANADA T6M 0A8**
Tel/Fax:	**780-414-6373 / -6376**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 22, 2013	ACR Env. / A2LA	Nov 22, 2014
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ A2LA	Nov 21, 2014
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1019 Norsonic	Calibration software	v.5.2	Validated Mar 2011	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 8, 2013	Scantek, Inc./ NVLAP	Nov 8, 2014

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.3 °C	99.964 kPa	45.0 %RH

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	10/08/2014	Date	10/9/2014

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B&K 2250 Unit #5 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32429

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2719777**
Composed of:

Date Calibrated: **10/3/2014** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**
Address: **5031 - 210 Street, Edmonton Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 11/30/2010

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 22, 2013	ACR Env. / A2LA	Nov 22, 2014
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ A2LA	Nov 21, 2014
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1017 Norsonic	Calibration software	v.6.1m	Validated July 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 8, 2013	Scantek, Inc./ NVLAP	Nov 8, 2014
1203-Norsonic	Preamplifier	14059	Jan 2, 2014	Scantek, Inc./ NVLAP	Jan 2, 2015
4180-Brüel&Kjær	Microphone	2246115	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	10/03/2014	Date	10/9/2014

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aci acoustical consultants inc

B&K 2250 Unit #6 SLM Calibration Certificate

Scantek, Inc.
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ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32430

Instrument:	**Sound Level Meter**
Model:	**2250**
Manufacturer:	**Brüel and Kjær**
Serial number:	**2661161**
Tested with:	**Microphone 4189 s/n 2650730** **Preamplifier ZC0032 s/n 9935**
Type (class):	**1**
Customer:	**ACI Acoustical Consultants Inc.**
Tel/Fax:	**780-414-6373 / -6376**

Date Calibrated: **10/9/2014** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __ **Yes** _X_ **No**
Calibration service: __ **Basic** _X_ **Standard**
Address: **5031 - 210 Street, Edmonton Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 22, 2013	ACR Env. / A2LA	Nov 22, 2014
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ A2LA	Nov 21, 2014
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1019 Norsonic	Calibration software	v.5.2	Validated Mar 2011	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 8, 2013	Scantek, Inc./ NVLAP	Nov 8, 2014

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
21.9 °C	100.694 kPa	45.5 %RH

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	10/09/2014	Date	10/9/2014

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B&K 2250 Unit #6 Microphone Calibration Certificate

Scantek, Inc.
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ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.32431

Instrument:	**Microphone**	*Date Calibrated:* **10/3/2014** *Cal Due:*		
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	X	X
Serial number:	**2650730**	*Out of tolerance:*		
Composed of:		*See comments:*		
		Contains non-accredited tests: __Yes X No		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:* **5031 - 210 Street, Edmonton Alberta, CANADA T6M 0A8**		
Tel/Fax:	**780-414-6373 / -6376**			

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 11/30/2010

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 22, 2013	ACR Env. / A2LA	Nov 22, 2014
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ A2LA	Nov 21, 2014
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1017 Norsonic	Calibration software	v.6.1m	Validated July 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 8, 2013	Scantek, Inc./ NVLAP	Nov 8, 2014
1203-Norsonic	Preamplifier	14059	Jan 2, 2014	Scantek, Inc./ NVLAP	Jan 2, 2015
4180-Brüel&Kjær	Microphone	2246115	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Valentin Buzduga	Authorized signatory:	Mariana Buzduga
Signature		Signature	
Date	10/03/2014	Date	10/9/2014

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B&K 2250 Unit #7 SLM Calibration Certificate

Scantek, Inc.
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NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32432

Instrument:	**Sound Level Meter**	*Date Calibrated:* **10/9/2014** *Cal Due:*		
Model:	**2250**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**2722859**	*Out of tolerance:*		
Tested with:	**Microphone 4189 s/n 2710791** **Preamplifier ZC0032 s/n 13398**	*See comments:*		
		Contains non-accredited tests: __Yes **X** No		
Type (class):	**1**	*Calibration service:* __ Basic **X** Standard		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:* **5031 - 210 Street, Edmonton Alberta, CANADA T6M 0A8**		
Tel/Fax:	**780-414-6373 / -6376**			

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 22, 2013	ACR Env. / A2LA	Nov 22, 2014
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ A2LA	Nov 21, 2014
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1019 Norsonic	Calibration software	v.5.2	Validated Mar 2011	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 8, 2013	Scantek, Inc./ NVLAP	Nov 8, 2014

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
24.0 °C	100.630 kPa	42.7 %RH

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature		Signature	
Date	10/09/2014	Date	10/9/2014

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B&K 2250 Unit #7 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.32433

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2710791**
Composed of:

Date Calibrated: **10/3/2014** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**
Address: **5031 - 210 Street, Edmonton Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 11/30/2010

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2014	Scantek, Inc./ NVLAP	Jul 2, 2015
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 22, 2013	ACR Env. / A2LA	Nov 22, 2014
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ A2LA	Nov 21, 2014
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
PC Program 1017 Norsonic	Calibration software	v.6.1m	Validated July 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 8, 2013	Scantek, Inc./ NVLAP	Nov 8, 2014
1203-Norsonic	Preamplifier	14059	Jan 2, 2014	Scantek, Inc./ NVLAP	Jan 2, 2015
4180-Brüel&Kjær	Microphone	2246115	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Valentin Buzduga	Authorized signatory:	Mariana Buzduga
Signature		Signature	
Date	10/03/2014	Date	10/9/2014

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B&K 2250 Unit #8 SLM Calibration Certificate

Scantek, Inc.
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ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.36136

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **3005978**
Tested with: **Microphone 4189 s/n 2851039**
Preamplifier ZC0032 s/n 20742
Type (class): **1**
Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 /**

Date Calibrated: **4/29/2016** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard
Address: **5031 210 Street,**
Edmonton, Alberta, Canada T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 20, 2015	Scantek, Inc./ NVLAP	Jul 20, 2016
DS-360-SRS	Function Generator	88077	Sep 9, 2014	ACR Env./ A2LA	Sep 9, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 24, 2015	ACR Env./ A2LA	Sep 24, 2016
HM30-Thommen	Meteo Station	1040170/39633	Oct 23, 2015	ACR Env./ A2LA	Oct 23, 2016
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.1	100.26	38.9

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature		Signature	
Date	4/29/16	Date	5/04/2016

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B&K 2250 Unit #8 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.36137

Instrument:	**Microphone**	*Date Calibrated:* **4/29/2016** *Cal Due:*		
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	X	X
Serial number:	**2851039**	*Out of tolerance:*		
Composed of:		*See comments:*		
		Contains non-accredited tests: __Yes _X_ No		
Customer:	**Acoustical Consultants Inc.**	*Address:*	**5031 210 Street, Edmonton, Alberta, Canada T6M 0A8**	
Tel/Fax:	**780-414-6373/**			

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 20, 2015	Scantek, Inc./ NVLAP	Jul 20, 2016
DS-360-SRS	Function Generator	88077	Sep 9, 2014	ACR Env./ A2LA	Sep 9, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 24, 2015	ACR Env./ A2LA	Sep 24, 2016
HM30-Thommen	Meteo Station	1040170/39633	Oct 23, 2015	ACR Env./ A2LA	Oct 23, 2016
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	22909	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 14, 2015	Scantek, Inc./ NVLAP	Oct 14, 2016
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature		Signature	
Date	4/29/16	Date	5/04/2016

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B&K 2250 Unit #10 SLM Calibration Certificate

Brüel & Kjær

MANUFACTURER'S CERTIFICATE OF CONFORMANCE

We certify that Brüel & Kjær **-2250--D00-** Serial No. **3007542**
has been tested and passed all production tests, confirming compliance with the manufacturer's published specification at the date of the test.

The final test has been performed using calibrated equipment, traceable to national or international standards or by ratio measurements.

Brüel & Kjær is certified under ISO 9001:2008 assuring that all test data is retained on file and is available for inspection upon request.

Nærum 30-apr-2015

Torben Bjørn
Vice President, Operations

Please note that this document is not a calibration certificate.
For information on our calibration services please go to www.bksv.com/service.

Bruel & Kjær

Prepolarized Free-field 1/2" Microphone Type 4189

Calibration Chart

Serial No:	2978664	
Open-circuit Sensitivity*, S_0:	*-27.1*	dB re 1V/Pa
Equivalent to:	*44.2*	mV/Pa
Uncertainty, 95 % confidence level	0.2	dB
Capacitance:	*13.3*	pF
Valid At:		
Temperature:	23	°C
Ambient Static Pressure:	101.3	kPa
Relative Humidity:	50	%
Frequency:	251.2	Hz
Polarization Voltage, external:	0	V

Sensitivity Traceable To:
DPLA: Danish Primary Laboratory of Acoustics
NIST: National Institute of Standards and Technology, USA

IEC 61094-4: Type WS 2 F

Environmental Calibration Conditions:
100.7 kPa 22 °C 52 % RH

Procedure: 704215 **Date:** 27. Feb. 2015 **Signature:**

$^*K_0 = -26 - S_0$ Example: $K_0 = -26 - (-26.2) = +0.2$ dB

Appendix II THE ASSESSMENT OF ENVIRONMENTAL NOISE (GENERAL)

Sound Pressure Level

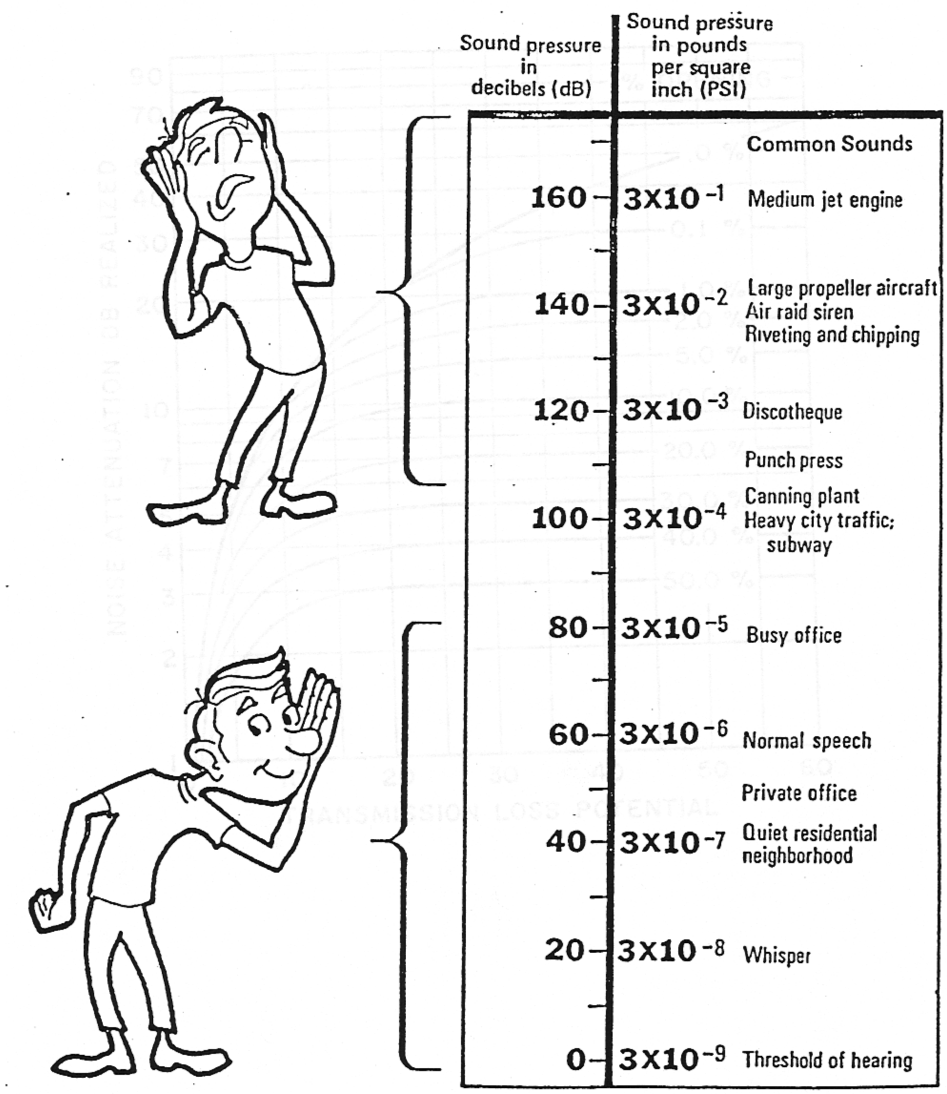
Sound pressure is initially measured in Pascal's (Pa). Humans can hear several orders of magnitude in sound pressure levels, so a more convenient scale is used. This scale is known as the decibel (dB) scale, named after Alexander Graham Bell (telephone guy). It is a base 10 logarithmic scale. When we measure pressure we typically measure the RMS sound pressure.

$$SPL = 10\log_{10}\left[\frac{P_{RMS}^{2}}{P_{ref}^{2}}\right] = 20\log_{10}\left[\frac{P_{RMS}}{P_{ref}}\right]$$

Where: SPL = Sound Pressure Level in dB
P_{RMS} = Root Mean Square measured pressure (Pa)
P_{ref} = Reference sound pressure level (P_{ref} = 2x10^{-5} Pa = 20 μPa)

This reference sound pressure level is an internationally agreed upon value. It represents the threshold of human hearing for "typical" people based on numerous testing. It is possible to have a threshold which is lower than 20 μPa which will result in negative dB levels. As such, zero dB does not mean there is no sound!

In general, a difference of 1 – 2 dB is the threshold for humans to notice that there has been a change in sound level. A difference of 3 dB (factor of 2 in acoustical energy) is perceptible and a change of 5 dB is strongly perceptible. A change of 10 dB is typically considered a factor of 2. This is quite remarkable when considering that 10 dB is 10-times the acoustical energy!


Sound pressure in decibels (dB)
Sound pressure in pounds per square inch (PSI)
Common Sounds
160 3X10^{-1} Medium jet engine
140 3X10^{-2} Large propeller aircraft
Air raid siren
Riveting and chipping
120 3X10^{-3} Discotheque
Punch press
Canning plant
100 3X10^{-4} Heavy city traffic; subway
80 3X10^{-5} Busy office
60 3X10^{-6} Normal speech
Private office
40 3X10^{-7} Quiet residential neighborhood
20 3X10^{-8} Whisper
0 3X10^{-9} Threshold of hearing

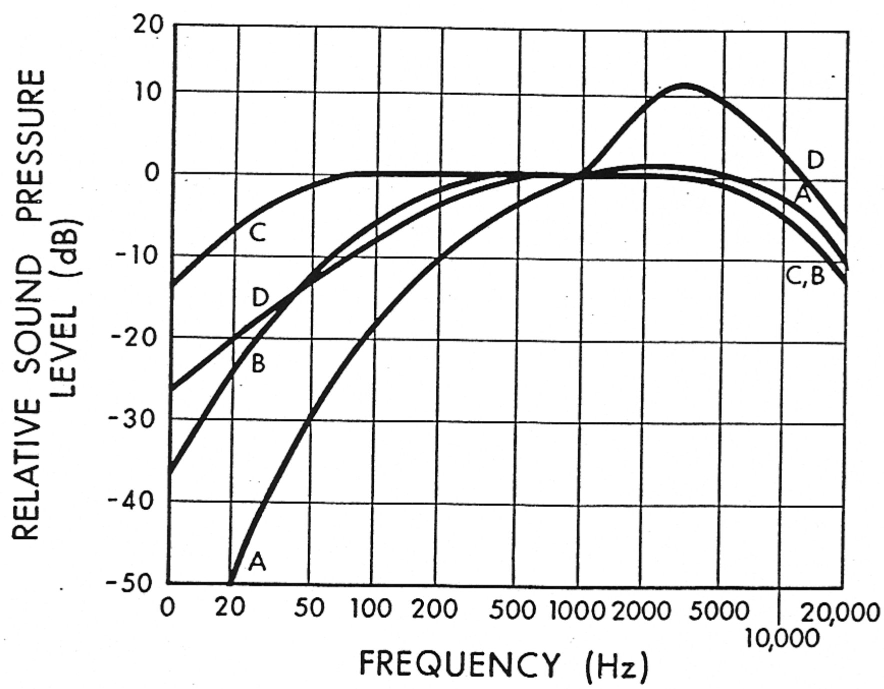
Frequency

The range of frequencies audible to the human ear ranges from approximately 20 Hz to 20 kHz. Within this range, the human ear does not hear equally at all frequencies. It is not very sensitive to low frequency sounds, is very sensitive to mid frequency sounds and is slightly less sensitive to high frequency sounds. Due to the large frequency range of human hearing, the entire spectrum is often divided into 31 bands, each known as a 1/3 octave band.

The internationally agreed upon center frequencies and upper and lower band limits for the 1/1 (whole octave) and 1/3 octave bands are as follows:

	Whole Octave			1/3 Octave	
Lower Band Limit	Center Frequency	Upper Band Limit	Lower Band Limit	Center Frequency	Upper Band Limit
11	**16**	22	14.1	**16**	17.8
			17.8	**20**	22.4
			22.4	**25**	28.2
22	**31.5**	44	28.2	**31.5**	35.5
			35.5	**40**	44.7
			44.7	**50**	56.2
44	**63**	88	56.2	**63**	70.8
			70.8	**80**	89.1
			89.1	**100**	112
88	**125**	177	112	**125**	141
			141	**160**	178
			178	**200**	224
177	**250**	355	224	**250**	282
			282	**315**	355
			355	**400**	447
355	**500**	710	447	**500**	562
			562	**630**	708
			708	**800**	891
710	**1000**	1420	891	**1000**	1122
			1122	**1250**	1413
			1413	**1600**	1778
1420	**2000**	2840	1778	**2000**	2239
			2239	**2500**	2818
			2818	**3150**	3548
2840	**4000**	5680	3548	**4000**	4467
			4467	**5000**	5623
			5623	**6300**	7079
5680	**8000**	11360	7079	**8000**	8913
			8913	**10000**	11220
			11220	**12500**	14130
11360	**16000**	22720	14130	**16000**	17780
			17780	**20000**	22390

Human hearing is most sensitive at approximately 3500 Hz which corresponds to the ¼ wavelength of the ear canal (approximately 2.5 cm). Because of this range of sensitivity to various frequencies, we typically apply various weighting networks to the broadband measured sound to more appropriately account for the way humans hear. By default, the most common weighting network used is the so-called "A-weighting". It can be seen in the figure that the low frequency sounds are reduced significantly with the A-weighting.



Combination of Sounds

When combining multiple sound sources the general equation is:

$$\Sigma SPL_n = 10\log_{10}\left[\sum_{i=1}^{n} 10^{\frac{SPL_i}{10}}\right]$$

Examples:

- Two sources of 50 dB each add together to result in 53 dB.
- Three sources of 50 dB each add together to result in 55 dB.
- Ten sources of 50 dB each add together to result in 60 dB.
- One source of 50 dB added to another source of 40 dB results in 50.4 dB

It can be seen that, if multiple similar sources exist, removing or reducing only one source will have little effect.

Sound Level Measurements

Over the years a number of methods for measuring and describing environmental noise have been developed. The most widely used and accepted is the concept of the Energy Equivalent Sound Level (L_{eq}) which was developed in the US (1970's) to characterize noise levels near US Air-force bases. This is the level of a steady state sound which, for a given period of time, would contain the same energy as the time varying sound. The concept is that the same amount of annoyance occurs from a sound having a high level for a short period of time as from a sound at a lower level for a longer period of time.
The L_{eq} is defined as:

$$L_{eq} = 10\log_{10}\left[\frac{1}{T}\int_0^T 10^{\frac{dB}{10}}\, dT\right] = 10\log_{10}\left[\frac{1}{T}\int_0^T \frac{P^2}{P_{ref}^2}\, dT\right]$$

We must specify the time period over which to measure the sound. i.e. 1-second, 10-seconds, 15-seconds, 1-minute, 1-day, etc**. An L_{eq} is meaningless if there is no time period associated**.

In general there a few very common L_{eq} sample durations which are used in describing environmental noise measurements. These include:

- L_{eq}24 - Measured over a 24-hour period
- L_{eq}Night - Measured over the night-time (typically 22:00 – 07:00)
- L_{eq}Day - Measured over the day-time (typically 07:00 – 22:00)
- L_{DN} - Same as L_{eq}24 with a 10 dB penalty added to the night-time

Statistical Descriptor

Another method of conveying long term noise levels utilizes statistical descriptors. These are calculated from a cumulative distribution of the sound levels over the entire measurement duration and then determining the sound level at xx % of the time.

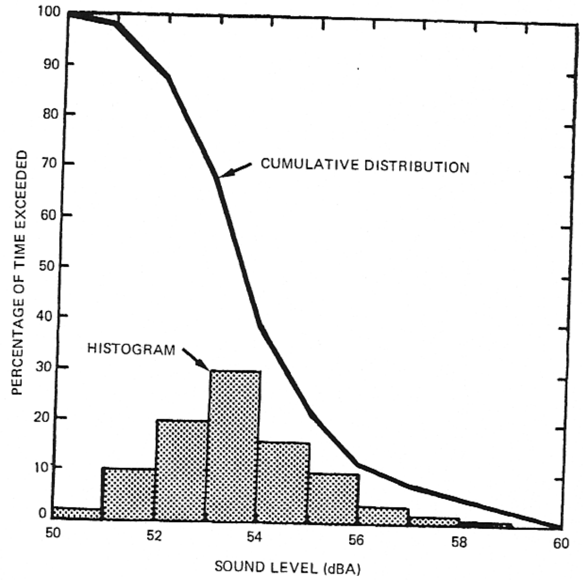


Figure 16.6 Statistically processed community noise showing histogram and cumulative distribution of A weighted sound levels.

Industrial Noise Control, Lewis Bell, Marcel Dekker, Inc. 1994

The most common statistical descriptors are:

- L_{min} - minimum sound level measured
- L_{01} - sound level that was exceeded only 1% of the time
- L_{10} - sound level that was exceeded only 10% of the time.
  - Good measure of intermittent or intrusive noise
  - Good measure of Traffic Noise
- L_{50} - sound level that was exceeded 50% of the time (arithmetic average)
  - Good to compare to L_{eq} to determine steadiness of noise
- L_{90} - sound level that was exceeded 90% of the time
  - Good indicator of typical “ambient” noise levels
- L_{99} - sound level that was exceeded 99% of the time
- L_{max} - maximum sound level measured

These descriptors can be used to provide a more detailed analysis of the varying noise climate:

- If there is a large difference between the L_{eq} and the L_{50} (L_{eq} can never be any lower than the L_{50}) then it can be surmised that one or more short duration, high level sound(s) occurred during the time period.
- If the gap between the L_{10} and L_{90} is relatively small (less than 15 – 20 dBA) then it can be surmised that the noise climate was relatively steady.

Sound Propagation

In order to understand sound propagation, the nature of the source must first be discussed. In general, there are three types of sources. These are known as 'point', 'line', and 'area'. This discussion will concentrate on point and line sources since area sources are much more complex and can usually be approximated by point sources at large distances.

Point Source

As sound radiates from a point source, it dissipates through geometric spreading. The basic relationship between the sound levels at two distances from a point source is:

$$\therefore SPL_1 - SPL_2 = 20\log_{10}\left(\frac{r_2}{r_1}\right)$$

Where: SPL_1 = sound pressure level at location 1, SPL_2 = sound pressure level at location 2
r_1 = distance from source to location 1, r_2 = distance from source to location 2

Thus, the reduction in sound pressure level for a point source radiating in a free field is **6 dB per doubling of distance**. This relationship is independent of reflectivity factors provided they are always present. Note that this only considers geometric spreading and does not take into account atmospheric effects. Point sources still have some physical dimension associated with them, and typically do not radiate sound equally in all directions in all frequencies. The directionality of a source is also highly dependent on frequency. As frequency increases, directionality increases.

Examples (note no atmospheric absorption):

- A point source measuring 50 dB at 100m will be 44 dB at 200m.
- A point source measuring 50 dB at 100m will be 40.5 dB at 300m.
- A point source measuring 50 dB at 100m will be 38 dB at 400m.
- A point source measuring 50 dB at 100m will be 30 dB at 1000m.

Line Source

A line source is similar to a point source in that it dissipates through geometric spreading. The difference is that a line source is equivalent to a long line of many point sources. The basic relationship between the sound levels at two distances from a line source is:

$$SPL_1 - SPL_2 = 10\log_{10}\left(\frac{r_2}{r_1}\right)$$

The difference from the point source is that the '20' term in front of the 'log' is now only 10. Thus, the reduction in sound pressure level for a line source radiating in a free field is **3 dB per doubling of distance**.

Examples (note no atmospheric absorption):

- A line source measuring 50 dB at 100m will be 47 dB at 200m.
- A line source measuring 50 dB at 100m will be 45 dB at 300m.
- A line source measuring 50 dB at 100m will be 44 dB at 400m.
- A line source measuring 50 dB at 100m will be 40 dB at 1000m.

Atmospheric Absorption

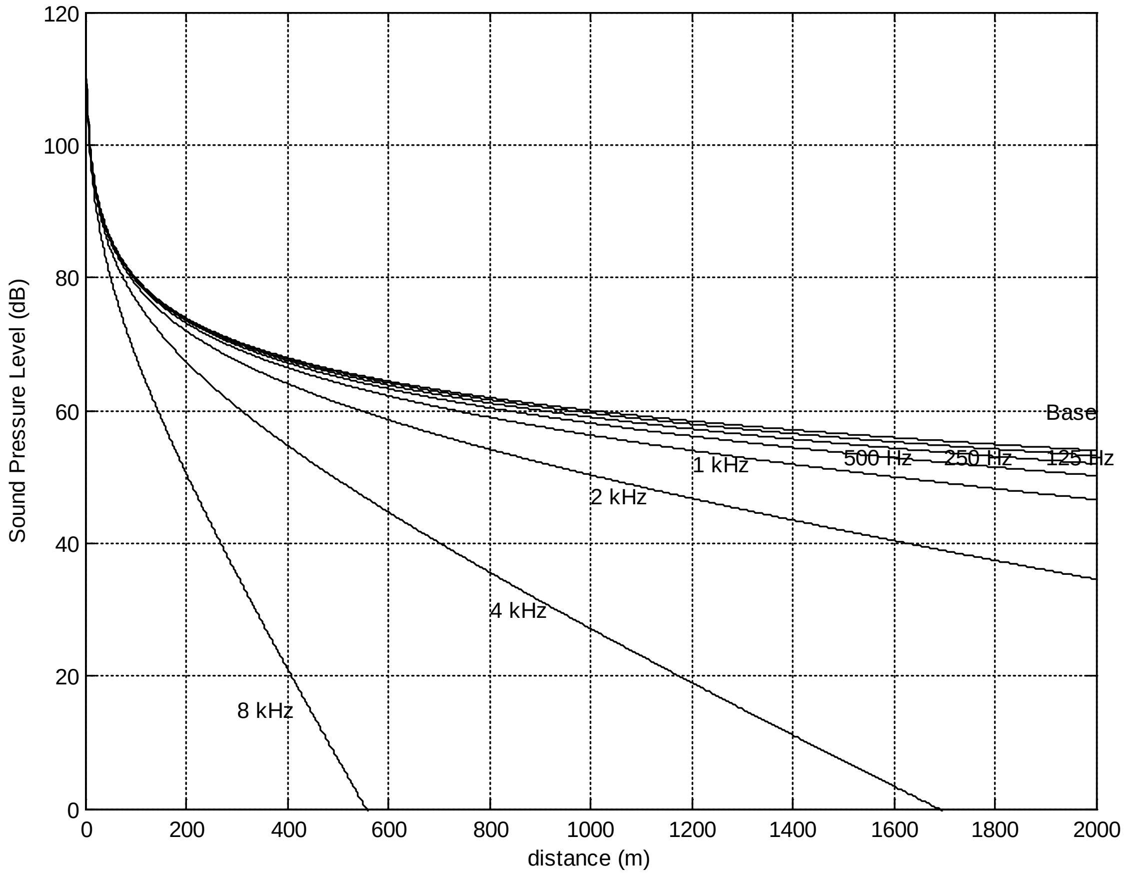
As sound transmits through a medium, there is an attenuation (or dissipation of acoustic energy) which can be attributed to three mechanisms:

1) **Viscous Effects** - Dissipation of acoustic energy due to fluid friction which results in thermodynamically irreversible propagation of sound.
2) **Heat Conduction Effects** - Heat transfer between high and low temperature regions in the wave which result in non-adiabatic propagation of the sound.
3) **Inter Molecular Energy Interchanges** - Molecular energy relaxation effects which result in a time lag between changes in translational kinetic energy and the energy associated with rotation and vibration of the molecules.

The following table illustrates the attenuation coefficient of sound at standard pressure (101.325 kPa) in units of dB/100m.

Temperature °C	Relative Humidity (%)	Frequency (Hz) 125	250	500	1000	2000	4000
30	20	0.06	0.18	0.37	0.64	1.40	4.40
	50	0.03	0.10	0.33	0.75	1.30	2.50
	90	0.02	0.06	0.24	0.70	1.50	2.60
20	20	0.07	0.15	0.27	0.62	1.90	6.70
	50	0.04	0.12	0.28	0.50	1.00	2.80
	90	0.02	0.08	0.26	0.56	0.99	2.10
10	20	0.06	0.11	0.29	0.94	3.20	9.00
	50	0.04	0.11	0.20	0.41	1.20	4.20
	90	0.03	0.10	0.21	0.38	0.81	2.50
0	20	0.05	0.15	0.50	1.60	3.70	5.70
	50	0.04	0.08	0.19	0.60	2.10	6.70
	90	0.03	0.08	0.15	0.36	1.10	4.10

- As frequency increases, absorption tends to increase
- As Relative Humidity increases, absorption tends to decrease
- There is no direct relationship between absorption and temperature
- **The net result of atmospheric absorption is to modify the sound propagation of a point source from 6 dB/doubling-of-distance to approximately 7 – 8 dB/doubling-of-distance (based on anecdotal experience)**



Atmospheric Absorption at 10ºC and 70% RH

Meteorological Effects

There are many meteorological factors which can affect how sound propagates over large distances. These various phenomena must be considered when trying to determine the relative impact of a noise source either after installation or during the design stage.

Wind
- Can greatly alter the noise climate away from a source depending on direction
- Sound levels downwind from a source can be increased due to refraction of sound back down towards the surface. This is due to the generally higher velocities as altitude increases.
- Sound levels upwind from a source can be decreased due to a "bending" of the sound away from the earth's surface.
- Sound level differences of ±10dB are possible depending on severity of wind and distance from source.
- Sound levels crosswind are generally not disturbed by an appreciable amount
- Wind tends to generate its own noise, however, and can provide a high degree of masking relative to a noise source of particular interest.

Temperature
- Temperature effects can be similar to wind effects
- Typically, the temperature is warmer at ground level than it is at higher elevations.
- If there is a very large difference between the ground temperature (very warm) and the air aloft (only a few hundred meters) then the transmitted sound refracts upward due to the changing speed of sound.
- If the air aloft is warmer than the ground temperature (known as an *inversion*) the resulting higher speed of sound aloft tends to refract the transmitted sound back down towards the ground. This essentially works on Snell's law of reflection and refraction.
- Temperature inversions typically happen early in the morning and are most common over large bodies of water or across river valleys.
- Sound level differences of ±10dB are possible depending on gradient of temperature and distance from source.

Rain
- Rain does not affect sound propagation by an appreciable amount unless it is very heavy
- The larger concern is the noise generated by the rain itself. A heavy rain striking the ground can cause a significant amount of highly broadband noise. The amount of noise generated is difficult to predict.
- Rain can also affect the output of various noise sources such as vehicle traffic.

Summary
- In general, these wind and temperature effects are difficult to predict
- Empirical models (based on measured data) have been generated to attempt to account for these effects.
- Environmental noise measurements must be conducted with these effects in mind. Sometimes it is desired to have completely calm conditions, other times a "worst case" of downwind noise levels are desired.

Topographical Effects

Similar to the various atmospheric effects outlined in the previous section, the effect of various geographical and vegetative factors must also be considered when examining the propagation of noise over large distances.

Topography

- One of the most important factors in sound propagation.
- Can provide a natural barrier between source and receiver (i.e. if berm or hill in between).
- Can provide a natural amplifier between source and receiver (i.e. large valley in between or hard reflective surface in between).
- Must look at location of topographical features relative to source and receiver to determine importance (i.e. small berm 1km away from source and 1km away from receiver will make negligible impact).

Grass

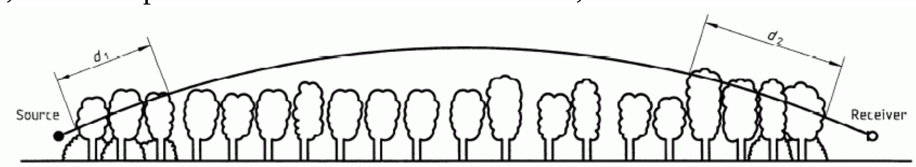
- Can be an effective absorber due to large area covered
- Only effective at low height above ground. Does not affect sound transmitted direct from source to receiver if there is line of sight.
- Typically less absorption than atmospheric absorption when there is line of sight.
- Approximate rule of thumb based on empirical data is:

$$A_g = 18\log_{10}(f) - 31 \qquad (dB/100m)$$

Where: A_g is the absorption amount

Trees

- Provide absorption due to foliage
- Deciduous trees are essentially ineffective in the winter
- Absorption depends heavily on density and height of trees
- No data found on absorption of various kinds of trees
- Large spans of trees are required to obtain even minor amounts of sound reduction
- In many cases, trees can provide an effective visual barrier, even if the noise attenuation is negligible.



NOTE — $d_f = d_1 + d_2$

For calculating d_1 and d_2, the curved path radius may be assumed to be 5 km.

Figure A.1 — Attenuation due to propagation through foliage increases linearly with propagation distance d_f through the foliage

Table A.1 — Attenuation of an octave band of noise due to propagation a distance d_f through dense foliage

Propagation distance d_f m	Nominal midband frequency Hz							
	63	125	250	500	1 000	2 000	4 000	8 000
	Attenuation, dB:							
$10 \leq d_f \leq 20$	0	0	1	1	1	1	2	3
	Attenuation, dB/m:							
$20 \leq d_f \leq 200$	0,02	0,03	0,04	0,05	0,06	0,08	0,09	0,12

Tree/Foliage attenuation from ISO 9613-2:1996

Bodies of Water

- Large bodies of water can provide the opposite effect to grass and trees.
- Reflections caused by small incidence angles (grazing) can result in larger sound levels at great distances (increased reflectivity, Q).
- Typically air temperatures are warmer high aloft since air temperatures near water surface tend to be more constant. Result is a high probability of temperature inversion.
- Sound levels can "carry" much further.

Snow

- Covers the ground for approximately 1/2 of the year in northern climates.
- Can act as an absorber or reflector (and varying degrees in between).
- Freshly fallen snow can be quite absorptive.
- Snow which has been sitting for a while and hard packed due to wind can be quite reflective.
- Falling snow can be more absorptive than rain, but does not tend to produce its own noise.
- Snow can cover grass which might have provided some means of absorption.
- Typically sound propagates with less impedance in winter due to hard snow on ground and no foliage on trees/shrubs.

Appendix III SOUND LEVELS OF FAMILIAR NOISE SOURCES

Used with Permission Obtained from the Alberta Energy Regulator (AER) Directive 038 (February 2007)

Source[1]	**Sound Level (dBA)**
Bedroom of a country home	30
Soft whisper at 1.5 m	30
Quiet office or living room	40
Moderate rainfall	50
Inside average urban home	50
Quiet street	50
Normal conversation at 1 m	60
Noisy office	60
Noisy restaurant	70
Highway traffic at 15 m	75
Loud singing at 1 m	75
Tractor at 15 m	78-95
Busy traffic intersection	80
Electric typewriter	80
Bus or heavy truck at 15 m	88-94
Jackhammer	88-98
Loud shout	90
Freight train at 15 m	95
Modified motorcycle	95
Jet taking off at 600 m	100
Amplified rock music	110
Jet taking off at 60 m	120
Air-raid siren	130

[1] Cottrell, Tom, 1980, *Noise in Alberta*, Table 1, p.8, ECA80 - 16/1B4 (Edmonton: Environment Council of Alberta).

SOUND LEVELS GENERATED BY COMMON APPLIANCES

Used with Permission Obtained from the Alberta Energy Regulator (AER) Directive 038 (February 2007)

Source[1]	**Sound level at 3 feet (dBA)**
Freezer	38-45
Refrigerator	34-53
Electric heater	47
Hair clipper	50
Electric toothbrush	48-57
Humidifier	41-54
Clothes dryer	51-65
Air conditioner	50-67
Electric shaver	47-68
Water faucet	62
Hair dryer	58-64
Clothes washer	48-73
Dishwasher	59-71
Electric can opener	60-70
Food mixer	59-75
Electric knife	65-75
Electric knife sharpener	72
Sewing machine	70-74
Vacuum cleaner	65-80
Food blender	65-85
Coffee mill	75-79
Food waste disposer	69-90
Edger and trimmer	81
Home shop tools	64-95
Hedge clippers	85
Electric lawn mower	80-90

[1] Reif, Z. F., and Vermeulen, P. J., 1979, "Noise from domestic appliances, construction, and industry," Table 1, p.166, in Jones, H. W., ed., *Noise in the Human Environment*, vol. 2, ECA79-SP/1 (Edmonton: Environment Council of Alberta).

Appendix IV DATA REMOVAL

Data Removal Noise Monitoring Location #1

Start Time	End Time	Duration (min)	Reason
6/27/16 22:04	6/27/16 22:06	2.1	Loud Vehicle Passby
6/27/16 22:09	6/27/16 22:10	0.9	Loud Vehicle Passby
6/27/16 22:15	6/27/16 22:16	0.9	Loud Vehicle Passby
6/27/16 22:18	6/27/16 22:19	1.1	Loud Vehicle Passby
6/27/16 22:23	6/27/16 22:24	0.6	Loud Vehicle Passby
6/27/16 22:25	6/27/16 22:26	0.6	Loud Vehicle Passby
6/27/16 22:27	6/27/16 22:28	0.9	Loud Vehicle Passby
6/27/16 22:28	6/27/16 22:29	0.9	Loud Vehicle Passby
6/27/16 22:53	6/27/16 22:54	0.6	Loud Vehicle Passby
6/27/16 22:58	6/27/16 22:59	1.1	Loud Vehicle Passby
6/27/16 23:07	6/27/16 23:07	0.6	Loud Vehicle Passby
6/27/16 23:14	6/27/16 23:15	0.9	Loud Vehicle Passby
6/27/16 23:34	6/27/16 23:35	0.6	Loud Vehicle Passby
6/28/16 00:11	6/28/16 00:11	0.9	Loud Vehicle Passby
6/28/16 00:43	6/28/16 00:44	1.6	Loud Vehicle Passby
6/28/16 00:52	6/28/16 00:52	0.9	Loud Vehicle Passby
6/28/16 02:30	6/28/16 02:31	1.1	Loud Vehicle Passby
6/28/16 02:52	6/28/16 02:53	0.9	Loud Vehicle Passby
6/28/16 03:12	6/28/16 03:12	0.9	Loud Vehicle Passby
6/28/16 03:14	6/28/16 03:16	1.9	Loud Vehicle Passby
6/28/16 03:18	6/28/16 03:18	0.1	Loud Vehicle Passby
6/28/16 03:19	6/28/16 03:20	0.6	Loud Vehicle Passby
6/28/16 03:21	6/28/16 03:21	0.9	Loud Vehicle Passby
6/28/16 03:24	6/28/16 03:25	1.4	Train Passby
6/28/16 03:40	6/28/16 03:42	2.4	Train Passby
6/28/16 03:47	6/28/16 03:48	1.1	Loud Vehicle Passby
6/28/16 04:00	6/28/16 04:00	0.9	Loud Vehicle Passby
6/28/16 04:01	6/28/16 04:02	1.1	Loud Vehicle Passby
6/28/16 04:09	6/28/16 04:12	2.6	Loud Vehicle Passby
6/28/16 04:12	6/28/16 04:14	2.4	Loud Vehicle Passby
6/28/16 04:23	6/28/16 04:24	1.1	Loud Vehicle Passby
6/28/16 04:25	6/28/16 04:33	7.9	Loud Vehicle Passby
6/28/16 04:34	6/28/16 07:00	146.4	Vehicles, Morning Chorus
6/28/16 22:06	6/28/16 22:07	0.9	Loud Vehicle Passby
6/28/16 22:13	6/28/16 22:14	1.1	Loud Vehicle Passby
6/28/16 22:17	6/28/16 22:18	0.9	Loud Vehicle Passby
6/28/16 22:33	6/28/16 22:33	0.6	Loud Vehicle Passby
6/28/16 22:40	6/28/16 22:42	1.9	Loud Vehicle Passby
6/28/16 22:56	6/28/16 22:57	0.6	Loud Vehicle Passby

Data Removal Noise Monitoring Location #1 Cont.

Start Time	End Time	Duration (min)	Reason
6/28/16 23:05	6/28/16 23:06	1.1	Loud Vehicle Passby
6/28/16 23:07	6/28/16 23:07	0.9	Loud Vehicle Passby
6/28/16 23:09	6/28/16 23:10	1.1	Loud Vehicle Passby
6/28/16 23:13	6/28/16 23:14	1.1	Loud Vehicle Passby
6/28/16 23:19	6/28/16 23:20	0.9	Loud Vehicle Passby
6/28/16 23:21	6/28/16 23:22	0.9	Loud Vehicle Passby
6/28/16 23:32	6/28/16 23:33	1.1	Loud Vehicle Passby
6/28/16 23:42	6/28/16 23:43	1.1	Loud Vehicle Passby
6/28/16 23:59	6/29/16 00:00	0.9	Loud Vehicle Passby
6/29/16 00:04	6/29/16 00:05	0.9	Loud Vehicle Passby
6/29/16 00:07	6/29/16 00:08	0.9	Loud Vehicle Passby
6/29/16 00:10	6/29/16 00:13	3.4	Train Passby
6/29/16 00:20	6/29/16 00:21	0.9	Loud Vehicle Passby
6/29/16 00:33	6/29/16 00:33	0.6	Loud Vehicle Passby
6/29/16 00:45	6/29/16 00:46	0.9	Loud Vehicle Passby
6/29/16 00:48	6/29/16 00:49	1.4	Loud Vehicle Passby
6/29/16 00:57	6/29/16 00:59	1.9	Loud Vehicle Passby
6/29/16 01:58	6/29/16 02:01	2.9	Train Passby
6/29/16 02:01	6/29/16 02:02	0.9	Loud Vehicle Passby
6/29/16 02:43	6/29/16 02:44	0.9	Loud Vehicle Passby
6/29/16 02:44	6/29/16 02:45	1.1	Loud Vehicle Passby
6/29/16 03:43	6/29/16 03:43	0.1	Loud Vehicle Passby
6/29/16 03:43	6/29/16 03:43	0.6	backup beeper
6/29/16 03:44	6/29/16 03:44	0.1	Backup beeper
6/29/16 04:04	6/29/16 04:05	1.1	Loud Vehicle Passby
6/29/16 04:15	6/29/16 04:17	1.4	Loud Vehicle Passby
6/29/16 04:19	6/29/16 04:20	0.9	Loud Vehicle Passby
6/29/16 04:24	6/29/16 04:25	1.4	Loud Vehicle Passby
6/29/16 04:27	6/29/16 04:28	1.6	Loud Vehicle Passby
6/29/16 04:31	6/29/16 04:33	1.4	Loud Vehicle Passby
6/29/16 04:33	6/29/16 04:34	0.6	Loud Vehicle Passby
6/29/16 04:34	6/29/16 07:00	145.9	Vehicles, Morning Chorus
	Total Night #1	**189**	
	Total Night #2	**187**	
	Total Data	**376**	

Data Removal Noise Monitoring Location #2

Start Time	End Time	Duration (min)	Reason
6/27/16 22:01	6/27/16 22:12	10.3	Train Passby
6/27/16 22:13	6/27/16 23:37	84.3	Several Train Passages
6/27/16 23:42	6/27/16 23:43	0.8	Train Whistle
6/28/16 00:19	6/28/16 00:20	1.1	Loud Vehicle Passby
6/28/16 01:24	6/28/16 01:34	9.8	Train Passby
6/28/16 01:41	6/28/16 01:43	2.1	Train Passby
6/28/16 01:43	6/28/16 02:16	33.3	Train Passby
6/28/16 03:03	6/28/16 03:03	0.1	Train Whistle
6/28/16 03:18	6/28/16 03:19	0.8	Train Whistle
6/28/16 03:31	6/28/16 03:32	1.1	Train Whistle
6/28/16 03:39	6/28/16 03:41	1.3	Train Whistle
6/28/16 03:46	6/28/16 03:47	1.1	Loud Vehicle Passby
6/28/16 03:47	6/28/16 03:48	0.8	Train Whistle
6/28/16 03:58	6/28/16 03:59	0.8	Train Whistle
6/28/16 04:05	6/28/16 04:06	0.6	Train Whistle
6/28/16 04:07	6/28/16 04:07	0.1	Train Whistle
6/28/16 04:07	6/28/16 04:08	0.6	Train Whistle
6/28/16 04:09	6/28/16 04:09	0.8	Train Whistle
6/28/16 04:10	6/28/16 04:11	0.8	Train Whistle
6/28/16 04:27	6/28/16 04:52	25.3	Train Passby
6/28/16 04:54	6/28/16 04:55	1.6	Excessive Bird Noise
6/28/16 04:56	6/28/16 04:59	2.6	Excessive Bird Noise
6/28/16 05:03	6/28/16 05:05	2.6	Train Whistle
6/28/16 05:06	6/28/16 05:13	7.1	Loud Vehicle Passby
6/28/16 05:13	6/28/16 07:02	108.6	Heavy Traffic, Morning Chorus
6/28/16 22:03	6/28/16 22:03	0.8	Train Whistle
6/28/16 22:10	6/28/16 22:14	4.1	Train Passby
6/28/16 22:18	6/28/16 22:19	1.1	Train Whistle
6/28/16 22:29	6/28/16 22:29	0.6	Monitor Check
6/28/16 22:31	6/28/16 22:34	3.6	Train Passby
6/28/16 22:45	6/28/16 22:57	12.1	Train Passby
6/28/16 22:59	6/28/16 23:00	0.8	Aircraft Flyover
6/28/16 23:03	6/29/16 00:09	66.6	Train Passby
6/29/16 01:13	6/29/16 01:13	0.8	Train Whistle
6/29/16 01:46	6/29/16 01:50	3.6	Train Passby
6/29/16 02:06	6/29/16 02:07	0.8	Train Whistle
6/29/16 02:10	6/29/16 02:14	4.3	Train Passby
6/29/16 02:35	6/29/16 02:38	2.8	Train Passby
6/29/16 02:39	6/29/16 02:40	0.8	Train Passby
6/29/16 02:42	6/29/16 02:43	1.3	Train Passby

Data Removal Noise Monitoring Location #2 Cont.

Start Time	End Time	Duration (min)	Reason
6/29/16 03:13	6/29/16 03:13	0.6	Train Whistle
6/29/16 03:38	6/29/16 03:41	3.3	Train Passby
6/29/16 03:46	6/29/16 04:12	26.1	Train Passby
6/29/16 04:16	6/29/16 04:17	1.1	Train Whistle
6/29/16 04:20	6/29/16 04:20	0.8	Train Whistle
6/29/16 04:26	6/29/16 04:26	0.8	Train Whistle
6/29/16 04:31	6/29/16 04:33	2.1	Train Whistle
6/29/16 04:40	6/29/16 04:42	2.3	Train Whistle
6/29/16 04:47	6/29/16 04:48	1.8	Loud Vehicle Passby
6/29/16 04:49	6/29/16 04:49	0.1	Loud Vehicle Passby
6/29/16 04:49	6/29/16 04:50	0.6	Loud Vehicle Passby
6/29/16 04:51	6/29/16 04:51	0.1	Train passages and whistles
6/29/16 04:51	6/29/16 04:59	8.3	Train Passby
6/29/16 05:02	6/29/16 05:03	0.8	Train Passby
6/29/16 05:03	6/29/16 07:00	116.3	Heavy Traffic, Trains, Morning Chorus
	Total Night #1	**298**	
	Total Night #2	**271**	
	Total Data	**569**	

Data Removal Noise Monitoring Location #3

Start Time	End Time	Duration (min)	Reason
8/02/16 22:07	8/02/16 22:08	1.9	Monitor Check
8/02/16 22:19	8/02/16 22:19	0.4	On-site
8/02/16 22:29	8/02/16 22:29	0.1	On-site
8/02/16 22:29	8/02/16 22:31	1.6	On-site
8/02/16 22:42	8/02/16 22:44	1.6	On-site (Beeping)
8/02/16 22:54	8/02/16 22:55	0.6	Wheel Squeal
8/02/16 23:14	8/02/16 23:22	8.1	Train Passby
8/02/16 23:36	8/02/16 23:37	1.6	Train Passby
8/02/16 23:51	8/02/16 23:52	1.4	Train Passby
8/03/16 00:17	8/03/16 00:24	6.9	Train Passby
8/03/16 00:44	8/03/16 00:45	0.6	Loud Vehicle Passby
8/03/16 01:04	8/03/16 01:04	0.9	Loud Vehicle Passby
8/03/16 02:25	8/03/16 02:28	3.1	Train Whistle
8/03/16 02:34	8/03/16 02:35	1.1	Train Whistle
8/03/16 03:18	8/03/16 03:19	0.9	Train Whistle
8/03/16 03:24	8/03/16 03:24	0.9	Train Whistle
8/03/16 04:23	8/03/16 04:26	3.6	Train Passby
8/03/16 04:31	8/03/16 04:33	1.6	Loud Vehicle Passby
8/03/16 04:48	8/03/16 04:49	1.1	Loud Vehicle Passby
8/03/16 04:50	8/03/16 04:51	1.6	Loud Vehicle Passby
8/03/16 04:57	8/03/16 04:58	1.9	Loud Vehicle Passby
8/03/16 05:05	8/03/16 05:06	1.6	Train Passby
8/03/16 05:08	8/03/16 05:09	1.1	Loud Vehicle Passby
8/03/16 05:11	8/03/16 05:12	1.1	Loud Vehicle Passby
8/03/16 05:18	8/03/16 05:20	2.1	Loud Vehicle Passby
8/03/16 05:21	8/03/16 05:23	2.4	Loud Vehicle Passby
8/03/16 05:24	8/03/16 05:27	3.4	Loud Vehicle Passby
8/03/16 05:30	8/03/16 05:30	0.6	Loud Vehicle Passby
8/03/16 05:30	8/03/16 05:32	1.9	Loud Vehicle Passby
8/03/16 05:33	8/03/16 05:33	0.9	Loud Vehicle Passby
8/03/16 05:34	8/03/16 05:35	0.6	Loud Vehicle Passby
8/03/16 05:36	8/03/16 05:38	2.4	Loud Vehicle Passby
8/03/16 05:39	8/03/16 05:47	8.1	Loud Vehicle Passby
8/03/16 05:48	8/03/16 05:59	11.9	Loud Vehicle Passby
8/03/16 06:00	8/03/16 06:03	2.9	Loud Vehicle Passby
8/03/16 06:03	8/03/16 06:05	2.1	Loud Vehicle Passby
8/03/16 06:06	8/03/16 06:09	3.1	Loud Vehicle Passby
8/03/16 06:10	8/03/16 06:21	11.6	Loud Vehicle Passby
8/03/16 06:22	8/03/16 06:26	4.9	Loud Vehicle Passby
8/03/16 06:27	8/03/16 07:00	32.9	Loud Vehicle Passby

Data Removal Noise Monitoring Location #3 Cont.

Start Time	End Time	Duration (min)	Reason
8/03/16 21:43	8/03/16 21:44	0.9	Train Passby
8/03/16 21:45	8/03/16 21:46	1.1	Train Passby
8/03/16 21:47	8/03/16 21:48	1.1	Loud Vehicle Passby
8/03/16 21:52	8/03/16 21:54	1.6	Loud Vehicle Passby
8/03/16 22:02	8/03/16 22:03	0.9	Loud Vehicle Passby
8/03/16 22:05	8/03/16 22:23	17.4	Train Passby
8/03/16 22:25	8/03/16 22:25	0.6	Loud Vehicle Passby
8/03/16 22:31	8/03/16 22:31	0.9	Loud Vehicle Passby
8/03/16 22:34	8/03/16 22:34	0.6	Train Whistle
8/03/16 22:39	8/03/16 22:40	0.9	Loud Vehicle Passby
8/03/16 22:42	8/03/16 22:43	1.1	Loud Vehicle Passby
8/03/16 23:08	8/03/16 23:09	0.9	Loud Vehicle Passby
8/03/16 23:28	8/03/16 23:29	0.6	Loud Vehicle Passby
8/03/16 23:37	8/03/16 23:38	1.1	Loud Vehicle Passby
8/03/16 23:49	8/03/16 23:49	0.6	Train Whistle
8/03/16 23:58	8/04/16 00:02	4.1	Train Passby
8/04/16 00:07	8/04/16 00:08	1.1	Loud Vehicle Passby
8/04/16 00:22	8/04/16 00:22	0.6	Train Passby
8/04/16 00:28	8/04/16 00:30	1.6	Train Passby
8/04/16 00:47	8/04/16 00:49	2.4	Train Passby
8/04/16 00:50	8/04/16 00:54	4.1	Train Passby
8/04/16 00:57	8/04/16 00:58	1.1	Train Whistle
8/04/16 01:03	8/04/16 01:08	4.6	Sirens
8/04/16 01:40	8/04/16 01:41	0.6	Loud Vehicle Passby
8/04/16 02:18	8/04/16 02:19	0.9	Loud Vehicle Passby
8/04/16 02:39	8/04/16 02:42	2.4	On-site equipment
8/04/16 03:53	8/04/16 03:56	3.6	Train Passby
8/04/16 04:03	8/04/16 04:06	3.4	Train Passby
8/04/16 04:41	8/04/16 04:41	0.9	Loud Vehicle Passby
8/04/16 04:43	8/04/16 04:44	1.4	On-site equipment
8/04/16 04:50	8/04/16 04:59	9.1	Loud Vehicle Passby
8/04/16 05:06	8/04/16 05:11	5.1	Loud Vehicle Passby
8/04/16 05:16	8/04/16 07:00	103.6	Heavy Traffic, Morning Chorus
	Total Night #1	**137**	
	Total Night #2	**250**	
	Total Data	**387**	

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Data Removal Noise Monitoring Location #4

Start Time	End Time	Duration (min)	Reason
6/27/16 22:17	6/27/16 22:18	0.7	Loud Vehicle Passby
6/27/16 22:39	6/27/16 22:40	1.2	Coyotes
6/27/16 22:44	6/27/16 22:45	0.9	Coyotes
6/27/16 23:08	6/27/16 23:09	0.7	Monitor Check
6/27/16 23:09	6/27/16 23:11	1.9	Train Passby
6/27/16 23:12	6/27/16 23:13	0.9	Loud Vehicle Passby
6/27/16 23:28	6/27/16 23:28	0.7	Train Whistle
6/28/16 00:15	6/28/16 00:18	2.9	Vehicle and Train
6/28/16 00:21	6/28/16 00:21	0.2	Back-up beeper
6/28/16 00:36	6/28/16 00:37	0.7	Train Passby
6/28/16 00:39	6/28/16 00:41	1.7	Train Passby
6/28/16 01:09	6/28/16 01:12	3.4	Train Passby
6/28/16 01:15	6/28/16 01:16	0.7	Train Whistle
6/28/16 01:31	6/28/16 01:32	1.2	Loud Vehicle Passby
6/28/16 01:35	6/28/16 01:36	1.2	Loud Vehicle Passby
6/28/16 01:44	6/28/16 01:46	2.4	Train Passby
6/28/16 01:51	6/28/16 01:54	3.7	Train Passby
6/28/16 02:25	6/28/16 02:26	1.2	Loud Vehicle Passby
6/28/16 02:29	6/28/16 02:30	0.4	Loud Vehicle Passby
6/28/16 02:38	6/28/16 02:38	0.7	Train Passby
6/28/16 02:40	6/28/16 02:42	2.2	Train Passby
6/28/16 02:44	6/28/16 02:44	0.9	Train Passby
6/28/16 03:02	6/28/16 03:02	0.7	Loud Vehicle Passby
6/28/16 03:02	6/28/16 03:04	1.7	Train Passby
6/28/16 03:05	6/28/16 03:06	0.9	Train Passby
6/28/16 03:08	6/28/16 03:09	0.9	Train Passby
6/28/16 03:49	6/28/16 03:52	2.4	Loud Vehicle Passby
6/28/16 03:52	6/28/16 03:55	3.4	Monitor Check
6/28/16 04:31	6/28/16 04:32	0.7	Train Whistle
6/28/16 04:36	6/28/16 04:39	2.9	Train Passby
6/28/16 04:46	6/28/16 04:53	6.9	Train Passby
6/28/16 05:17	6/28/16 05:20	2.9	Train Passby
6/28/16 06:00	6/28/16 06:03	3.2	Train Passby
6/28/16 06:05	6/28/16 06:07	2.2	Train Passby
6/28/16 06:14	6/28/16 06:14	0.2	Loud Vehicle Passby
6/28/16 06:14	6/28/16 06:16	1.7	Loud Vehicle Passby
6/28/16 06:17	6/28/16 06:20	2.7	Loud Vehicle Passby
6/28/16 06:42	6/28/16 06:47	4.9	Train Passby
6/28/16 22:00	6/28/16 22:01	0.9	Loud Vehicle Passby
6/28/16 22:02	6/28/16 22:03	0.9	Train Whistle

Data Removal Noise Monitoring Location #4 Cont.

Start Time	End Time	Duration (min)	Reason
6/28/16 22:06	6/28/16 22:07	1.4	Train Whistle
6/28/16 22:39	6/28/16 22:39	0.7	Loud Vehicle Passby
6/28/16 23:06	6/28/16 23:07	1.2	Loud Vehicle Passby
6/28/16 23:08	6/28/16 23:09	1.2	Loud Vehicle Passby
6/29/16 00:12	6/29/16 00:12	0.7	Loud Vehicle Passby
6/29/16 00:15	6/29/16 00:16	0.9	Monitor Check
6/29/16 01:07	6/29/16 01:09	2.2	Train Whistle
6/29/16 01:35	6/29/16 01:35	0.9	Loud Vehicle Passby
6/29/16 01:38	6/29/16 01:38	0.7	Loud Vehicle Passby
6/29/16 02:33	6/29/16 02:33	0.9	Loud Vehicle Passby
6/29/16 03:05	6/29/16 03:07	1.7	Train Passby
6/29/16 03:16	6/29/16 03:18	2.2	Coyotes
6/29/16 03:40	6/29/16 03:43	2.9	Train Whistles
6/29/16 04:02	6/29/16 04:02	0.9	Train Whistle
6/29/16 04:36	6/29/16 04:38	2.9	Train Passby
6/29/16 04:46	6/29/16 04:47	1.9	Train Whistle
6/29/16 06:35	6/29/16 06:36	1.2	Loud Vehicle Passby
6/29/16 06:40	6/29/16 06:41	1.2	Loud Vehicle Passby
	Total Night #1	**68**	
	Total Night #2	**27**	
	Total Data	**96**	

Data Removal Noise Monitoring Location #5

Start Time	End Time	Duration (min)	Reason
6/27/16 22:35	6/27/16 22:36	1.0	Loud Vehicle Passby
6/28/16 00:38	6/28/16 00:39	1.0	Loud Vehicle Passby
6/28/16 01:50	6/28/16 01:50	0.7	Loud Vehicle Passby
6/28/16 04:01	6/28/16 04:02	1.0	Loud Vehicle Passby
6/28/16 04:05	6/28/16 04:05	1.0	Loud Vehicle Passby
6/28/16 05:22	6/28/16 05:23	0.7	Loud Vehicle Passby
6/28/16 05:47	6/28/16 05:48	1.0	Loud Vehicle Passby
6/28/16 06:10	6/28/16 06:11	1.0	Loud Vehicle Passby
6/28/16 06:14	6/28/16 06:15	1.0	Loud Vehicle Passby
6/28/16 06:16	6/28/16 06:17	1.2	Train Passby
6/28/16 06:21	6/28/16 06:22	1.2	Loud Vehicle Passby
6/28/16 06:33	6/28/16 06:33	1.0	Loud Vehicle Passby
6/28/16 06:34	6/28/16 06:35	1.2	Loud Vehicle Passby
6/28/16 06:38	6/28/16 06:38	0.7	Loud Vehicle Passby
6/28/16 06:41	6/28/16 06:42	1.2	Loud Vehicle Passby
6/28/16 06:43	6/28/16 06:44	1.2	Loud Vehicle Passby
6/28/16 06:46	6/28/16 06:47	0.3	Excessive Bird Noise
6/28/16 06:49	6/28/16 06:51	1.3	Loud Vehicle Passby
6/28/16 06:54	6/28/16 06:55	1.0	Loud Vehicle Passby
6/28/16 22:05	6/28/16 22:05	0.2	Train Passby
6/28/16 22:08	6/28/16 22:08	0.5	Train Passby
6/28/16 22:16	6/28/16 22:17	0.7	Loud Vehicle Passby
6/29/16 00:03	6/29/16 00:04	1.2	Loud Vehicle Passby
6/29/16 00:06	6/29/16 00:07	1.0	Loud Vehicle Passby
6/29/16 00:13	6/29/16 00:14	0.7	Loud Vehicle Passby
6/29/16 01:20	6/29/16 01:21	1.0	Train Whistle
6/29/16 03:36	6/29/16 03:37	0.7	Train Whistle
6/29/16 04:14	6/29/16 04:15	1.2	Excessive Bird Noise
6/29/16 04:59	6/29/16 05:03	3.5	Excessive Bird Noise
6/29/16 05:12	6/29/16 05:14	1.5	Loud Vehicle Passby
6/29/16 05:14	6/29/16 05:15	1.0	Loud Vehicle Passby
6/29/16 05:20	6/29/16 05:21	1.0	Loud Vehicle Passby
6/29/16 05:28	6/29/16 05:29	1.2	Loud Vehicle Passby
6/29/16 05:47	6/29/16 05:48	1.2	Loud Vehicle Passby
6/29/16 06:03	6/29/16 06:04	1.2	Loud Vehicle Passby
6/29/16 06:09	6/29/16 06:16	7.0	Loud Vehicle Passby
6/29/16 06:22	6/29/16 06:23	1.2	Loud Vehicle Passby
6/29/16 06:45	6/29/16 06:47	2.5	Loud Vehicle Passby
6/29/16 06:52	6/29/16 06:53	0.7	Loud Vehicle Passby
6/29/16 06:58	6/29/16 06:59	1.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #5 Cont

Start Time	End Time	Duration (min)	Reason
	Total Night #1	19	
	Total Night #2	30	
	Total Data	49	

Data Removal Noise Monitoring Location #6

Start Time	End Time	Duration (min)	Reason
Start Time	**End Time**	**Duration (min)**	**Reason**
6/27/16 22:00	6/27/16 22:00	0.4	Train Whistle
6/27/16 22:09	6/27/16 22:10	0.9	Loud Vehicle Passby
6/27/16 22:48	6/27/16 22:49	1.4	Loud Vehicle Passby
6/28/16 01:33	6/28/16 01:34	0.9	Train Whistle
6/28/16 04:10	6/28/16 04:11	0.9	Loud Vehicle Passby
6/28/16 04:13	6/28/16 04:14	1.1	Monitor Check
6/28/16 04:48	6/28/16 04:49	1.1	Excessive Bird Noise
6/28/16 06:45	6/28/16 06:46	1.6	Loud Vehicle Passby
6/28/16 06:51	6/28/16 06:52	1.4	Loud Vehicle Passby
6/28/16 22:05	6/28/16 22:06	0.9	Loud Vehicle Passby
6/28/16 22:09	6/28/16 22:10	1.6	Loud Vehicle Passby
6/28/16 22:27	6/28/16 22:27	0.9	Loud Vehicle Passby
6/28/16 22:30	6/28/16 22:31	0.9	Excessive Bird Noise
6/28/16 22:36	6/28/16 22:37	1.1	Loud Vehicle Passby
6/28/16 23:53	6/28/16 23:55	2.1	Loud Vehicle Passby
6/28/16 23:58	6/28/16 23:59	1.4	Loud Vehicle Passby
6/29/16 01:05	6/29/16 01:06	0.6	Loud Vehicle Passby
6/29/16 01:20	6/29/16 01:20	0.6	Train Whistle
6/29/16 01:31	6/29/16 01:32	0.6	Train Whistle
6/29/16 01:35	6/29/16 01:36	0.9	Train Whistle
6/29/16 02:18	6/29/16 02:19	1.1	Train Whistle
6/29/16 03:56	6/29/16 03:57	0.6	Excessive Bird Noise
6/29/16 06:39	6/29/16 06:42	3.1	Loud Vehicle Passby
6/29/16 06:57	6/29/16 06:58	0.9	Loud Vehicle Passby
	Total Night #1	**10**	
	Total Night #2	**17**	
	Total Data	**27**	

Data Removal Noise Monitoring Location #8

Start Time	End Time	Duration (min)	Reason
8/03/16 00:07	8/03/16 00:08	1.2	Train Whistle
8/03/16 00:38	8/03/16 00:39	0.7	Train Whistle
8/03/16 00:42	8/03/16 00:43	1.7	Train Whistle
8/03/16 00:47	8/03/16 00:48	1.0	Train Whistle
8/03/16 01:53	8/03/16 01:55	2.8	Train Passby
8/03/16 02:00	8/03/16 02:04	3.8	Train Passby
8/03/16 03:28	8/03/16 03:29	1.5	Train Whistle
8/03/16 03:48	8/03/16 03:49	1.2	Train Passby
8/03/16 04:52	8/03/16 04:53	2.0	Train Passby
8/03/16 04:58	8/03/16 04:59	1.2	Train Passby
8/03/16 05:52	8/03/16 05:53	1.7	Loud Vehicle Passby
8/03/16 06:25	8/03/16 06:29	3.7	Loud Vehicle Passby
8/03/16 06:45	8/03/16 06:46	1.7	Loud Vehicle Passby
8/03/16 06:50	8/03/16 06:51	1.2	Loud Vehicle Passby
8/03/16 22:33	8/03/16 22:35	2.5	Loud Vehicle Passby
8/03/16 23:19	8/03/16 23:20	1.0	Loud Vehicle Passby
8/04/16 01:07	8/04/16 01:09	1.5	Loud Vehicle Passby
8/04/16 01:12	8/04/16 01:14	1.7	Loud Vehicle Passby
8/04/16 01:19	8/04/16 01:21	1.7	Loud Vehicle Passby
8/04/16 01:43	8/04/16 01:46	3.0	Loud Vehicle Passby
8/04/16 01:50	8/04/16 01:52	2.2	Loud Vehicle Passby
8/04/16 01:57	8/04/16 01:58	1.7	Loud Vehicle Passby
8/04/16 02:19	8/04/16 02:24	5.7	Aircraft Flyover
8/04/16 02:57	8/04/16 02:57	0.2	Train Passby
8/04/16 03:32	8/04/16 03:34	2.5	Train Whistle
8/04/16 06:05	8/04/16 06:06	0.5	Excessive Bird Noise
8/04/16 06:09	8/04/16 06:09	1.0	Excessive Bird Noise
8/04/16 06:32	8/04/16 06:33	1.2	Excessive Bird Noise
8/04/16 06:39	8/04/16 06:46	7.5	Loud Vehicle Passby
8/04/16 06:54	8/04/16 06:55	1.0	Loud Vehicle Passby
8/04/16 06:59	8/04/16 07:01	2.0	Loud Vehicle Passby
	Total Night #1	**25**	
	Total Night #2	**36**	
	Total Data	**62**	

Data Removal Noise Monitoring Location #9

Start Time	End Time	Duration (min)	Reason
Start Time	End Time	Duration (min)	Reason
8/02/16 22:00	8/02/16 22:09	8.6	Train Passby
8/02/16 22:17	8/02/16 22:17	0.6	Loud Vehicle Passby
8/02/16 22:20	8/02/16 22:20	0.3	Abnormal
8/02/16 22:46	8/02/16 22:48	1.3	Loud Vehicle Passby
8/02/16 22:54	8/02/16 22:56	1.6	Loud Vehicle Passby
8/02/16 23:03	8/02/16 23:04	1.1	Train Whistle
8/02/16 23:05	8/02/16 23:06	0.8	Train Whistle
8/02/16 23:10	8/02/16 23:11	1.1	Loud Vehicle Passby
8/02/16 23:13	8/02/16 23:14	0.8	Loud Vehicle Passby
8/02/16 23:30	8/02/16 23:30	0.1	Monitor Check
8/02/16 23:30	8/02/16 23:30	0.1	Monitor Check
8/02/16 23:30	8/02/16 23:35	4.3	Monitor Check
8/02/16 23:36	8/02/16 23:36	0.8	Monitor Check
8/03/16 00:02	8/03/16 00:03	1.3	Backup beeper
8/03/16 00:07	8/03/16 00:07	0.6	Train Whistle
8/03/16 00:08	8/03/16 00:10	1.6	Train Whistle
8/03/16 00:21	8/03/16 00:22	0.6	Train Passby
8/03/16 00:27	8/03/16 00:27	0.8	Loud Vehicle Passby
8/03/16 02:06	8/03/16 02:07	1.1	Train Passby
8/03/16 02:27	8/03/16 02:29	1.8	Train Passby
8/03/16 02:36	8/03/16 02:42	6.6	Train Passby
8/03/16 03:30	8/03/16 03:38	7.3	Train Passby
8/03/16 04:32	8/03/16 04:33	1.1	Loud Vehicle Passby
8/03/16 04:45	8/03/16 04:48	2.6	Train Whistle
8/03/16 04:54	8/03/16 04:55	1.1	Loud Vehicle Passby
8/03/16 05:03	8/03/16 05:03	0.8	Loud Vehicle Passby
8/03/16 05:06	8/03/16 05:06	0.6	Loud Vehicle Passby
8/03/16 05:19	8/03/16 05:20	0.8	Loud Vehicle Passby
8/03/16 05:24	8/03/16 05:24	0.8	Loud Vehicle Passby
8/03/16 05:33	8/03/16 05:34	0.6	Excessive Bird Noise
8/03/16 05:55	8/03/16 05:55	0.1	Loud Vehicle Passby
8/03/16 06:05	8/03/16 06:08	2.8	Loud Vehicle Passby
8/03/16 06:09	8/03/16 06:09	0.3	Loud Vehicle Passby
8/03/16 06:11	8/03/16 06:12	0.6	Loud Vehicle Passby
8/03/16 06:12	8/03/16 06:13	1.1	Loud Vehicle Passby
8/03/16 06:15	8/03/16 06:16	0.6	Loud Vehicle Passby
8/03/16 06:17	8/03/16 06:17	0.3	Loud Vehicle Passby
8/03/16 06:18	8/03/16 06:22	4.1	Loud Vehicle Passby
8/03/16 06:24	8/03/16 06:25	0.8	Loud Vehicle Passby

Data Removal Noise Monitoring Location #9 Cont.

Start Time	End Time	Duration (min)	Reason
8/03/16 06:27	8/03/16 06:29	2.1	Loud Vehicle Passby
8/03/16 06:30	8/03/16 06:30	0.6	Loud Vehicle Passby
8/03/16 06:33	8/03/16 06:36	2.6	Loud Vehicle Passby
8/03/16 06:37	8/03/16 06:41	3.6	Loud Vehicle Passby
8/03/16 06:42	8/03/16 06:44	2.1	Loud Vehicle Passby
8/03/16 06:45	8/03/16 06:49	3.6	Loud Vehicle Passby
8/03/16 06:50	8/03/16 06:51	1.1	Loud Vehicle Passby
8/03/16 06:51	8/03/16 06:59	8.3	Loud Vehicle Passby
8/03/16 22:02	8/03/16 22:03	1.6	Dog Barking
8/03/16 22:04	8/03/16 22:09	5.1	Train Passby
8/03/16 22:09	8/03/16 22:12	3.3	Train Passby
8/03/16 22:19	8/03/16 22:19	0.1	Loud Vehicle Passby
8/03/16 22:19	8/03/16 22:20	1.1	Loud Vehicle Passby
8/03/16 22:25	8/03/16 22:26	1.8	Loud Vehicle Passby
8/03/16 22:34	8/03/16 22:36	1.8	Train Passby
8/03/16 22:40	8/03/16 22:41	1.6	Loud Vehicle Passby
8/03/16 23:07	8/03/16 23:08	1.1	Train Passby
8/03/16 23:13	8/03/16 23:14	1.1	Loud Vehicle Passby
8/03/16 23:15	8/03/16 23:15	0.1	Train Passby
8/03/16 23:20	8/03/16 23:21	1.1	Aircraft Flyover
8/03/16 23:38	8/03/16 23:41	3.1	Loud Vehicle Passby
8/03/16 23:46	8/03/16 23:47	1.1	Train Passby
8/03/16 23:59	8/03/16 23:59	0.8	Loud Vehicle Passby
8/04/16 00:43	8/04/16 00:44	0.8	Loud Vehicle Passby
8/04/16 00:48	8/04/16 00:49	1.1	Loud Vehicle Passby
8/04/16 00:56	8/04/16 00:57	1.6	Loud Vehicle Passby
8/04/16 01:02	8/04/16 01:03	1.6	Loud Vehicle Passby
8/04/16 01:48	8/04/16 01:49	1.3	Train Passby
8/04/16 02:09	8/04/16 02:12	3.1	Monitor Check
8/04/16 02:15	8/04/16 02:16	1.1	Loud Vehicle Passby
8/04/16 02:17	8/04/16 02:19	2.1	Loud Vehicle Passby
8/04/16 03:23	8/04/16 03:23	0.8	Train Whistle
8/04/16 04:05	8/04/16 04:13	8.6	Train Passby
8/04/16 04:15	8/04/16 04:16	1.3	Loud Vehicle Passby
8/04/16 04:34	8/04/16 04:35	0.8	Loud Vehicle Passby
8/04/16 04:51	8/04/16 04:52	1.1	Train Whistle
8/04/16 04:54	8/04/16 04:55	1.8	Train Whistle
8/04/16 04:56	8/04/16 05:00	4.1	Train Passby
8/04/16 05:22	8/04/16 05:25	2.6	Train Passby
8/04/16 05:42	8/04/16 05:43	0.8	Loud Vehicle Passby

Data Removal Noise Monitoring Location #9 Cont.

Start Time	End Time	Duration (min)	Reason
8/04/16 05:56	8/04/16 05:57	1.1	Loud Vehicle Passby
8/04/16 05:59	8/04/16 06:00	1.8	Loud Vehicle Passby
8/04/16 06:04	8/04/16 06:06	1.3	Loud Vehicle Passby
8/04/16 06:08	8/04/16 06:11	3.1	Loud Vehicle Passby
8/04/16 06:13	8/04/16 06:16	2.6	Loud Vehicle Passby
8/04/16 06:19	8/04/16 06:22	3.1	Loud Vehicle Passby
8/04/16 06:30	8/04/16 06:33	3.1	Loud Vehicle Passby
8/04/16 06:37	8/04/16 06:39	2.8	Loud Vehicle Passby
8/04/16 06:46	8/04/16 06:52	6.1	Train Passby
8/04/16 06:53	8/04/16 07:00	6.8	Loud Vehicle Passby
	Total Night #1	**85**	
	Total Night #2	**90**	
	Total Data	**175**	

Data Removal Noise Monitoring Location #10

Start Time	End Time	Duration (min)	Reason
6/27/16 22:02	6/27/16 22:03	1.1	Train Whistle
6/27/16 22:06	6/27/16 22:09	3.1	Loud Vehicle Passby
6/27/16 22:18	6/27/16 22:20	1.4	Loud Vehicle Passby
6/27/16 22:22	6/27/16 22:23	0.9	Loud Vehicle Passby
6/27/16 22:34	6/27/16 22:36	2.4	Loud Vehicle Passby
6/27/16 22:40	6/27/16 22:42	1.9	Loud Vehicle Passby
6/27/16 22:43	6/27/16 22:44	1.9	Loud Vehicle Passby
6/27/16 22:47	6/27/16 22:49	1.6	Loud Vehicle Passby
6/27/16 22:50	6/27/16 22:52	2.4	Loud Vehicle Passby
6/27/16 23:04	6/27/16 23:05	0.9	Loud Vehicle Passby
6/27/16 23:13	6/27/16 23:13	0.9	Loud Vehicle Passby
6/27/16 23:16	6/27/16 23:17	1.1	Loud Vehicle Passby
6/27/16 23:24	6/27/16 23:25	1.1	Loud Vehicle Passby
6/27/16 23:42	6/27/16 23:43	0.9	Train Whistle
6/27/16 23:44	6/27/16 23:44	0.9	Train Whistle
6/27/16 23:45	6/27/16 23:46	0.6	Loud Vehicle Passby
6/27/16 23:48	6/27/16 23:50	1.9	Loud Vehicle Passby
6/27/16 23:51	6/27/16 23:52	0.6	Loud Vehicle Passby
6/28/16 00:16	6/28/16 00:17	0.9	Loud Vehicle Passby
6/28/16 00:28	6/28/16 00:29	1.1	Train Whistle
6/28/16 00:46	6/28/16 00:47	0.6	Loud Vehicle Passby
6/28/16 00:49	6/28/16 00:51	2.1	Loud Vehicle Passby
6/28/16 01:02	6/28/16 01:02	0.6	Train Whistle
6/28/16 01:08	6/28/16 01:08	0.6	Loud Vehicle Passby
6/28/16 01:10	6/28/16 01:11	0.6	Loud Vehicle Passby
6/28/16 01:25	6/28/16 01:26	1.1	Loud Vehicle Passby
6/28/16 01:33	6/28/16 01:33	0.9	Loud Vehicle Passby
6/28/16 01:34	6/28/16 01:38	3.9	Loud Vehicle Passby
6/28/16 01:42	6/28/16 01:42	0.9	Loud Vehicle Passby
6/28/16 01:44	6/28/16 01:45	1.1	Train Passby
6/28/16 01:49	6/28/16 01:51	2.4	Loud Vehicle Passby
6/28/16 01:58	6/28/16 01:59	1.1	Loud Vehicle Passby
6/28/16 02:03	6/28/16 02:04	1.1	Loud Vehicle Passby
6/28/16 02:26	6/28/16 02:26	0.6	Loud Vehicle Passby
6/28/16 02:34	6/28/16 02:35	0.6	Loud Vehicle Passby
6/28/16 02:38	6/28/16 02:39	0.6	Loud Vehicle Passby
6/28/16 02:53	6/28/16 02:54	1.6	Loud Vehicle Passby
6/28/16 02:59	6/28/16 03:01	2.6	Loud Vehicle Passby
6/28/16 03:15	6/28/16 03:15	0.6	Loud Vehicle Passby
6/28/16 03:41	6/28/16 03:42	0.9	Loud Vehicle Passby

Data Removal Noise Monitoring Location #10 Cont.

Start Time	End Time	Duration (min)	Reason
6/28/16 03:44	6/28/16 03:44	0.9	Loud Vehicle Passby
6/28/16 03:45	6/28/16 03:46	1.1	Loud Vehicle Passby
6/28/16 03:50	6/28/16 03:52	1.9	Loud Vehicle Passby
6/28/16 04:07	6/28/16 04:09	1.4	Loud Vehicle Passby
6/28/16 04:23	6/28/16 04:24	1.4	Loud Vehicle Passby
6/28/16 04:30	6/28/16 04:31	1.1	Loud Vehicle Passby
6/28/16 04:36	6/28/16 04:37	1.6	Loud Vehicle Passby
6/28/16 04:43	6/28/16 04:44	1.4	Loud Vehicle Passby
6/28/16 04:47	6/28/16 04:51	3.9	Loud Vehicle Passby
6/28/16 04:58	6/28/16 05:01	2.6	Loud Vehicle Passby
6/28/16 05:07	6/28/16 05:08	1.9	Loud Vehicle Passby
6/28/16 05:11	6/28/16 05:12	1.6	Loud Vehicle Passby
6/28/16 05:13	6/28/16 05:16	2.9	Loud Vehicle Passby
6/28/16 05:16	6/28/16 05:26	10.4	Loud Vehicle Passby
6/28/16 05:28	6/28/16 05:30	1.9	Loud Vehicle Passby
6/28/16 05:30	6/28/16 06:59	89.6	Loud Vehicle Passby
6/28/16 22:04	6/28/16 22:04	0.4	Loud Vehicle Passby
6/28/16 22:11	6/28/16 22:11	0.4	Loud Vehicle Passby
6/28/16 22:18	6/28/16 22:19	0.6	Loud Vehicle Passby
6/28/16 22:21	6/28/16 22:21	0.9	Loud Vehicle Passby
6/28/16 22:22	6/28/16 22:23	0.6	Loud Vehicle Passby
6/28/16 22:27	6/28/16 22:27	0.4	Loud Vehicle Passby
6/28/16 22:30	6/28/16 22:31	1.1	Loud Vehicle Passby
6/28/16 22:33	6/28/16 22:33	0.6	Loud Vehicle Passby
6/28/16 22:47	6/28/16 22:47	0.9	Loud Vehicle Passby
6/28/16 22:53	6/28/16 22:54	0.9	Loud Vehicle Passby
6/28/16 22:54	6/28/16 22:55	0.9	Loud Vehicle Passby
6/28/16 22:57	6/28/16 22:57	0.9	Loud Vehicle Passby
6/28/16 23:01	6/28/16 23:02	0.6	Loud Vehicle Passby
6/28/16 23:03	6/28/16 23:04	1.1	Loud Vehicle Passby
6/28/16 23:11	6/28/16 23:11	0.9	Loud Vehicle Passby
6/28/16 23:12	6/28/16 23:13	0.9	Loud Vehicle Passby
6/28/16 23:14	6/28/16 23:15	0.9	Loud Vehicle Passby
6/28/16 23:18	6/28/16 23:18	0.6	Loud Vehicle Passby
6/28/16 23:24	6/28/16 23:24	0.9	Loud Vehicle Passby
6/28/16 23:30	6/28/16 23:31	1.1	Loud Vehicle Passby
6/28/16 23:33	6/28/16 23:34	1.4	Loud Vehicle Passby
6/28/16 23:45	6/28/16 23:46	1.1	Loud Vehicle Passby
6/28/16 23:48	6/28/16 23:48	0.1	Loud Vehicle Passby
6/28/16 23:49	6/28/16 23:49	0.9	Loud Vehicle Passby

Data Removal Noise Monitoring Location #10 Cont.

Start Time	End Time	Duration (min)	Reason
6/29/16 00:11	6/29/16 00:11	0.6	Loud Vehicle Passby
6/29/16 00:21	6/29/16 00:22	0.9	Loud Vehicle Passby
6/29/16 00:23	6/29/16 00:23	0.6	Loud Vehicle Passby
6/29/16 00:27	6/29/16 00:28	0.9	Loud Vehicle Passby
6/29/16 00:39	6/29/16 00:40	0.9	Loud Vehicle Passby
6/29/16 00:48	6/29/16 00:48	0.1	Loud Vehicle Passby
6/29/16 00:48	6/29/16 00:48	0.4	Loud Vehicle Passby
6/29/16 01:00	6/29/16 01:00	0.6	Loud Vehicle Passby
6/29/16 01:01	6/29/16 01:02	0.9	Loud Vehicle Passby
6/29/16 01:10	6/29/16 01:11	0.6	Loud Vehicle Passby
6/29/16 01:12	6/29/16 01:13	0.9	Loud Vehicle Passby
6/29/16 01:27	6/29/16 01:28	1.1	Loud Vehicle Passby
6/29/16 01:34	6/29/16 01:35	0.9	Loud Vehicle Passby
6/29/16 01:36	6/29/16 01:36	0.6	Loud Vehicle Passby
6/29/16 01:48	6/29/16 01:48	0.9	Loud Vehicle Passby
6/29/16 02:06	6/29/16 02:07	1.1	Loud Vehicle Passby
6/29/16 02:12	6/29/16 02:14	1.9	Loud Vehicle Passby
6/29/16 02:41	6/29/16 02:42	1.1	Loud Vehicle Passby
6/29/16 02:51	6/29/16 02:59	7.9	Train Passby
6/29/16 03:35	6/29/16 03:35	0.1	Loud Vehicle Passby
6/29/16 03:35	6/29/16 03:37	2.1	Loud Vehicle Passby
6/29/16 03:44	6/29/16 03:46	1.9	Loud Vehicle Passby
6/29/16 03:55	6/29/16 03:55	0.9	Loud Vehicle Passby
6/29/16 04:15	6/29/16 04:17	1.6	Loud Vehicle Passby
6/29/16 04:25	6/29/16 04:26	1.4	Loud Vehicle Passby
6/29/16 04:30	6/29/16 04:31	1.4	Loud Vehicle Passby
6/29/16 04:36	6/29/16 04:38	2.6	Loud Vehicle Passby
6/29/16 04:44	6/29/16 05:01	17.6	Loud Vehicle Passby
6/29/16 05:08	6/29/16 05:14	5.9	Loud Vehicle Passby
6/29/16 05:16	6/29/16 05:36	20.9	Loud Vehicle Passby
6/29/16 05:37	6/29/16 06:58	81.4	Loud Vehicle Passby
6/29/16 06:59	6/29/16 07:00	1.4	Loud Vehicle Passby
	Total Night #1	**177**	
	Total Night #2	**181**	
	Total Data	**358**	

Data Removal Noise Monitoring Location #11

Start Time	End Time	Duration (min)	Reason
8/02/16 23:11	8/02/16 23:11	0.9	Train Passby
8/02/16 23:15	8/02/16 23:20	5.4	Monitor Check
8/02/16 23:21	8/02/16 23:22	0.9	Loud Vehicle Passby
8/02/16 23:44	8/02/16 23:45	1.4	Loud Vehicle Passby
8/03/16 00:07	8/03/16 00:07	0.9	Train Passby
8/03/16 00:41	8/03/16 00:42	0.9	Train Passby
8/03/16 00:47	8/03/16 00:48	1.2	Train Passby
8/03/16 01:19	8/03/16 01:19	0.7	Train Whistle
8/03/16 01:22	8/03/16 01:23	0.7	Train Whistle
8/03/16 01:45	8/03/16 01:45	0.7	Train Whistle
8/03/16 03:48	8/03/16 03:48	0.7	Train Whistle
8/03/16 04:12	8/03/16 04:12	0.7	Train Whistle
8/03/16 04:21	8/03/16 04:21	0.2	Train Whistle
8/03/16 04:21	8/03/16 04:22	0.7	Train Whistle
8/03/16 04:44	8/03/16 04:50	5.9	Loud Vehicle Passby
8/03/16 04:57	8/03/16 04:59	1.9	Train Whistle
8/03/16 05:09	8/03/16 05:13	3.4	Excessive Bird Noise
8/03/16 05:26	8/03/16 05:27	0.9	Train Passby
8/03/16 05:38	8/03/16 05:40	1.9	Loud Vehicle Passby
8/03/16 05:45	8/03/16 05:49	4.2	Loud Vehicle Passby
8/03/16 05:50	8/03/16 05:54	4.7	Loud Vehicle Passby
8/03/16 05:57	8/03/16 06:03	6.7	Loud Vehicle Passby
8/03/16 06:04	8/03/16 06:48	44.4	Loud Vehicle Passby
8/03/16 06:52	8/03/16 06:55	2.4	Loud Vehicle Passby
8/03/16 22:28	8/03/16 22:29	0.9	Loud Vehicle Passby
8/03/16 22:30	8/03/16 22:31	1.4	Loud Vehicle Passby
8/03/16 22:45	8/03/16 22:52	7.2	Train Passby
8/03/16 23:19	8/03/16 23:20	1.4	Aircraft Flyover
8/03/16 23:36	8/03/16 23:37	1.7	Loud Vehicle Passby
8/03/16 23:44	8/03/16 23:44	0.4	Train Whistle
8/03/16 23:47	8/03/16 23:48	0.7	Train Whistle
8/04/16 00:14	8/04/16 00:14	0.2	Loud Vehicle Passby
8/04/16 00:14	8/04/16 00:15	1.4	Loud Vehicle Passby
8/04/16 00:39	8/04/16 00:42	3.2	Train Passby
8/04/16 01:52	8/04/16 01:56	4.4	Monitor Check
8/04/16 02:00	8/04/16 02:02	1.9	Loud Vehicle Passby
8/04/16 02:18	8/04/16 02:20	1.4	Aircraft Flyover
8/04/16 04:14	8/04/16 04:16	1.7	Train Whistle
8/04/16 04:39	8/04/16 04:40	1.2	Train Whistle
8/04/16 04:58	8/04/16 04:59	1.7	Loud Vehicle Passby

Data Removal Noise Monitoring Location #11 Cont.

Start Time	End Time	Duration (min)	Reason
8/04/16 05:34	8/04/16 05:37	3.9	Loud Vehicle Passby
8/04/16 05:42	8/04/16 05:44	2.2	Loud Vehicle Passby
8/04/16 05:45	8/04/16 05:49	4.2	Loud Vehicle Passby
8/04/16 05:50	8/04/16 05:52	2.2	Loud Vehicle Passby
8/04/16 05:53	8/04/16 05:56	2.7	Loud Vehicle Passby
8/04/16 05:58	8/04/16 06:00	2.4	Loud Vehicle Passby
8/04/16 06:00	8/04/16 06:02	1.7	Loud Vehicle Passby
8/04/16 06:03	8/04/16 06:05	2.9	Loud Vehicle Passby
8/04/16 06:06	8/04/16 06:13	6.7	Loud Vehicle Passby
8/04/16 06:13	8/04/16 06:32	18.7	Loud Vehicle Passby
8/04/16 06:34	8/04/16 06:47	13.2	Loud Vehicle Passby
8/04/16 06:49	8/04/16 06:50	1.2	Loud Vehicle Passby
8/04/16 06:53	8/04/16 06:54	1.4	Loud Vehicle Passby
8/04/16 06:57	8/04/16 06:59	1.9	Loud Vehicle Passby
	Total Night #1	**93**	
	Total Night #2	**96**	
	Total Data	**189**	

Data Removal Noise Monitoring Location #12 (First Monitoring Period)

Start Time	End Time	Duration (min)	Reason
6/27/16 22:01	6/27/16 22:02	1.6	Excessive Bird Noise
6/27/16 22:06	6/27/16 22:12	6.1	Excessive Bird Noise
6/27/16 22:14	6/27/16 22:19	5.8	Excessive Bird Noise
6/27/16 22:27	6/27/16 22:30	3.1	Excessive Bird Noise
6/27/16 22:33	6/27/16 22:35	1.6	Excessive Bird Noise
6/27/16 22:43	6/27/16 22:44	0.8	Train Passby
6/27/16 22:47	6/27/16 22:51	4.3	Train Passby
6/27/16 22:59	6/27/16 23:02	2.6	Loud Vehicle Passby
6/27/16 23:05	6/27/16 23:06	1.3	Train Whistle
6/27/16 23:08	6/27/16 23:14	6.8	Train Passby
6/27/16 23:20	6/27/16 23:22	2.1	Loud Vehicle Passby
6/27/16 23:29	6/27/16 23:34	5.3	Train Passby
6/27/16 23:37	6/27/16 23:42	4.8	Train Passby
6/27/16 23:43	6/27/16 23:44	0.8	Site noise
6/28/16 00:24	6/28/16 00:30	6.6	Train Passby
6/28/16 00:36	6/28/16 00:37	0.8	Train Passby
6/28/16 00:45	6/28/16 00:47	2.1	Loud Vehicle Passby
6/28/16 01:14	6/28/16 01:25	11.1	Train Passby
6/28/16 01:39	6/28/16 01:40	0.6	Train Whistle
6/28/16 01:55	6/28/16 01:59	4.8	Train Passby
6/28/16 02:06	6/28/16 02:14	8.1	Train Passby
6/28/16 03:04	6/28/16 03:05	1.6	Loud Vehicle Passby
6/28/16 03:08	6/28/16 03:10	2.1	Loud Vehicle Passby
6/28/16 03:14	6/28/16 03:15	0.8	Train Whistle
6/28/16 03:17	6/28/16 03:18	1.6	Train Whistle
6/28/16 03:19	6/28/16 03:19	0.1	Train Passby
6/28/16 03:20	6/28/16 03:21	1.6	Train Passby
6/28/16 03:26	6/28/16 03:30	4.3	Train Passby
6/28/16 03:35	6/28/16 03:36	0.6	Train Whistle
6/28/16 03:51	6/28/16 04:06	15.6	Birds
6/28/16 04:07	6/28/16 04:24	17.3	Excessive Bird Noise
6/28/16 04:24	6/28/16 04:33	8.8	Train Passby
6/28/16 04:36	6/28/16 05:23	47.3	Excessive Bird Noise
6/28/16 05:25	6/28/16 07:01	95.3	Morning Chorus
6/28/16 22:13	6/28/16 22:15	2.3	Excessive Bird Noise
6/28/16 22:16	6/28/16 22:29	13.8	Train Passby
6/28/16 22:39	6/28/16 22:41	1.8	Loud Vehicle Passby
6/28/16 22:49	6/28/16 22:50	1.1	Train Passby
6/28/16 22:51	6/28/16 22:55	4.3	Train Passby
6/28/16 23:00	6/28/16 23:01	0.8	Animal

Data Removal Noise Monitoring Location #12 (First Monitoring Period) Cont.

Start Time	End Time	Duration (min)	Reason
6/28/16 23:03	6/28/16 23:04	0.6	Loud Vehicle Passby
6/28/16 23:05	6/28/16 23:05	0.8	Loud Vehicle Passby
6/28/16 23:06	6/28/16 23:08	2.3	Train Passby
6/28/16 23:14	6/28/16 23:15	1.1	Loud Vehicle Passby
6/28/16 23:20	6/28/16 23:21	1.3	Loud Vehicle Passby
6/28/16 23:25	6/28/16 23:27	1.8	Loud Vehicle Passby
6/28/16 23:36	6/28/16 23:36	0.8	Loud Vehicle Passby
6/28/16 23:39	6/28/16 23:40	1.6	Loud Vehicle Passby
6/28/16 23:45	6/28/16 23:46	0.8	Loud Vehicle Passby
6/28/16 23:47	6/28/16 23:49	1.6	Loud Vehicle Passby
6/29/16 00:01	6/29/16 00:03	2.1	Loud Vehicle Passby
6/29/16 00:13	6/29/16 00:17	3.8	Loud Vehicle Passby
6/29/16 00:22	6/29/16 00:24	2.3	Loud Vehicle Passby
6/29/16 00:37	6/29/16 00:39	1.6	Loud Vehicle Passby
6/29/16 00:42	6/29/16 00:43	1.1	Loud Vehicle Passby
6/29/16 00:48	6/29/16 00:49	1.8	Loud Vehicle Passby
6/29/16 00:56	6/29/16 00:58	2.6	Train Passby
6/29/16 01:01	6/29/16 01:02	1.1	Loud Vehicle Passby
6/29/16 01:07	6/29/16 01:08	1.8	Train Passby
6/29/16 01:20	6/29/16 01:30	10.8	Train Passby
6/29/16 01:34	6/29/16 01:49	14.8	Train Passby
6/29/16 01:51	6/29/16 01:52	1.8	Loud Vehicle Passby
6/29/16 01:53	6/29/16 01:55	1.8	Loud Vehicle Passby
6/29/16 01:56	6/29/16 01:58	2.3	Loud Vehicle Passby
6/29/16 02:00	6/29/16 02:03	3.1	Loud Vehicle Passby
6/29/16 02:08	6/29/16 02:10	1.3	Loud Vehicle Passby
6/29/16 02:26	6/29/16 02:30	3.8	Train Passby
6/29/16 02:32	6/29/16 02:33	0.6	Loud Vehicle Passby
6/29/16 02:41	6/29/16 02:41	0.1	Loud Vehicle Passby
6/29/16 02:50	6/29/16 02:53	3.3	Loud Vehicle Passby
6/29/16 03:01	6/29/16 03:02	1.8	Loud Vehicle Passby
6/29/16 03:25	6/29/16 03:28	3.3	Loud Vehicle Passby
6/29/16 03:29	6/29/16 03:31	1.8	Loud Vehicle Passby
6/29/16 03:36	6/29/16 03:38	2.1	Loud Vehicle Passby
6/29/16 03:53	6/29/16 04:18	25.1	Loud Vehicle Passby
6/29/16 04:19	6/29/16 04:40	20.8	Excessive Bird Noise
6/29/16 04:41	6/29/16 05:03	22.6	Excessive Bird Noise
6/29/16 05:16	6/29/16 05:27	11.6	Loud Vehicle Passby
6/29/16 05:28	6/29/16 06:59	91.1	Heavy Traffic, Morning Chorus

Data Removal Noise Monitoring Location #12 (First Monitoring Period) Cont.

Start Time	End Time	Duration (min)	Reason
	Total Night #1	**278**	
	Total Night #2	**280**	
	Total Data	**558**	

Data Removal Noise Monitoring Location #12 (Second Monitoring Period)

Start Time	End Time	Duration (min)	Reason
8/02/16 22:00	8/02/16 22:03	3.1	Loud Vehicle Passby
8/02/16 22:21	8/02/16 22:28	7.1	Loud Vehicle Passby
8/02/16 22:29	8/02/16 22:32	2.9	Loud Vehicle Passby
8/02/16 22:45	8/02/16 22:48	2.6	Loud Vehicle Passby
8/02/16 22:55	8/02/16 22:57	1.4	Loud Vehicle Passby
8/02/16 23:09	8/02/16 23:09	0.1	Loud Vehicle Passby
8/02/16 23:09	8/02/16 23:13	3.6	Loud Vehicle Passby
8/02/16 23:15	8/02/16 23:15	0.1	Loud Vehicle Passby
8/02/16 23:16	8/02/16 23:18	2.1	Loud Vehicle Passby
8/02/16 23:24	8/02/16 23:26	2.1	Loud Vehicle Passby
8/02/16 23:28	8/02/16 23:31	2.9	Loud Vehicle Passby
8/02/16 23:40	8/02/16 23:41	1.9	Loud Vehicle Passby
8/02/16 23:50	8/02/16 23:54	4.9	Loud Vehicle Passby
8/02/16 23:59	8/03/16 00:00	1.4	Loud Vehicle Passby
8/03/16 00:14	8/03/16 00:15	1.9	Loud Vehicle Passby
8/03/16 00:27	8/03/16 00:29	2.9	Loud Vehicle Passby
8/03/16 00:35	8/03/16 00:37	2.4	Loud Vehicle Passby
8/03/16 00:49	8/03/16 00:52	3.1	Loud Vehicle Passby
8/03/16 00:59	8/03/16 01:02	2.6	Loud Vehicle Passby
8/03/16 01:06	8/03/16 01:07	1.4	Loud Vehicle Passby
8/03/16 01:20	8/03/16 01:20	0.6	Loud Vehicle Passby
8/03/16 01:49	8/03/16 02:07	18.1	Train Passby
8/03/16 02:16	8/03/16 02:30	14.6	Train Passby
8/03/16 02:42	8/03/16 02:46	3.4	Loud Vehicle Passby
8/03/16 02:49	8/03/16 02:53	3.4	Loud Vehicle Passby
8/03/16 02:56	8/03/16 03:09	13.1	Loud Vehicle Passby
8/03/16 03:20	8/03/16 03:20	0.1	Train Passby
8/03/16 03:20	8/03/16 03:21	1.4	Train Passby
8/03/16 03:25	8/03/16 03:27	2.1	Train Passby
8/03/16 03:42	8/03/16 03:44	1.9	Loud Vehicle Passby
8/03/16 03:56	8/03/16 03:56	0.1	Train Whistle
8/03/16 03:57	8/03/16 03:58	1.4	Train Whistle
8/03/16 04:00	8/03/16 04:04	4.1	Train Passby
8/03/16 04:05	8/03/16 04:20	15.4	Loud Vehicle Passby
8/03/16 04:21	8/03/16 04:27	6.1	Train Passby
8/03/16 04:28	8/03/16 04:32	4.6	Loud Vehicle Passby
8/03/16 04:34	8/03/16 04:36	2.1	Loud Vehicle Passby
8/03/16 04:41	8/03/16 04:44	2.4	Loud Vehicle Passby
8/03/16 04:48	8/03/16 04:49	1.4	Train Passby
8/03/16 05:03	8/03/16 05:55	51.9	Heavy Traffic, Morning Chorus

Data Removal Noise Monitoring Location #12 (Second Monitoring Period) Cont.

Start Time	End Time	Duration (min)	Reason
8/03/16 05:56	8/03/16 06:59	63.9	Heavy Traffic, Morning Chorus
8/03/16 22:01	8/03/16 22:04	2.8	Aircraft Flyover
8/03/16 22:08	8/03/16 22:10	2.5	Loud Vehicle Passby
8/03/16 22:14	8/03/16 22:20	5.3	Loud Vehicle Passby
8/03/16 22:54	8/03/16 22:56	2.5	Train Passby
8/03/16 23:03	8/03/16 23:05	2.3	Train Whistle
8/03/16 23:10	8/03/16 23:11	1.5	Train Whistle
8/03/16 23:19	8/03/16 23:21	2.5	Train Passby
8/04/16 00:06	8/04/16 00:08	1.8	Train Passby
8/04/16 00:18	8/04/16 00:38	19.8	Train Passby
8/04/16 00:47	8/04/16 00:47	0.8	Loud Vehicle Passby
8/04/16 01:03	8/04/16 01:04	1.0	Train Whistle
8/04/16 01:11	8/04/16 01:12	1.0	Loud Vehicle Passby
8/04/16 01:16	8/04/16 01:19	3.5	Monitor Check
8/04/16 01:26	8/04/16 01:34	7.5	Train Passby
8/04/16 01:35	8/04/16 01:36	1.5	Train Whistle
8/04/16 01:41	8/04/16 01:56	15.3	Train Passby
8/04/16 02:25	8/04/16 02:26	1.0	Train Whistle
8/04/16 02:29	8/04/16 02:31	2.3	Loud Vehicle Passby
8/04/16 02:41	8/04/16 02:44	2.5	Train Passby
8/04/16 03:16	8/04/16 03:18	1.8	Loud Vehicle Passby
8/04/16 03:22	8/04/16 03:24	1.8	Train Whistle
8/04/16 03:28	8/04/16 03:28	0.3	Train Passby
8/04/16 03:28	8/04/16 03:31	3.0	Train Passby
8/04/16 03:33	8/04/16 03:36	3.5	Train Passby
8/04/16 03:40	8/04/16 03:46	5.5	Train Passby
8/04/16 03:51	8/04/16 03:55	3.8	Train Passby
8/04/16 04:07	8/04/16 04:19	12.0	Train Passby
8/04/16 04:20	8/04/16 04:21	1.3	Train Whistle
8/04/16 04:22	8/04/16 04:26	4.0	Loud Vehicle Passby
8/04/16 04:27	8/04/16 04:30	3.8	Train Whistle
8/04/16 04:38	8/04/16 04:42	3.5	Loud Vehicle Passby
8/04/16 04:44	8/04/16 04:45	1.5	Train Whistle
8/04/16 04:52	8/04/16 04:55	2.3	Loud Vehicle Passby
8/04/16 04:58	8/04/16 04:59	1.0	Train Whistle
8/04/16 04:59	8/04/16 05:00	1.0	Train Whistle
8/04/16 05:03	8/04/16 05:04	1.3	Train Whistle
8/04/16 05:08	8/04/16 05:09	1.0	Train Whistle

Data Removal Noise Monitoring Location #12 (Second Monitoring Period) Cont.

Start Time	End Time	Duration (min)	Reason
8/04/16 05:10	8/04/16 05:24	13.5	Train Passby
8/04/16 05:24	8/04/16 05:28	3.5	Loud Vehicle Passby
8/04/16 05:28	8/04/16 05:30	1.8	Excessive Bird Noise
8/04/16 05:30	8/04/16 05:46	16.0	Excessive Bird Noise
8/04/16 05:46	8/04/16 07:02	75.8	Morning Chorus
	Total Night #1	**262**	
	Total Night #2	**164**	
	Total Data	**426**	

Data Removal Noise Monitoring Location #13

Start Time	End Time	Duration (min)	Reason
8/02/16 22:04	8/02/16 22:05	1.0	Abnormal
8/02/16 22:17	8/02/16 22:20	3.0	Loud Vehicle Passby
8/02/16 22:47	8/02/16 22:48	1.7	Loud Vehicle Passby
8/02/16 22:49	8/02/16 22:51	2.2	Loud Vehicle Passby
8/02/16 22:54	8/02/16 22:55	1.5	Loud Vehicle Passby
8/02/16 22:56	8/02/16 22:57	0.5	Abnormal
8/02/16 23:03	8/02/16 23:04	2.0	Loud Vehicle Passby
8/02/16 23:11	8/02/16 23:12	1.5	Aircraft Flyover
8/02/16 23:18	8/02/16 23:19	1.0	Abnormal (Sounds like gunfire)
8/02/16 23:26	8/02/16 23:26	0.7	Abnormal (Gun fire)
8/02/16 23:40	8/02/16 23:41	2.0	Aircraft Flyover
8/02/16 23:44	8/02/16 23:44	0.7	Loud Vehicle Passby
8/02/16 23:48	8/02/16 23:49	1.2	Abnormal (Gun fire)
8/02/16 23:56	8/02/16 23:56	1.0	Abnormal (Gun fire)
8/03/16 00:02	8/03/16 00:04	1.7	Abnormal (Gun fire)
8/03/16 00:08	8/03/16 00:08	0.5	Abnormal (Gun fire)
8/03/16 00:10	8/03/16 00:11	1.0	Abnormal (Gun fire)
8/03/16 00:13	8/03/16 00:14	0.7	Abnormal (Gun fire)
8/03/16 00:18	8/03/16 00:19	1.0	Abnormal (Gun fire)
8/03/16 00:21	8/03/16 00:22	0.7	Abnormal (Gun fire)
8/03/16 00:25	8/03/16 00:26	1.2	Abnormal (Gun fire)
8/03/16 00:33	8/03/16 00:33	1.0	Abnormal (Gun fire)
8/03/16 00:40	8/03/16 00:41	1.2	Abnormal (Gun fire)
8/03/16 00:47	8/03/16 00:48	2.0	Abnormal (Gun fire)
8/03/16 00:50	8/03/16 00:51	1.5	Abnormal (Gun fire)
8/03/16 00:54	8/03/16 00:56	1.7	Abnormal (Gun fire)
8/03/16 01:02	8/03/16 01:03	1.7	Abnormal (Gun fire)
8/03/16 01:10	8/03/16 01:11	1.0	Abnormal (Gun fire)
8/03/16 01:14	8/03/16 01:14	1.0	Abnormal (Gun fire)
8/03/16 01:17	8/03/16 01:18	1.0	Abnormal (Gun fire)
8/03/16 01:22	8/03/16 01:23	1.0	Abnormal (Gun fire)
8/03/16 01:25	8/03/16 01:26	1.7	Abnormal (Gun fire)
8/03/16 01:31	8/03/16 01:33	2.0	Abnormal (Gun fire)
8/03/16 01:38	8/03/16 01:41	2.5	Abnormal (Gun fire)
8/03/16 01:47	8/03/16 01:48	1.0	Abnormal (Gun fire)
8/03/16 01:54	8/03/16 01:55	1.2	Abnormal (Gun fire)
8/03/16 01:57	8/03/16 01:58	1.0	Abnormal (Gun fire)
8/03/16 02:02	8/03/16 02:03	1.0	Abnormal (Gun fire)
8/03/16 02:06	8/03/16 02:07	1.0	Abnormal (Gun fire)
8/03/16 02:09	8/03/16 02:10	1.0	Abnormal (Gun fire)

Data Removal Noise Monitoring Location #13 Cont.

Start Time	End Time	Duration (min)	Reason
8/03/16 02:13	8/03/16 02:13	0.7	Abnormal (Gun fire)
8/03/16 02:17	8/03/16 02:18	1.0	Abnormal (Gun fire)
8/03/16 02:24	8/03/16 02:25	1.0	Abnormal (Gun fire)
8/03/16 02:32	8/03/16 02:33	1.2	Abnormal (Gun fire)
8/03/16 02:34	8/03/16 02:35	0.7	Abnormal (Gun fire)
8/03/16 02:36	8/03/16 02:40	3.7	Abnormal (Gun fire)
8/03/16 02:47	8/03/16 02:47	1.0	Abnormal (Gun fire)
8/03/16 03:01	8/03/16 03:02	1.2	Abnormal (Gun fire)
8/03/16 03:08	8/03/16 03:10	2.2	Aircraft Flyover
8/03/16 03:16	8/03/16 03:17	1.2	Abnormal (Gun fire)
8/03/16 03:24	8/03/16 03:24	1.0	Abnormal (Gun fire)
8/03/16 03:31	8/03/16 03:32	1.0	Abnormal (Gun fire)
8/03/16 03:39	8/03/16 03:40	1.5	Abnormal (Gun fire)
8/03/16 03:42	8/03/16 03:42	0.7	Abnormal (Gun fire)
8/03/16 03:46	8/03/16 03:47	1.5	Abnormal (Gun fire)
8/03/16 03:54	8/03/16 03:54	0.7	Abnormal (Gun fire)
8/03/16 03:55	8/03/16 03:57	2.5	Loud Vehicle Passby
8/03/16 03:59	8/03/16 04:02	3.2	Equipment on site
8/03/16 04:08	8/03/16 04:09	1.2	Abnormal (Gun fire)
8/03/16 04:15	8/03/16 04:17	1.5	Abnormal (Gun fire)
8/03/16 04:23	8/03/16 04:24	1.0	Abnormal (Gun fire)
8/03/16 04:26	8/03/16 04:26	0.2	Abnormal (Gun fire)
8/03/16 04:26	8/03/16 04:27	0.5	Abnormal (Gun fire)
8/03/16 04:28	8/03/16 04:30	2.2	Abnormal (Gun fire)
8/03/16 04:31	8/03/16 04:31	1.0	Abnormal (Gun fire)
8/03/16 04:33	8/03/16 04:34	1.5	Abnormal (Gun fire)
8/03/16 04:34	8/03/16 04:36	2.0	Abnormal (Gun fire)
8/03/16 04:38	8/03/16 04:39	1.5	Abnormal (Gun fire)
8/03/16 04:43	8/03/16 04:43	1.0	Abnormal (Gun fire)
8/03/16 04:45	8/03/16 04:47	2.0	Abnormal (Gun fire)
8/03/16 04:53	8/03/16 04:54	1.5	Abnormal (Gun fire)
8/03/16 05:08	8/03/16 05:08	0.7	Abnormal (Gun fire)
8/03/16 05:13	8/03/16 05:17	3.5	Loud Vehicle Passby
8/03/16 05:22	8/03/16 05:26	4.2	Abnormal (Gun fire)
8/03/16 05:30	8/03/16 05:31	1.0	Abnormal (Gun fire)
8/03/16 05:37	8/03/16 05:38	1.7	Abnormal (Gun fire)
8/03/16 05:39	8/03/16 05:39	0.2	Abnormal (Gun fire)
8/03/16 05:40	8/03/16 05:40	0.2	Abnormal (Gun fire)
8/03/16 05:40	8/03/16 05:40	0.2	Abnormal (Gun fire)
8/03/16 05:45	8/03/16 05:54	9.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #13 Cont.

Start Time	End Time	Duration (min)	Reason
8/03/16 05:56	8/03/16 05:59	3.2	Abnormal (Gun fire)
8/03/16 05:59	8/03/16 06:00	1.2	Abnormal (Gun fire)
8/03/16 06:06	8/03/16 06:08	2.7	Loud Vehicle Passby
8/03/16 06:09	8/03/16 06:44	34.5	Loud Vehicle Passby
8/03/16 06:44	8/03/16 06:45	0.7	Abnormal (Gun fire)
8/03/16 06:46	8/03/16 06:53	6.5	Loud Vehicle Passby
8/03/16 06:59	8/03/16 07:00	1.2	Abnormal (Gun fire)
8/03/16 22:01	8/03/16 22:03	1.5	Train Passby
8/03/16 22:03	8/03/16 22:08	5.0	Loud Vehicle Passby
8/03/16 22:13	8/03/16 22:14	1.0	Abnormal (Gun fire)
8/03/16 22:21	8/03/16 22:22	1.0	Abnormal (Gun fire)
8/03/16 22:28	8/03/16 22:28	0.2	Abnormal (Gun fire)
8/03/16 22:29	8/03/16 22:29	0.5	Abnormal (Gun fire)
8/03/16 22:36	8/03/16 22:37	1.5	Abnormal (Gun fire)
8/03/16 22:43	8/03/16 22:46	2.7	Loud Vehicle Passby
8/03/16 22:56	8/03/16 23:00	4.0	Loud Vehicle Passby
8/03/16 23:05	8/03/16 23:08	3.0	Abnormal (Gun fire)
8/03/16 23:13	8/03/16 23:14	1.0	Abnormal (Gun fire)
8/03/16 23:18	8/03/16 23:21	3.7	Aircraft Flyover
8/03/16 23:22	8/03/16 23:23	1.5	Abnormal (Gun fire)
8/03/16 23:27	8/03/16 23:28	1.0	Abnormal (Gun fire)
8/03/16 23:28	8/03/16 23:29	0.5	Abnormal (Gun fire)
8/03/16 23:35	8/03/16 23:37	1.7	Abnormal (Gun fire)
8/03/16 23:43	8/03/16 23:43	1.0	Abnormal (Gun fire)
8/03/16 23:49	8/03/16 23:49	0.2	Abnormal (Gun fire)
8/03/16 23:50	8/03/16 23:51	1.5	Abnormal (Gun fire)
8/03/16 23:55	8/03/16 23:56	0.7	Abnormal (Gun fire)
8/03/16 23:58	8/03/16 23:58	1.0	Abnormal (Gun fire)
8/04/16 00:04	8/04/16 00:04	0.2	Abnormal (Gun fire)
8/04/16 00:04	8/04/16 00:07	3.0	Abnormal (Gun fire)
8/04/16 00:11	8/04/16 00:14	3.7	Loud Vehicle Passby
8/04/16 00:16	8/04/16 00:18	2.0	Abnormal (Gun fire)
8/04/16 00:20	8/04/16 00:21	1.0	Abnormal (Gun fire)
8/04/16 00:27	8/04/16 00:28	1.0	Abnormal (Gun fire)
8/04/16 00:35	8/04/16 00:35	1.0	Abnormal (Gun fire)
8/04/16 00:42	8/04/16 00:43	1.2	Abnormal (Gun fire)
8/04/16 01:06	8/04/16 01:09	2.5	Abnormal (Gun fire)
8/04/16 01:34	8/04/16 01:36	2.2	Loud Vehicle Passby
8/04/16 01:38	8/04/16 01:39	1.5	Loud Vehicle Passby
8/04/16 01:43	8/04/16 01:45	2.7	Loud Vehicle Passby

Data Removal Noise Monitoring Location #13 Cont.

Start Time	End Time	Duration (min)	Reason
8/04/16 02:14	8/04/16 02:15	0.7	Abnormal (Gun fire)
8/04/16 02:17	8/04/16 02:22	4.7	Aircraft Flyover
8/04/16 02:51	8/04/16 02:53	1.7	Abnormal (Gun fire)
8/04/16 04:36	8/04/16 04:36	0.2	Abnormal (Gun fire)
8/04/16 04:37	8/04/16 04:37	1.0	Abnormal (Gun fire)
8/04/16 04:43	8/04/16 04:43	0.2	Abnormal (Gun fire)
8/04/16 04:44	8/04/16 04:44	0.2	Abnormal (Gun fire)
8/04/16 05:08	8/04/16 05:10	2.0	Loud Vehicle Passby
8/04/16 05:18	8/04/16 05:20	2.2	Aircraft Flyover
8/04/16 05:27	8/04/16 05:28	1.2	Abnormal (Gun fire)
8/04/16 05:39	8/04/16 05:44	5.2	Excessive Bird Noise
8/04/16 05:44	8/04/16 05:47	3.2	Loud Vehicle Passby
8/04/16 05:51	8/04/16 05:54	2.5	Excessive Bird Noise
8/04/16 05:56	8/04/16 05:58	1.7	Loud Vehicle Passby
8/04/16 05:58	8/04/16 06:00	2.0	Loud Vehicle Passby
8/04/16 06:02	8/04/16 06:02	0.2	Loud Vehicle Passby
8/04/16 06:02	8/04/16 06:03	1.2	Loud Vehicle Passby
8/04/16 06:08	8/04/16 06:50	42.2	Loud Vehicle Passby
8/04/16 06:52	8/04/16 06:54	2.2	Abnormal (Gun fire)
8/04/16 06:56	8/04/16 06:56	1.0	Abnormal (Gun fire)
8/04/16 06:59	8/04/16 07:00	2.0	Abnormal (Gun fire)
	Total Night #1	**164**	
	Total Night #2	**132**	
	Total Data	**296**	

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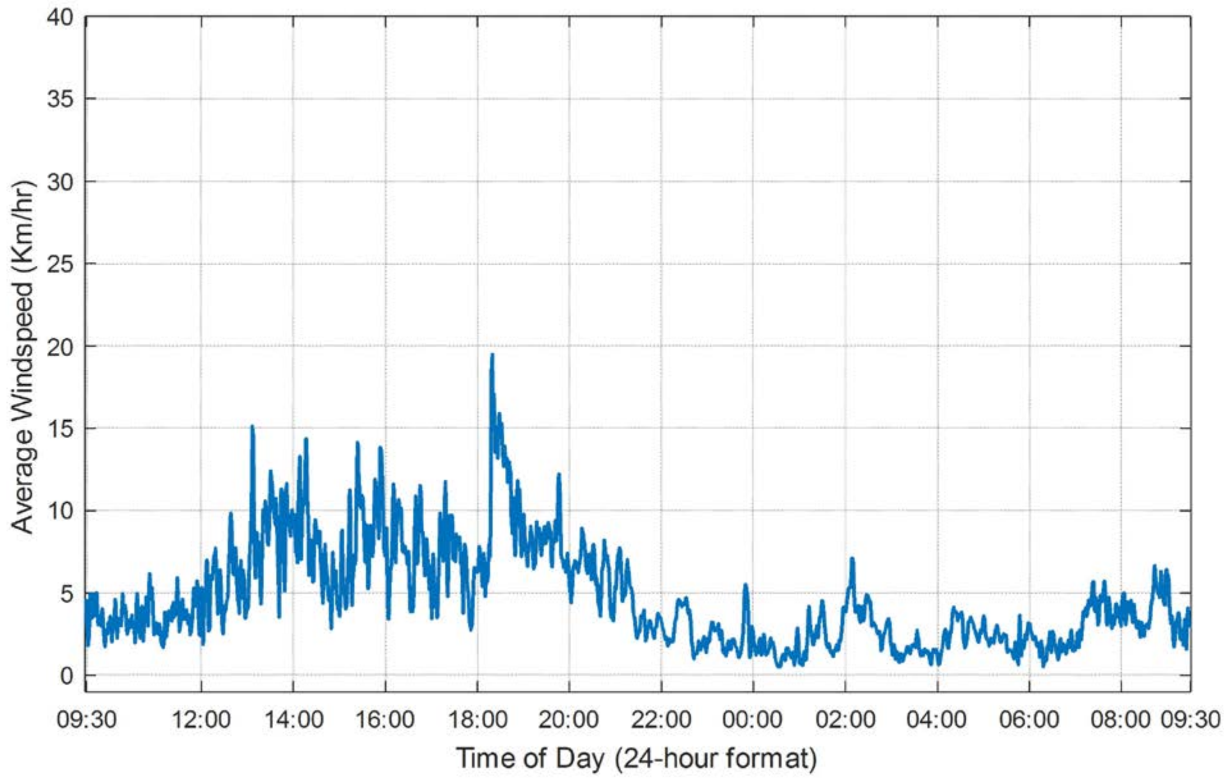
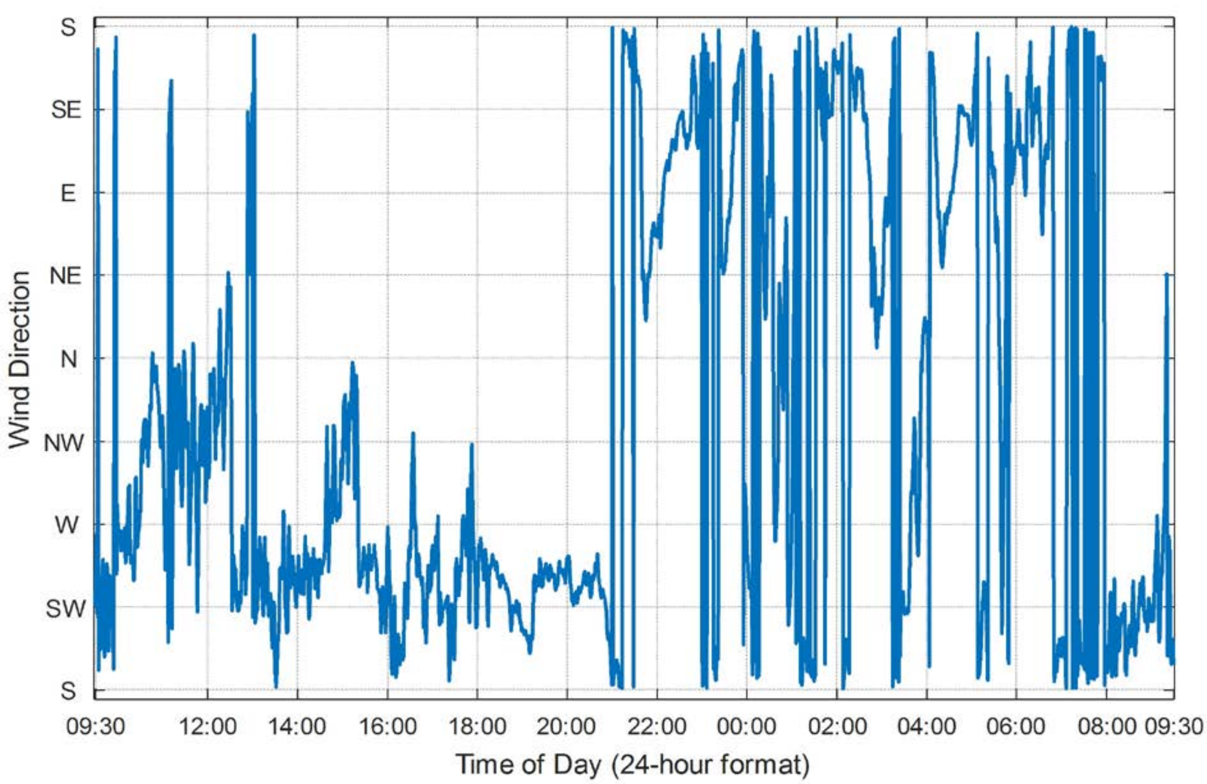
Appendix V WEATHER DATA

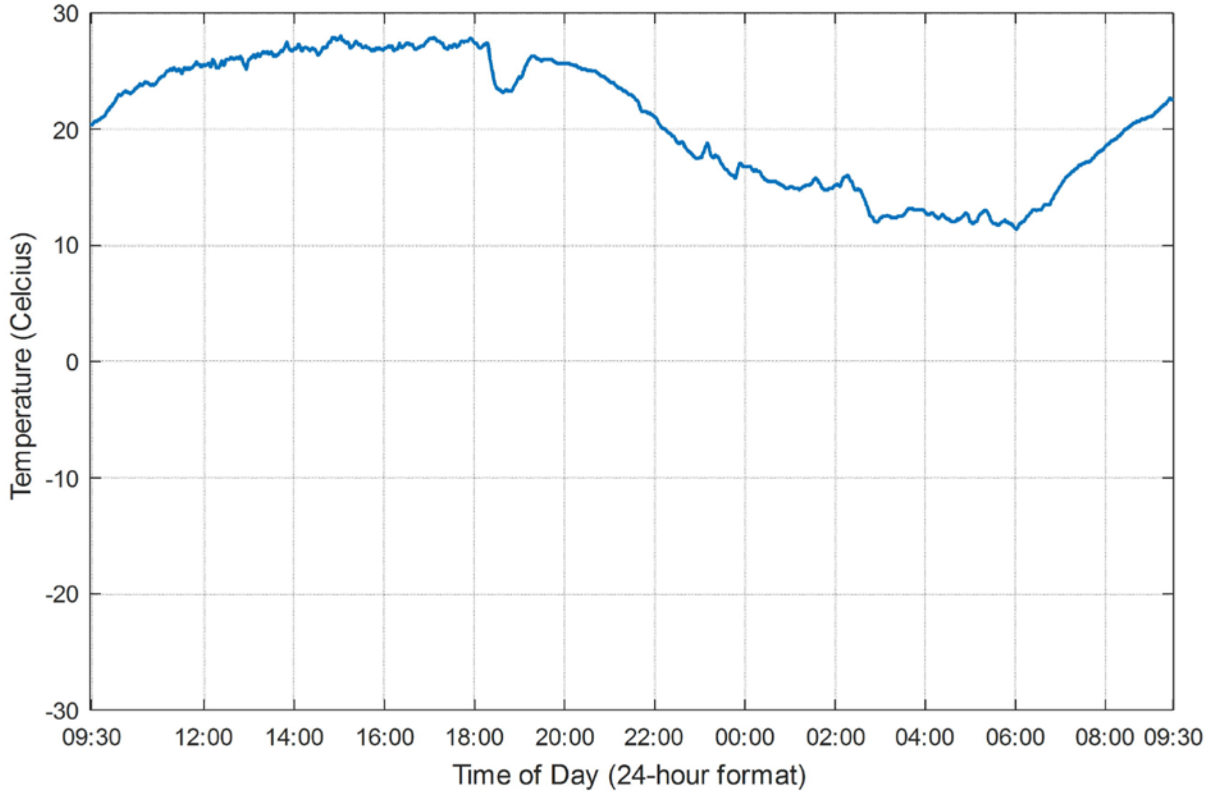
June 27 - 28, 2016 Weather Data



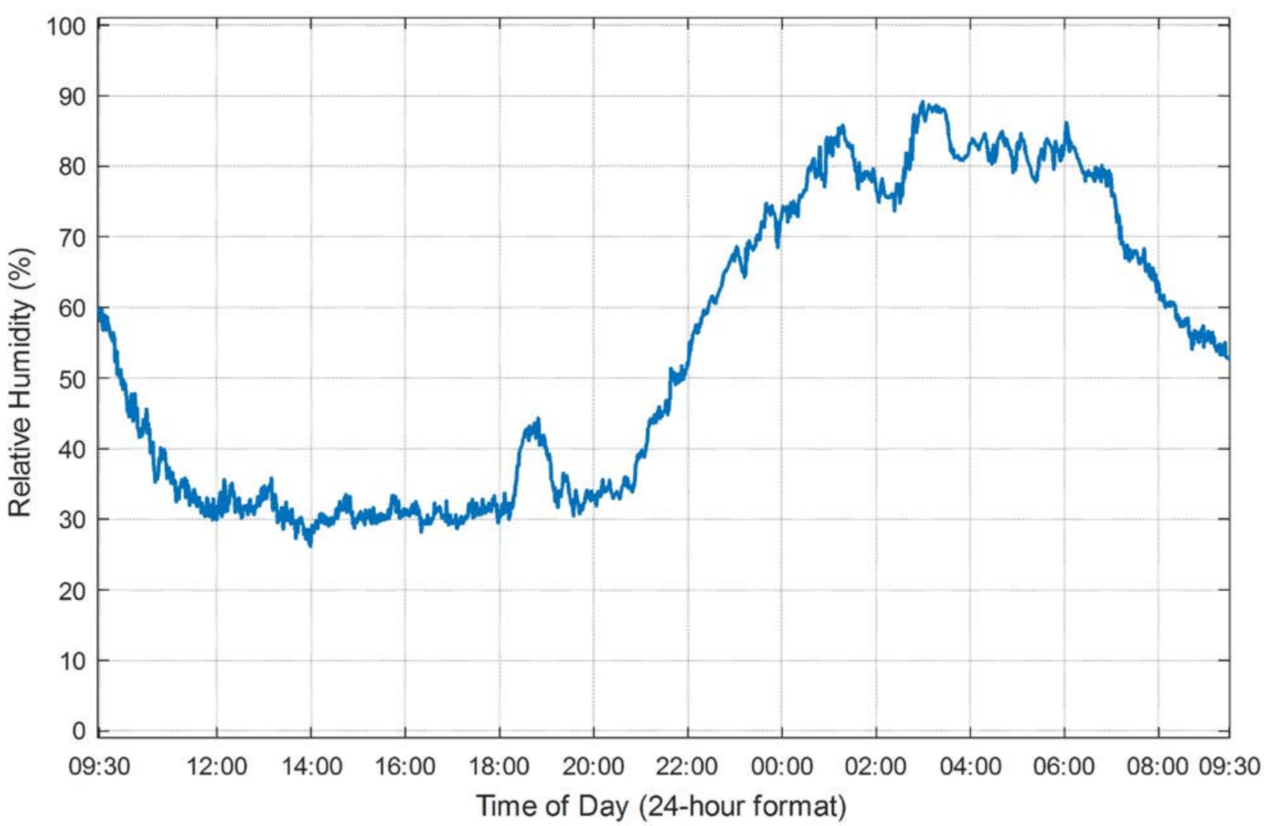
Monitored Wind Speed (June 27 – 28, 2016) at Noise Monitor Location 6



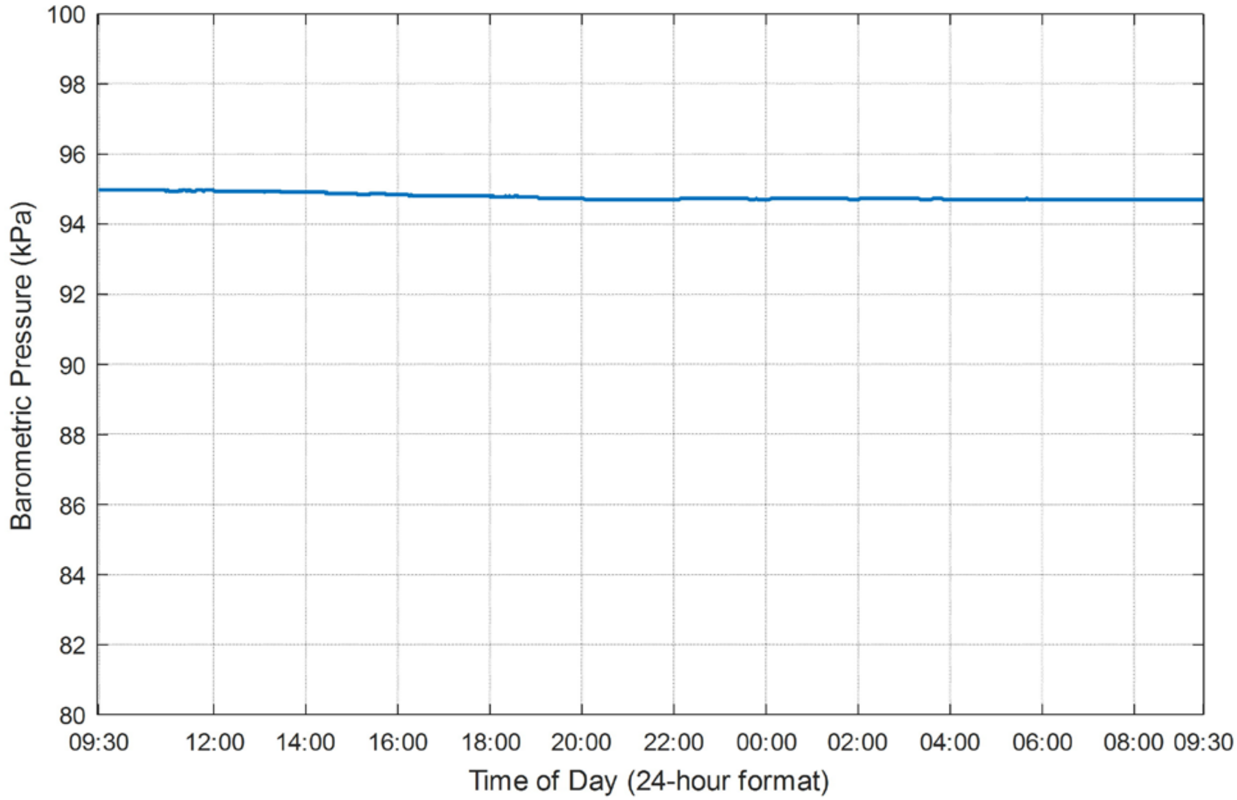
Monitored Wind Direction (June 27 – 28, 2016) at Noise Monitor Location 6



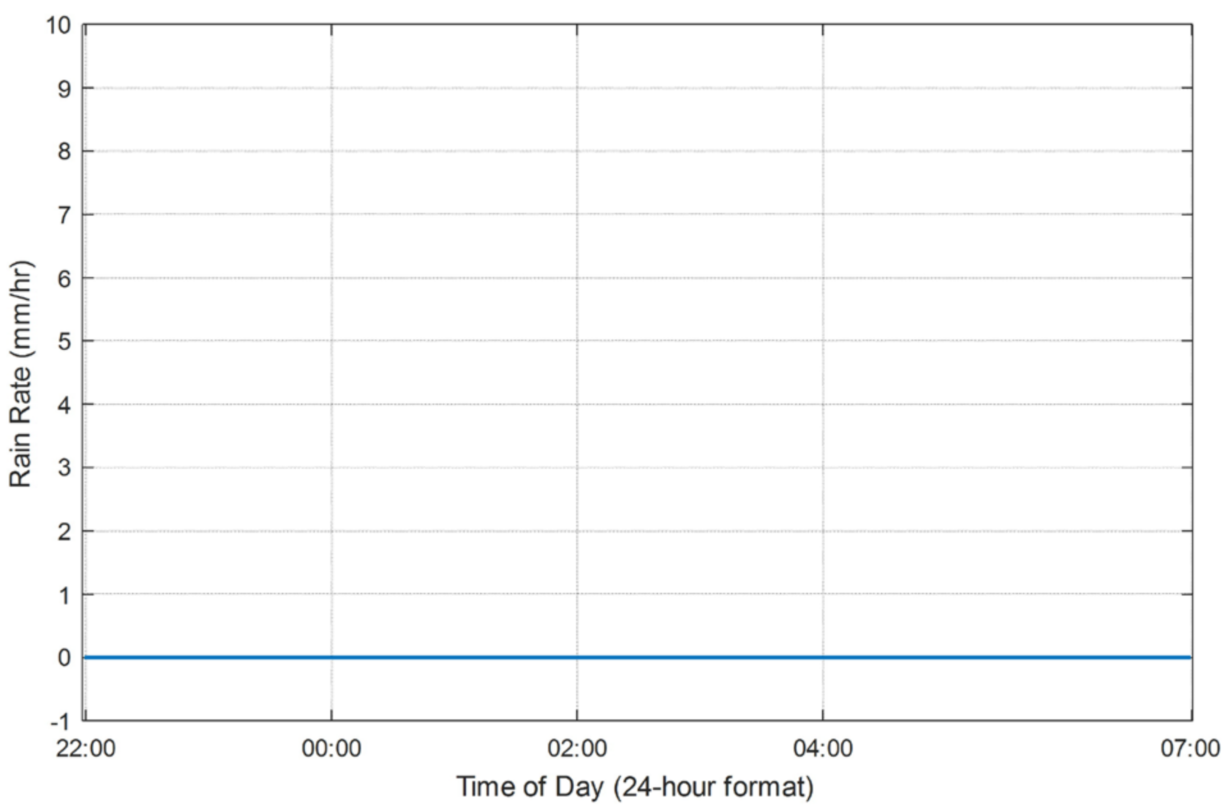
Monitored Temperature (June 27 – 28, 2016) at Noise Monitor Location 6



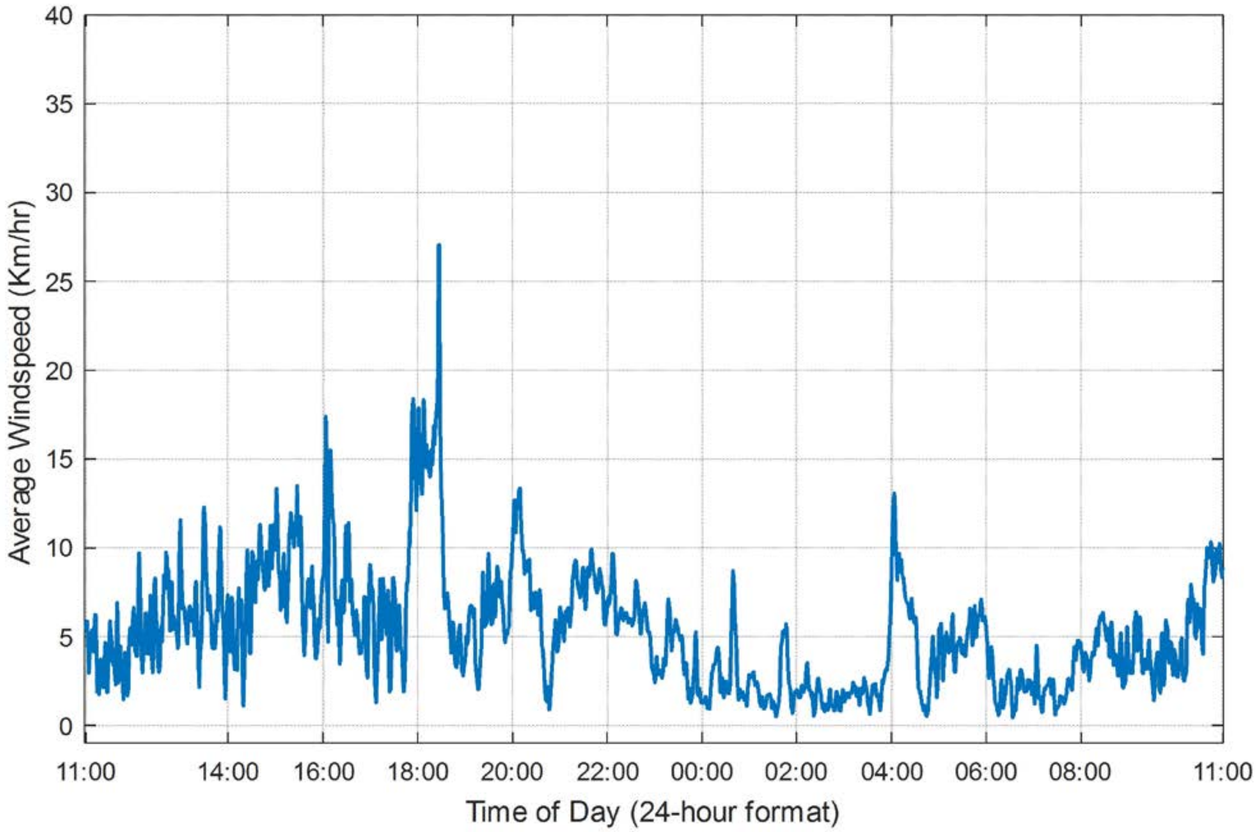
Monitored Humidity (June 27 – 28, 2016) at Noise Monitor Location 6



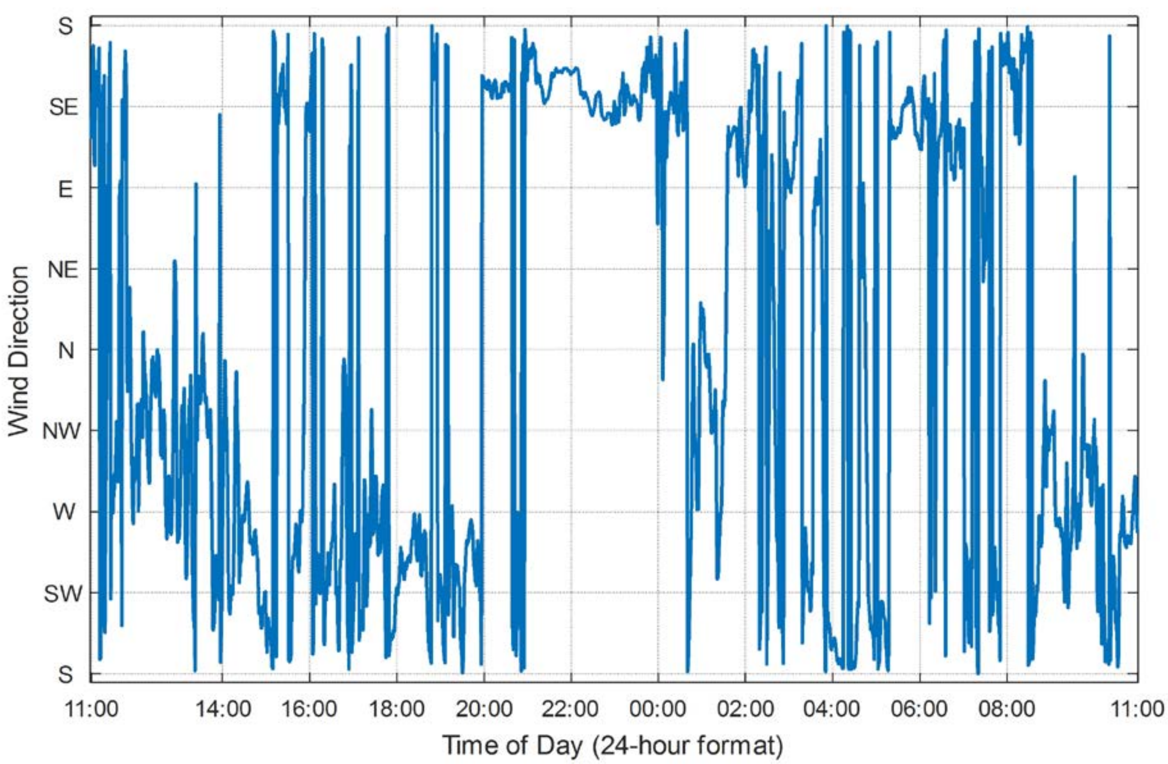
Monitored Barometric Pressure (June 27 – 28, 2016) at Noise Monitor Location 6



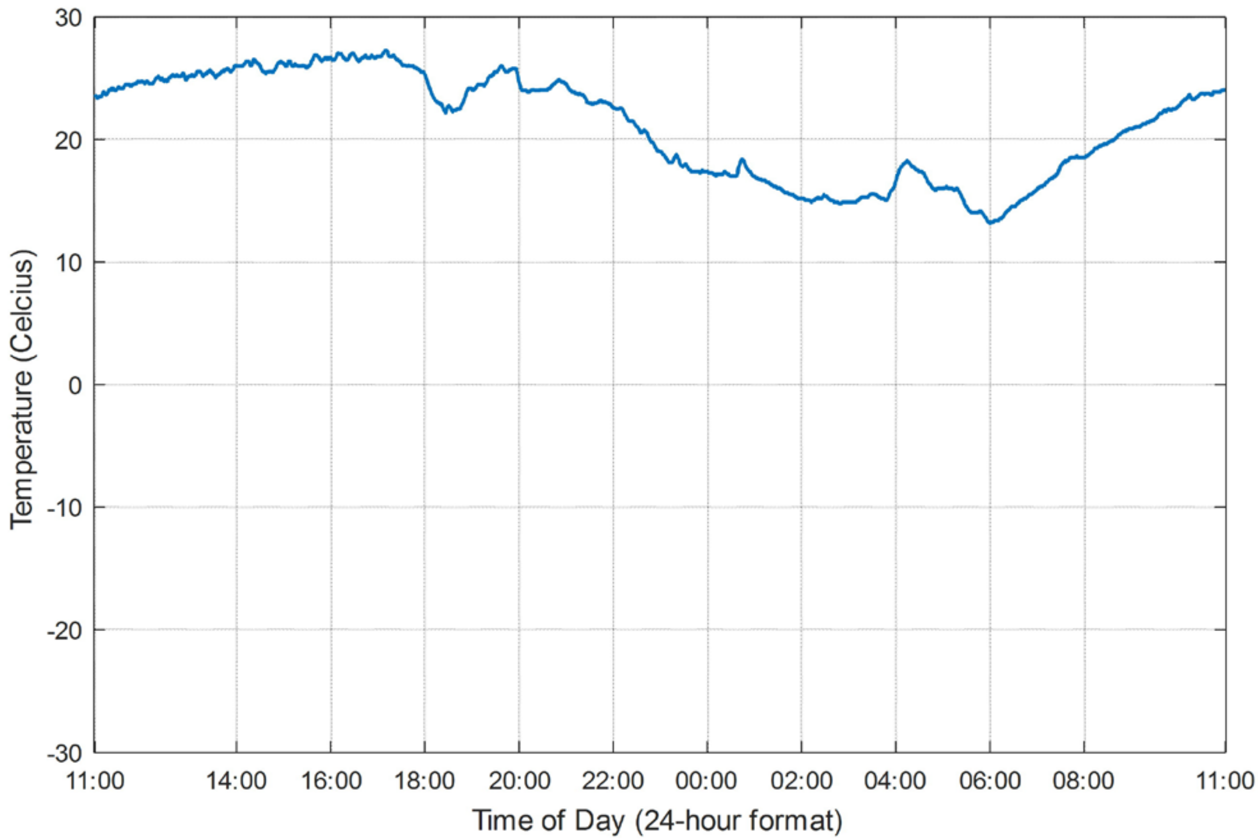
Night-time Monitored Rain Rate (June 27 – 28, 2016) at Noise Monitor Location 6



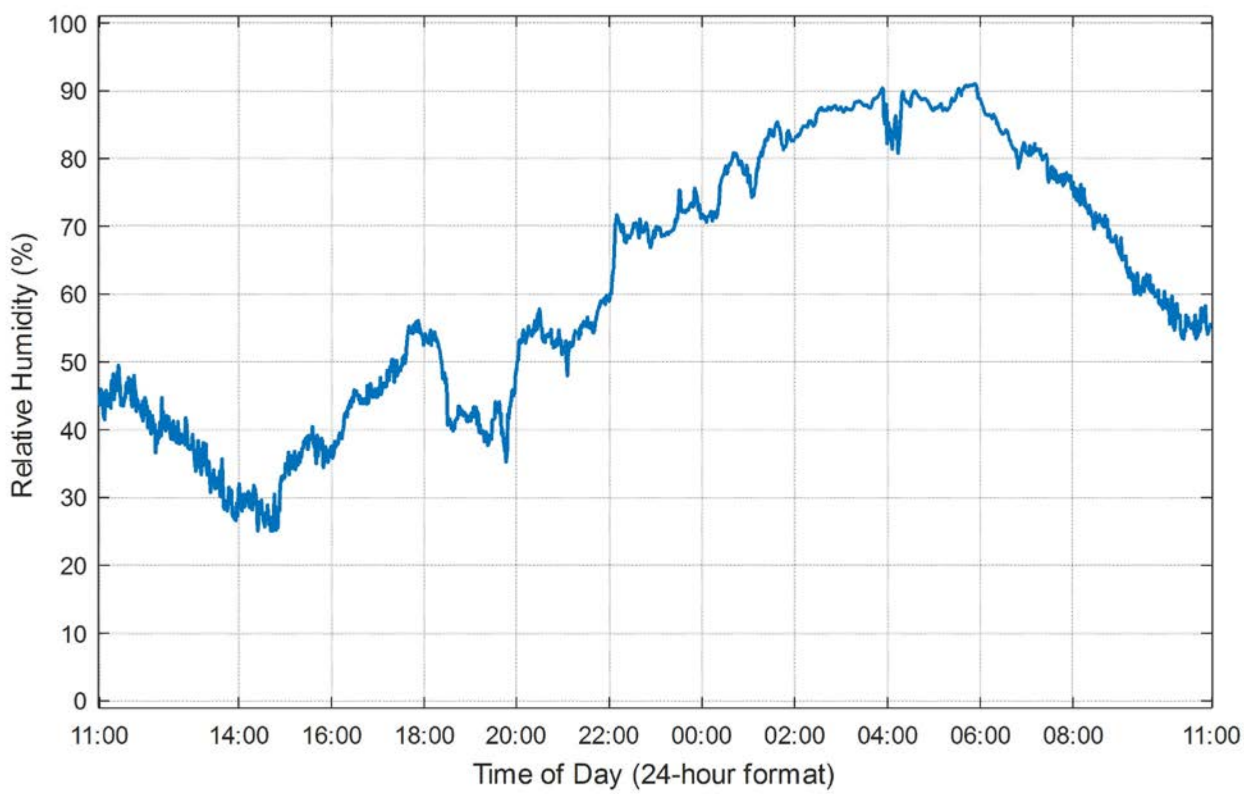
Monitored Wind Speed (June 27 – 28, 2016) at Noise Monitor Location 10



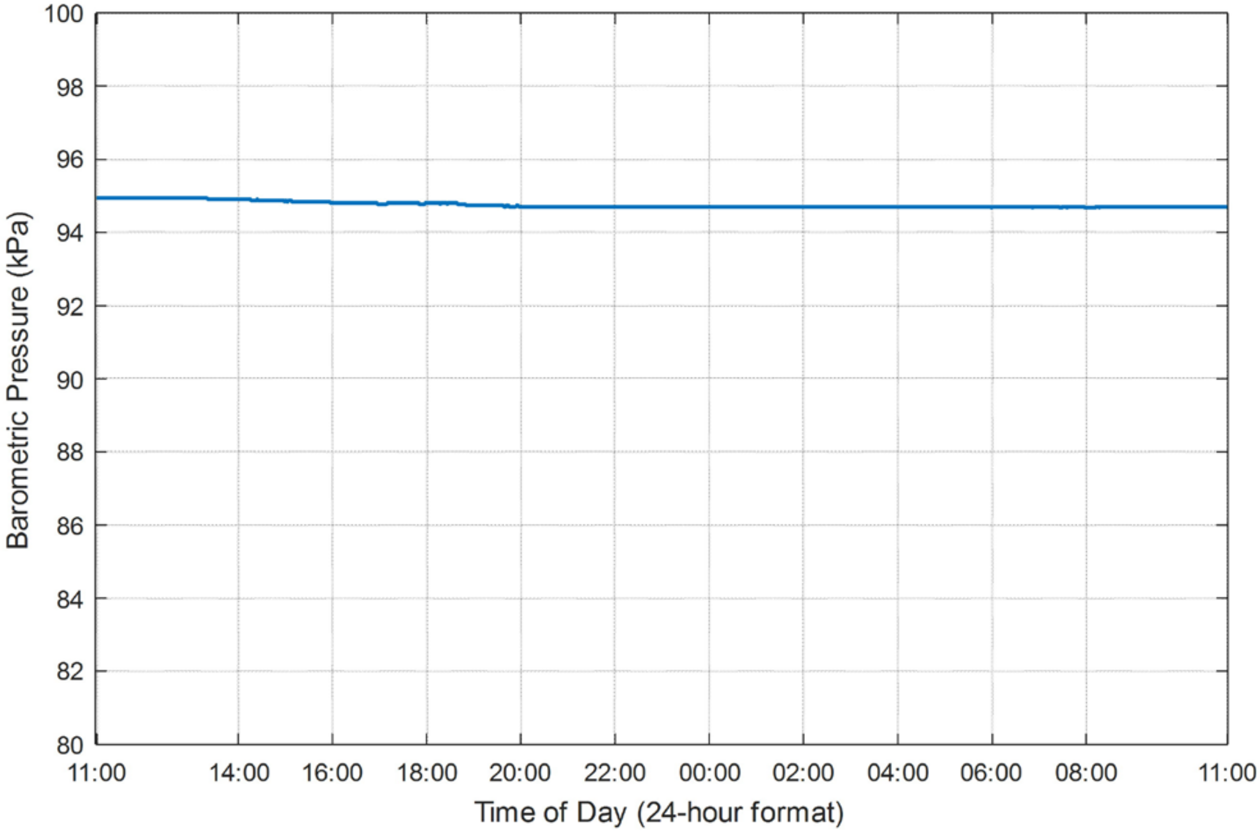
Monitored Wind Direction (June 27 – 28, 2016) at Noise Monitor Location 10



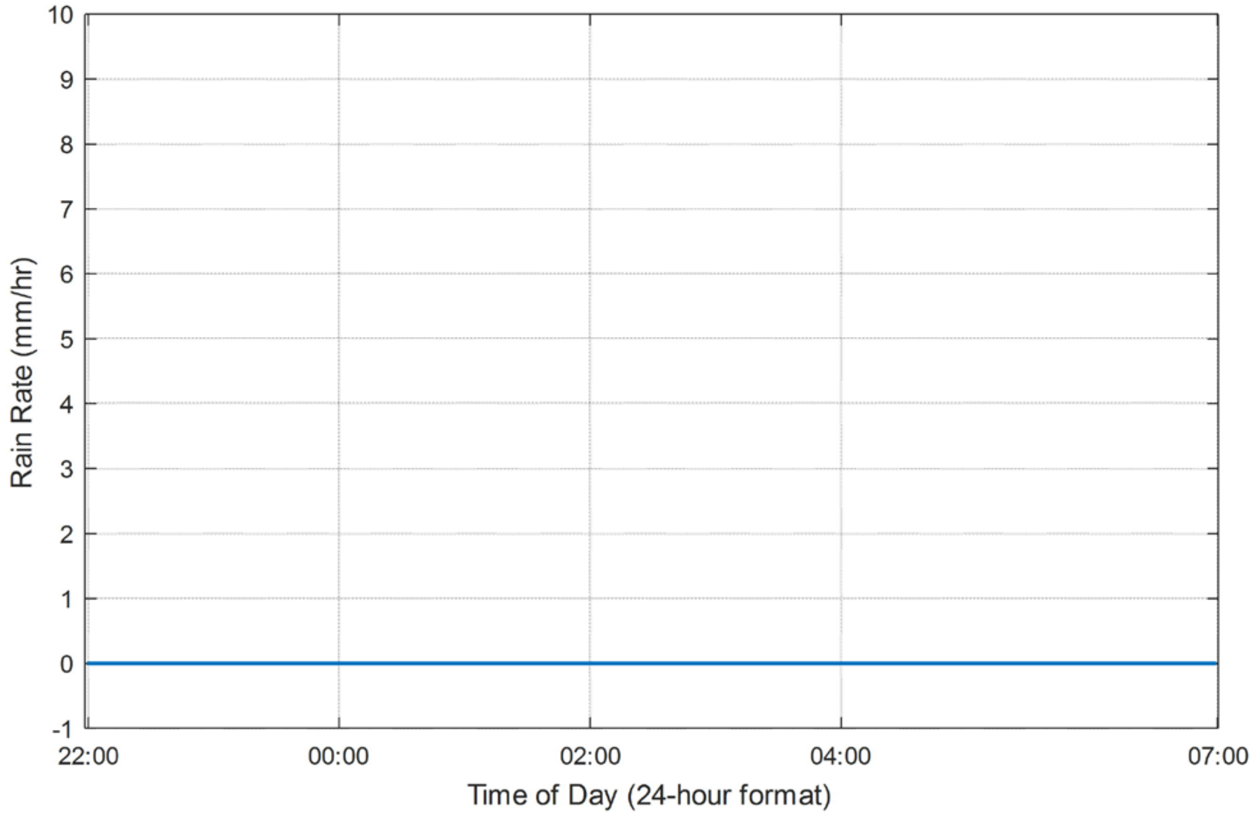
Monitored Temperature (June 27 – 28, 2016) at Noise Monitor Location 10



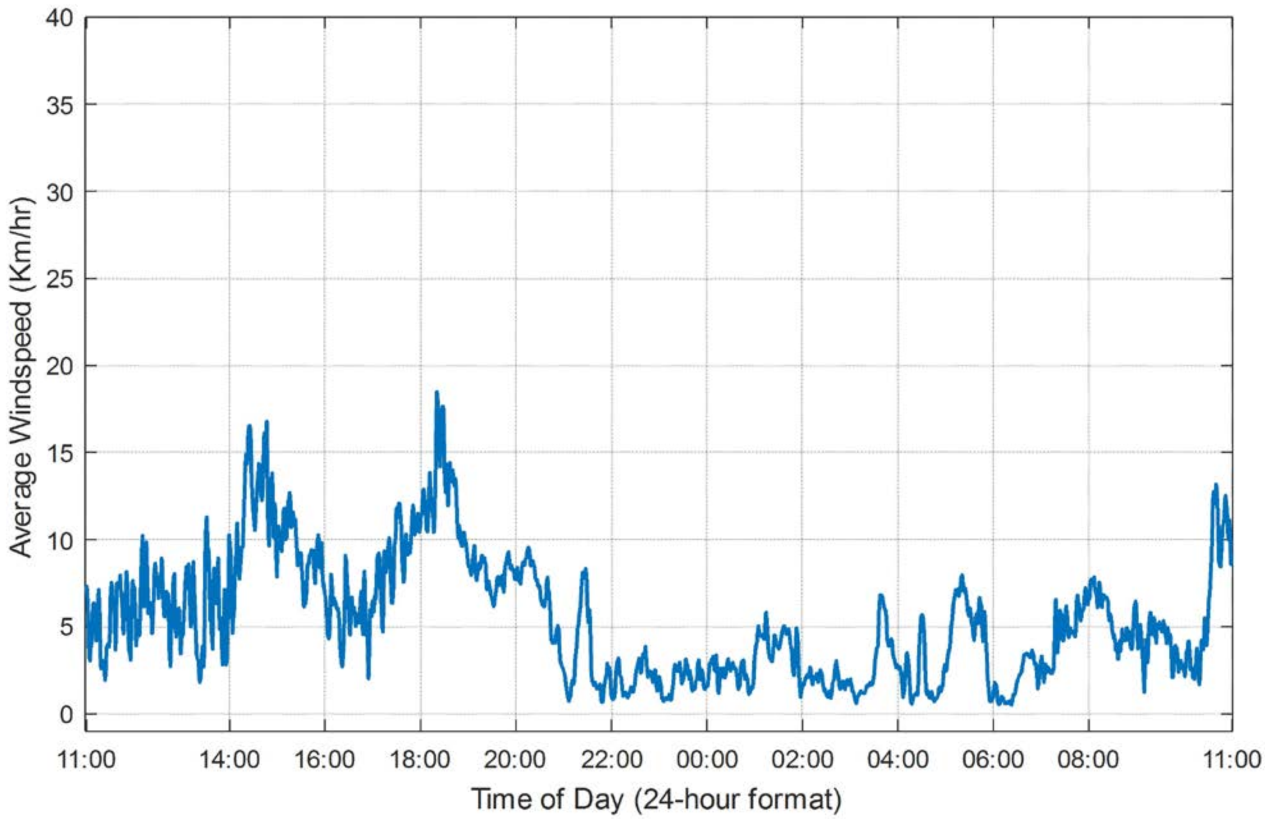
Monitored Humidity (June 27 – 28, 2016) at Noise Monitor Location 10



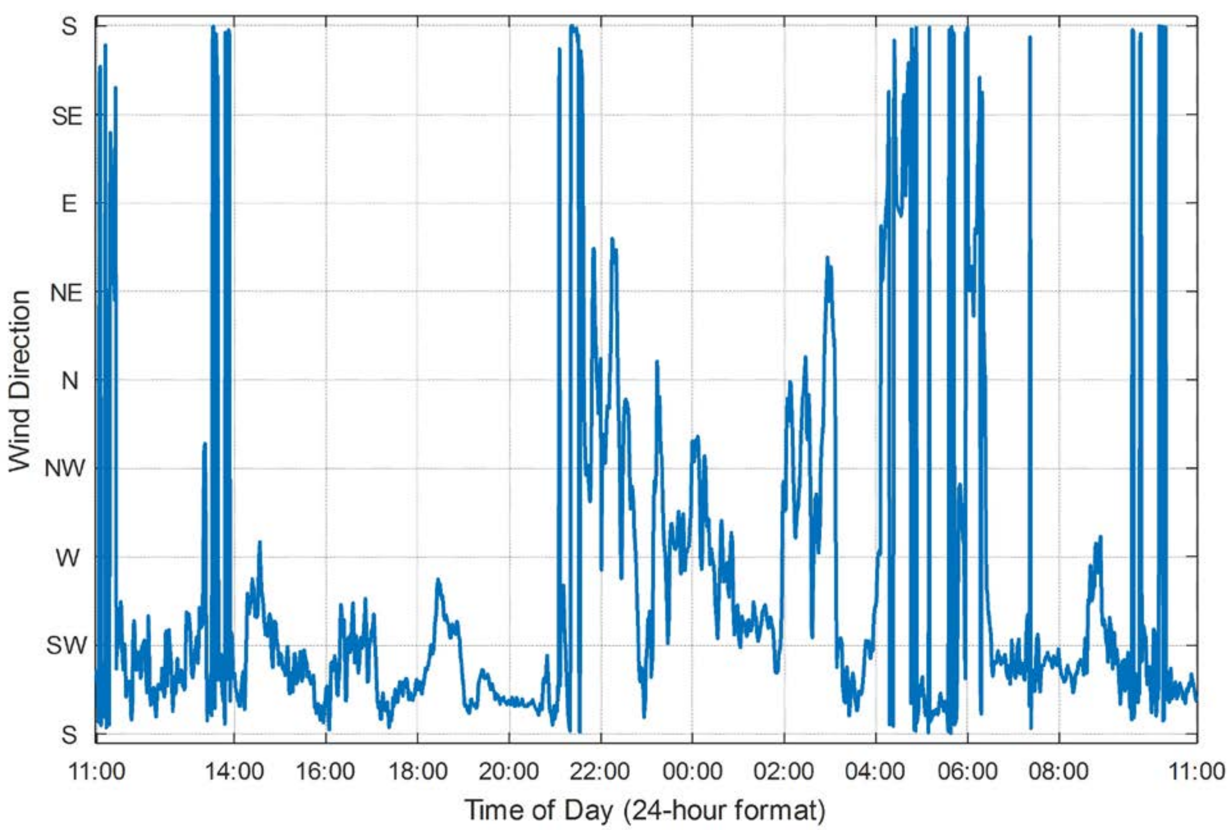
Monitored Barometric Pressure (June 27 – 28, 2016) at Noise Monitor Location 10



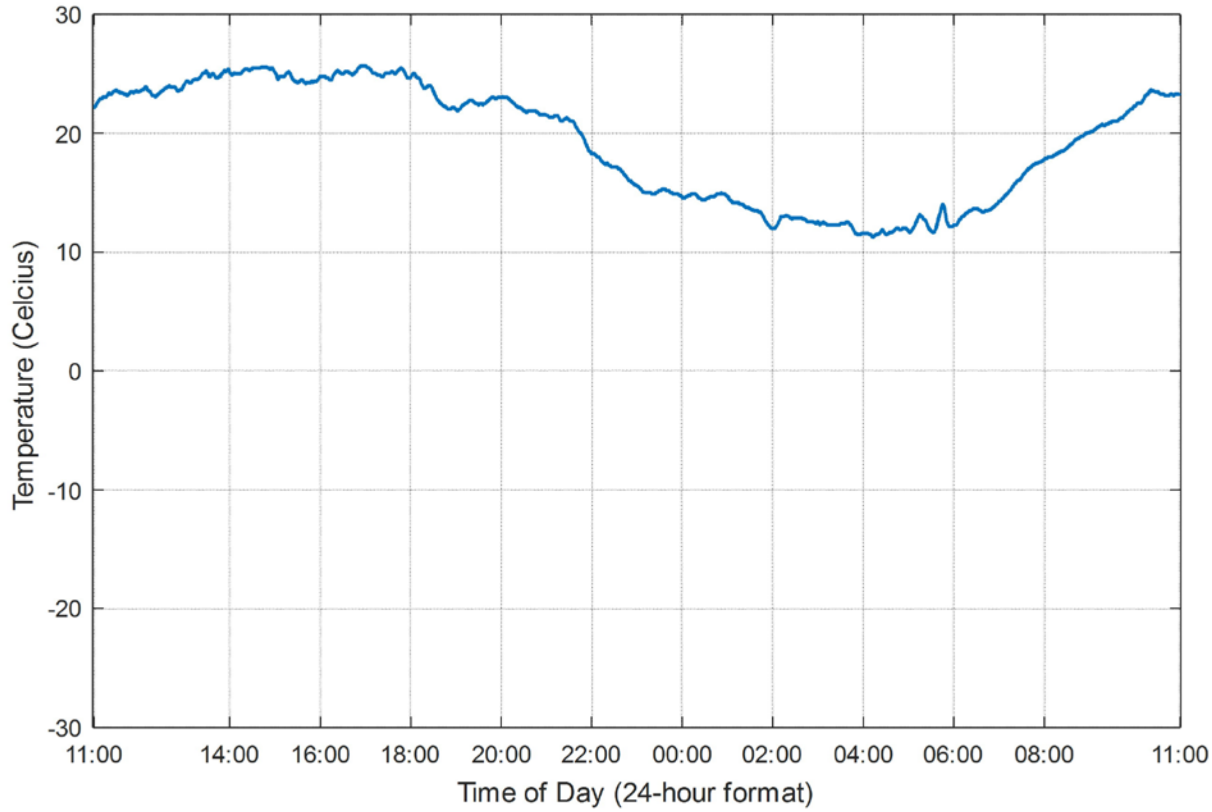
Night-time Monitored Rain Rate (June 27 – 28, 2016) at Noise Monitor Location 10



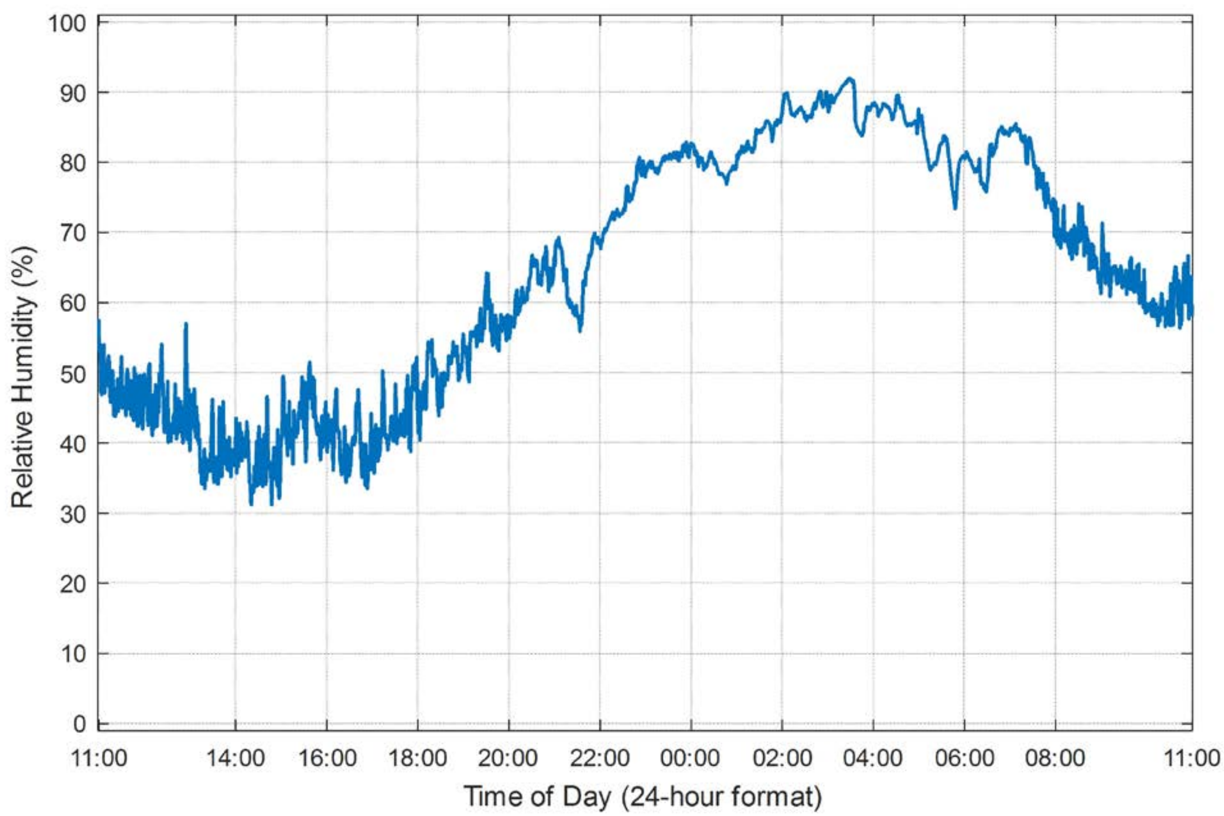
Monitored Wind Speed (June 27 – 28, 2016) at Noise Monitor Location 12



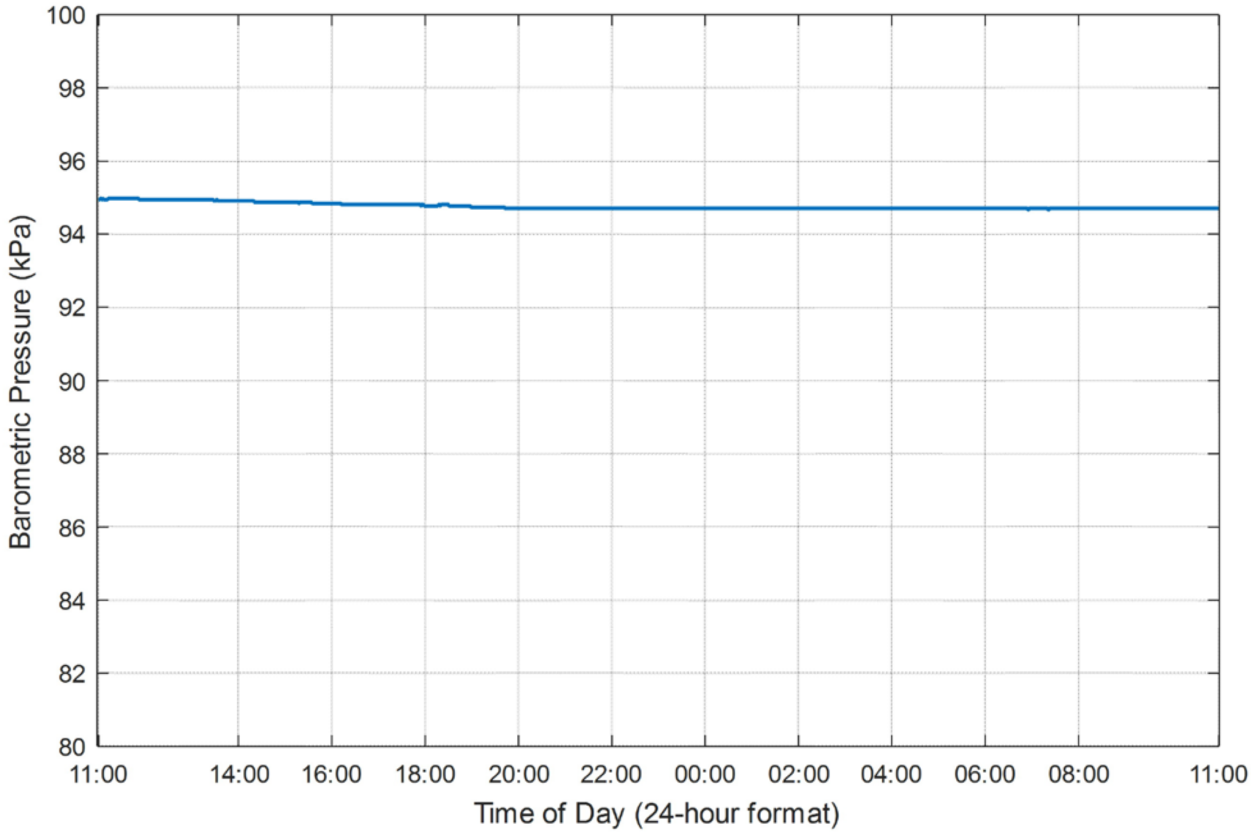
Monitored Wind Direction (June 27 – 28, 2016) at Noise Monitor Location 12



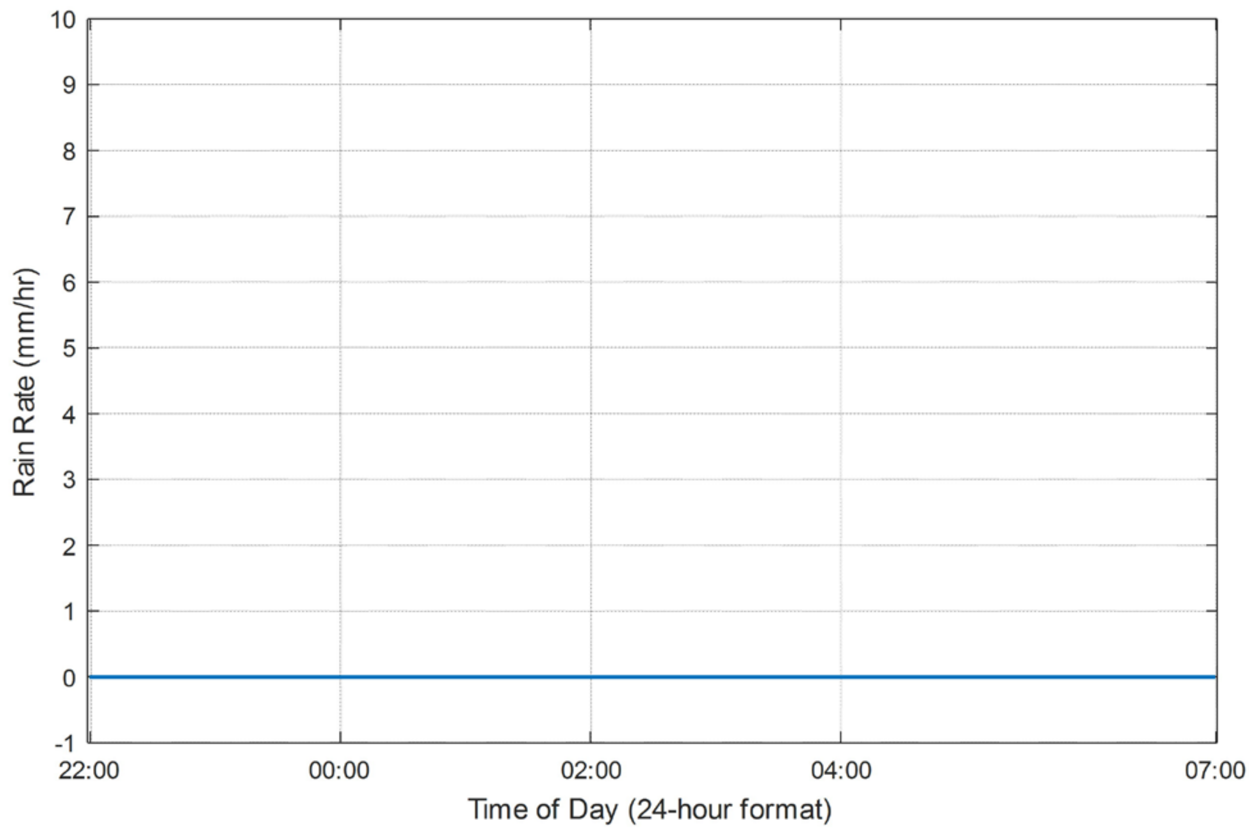
Monitored Temperature (June 27 – 28, 2016) at Noise Monitor Location 12



Monitored Humidity (June 27 – 28, 2016) at Noise Monitor Location 12

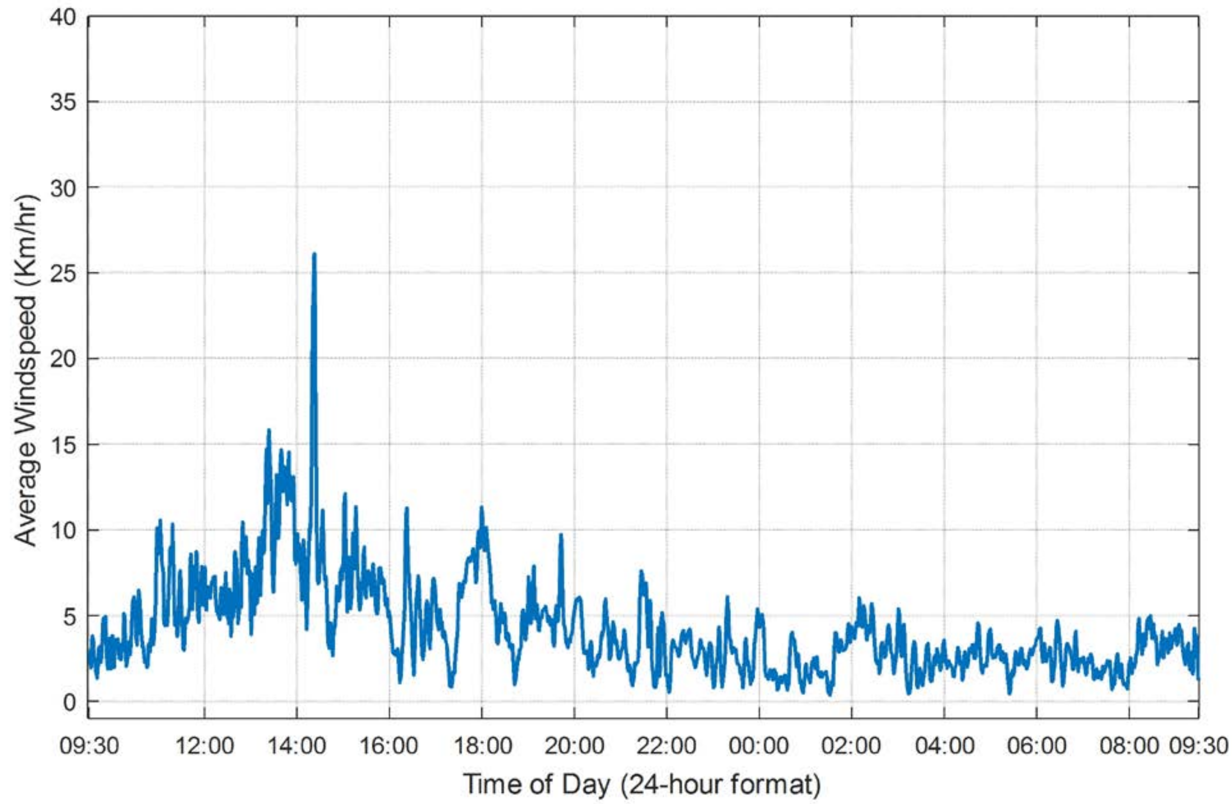


Monitored Barometric Pressure (June 27 – 28, 2016) at Noise Monitor Location 12

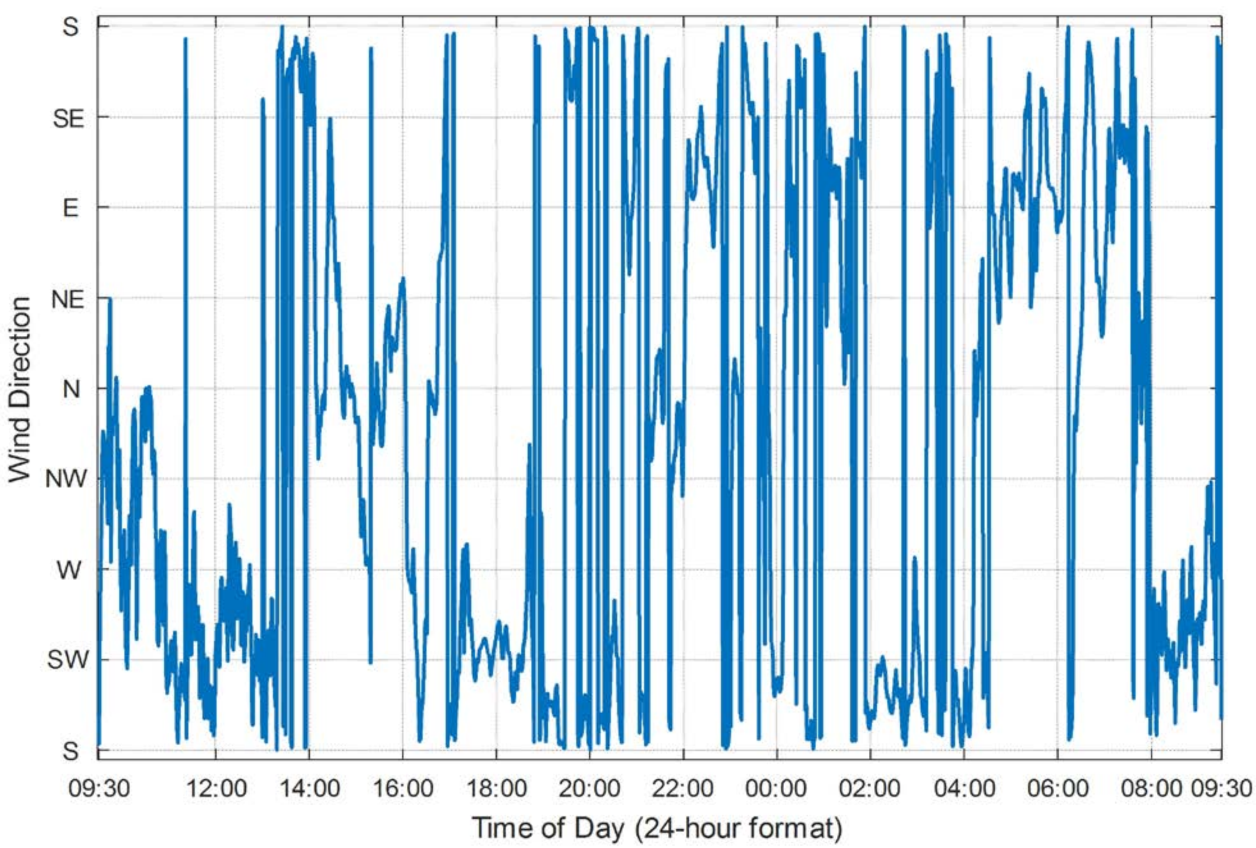


Night-time Monitored Rain Rate (June 27 – 28, 2016) at Noise Monitor Location 12

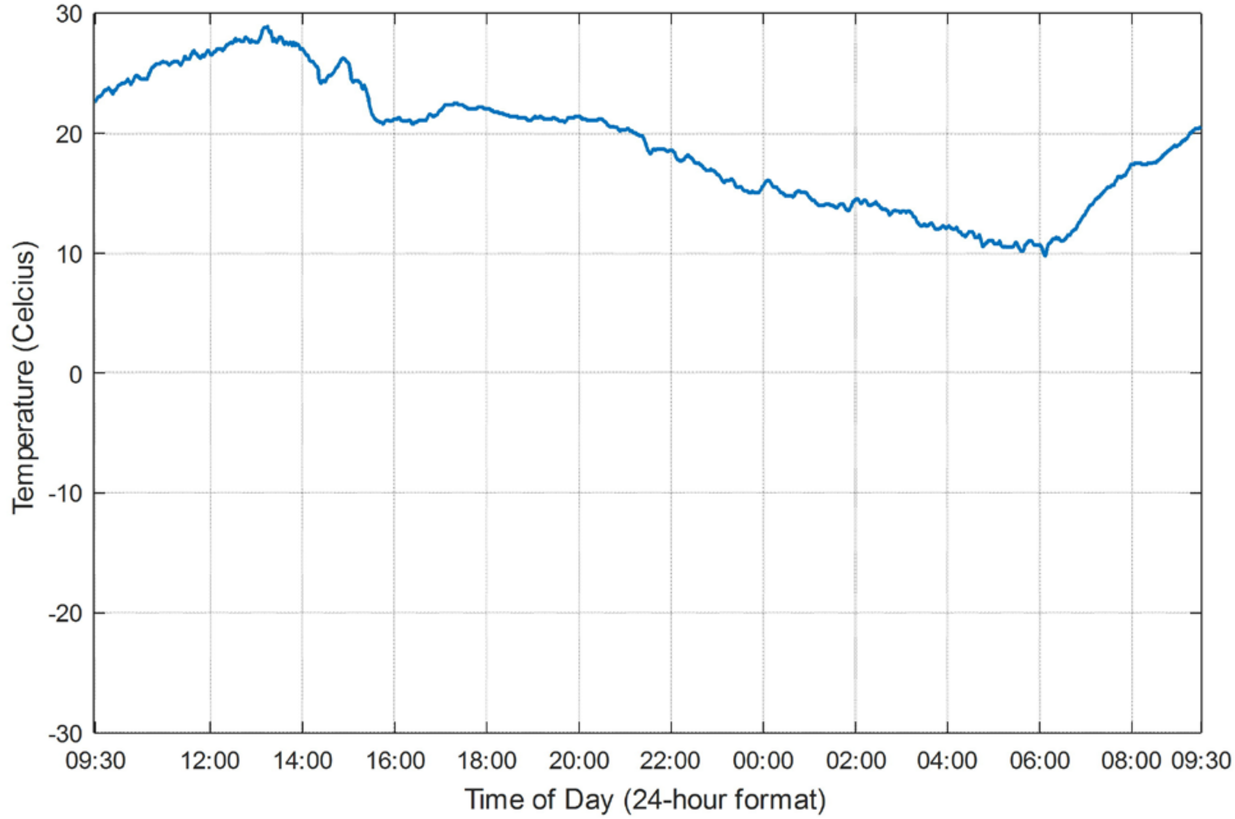
June 28 – 29, 2016 Weather Data



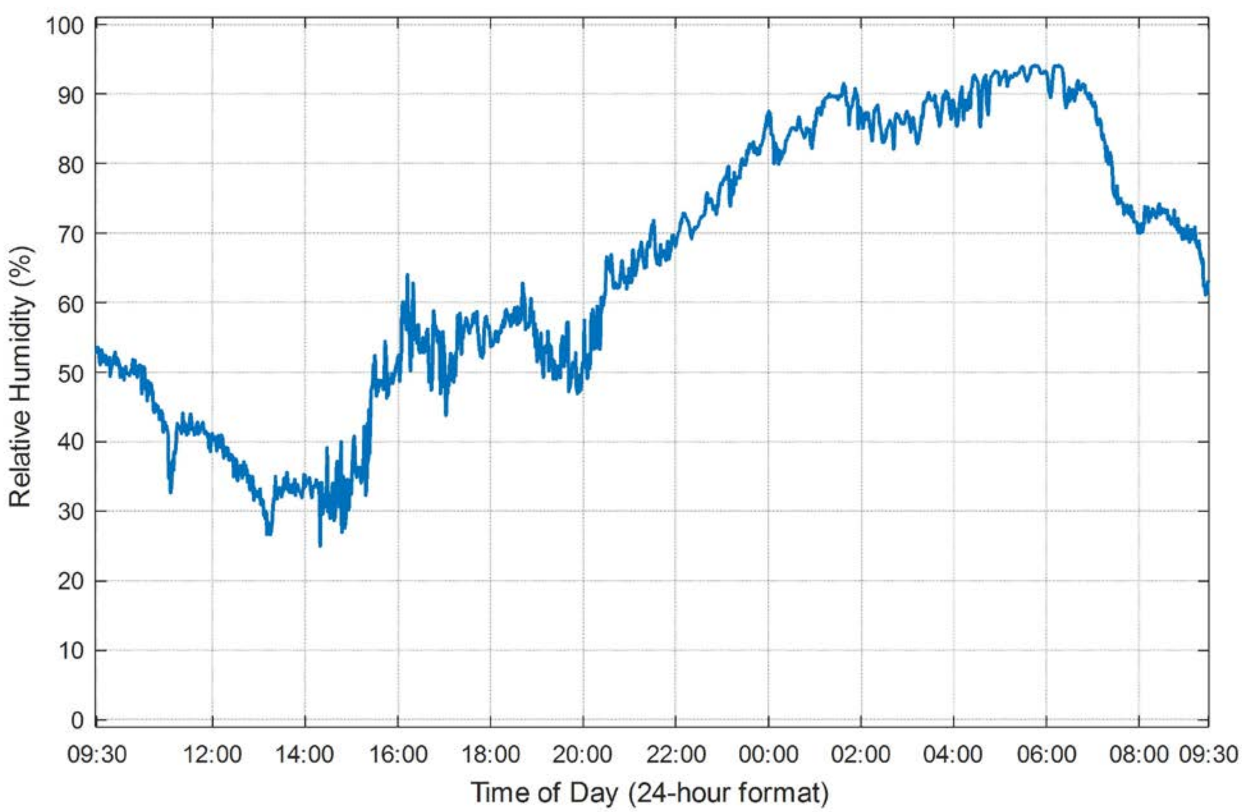
Monitored Wind Speed (June 28 – 29, 2016) at Noise Monitor Location 6



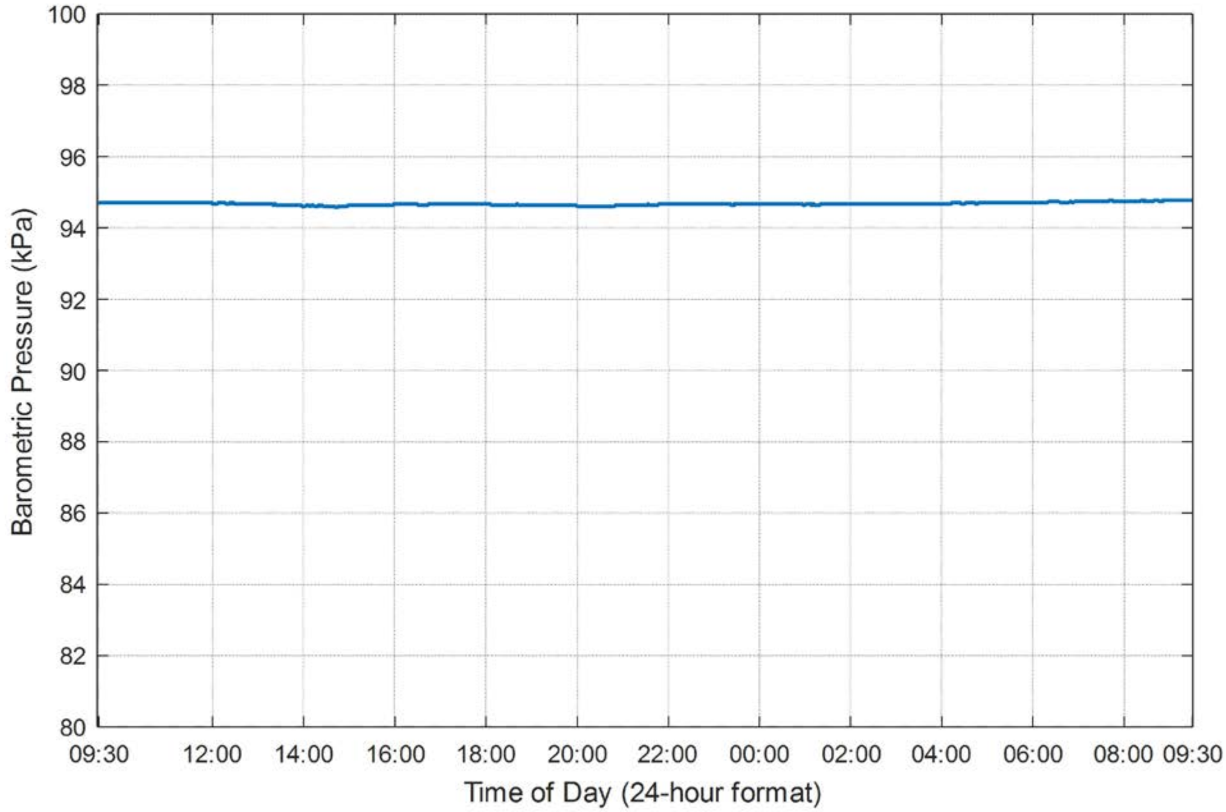
Monitored Wind Direction (June 28 – 29, 2016) at Noise Monitor Location 6



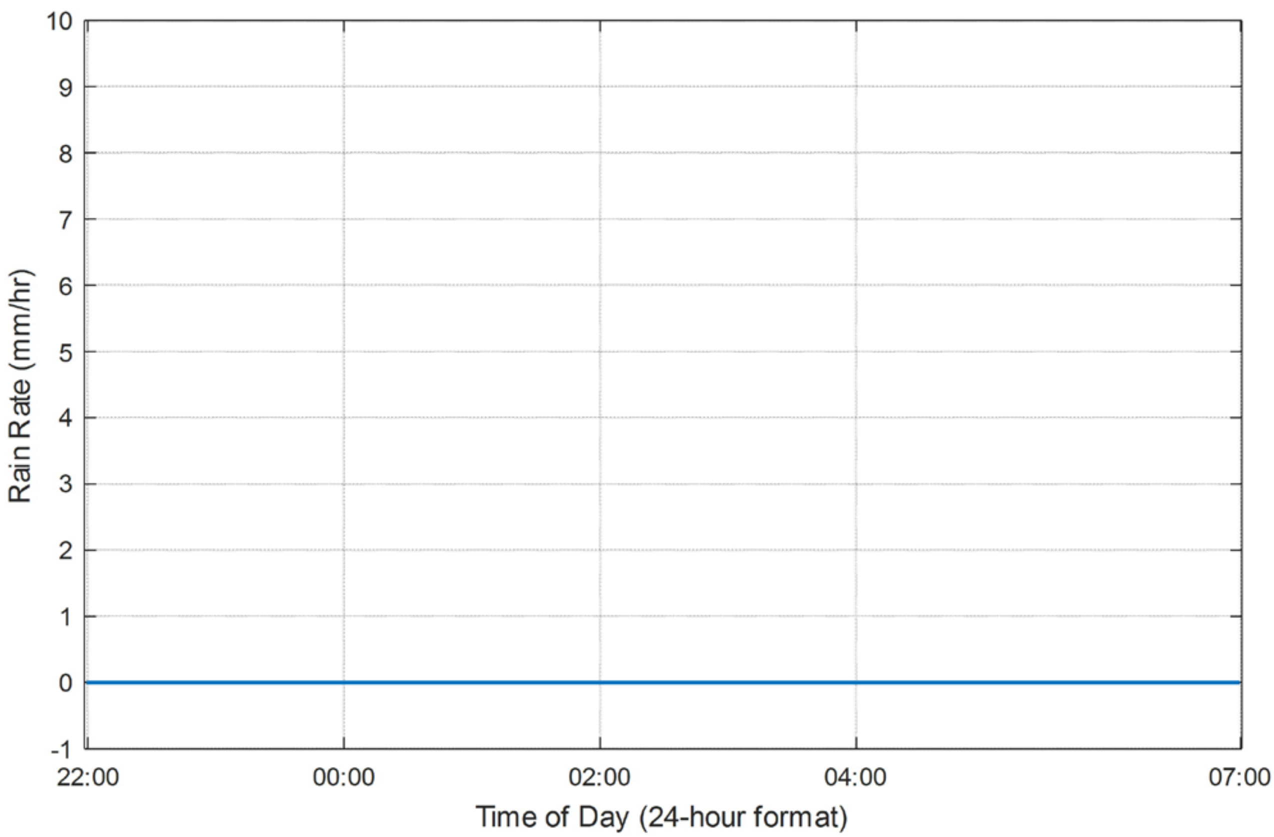
Monitored Temperature (June 28 – 29, 2016) at Noise Monitor Location 6



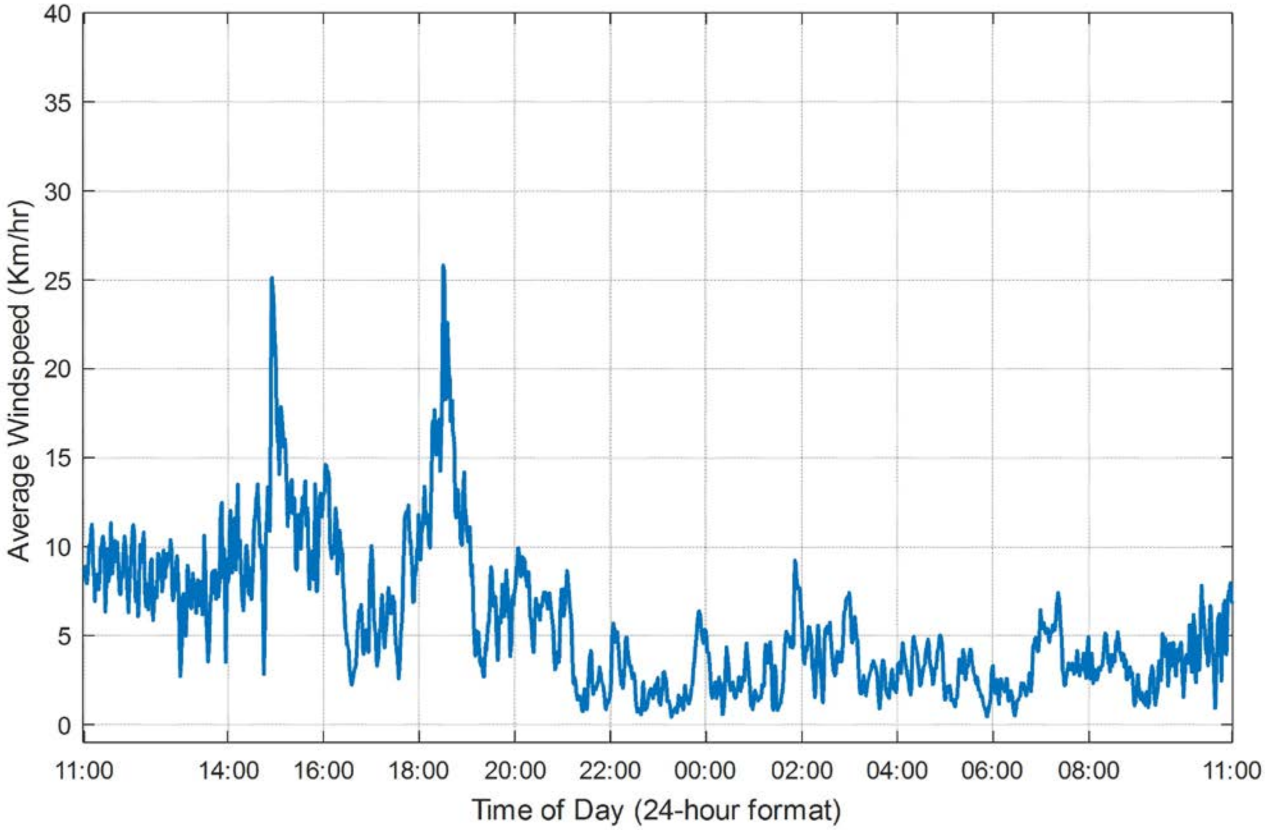
Monitored Humidity (June 28 – 29, 2016) at Noise Monitor Location 6



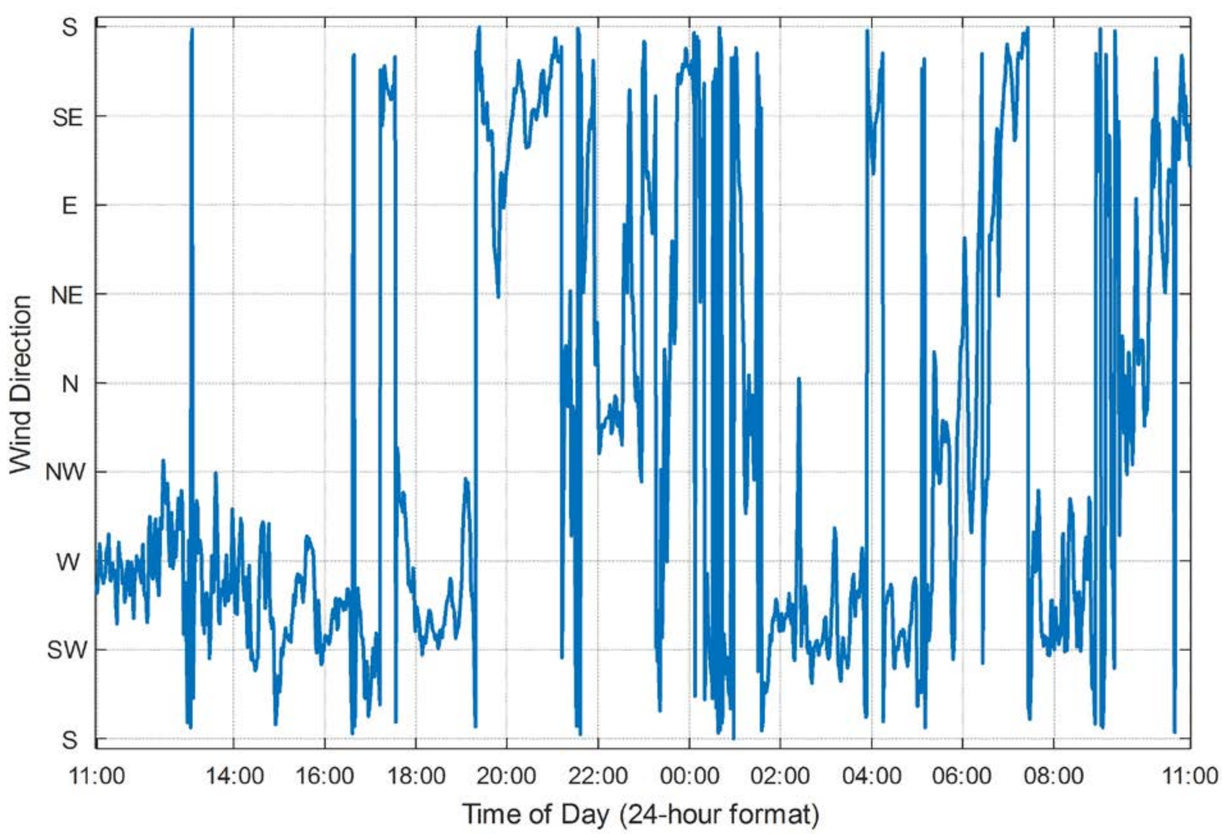
Monitored Barometric Pressure (June 28 – 29, 2016) at Noise Monitor Location 6



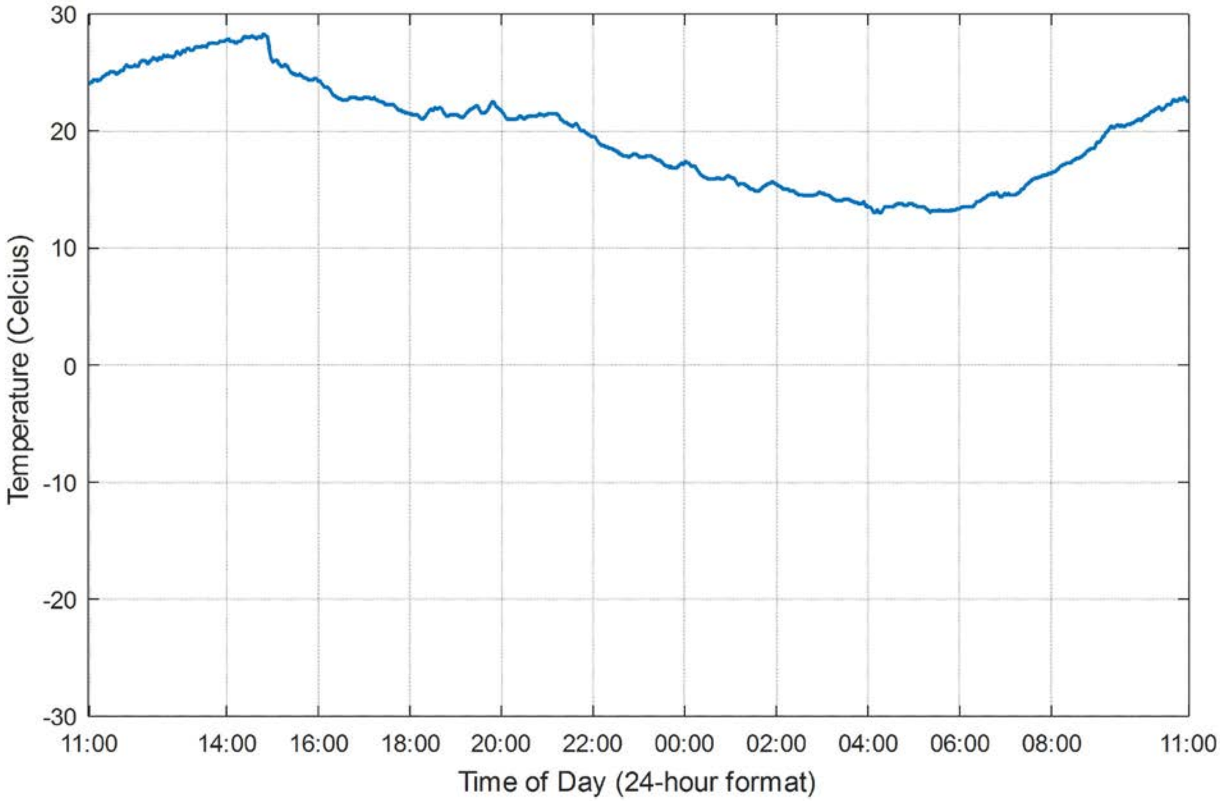
Night-time Monitored Rain Rate (June 28 – 29, 2016) at Noise Monitor Location 6



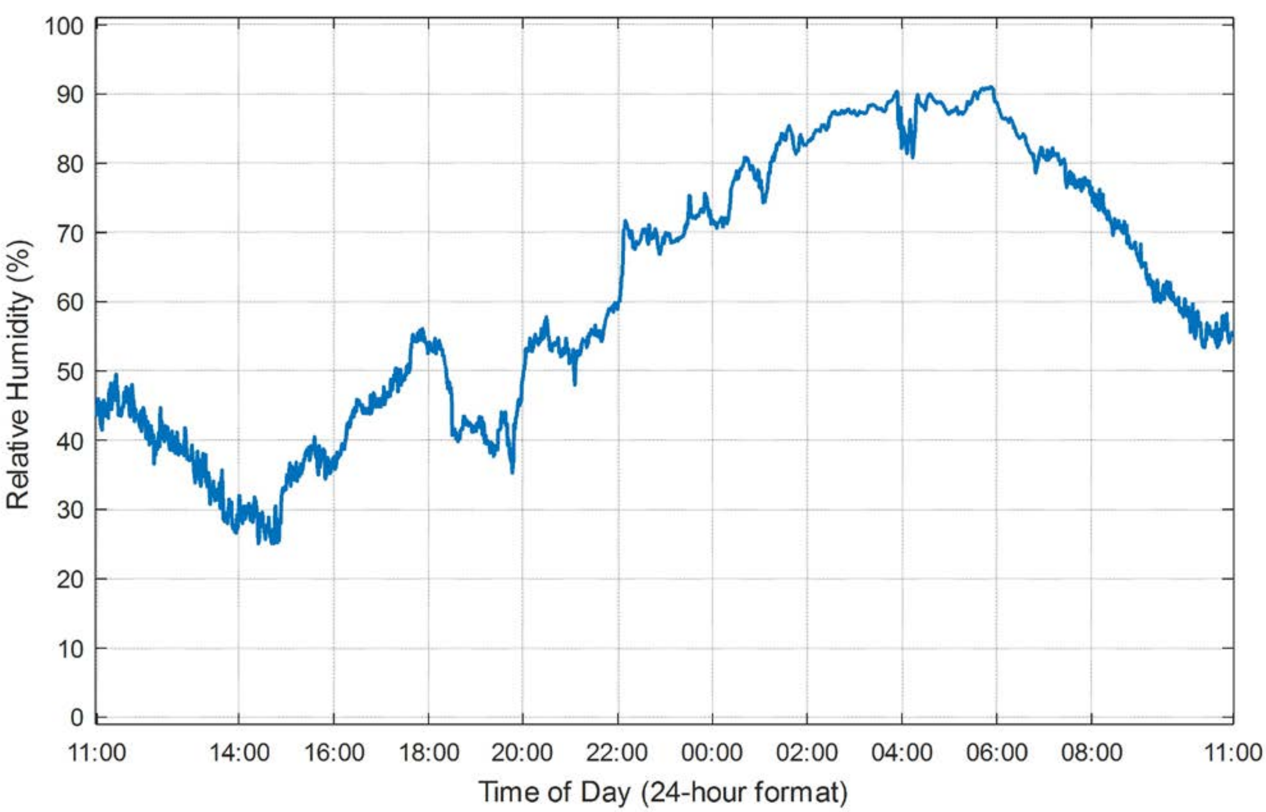
Monitored Wind Speed (June 28 – 29, 2016) at Noise Monitor Location 10



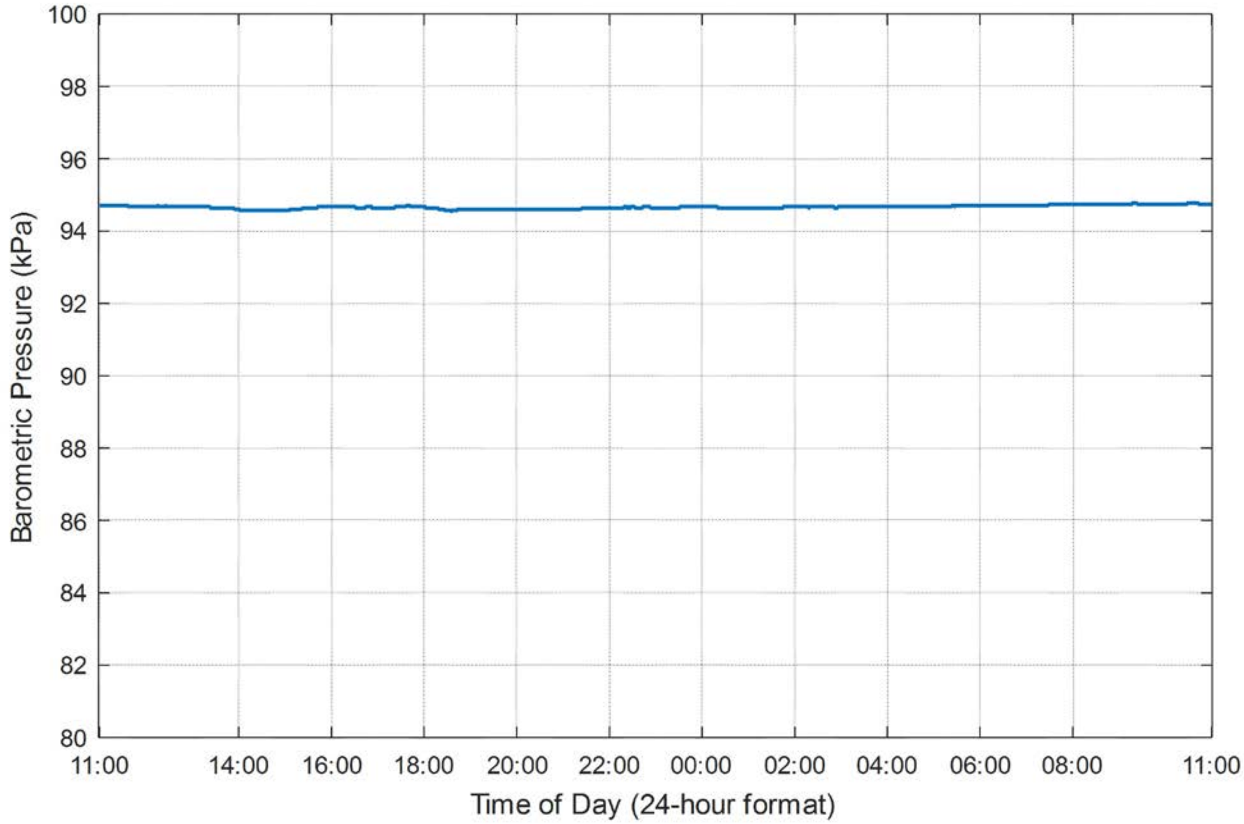
Monitored Wind Direction (June 28 – 29, 2016) at Noise Monitor Location 10



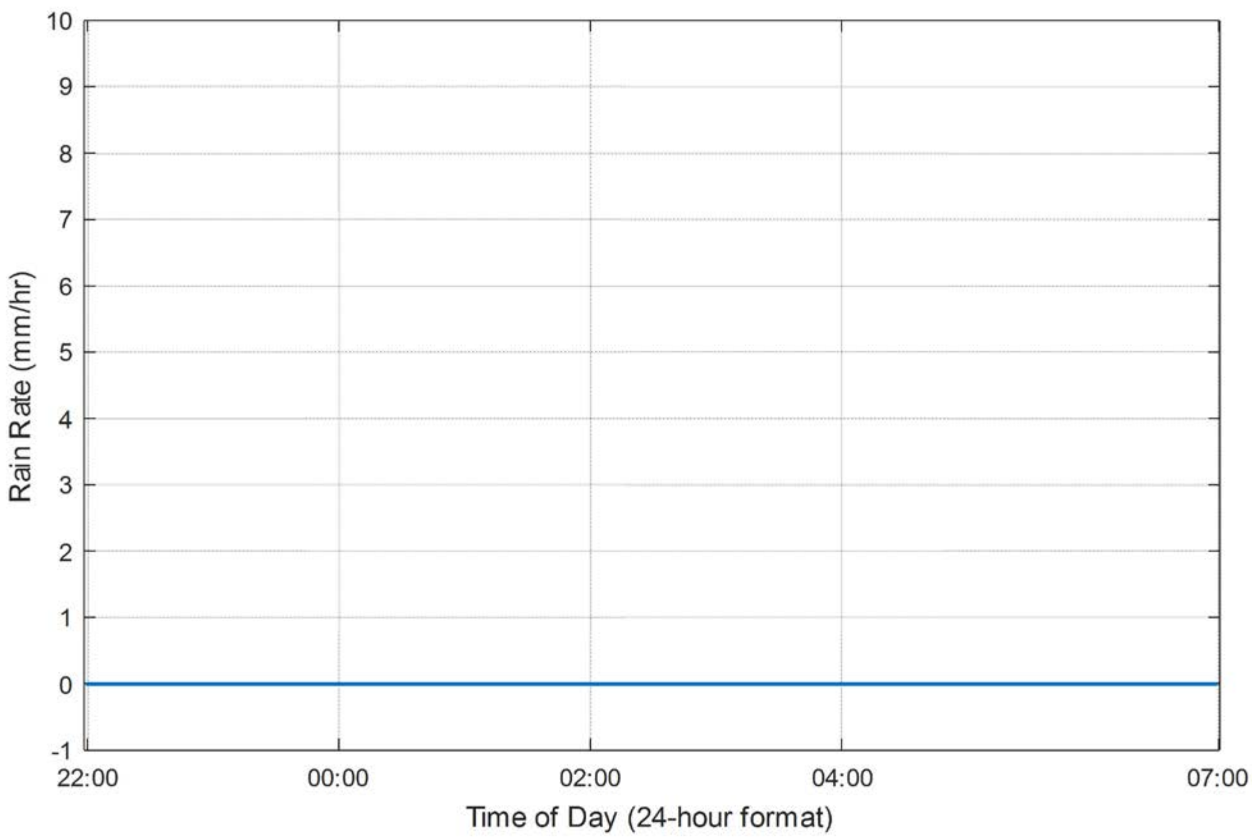
Monitored Temperature (June 28 – 29, 2016) at Noise Monitor Location 10



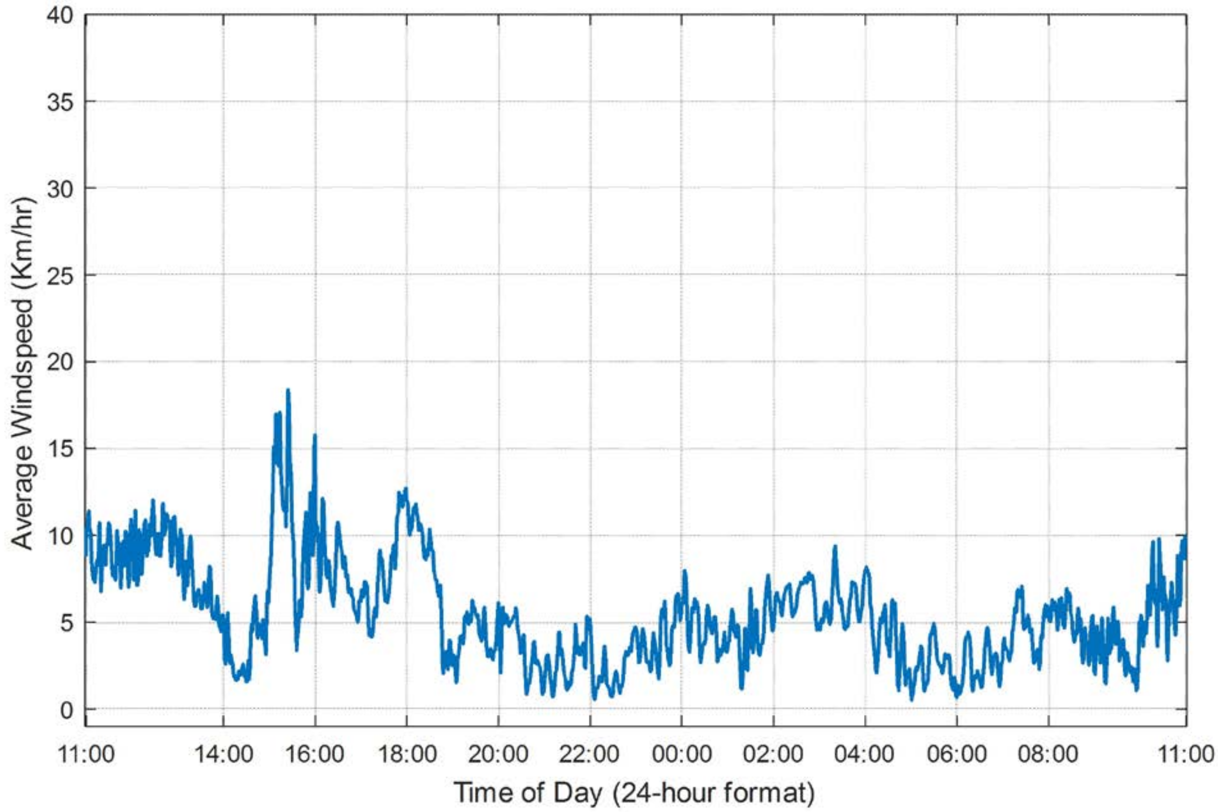
Monitored Humidity (June 28 – 29, 2016) at Noise Monitor Location 10



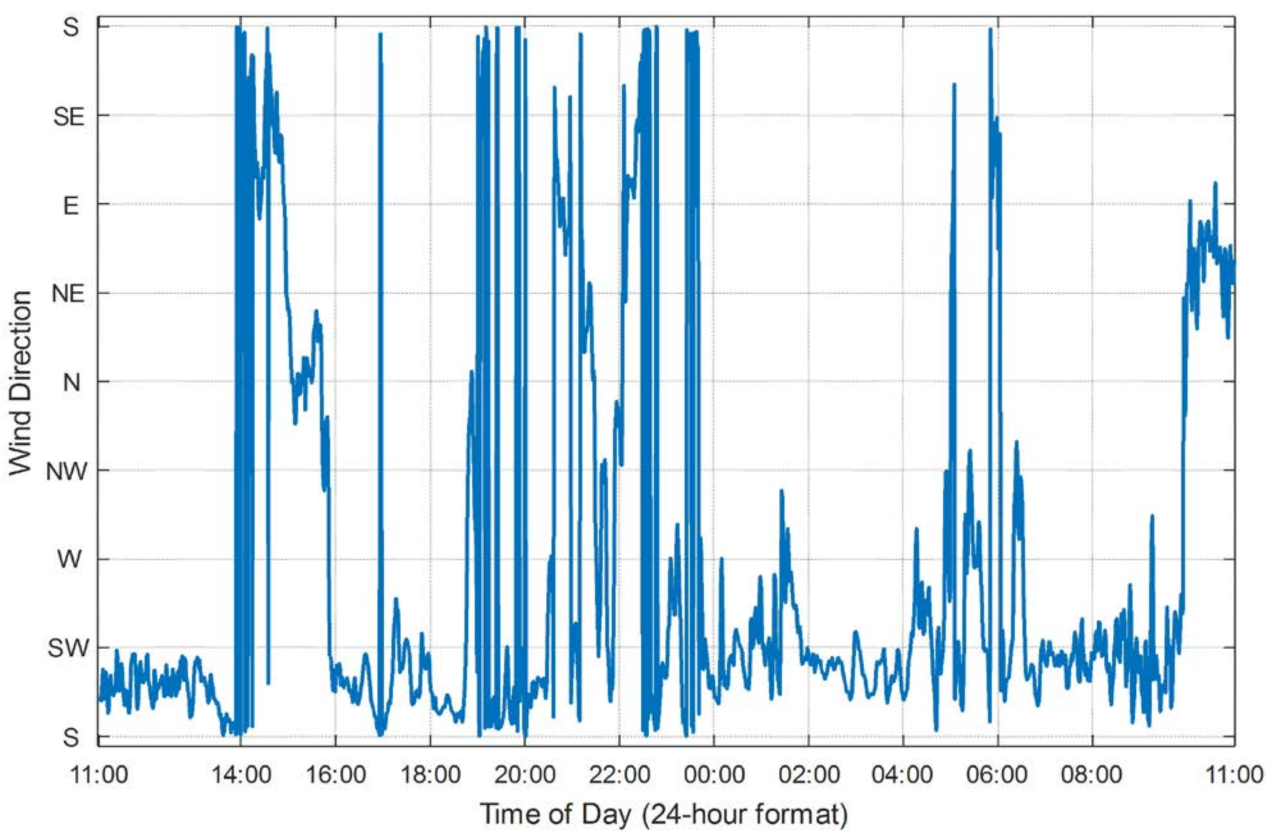
Monitored Barometric Pressure (June 28 – 29, 2016) at Noise Monitor Location 10



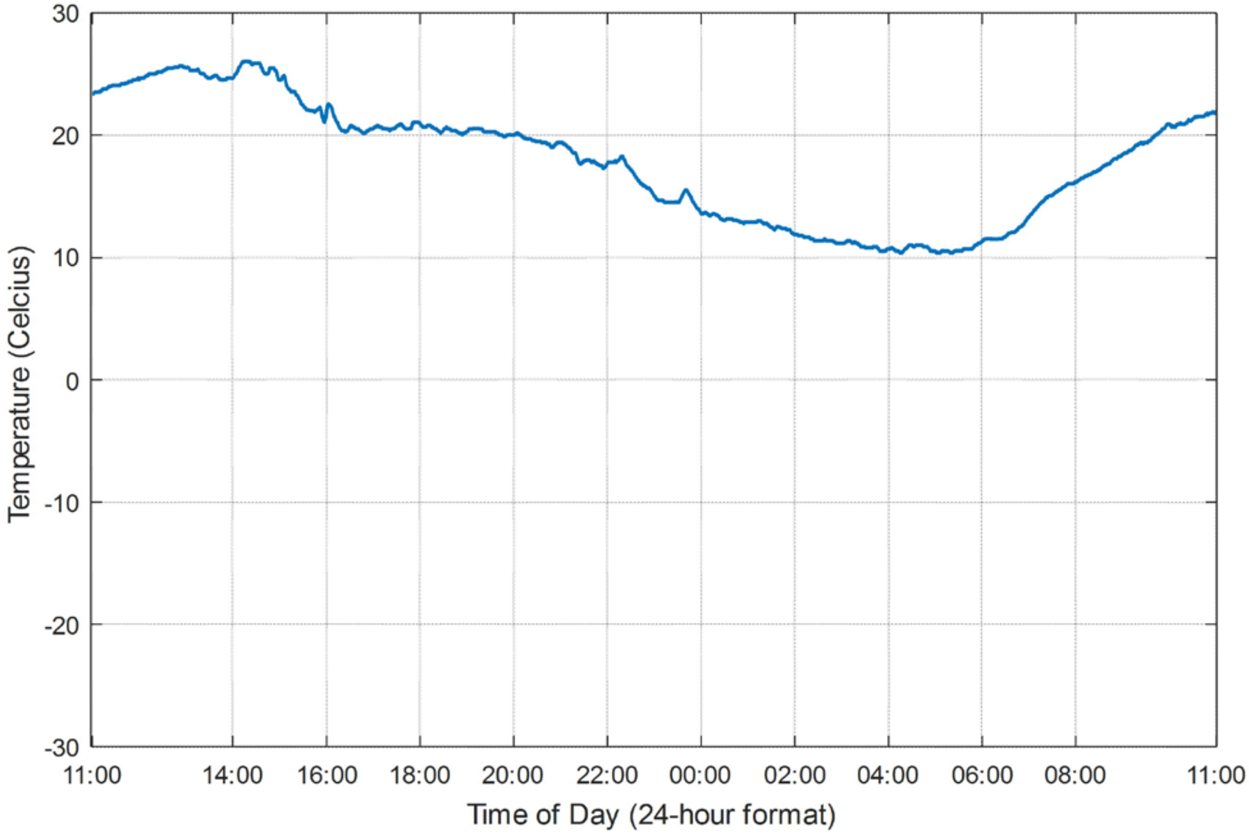
Night-time Monitored Rain Rate (June 28 – 29, 2016) at Noise Monitor Location 10



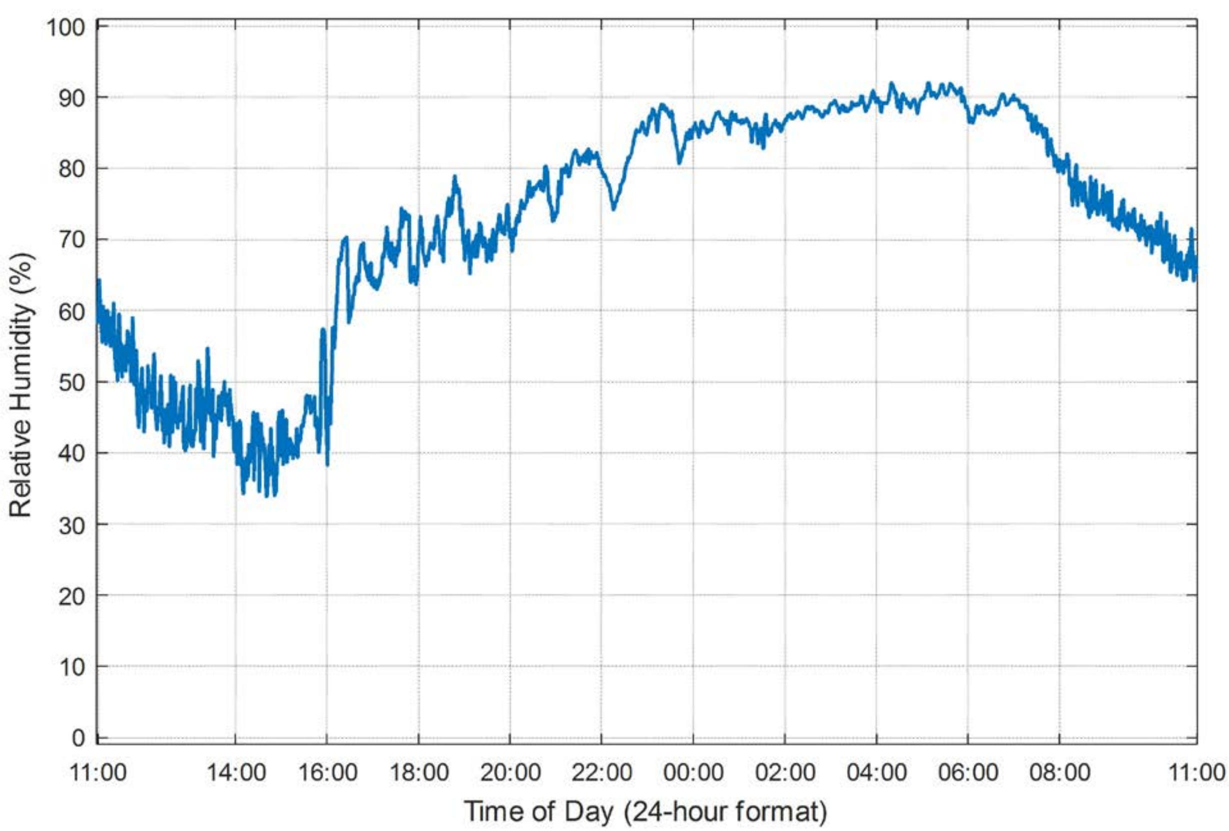
Monitored Wind Speed (June 28 – 29, 2016) at Noise Monitor Location 12



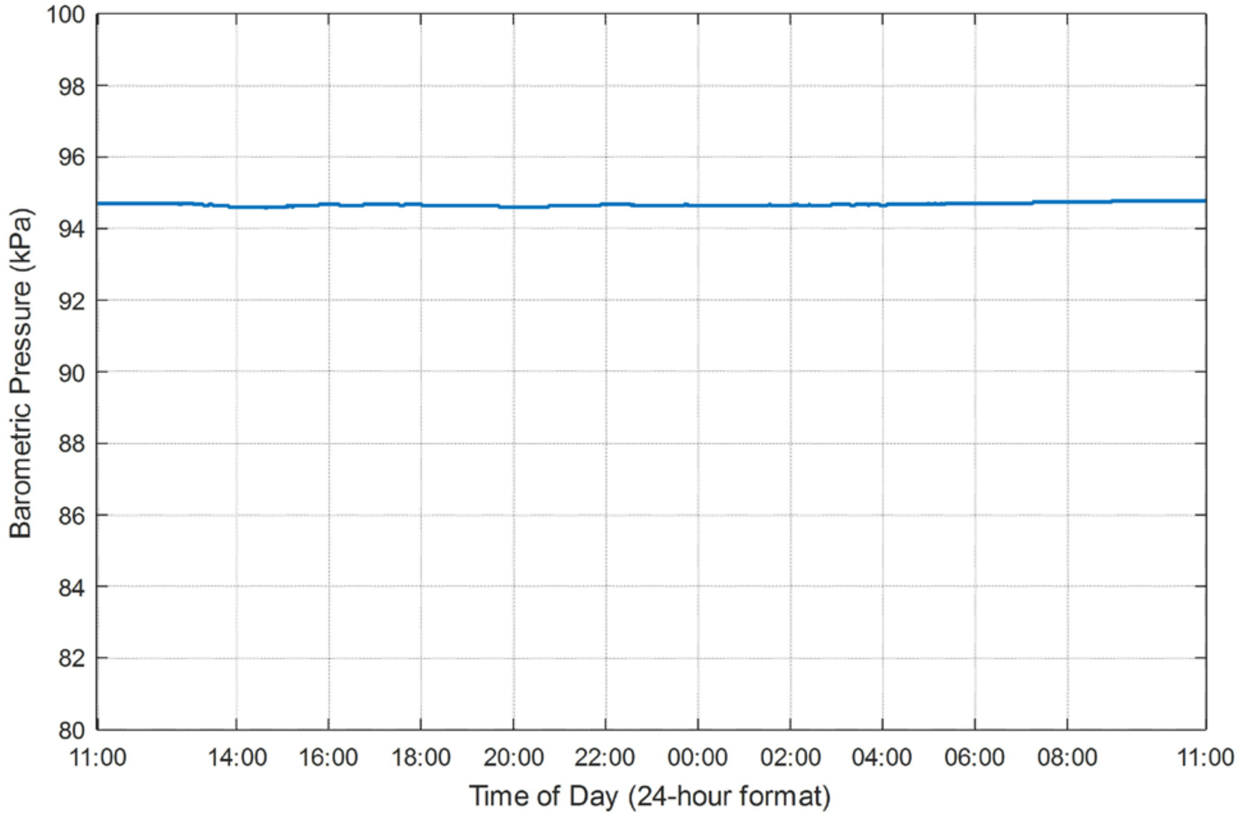
Monitored Wind Direction (June 28 – 29, 2016) at Noise Monitor Location 12



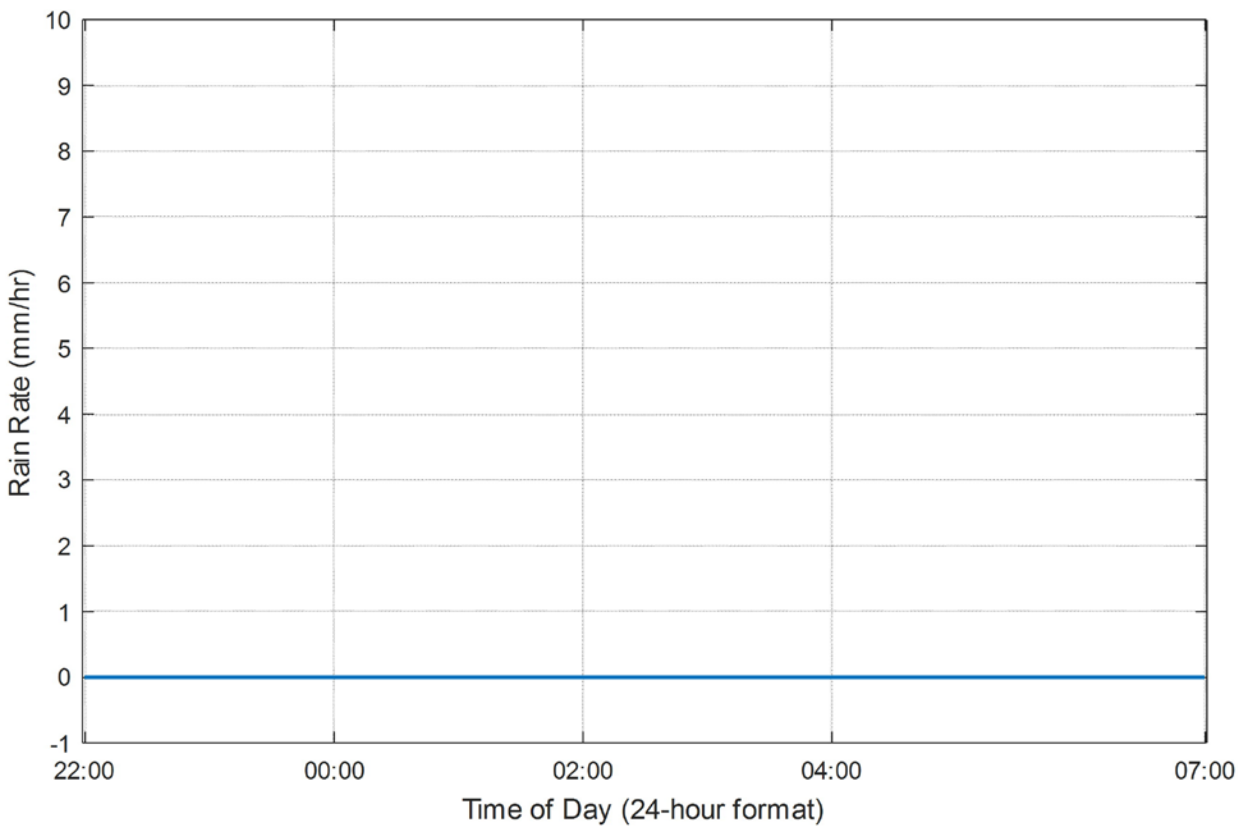
Monitored Temperature (June 28 – 29, 2016) at Noise Monitor Location 12



Monitored Humidity (June 28 – 29, 2016) at Noise Monitor Location 12

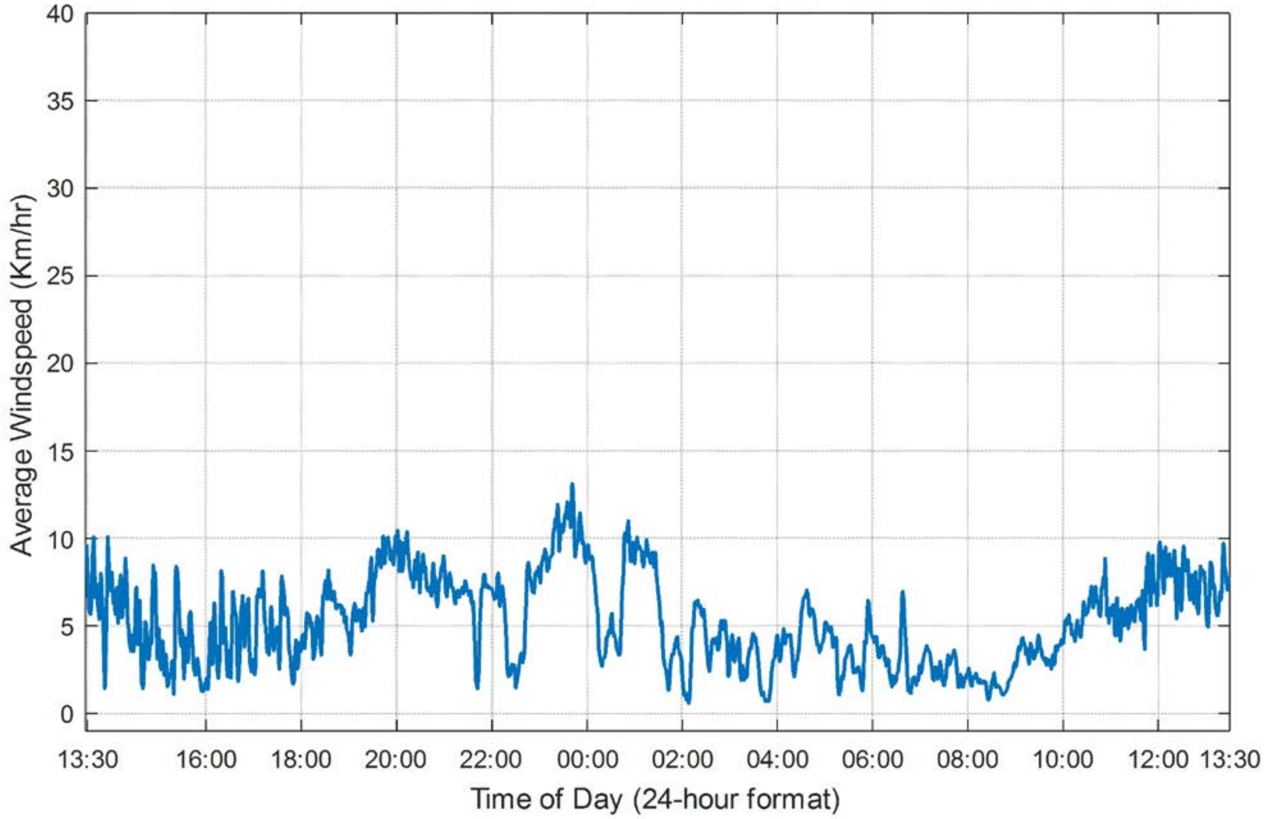


Monitored Barometric Pressure (June 28 – 29, 2016) at Noise Monitor Location 12

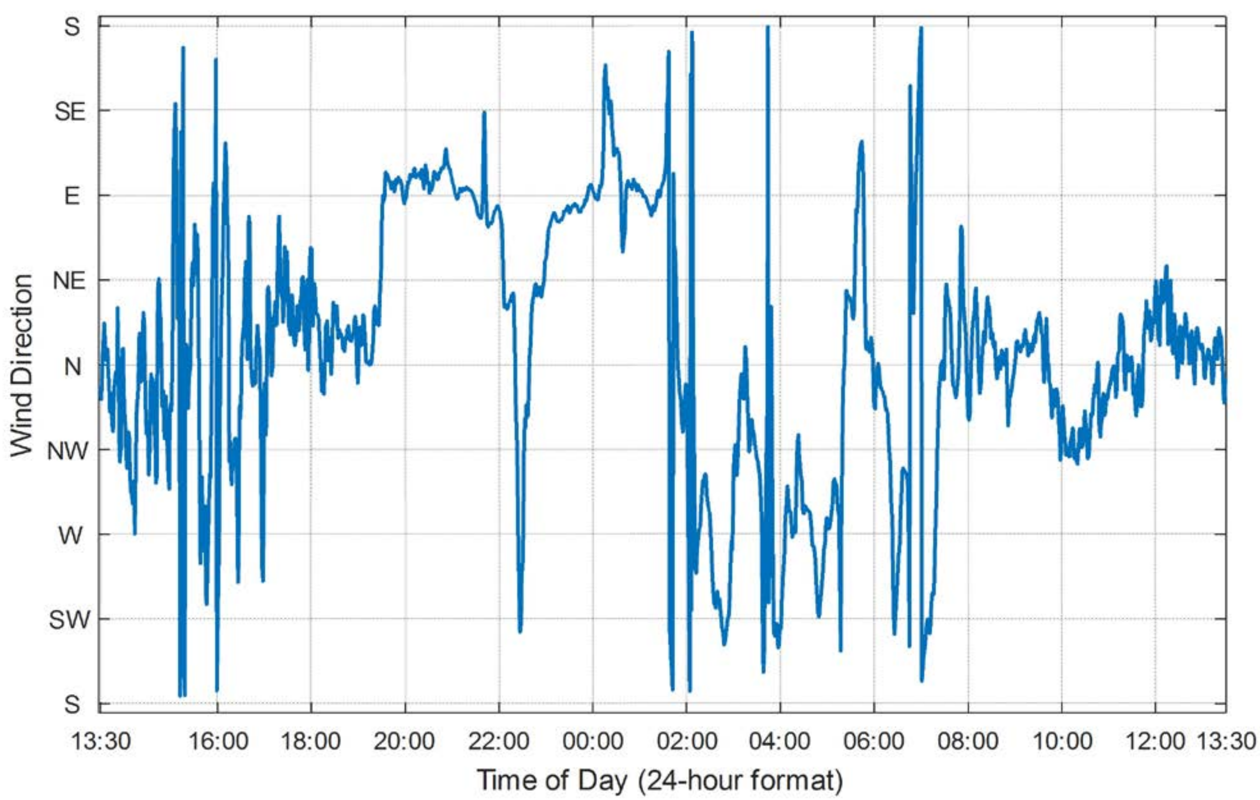


Night-time Monitored Rain Rate (June 28 – 29, 2016) at Noise Monitor Location 12

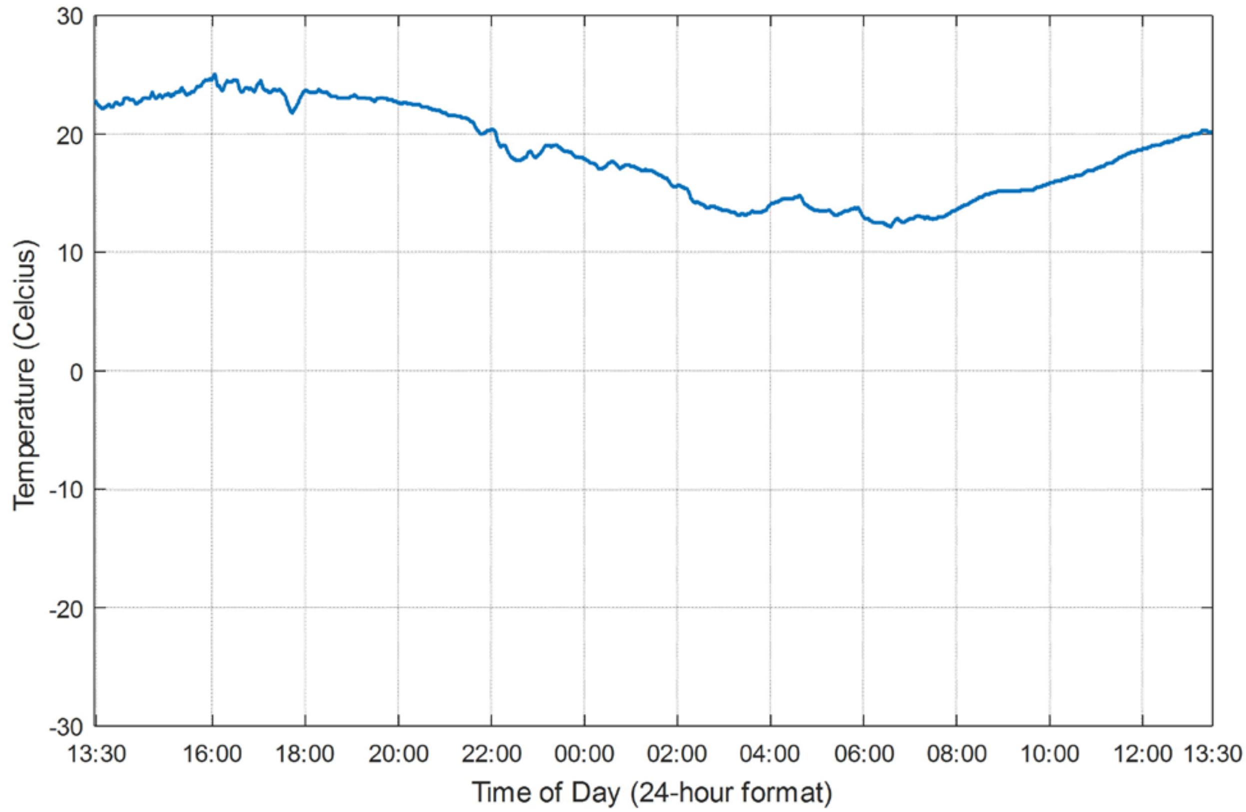
August 2 – 3, 2016 Weather Data



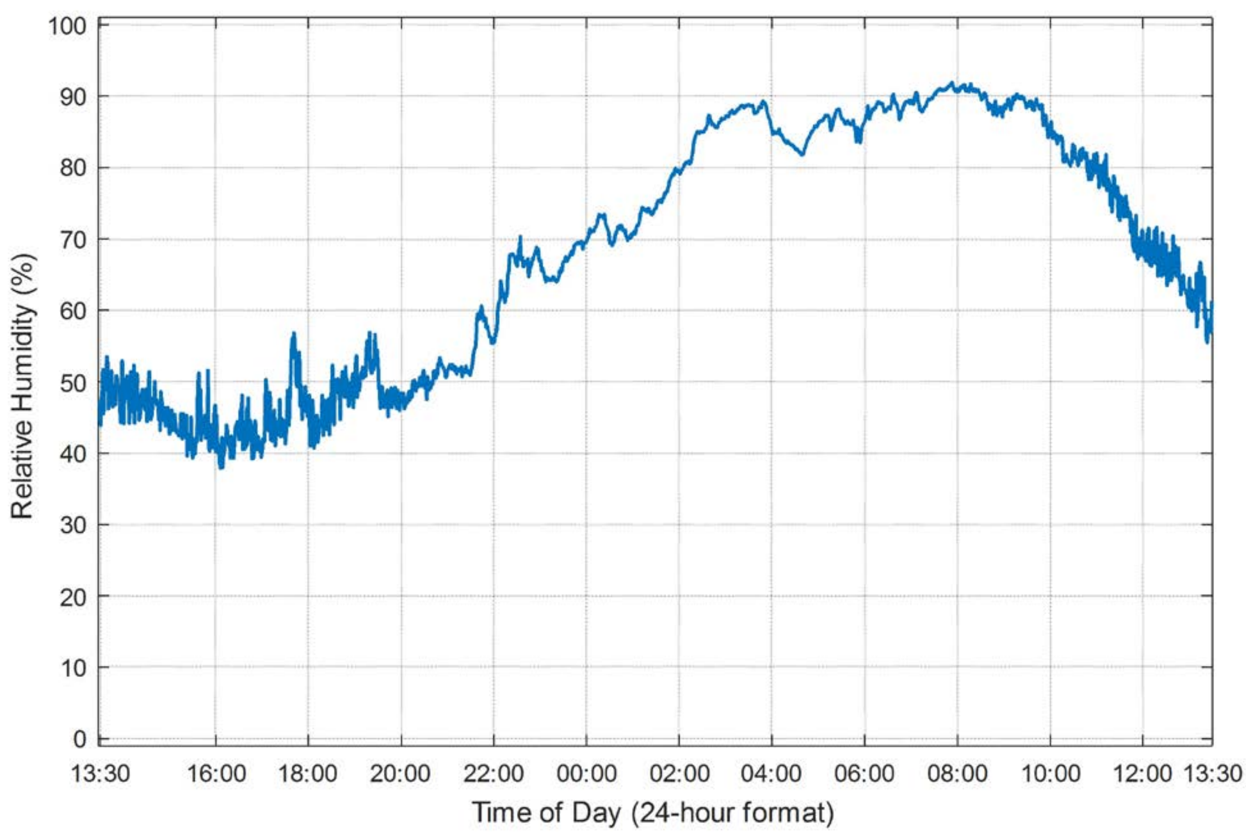
Monitored Wind Speed (August 2 – 3, 2016) at Noise Monitor Location 11



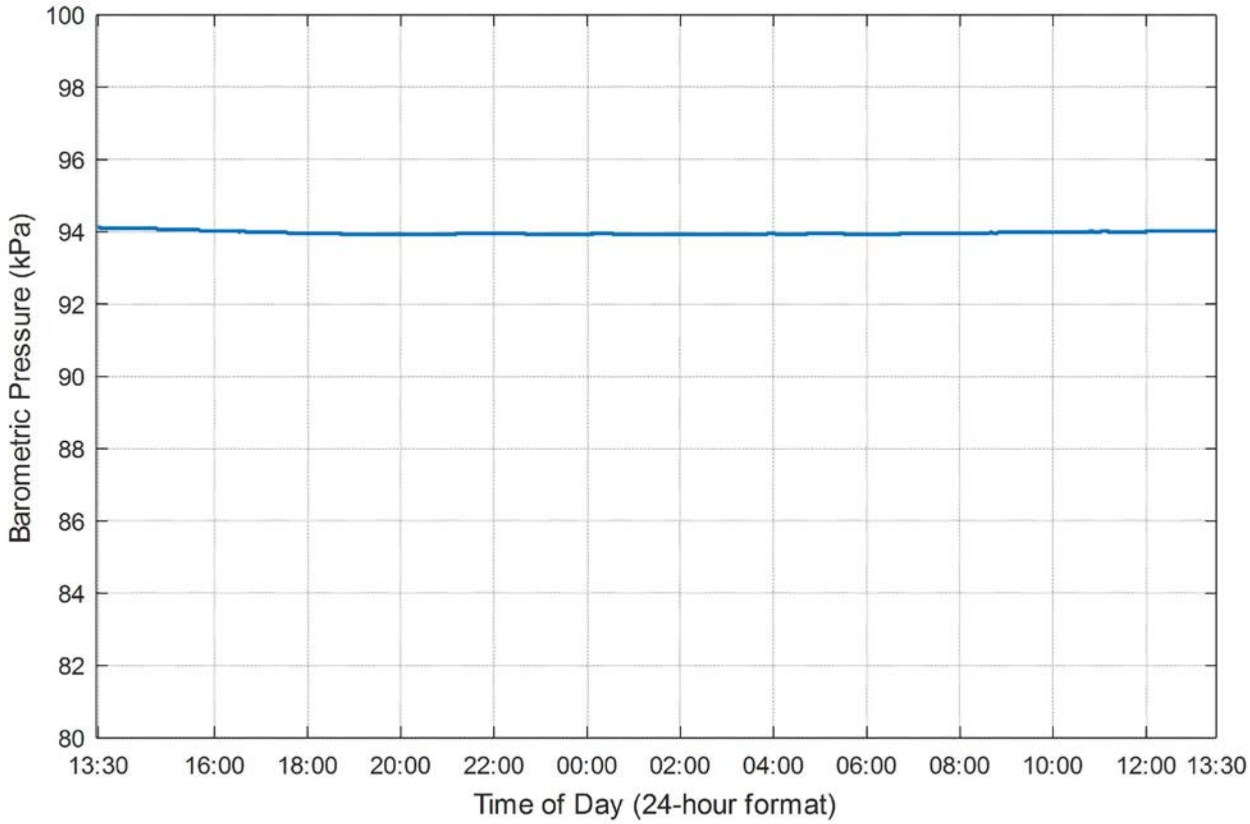
Monitored Wind Direction (August 2 – 3, 2016) at Noise Monitor Location 11



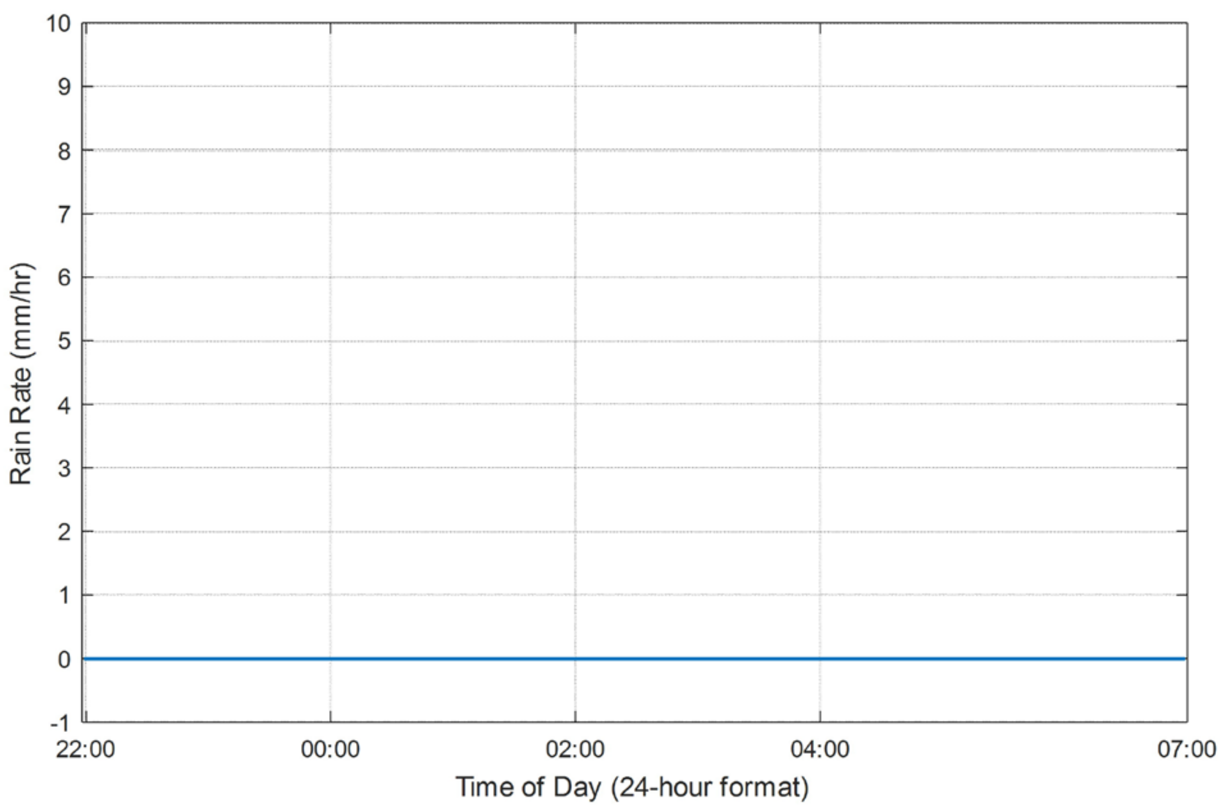
Monitored Temperature (August 2 – 3, 2016) at Noise Monitor Location 11



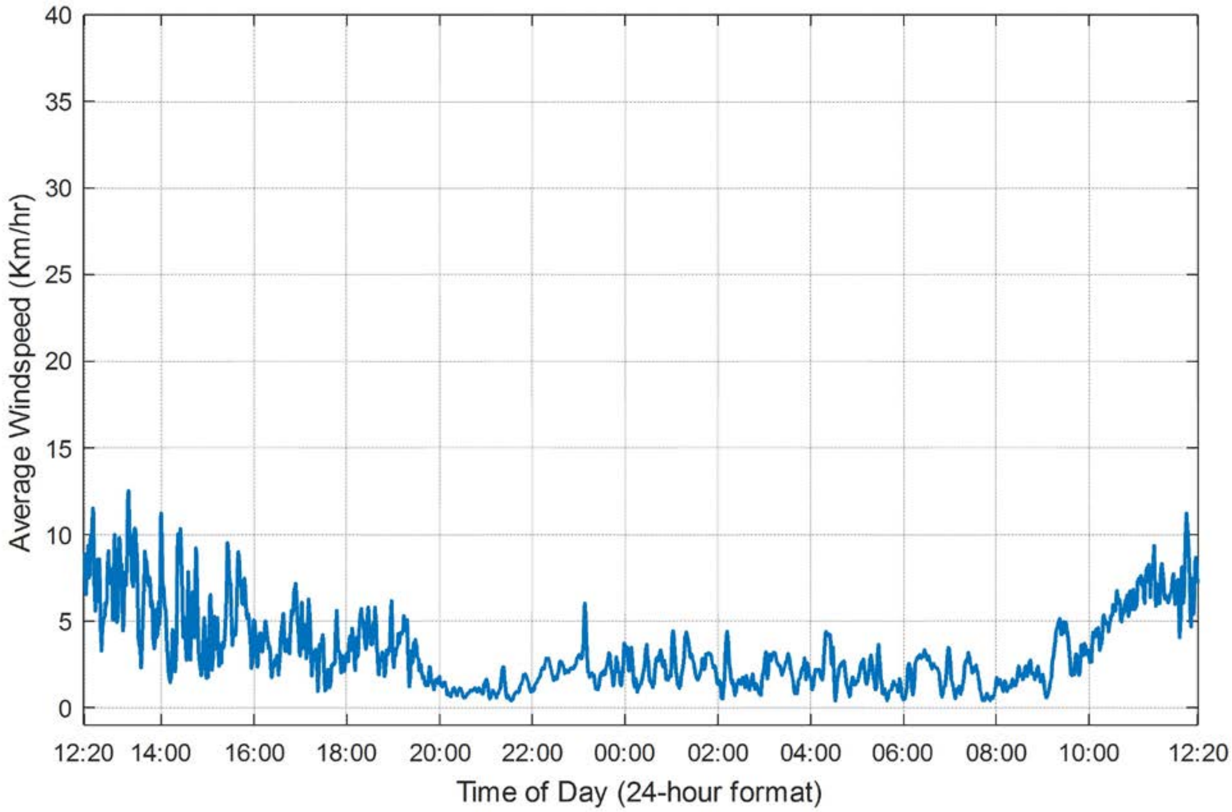
Monitored Humidity (August 2 – 3, 2016) at Noise Monitor Location 11



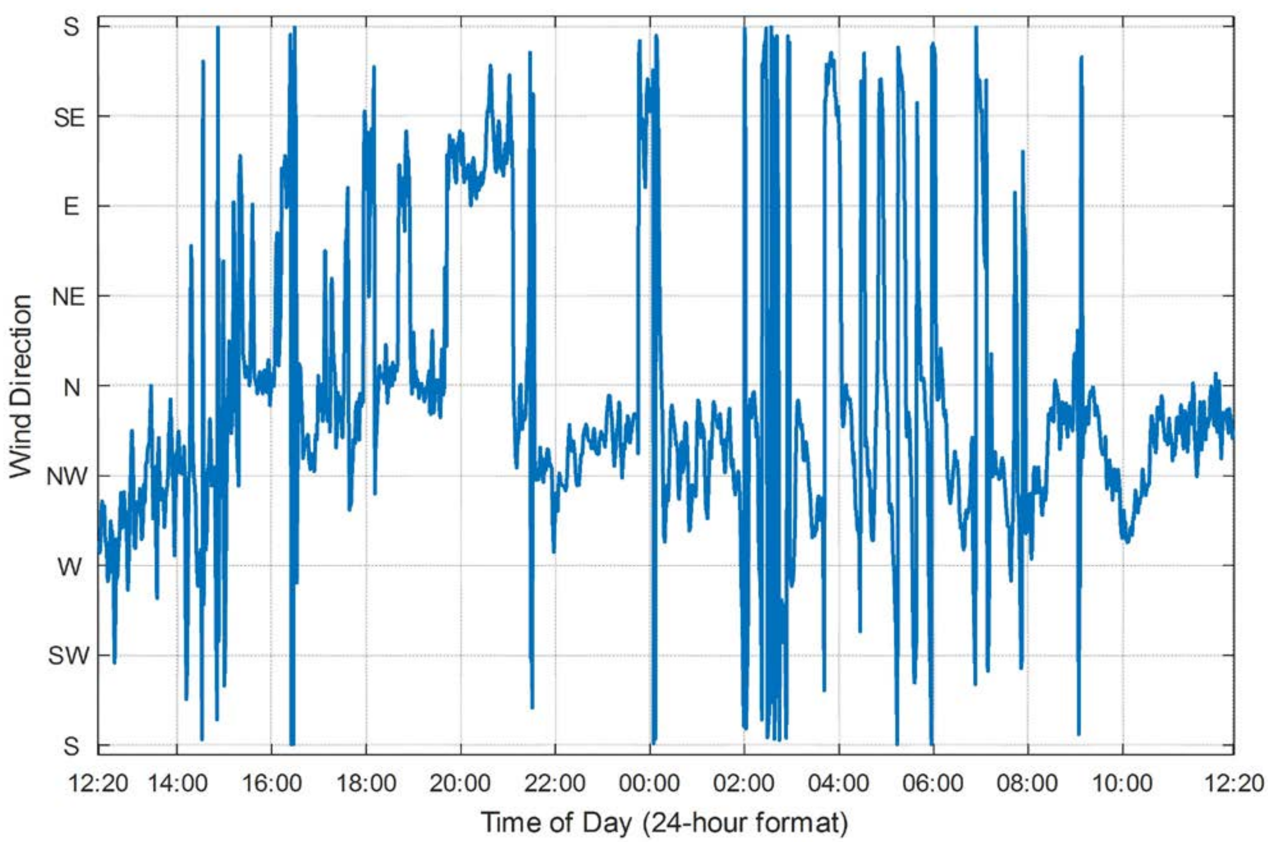
Monitored Barometric Pressure (August 2 – 3, 2016) at Noise Monitor Location 11



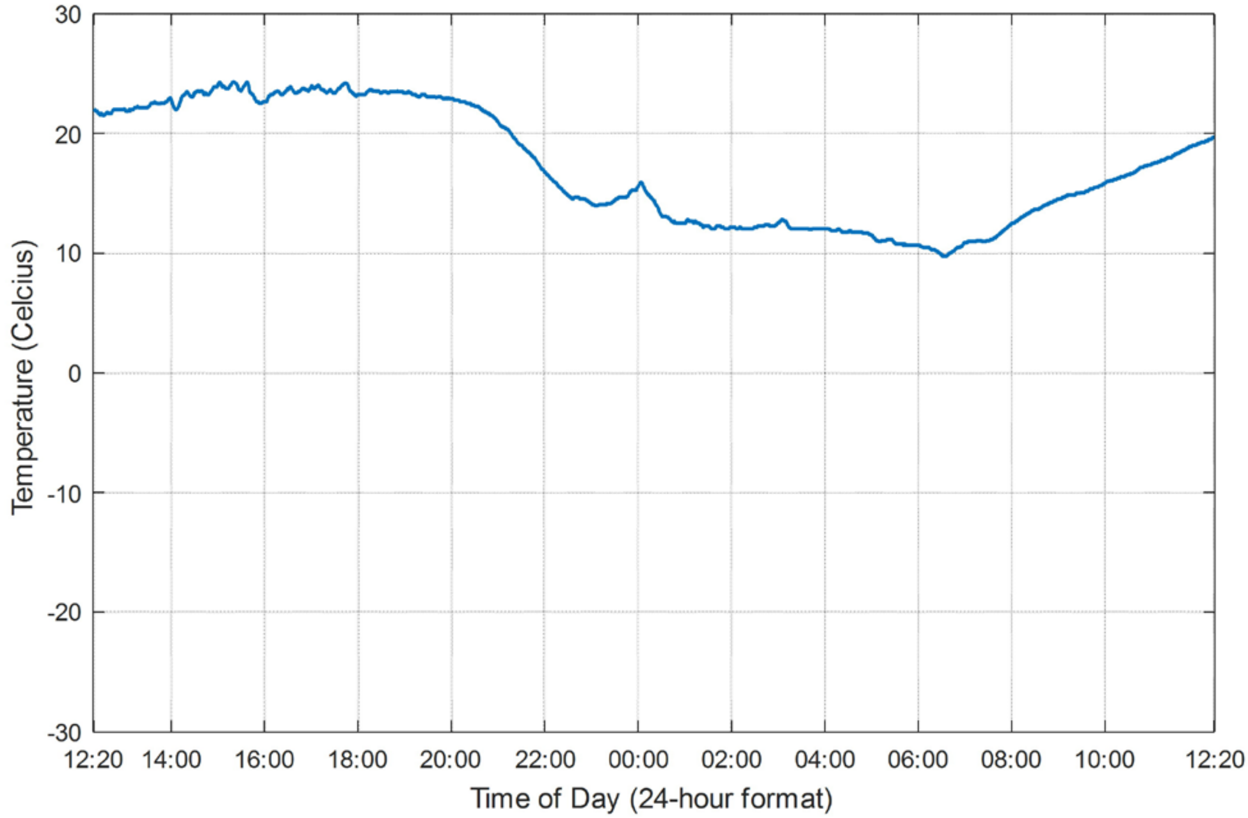
Night-time Monitored Rain Rate (August 2 – 3, 2016) at Noise Monitor Location 11



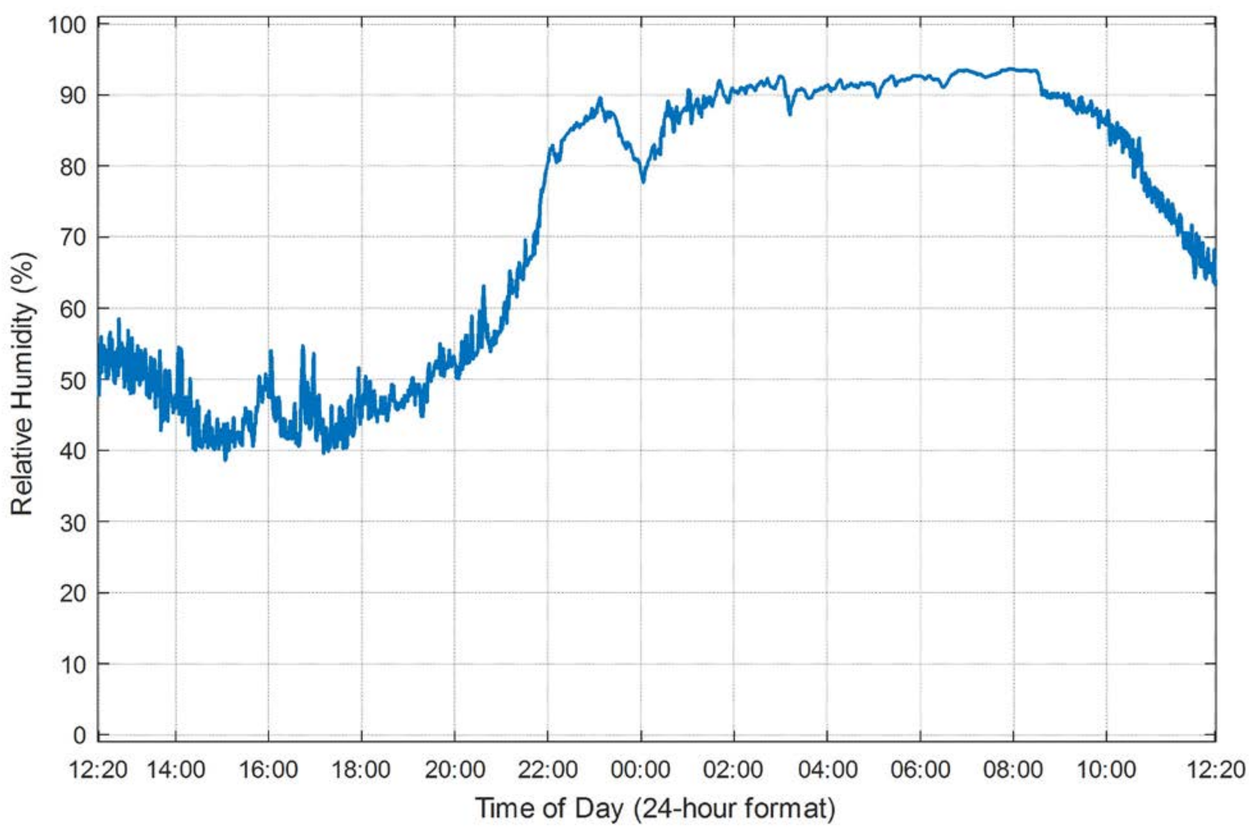
Monitored Wind Speed (August 2 – 3, 2016) at Noise Monitor Location 13



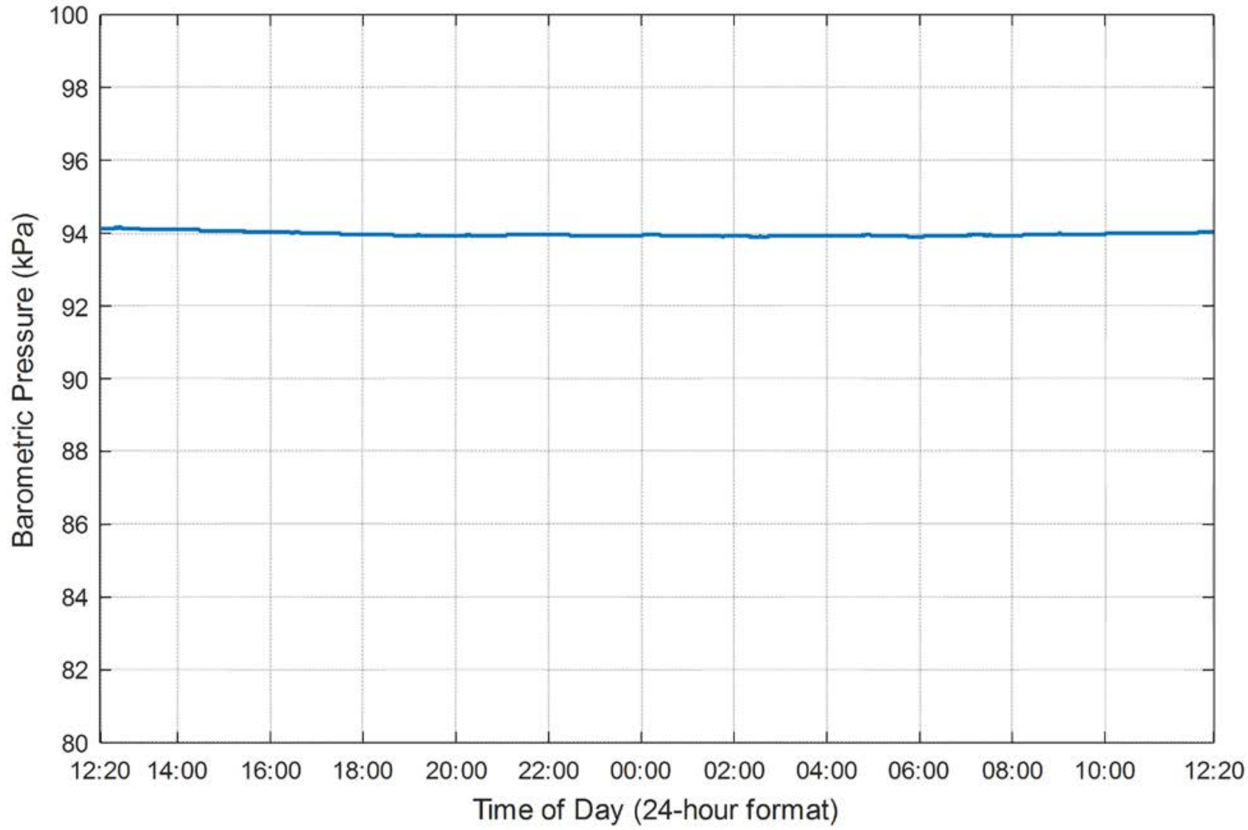
Monitored Wind Direction (August 2 – 3, 2016) at Noise Monitor Location 13



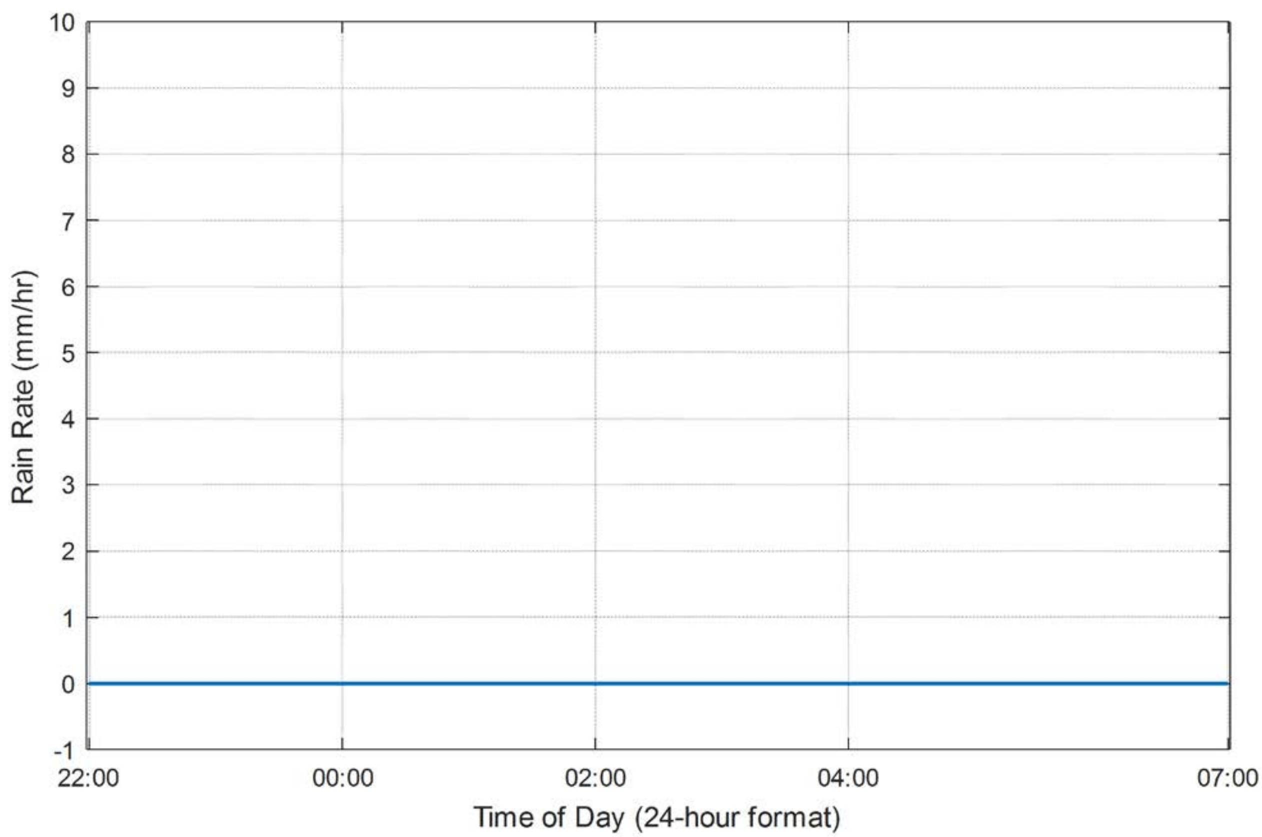
Monitored Temperature (August 2 – 3, 2016) at Noise Monitor Location 13



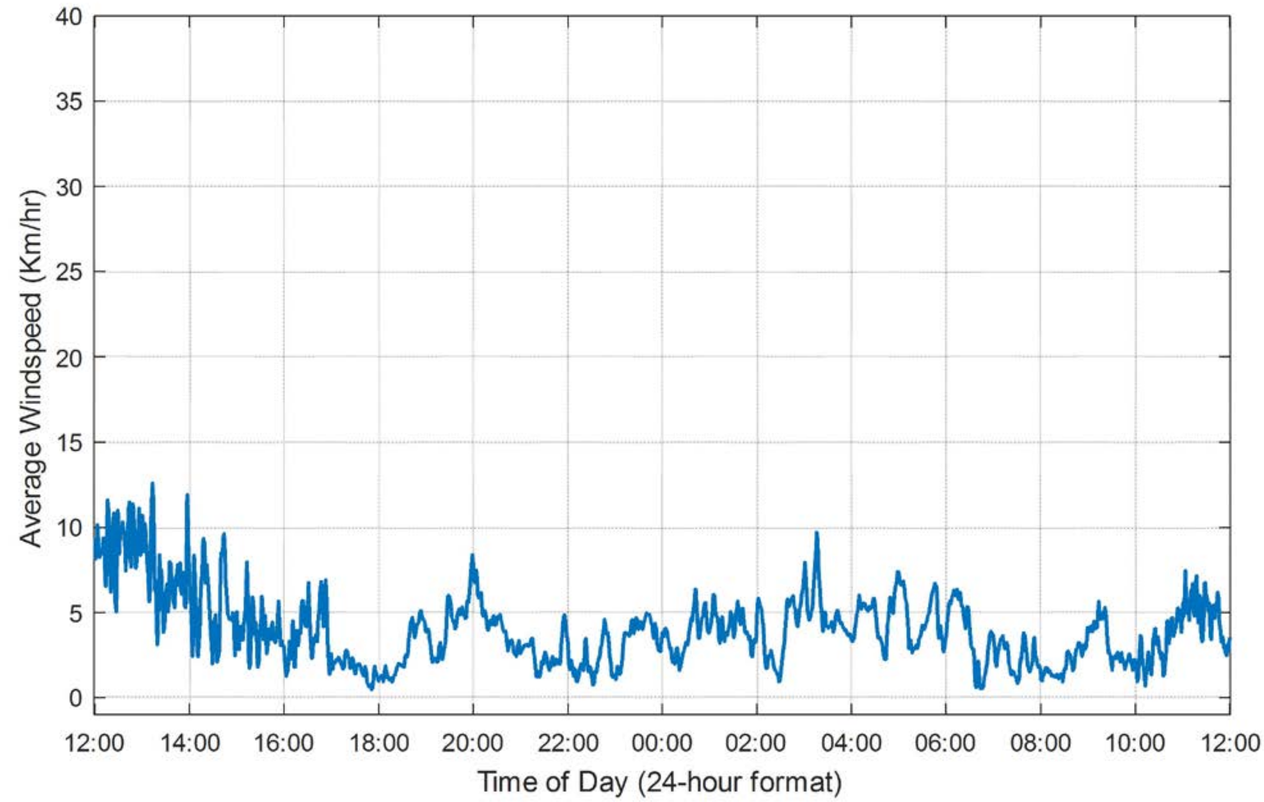
Monitored Humidity (August 2 – 3, 2016) at Noise Monitor Location 13



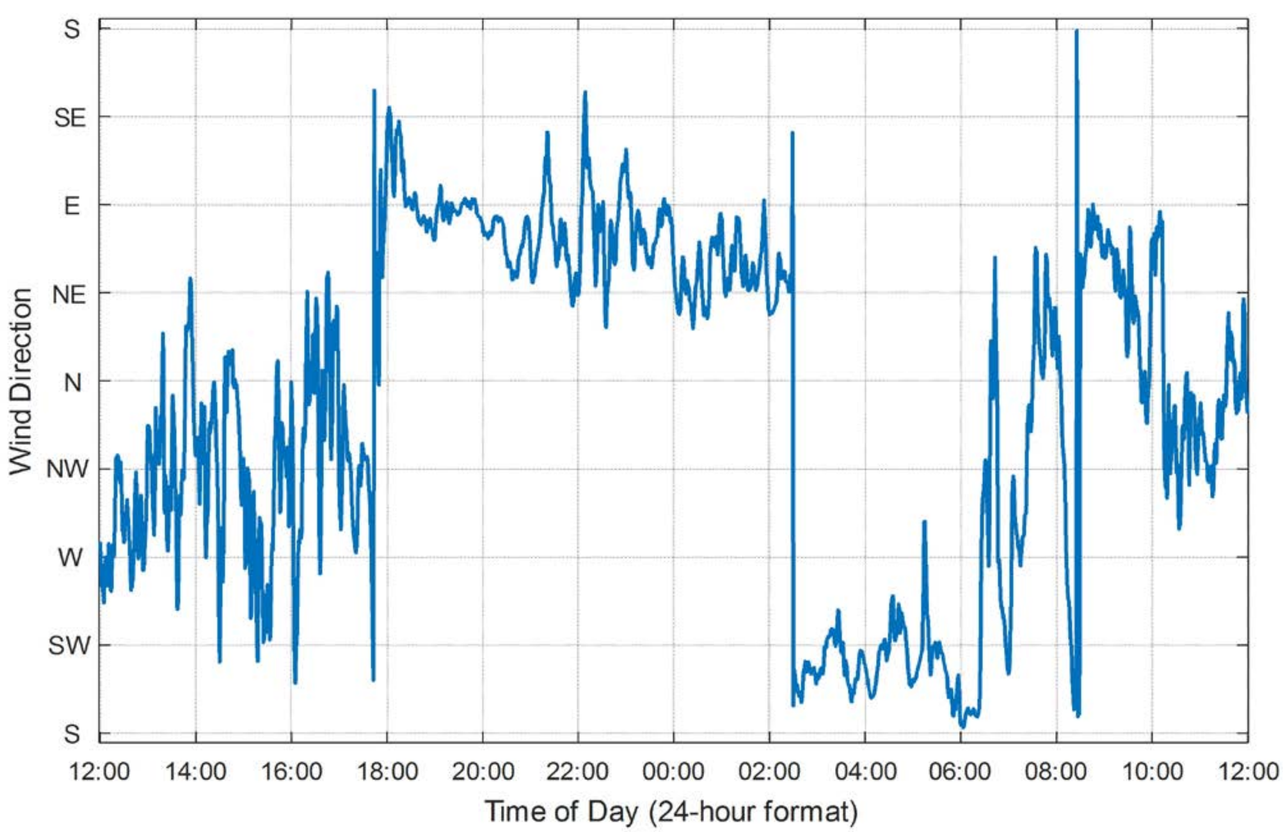
Monitored Barometric Pressure (August 2 – 3, 2016) at Noise Monitor Location 13



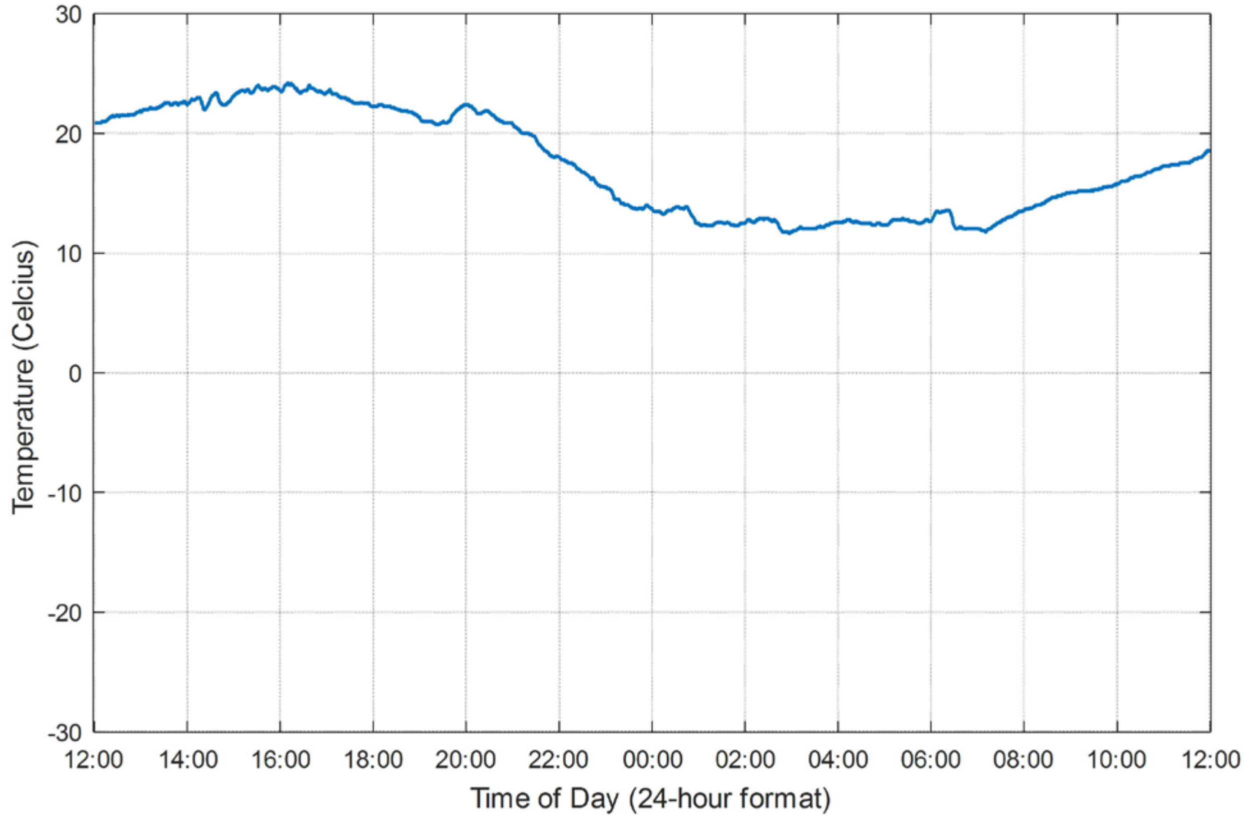
Night-time Monitored Rain Rate (August 2 – 3, 2016) at Noise Monitor Location 13



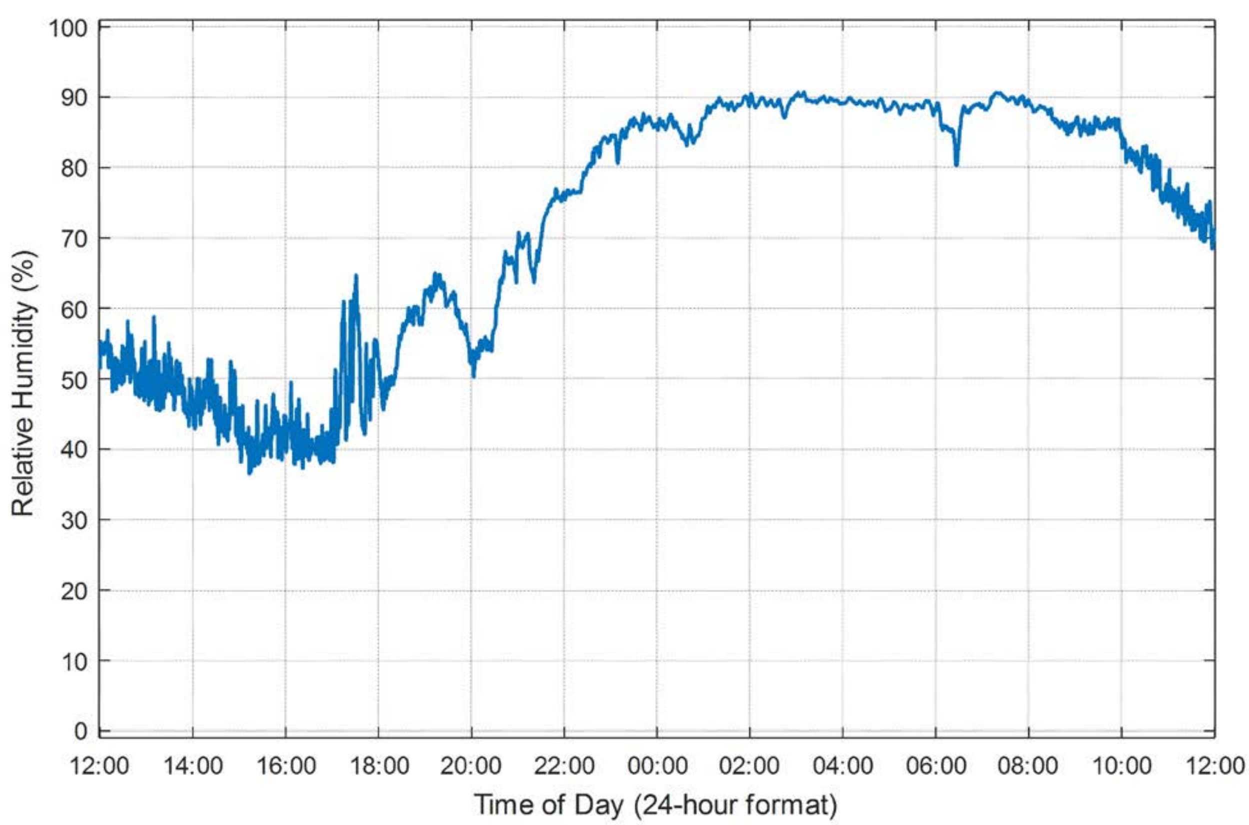
Monitored Wind Speed (August 2 – 3, 2016) at Noise Monitor Location 12



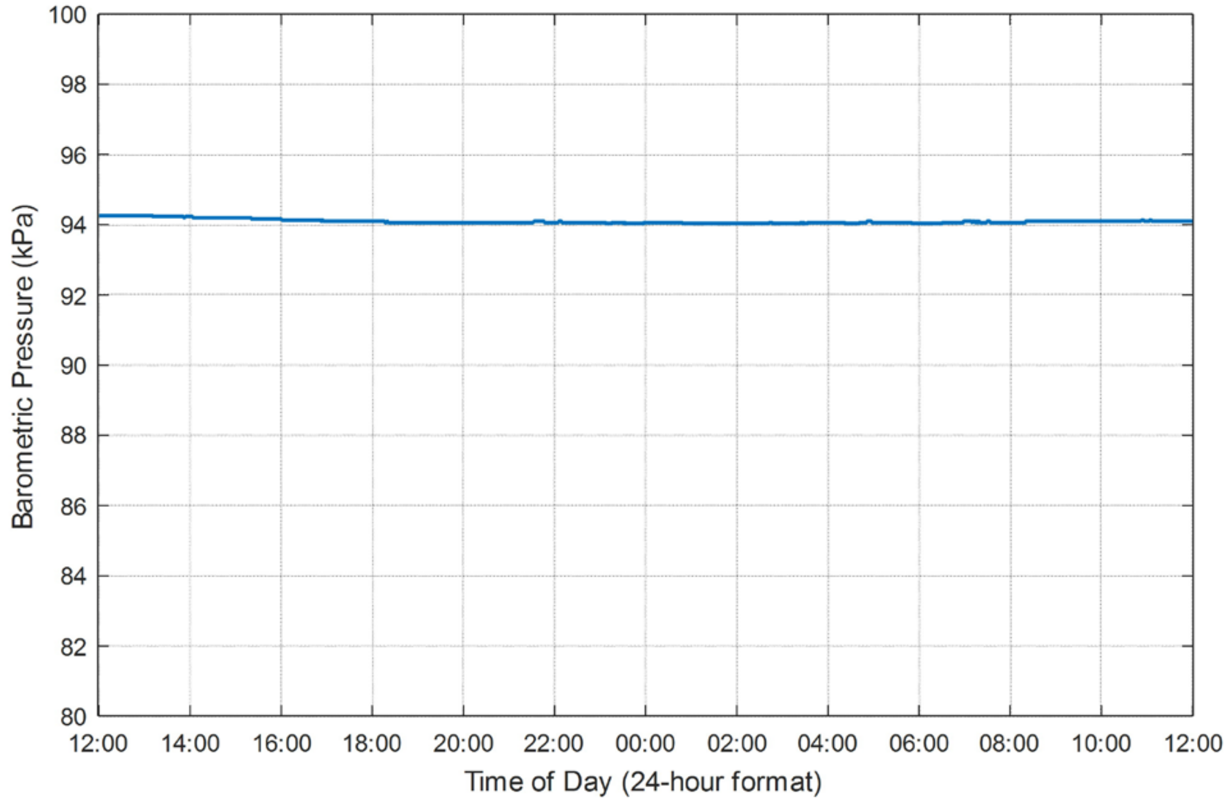
Monitored Wind Direction (August 2 – 3, 2016) at Noise Monitor Location 12



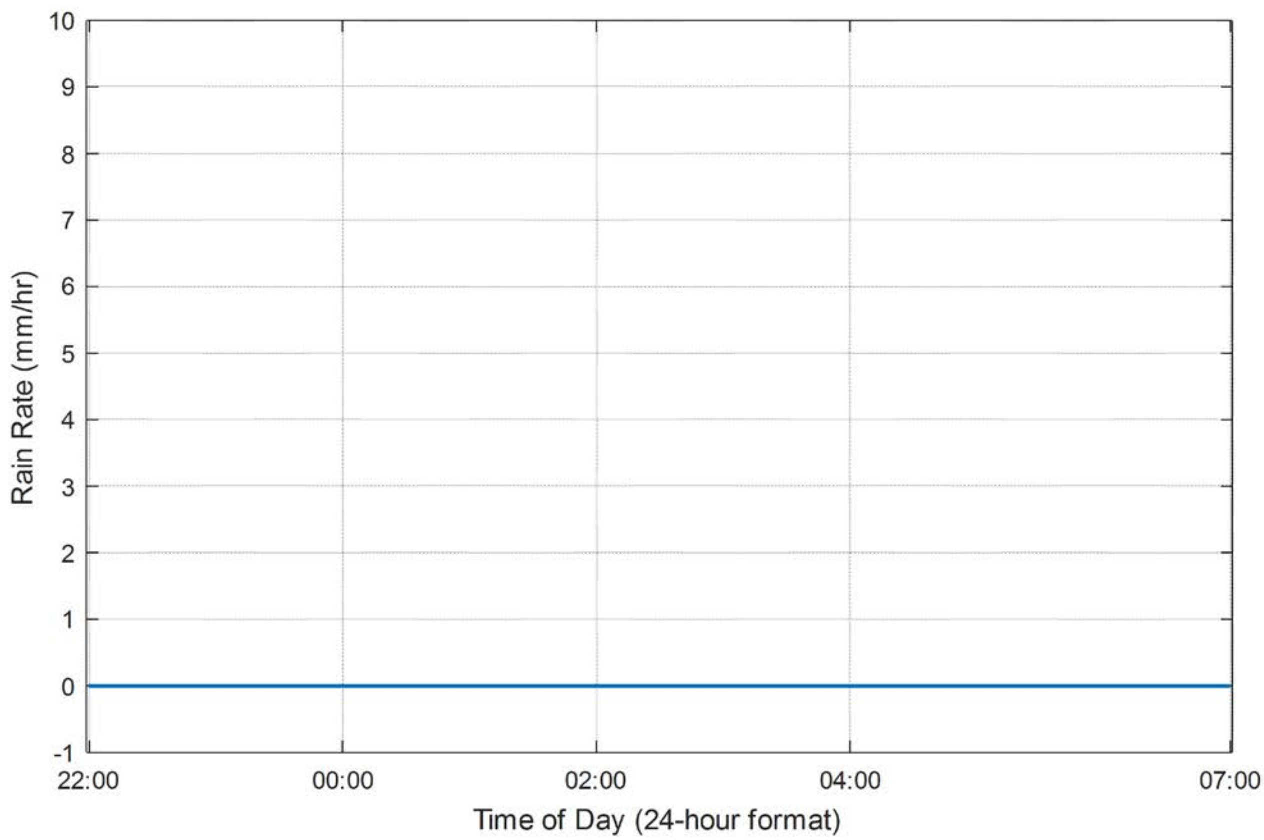
Monitored Temperature (August 2 – 3, 2016) at Noise Monitor Location 12



Monitored Humidity (August 2 – 3, 2016) at Noise Monitor Location 12

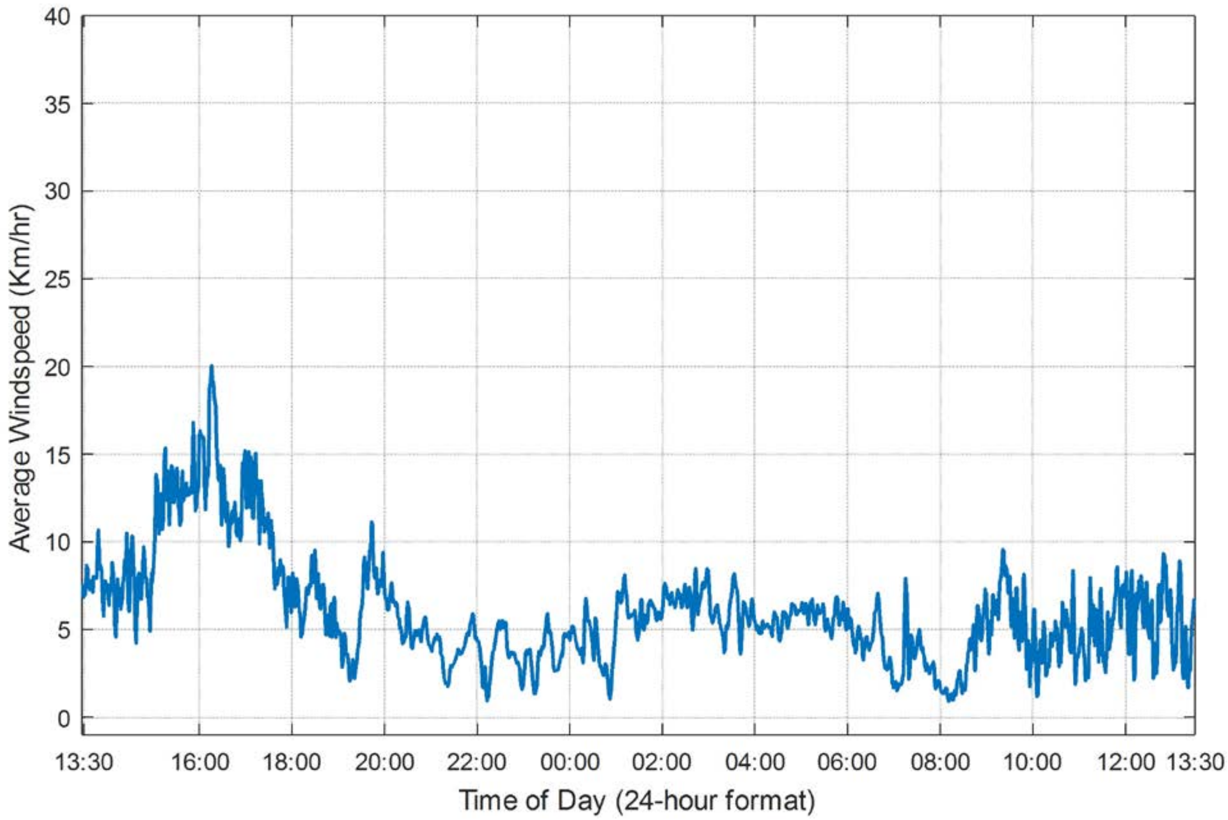


Monitored Barometric Pressure (August 2 – 3, 2016) at Noise Monitor Location 12

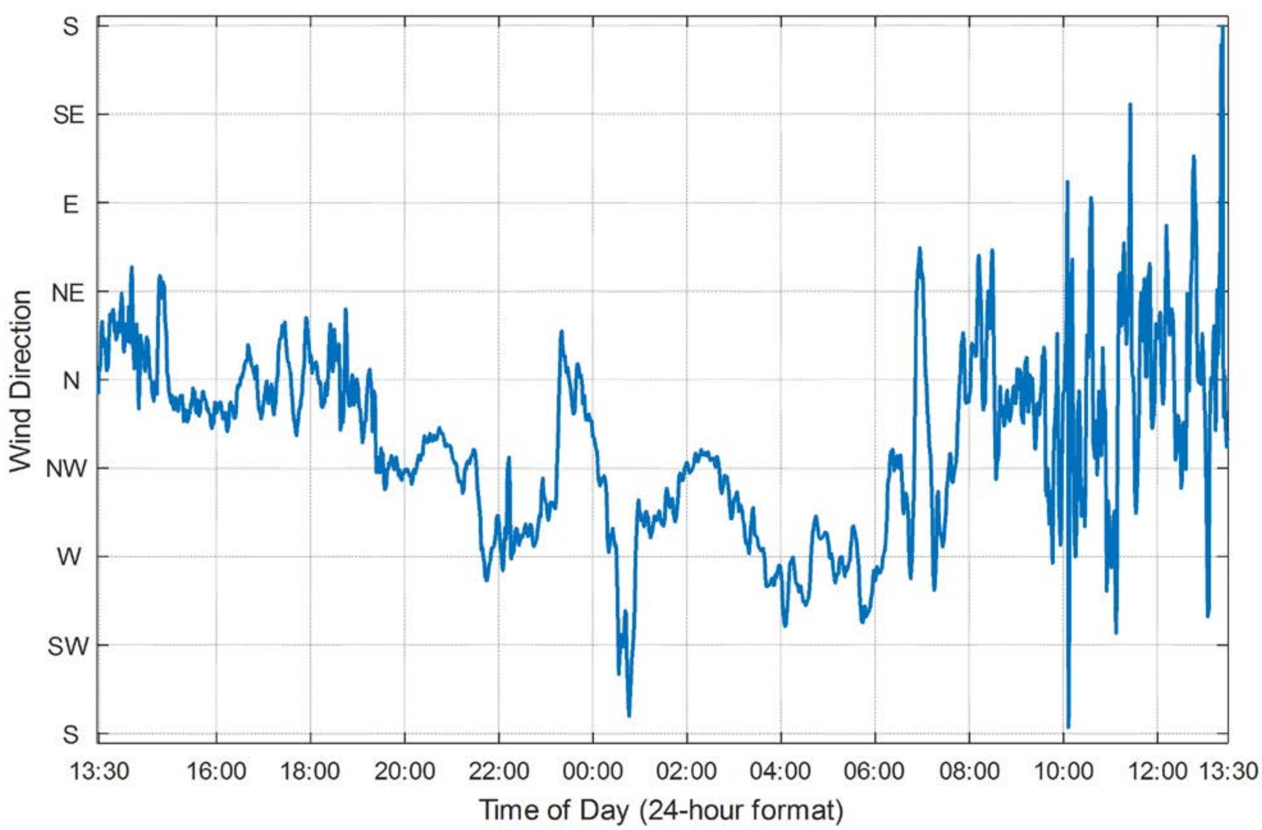


Night-time Monitored Rain Rate (August 2 – 3, 2016) at Noise Monitor Location 12

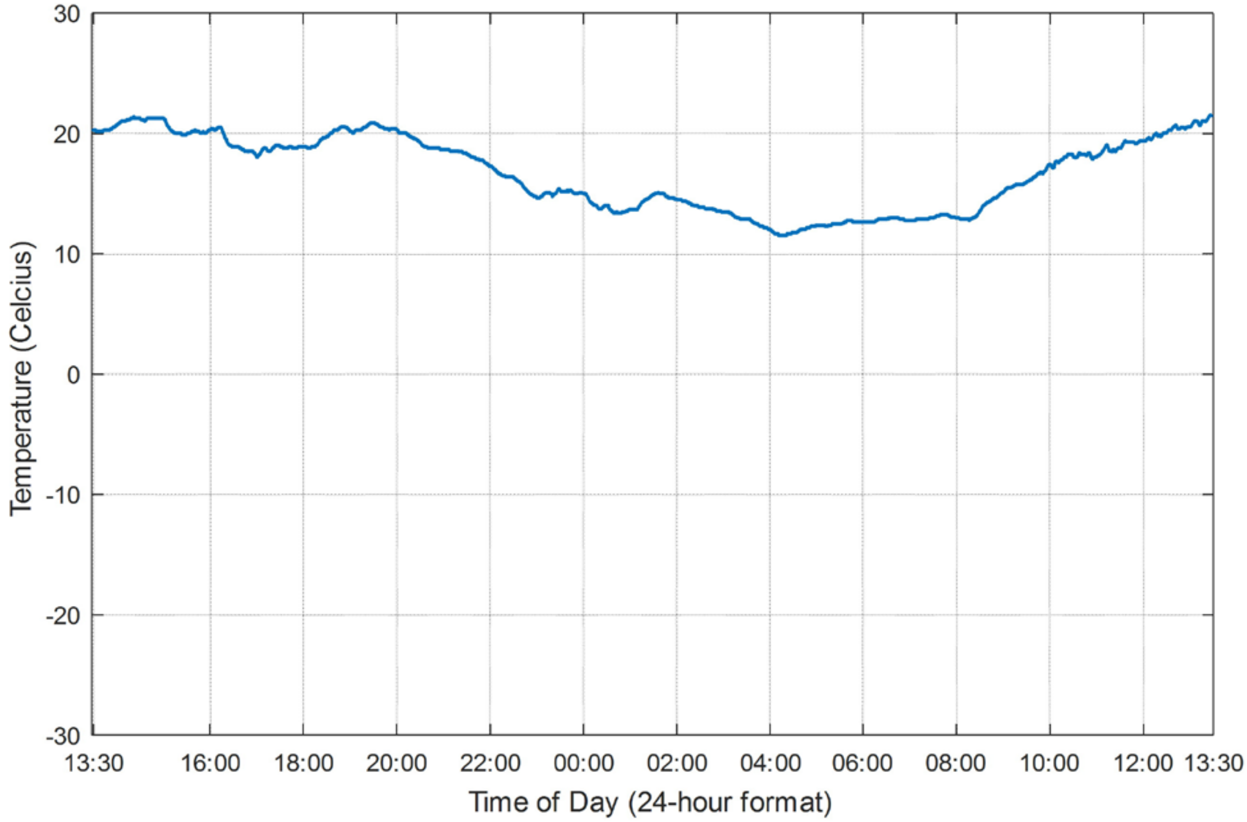
August 3 – 4, 2016 Weather Data



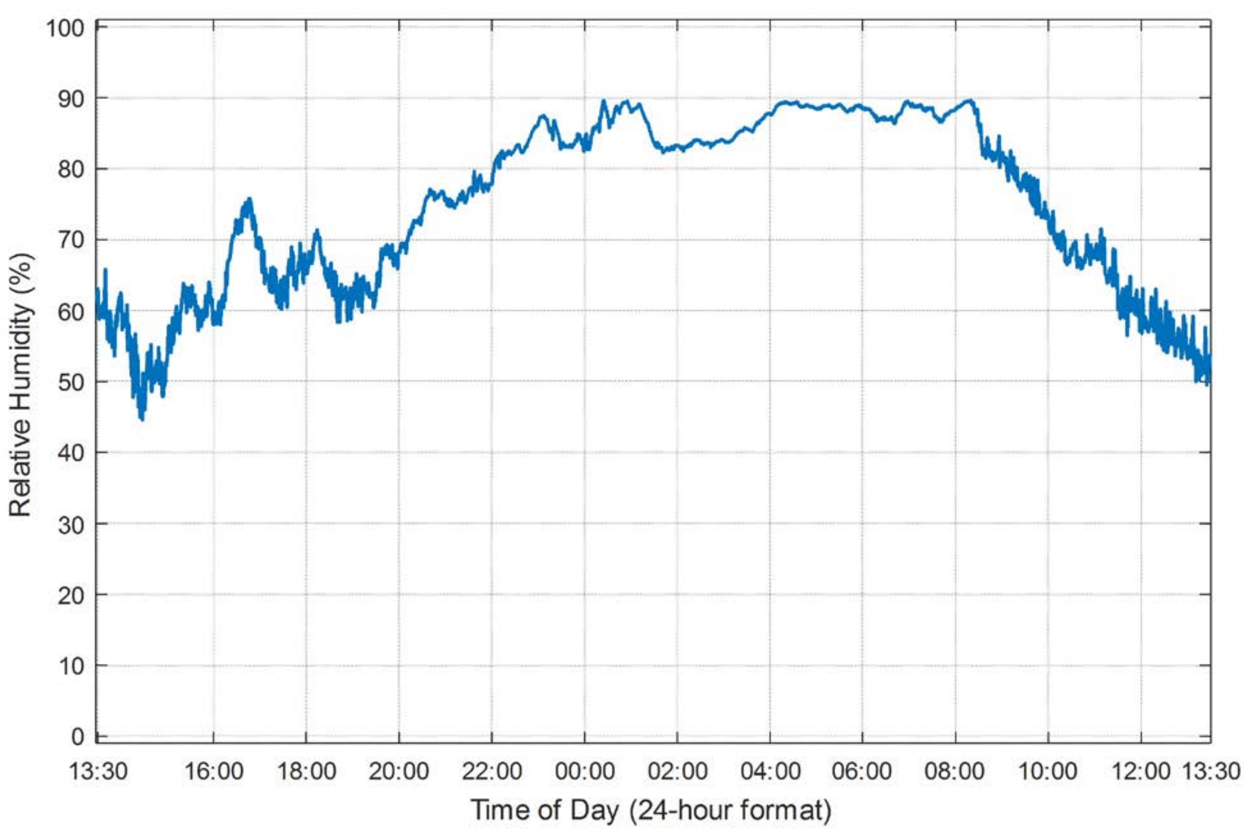
Monitored Wind Speed (August 3 – 4, 2016) at Noise Monitor Location 11



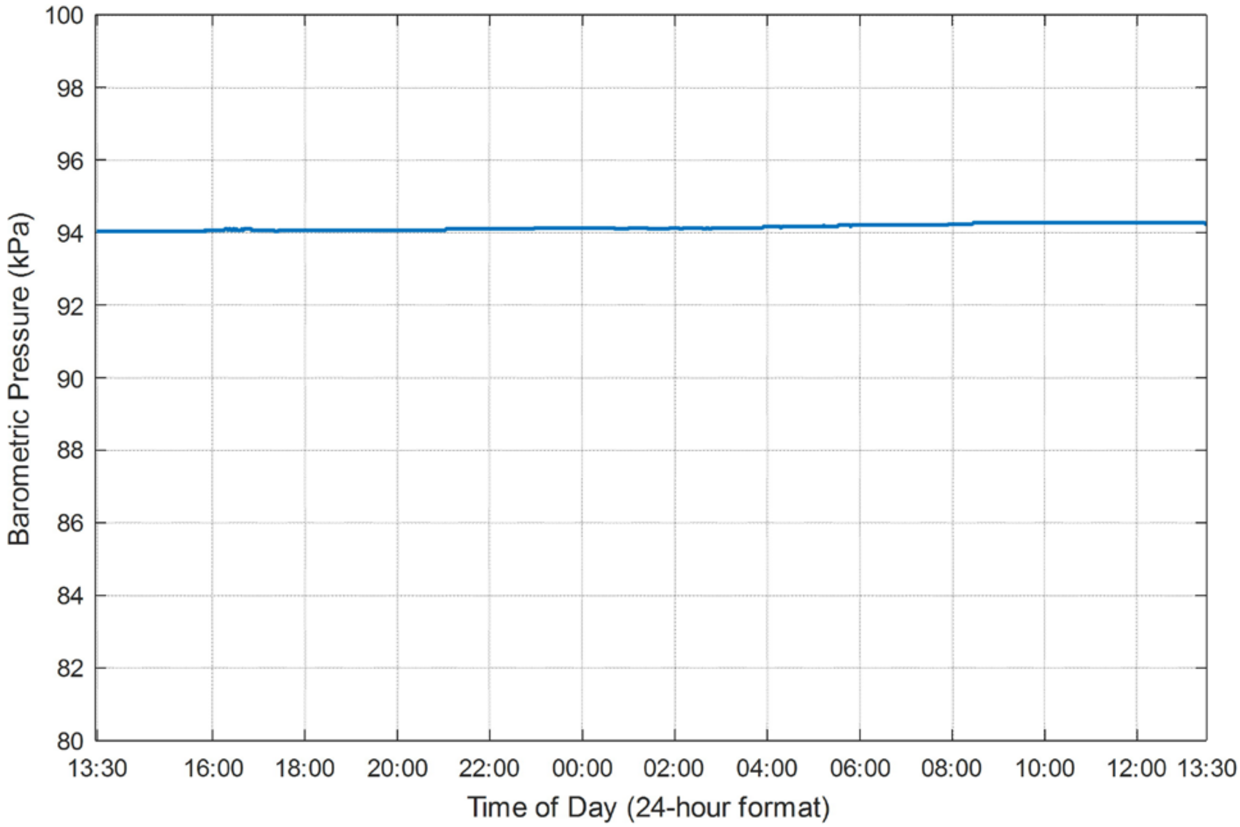
Monitored Wind Direction (August 3 – 4, 2016) at Noise Monitor Location 11



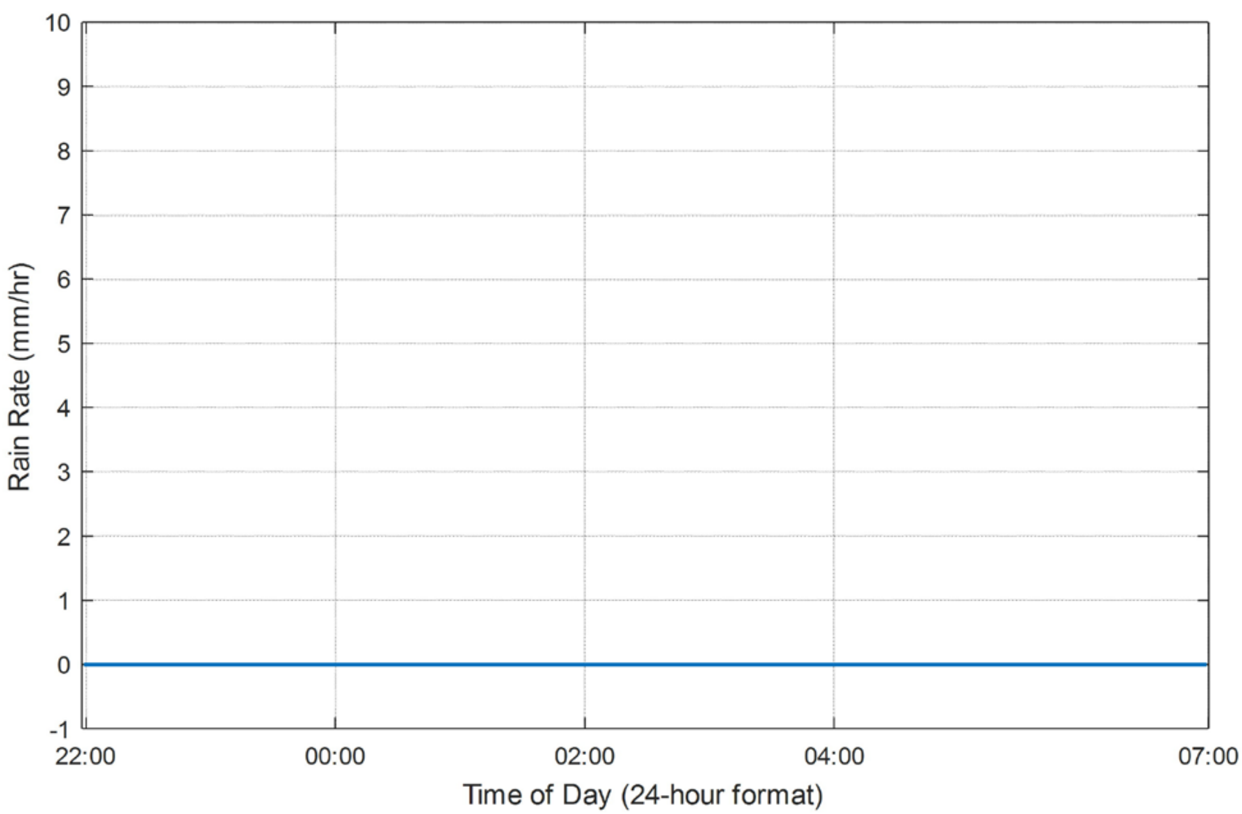
Monitored Temperature (August 3 – 4, 2016) at Noise Monitor Location 11



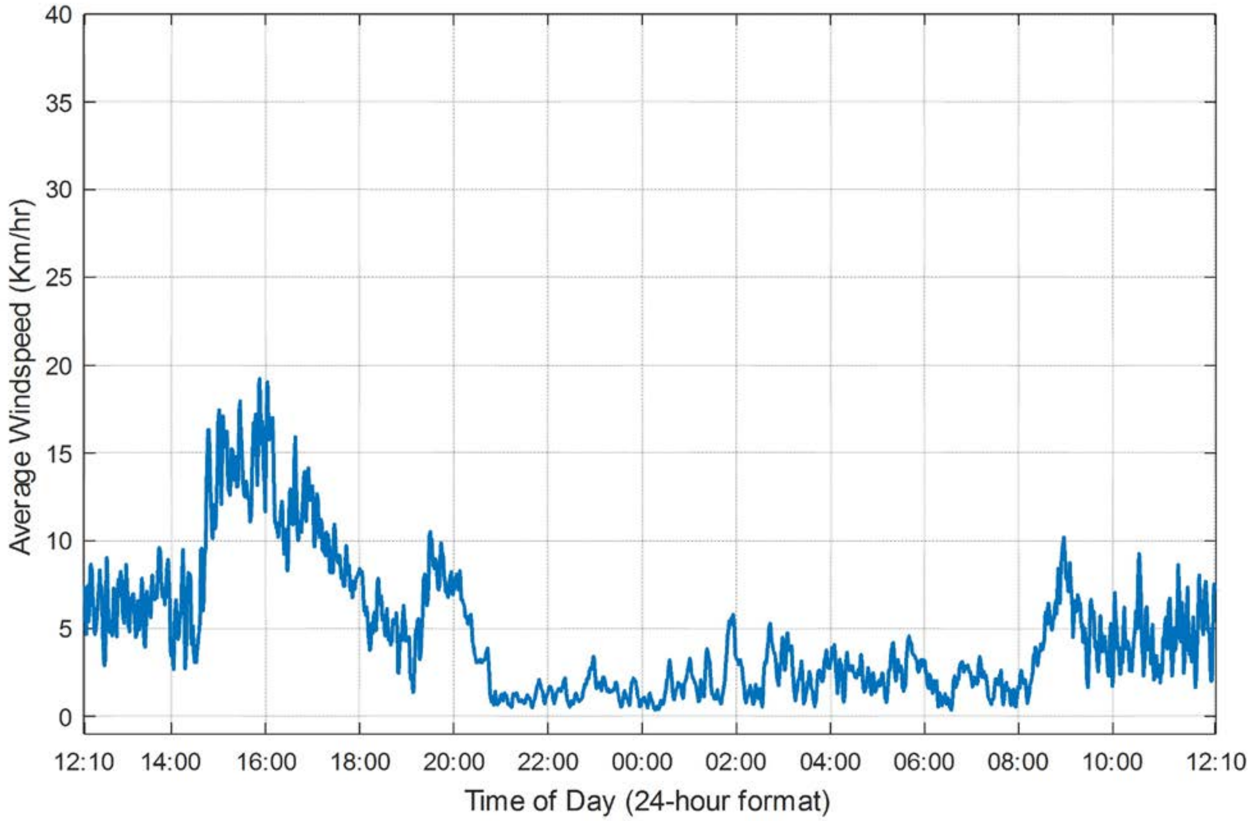
Monitored Humidity (August 3 – 4, 2016) at Noise Monitor Location 11



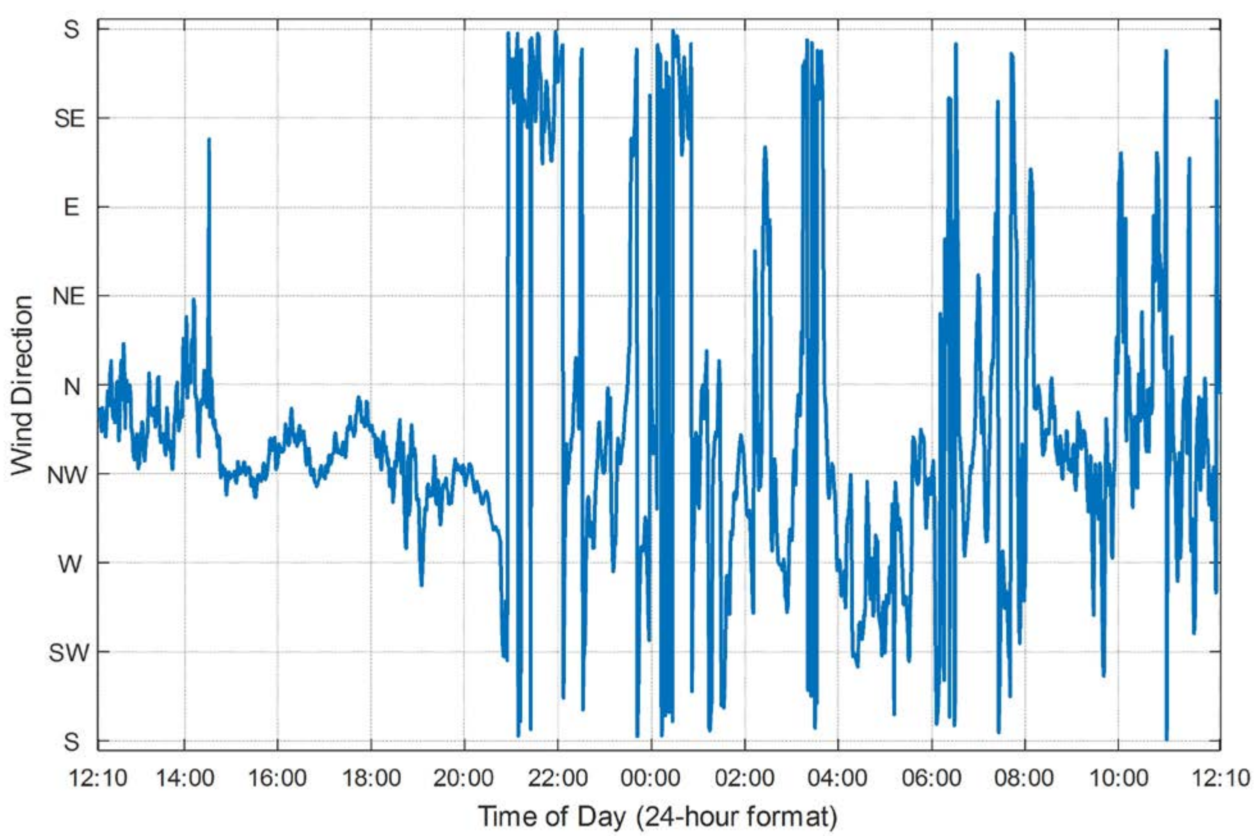
Monitored Barometric Pressure (August 3 – 4, 2016) at Noise Monitor Location 11



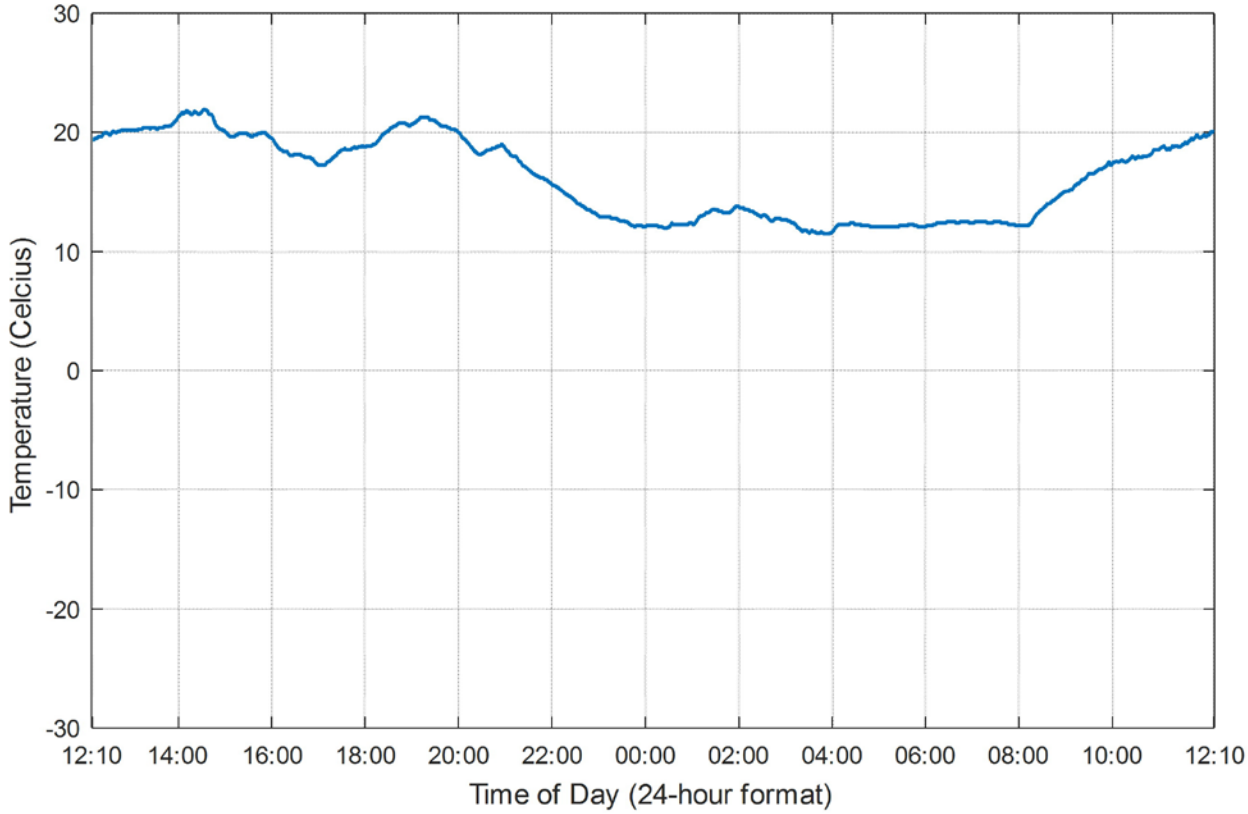
Night-time Monitored Rain Rate (August 3 – 4, 2016) at Noise Monitor Location 11



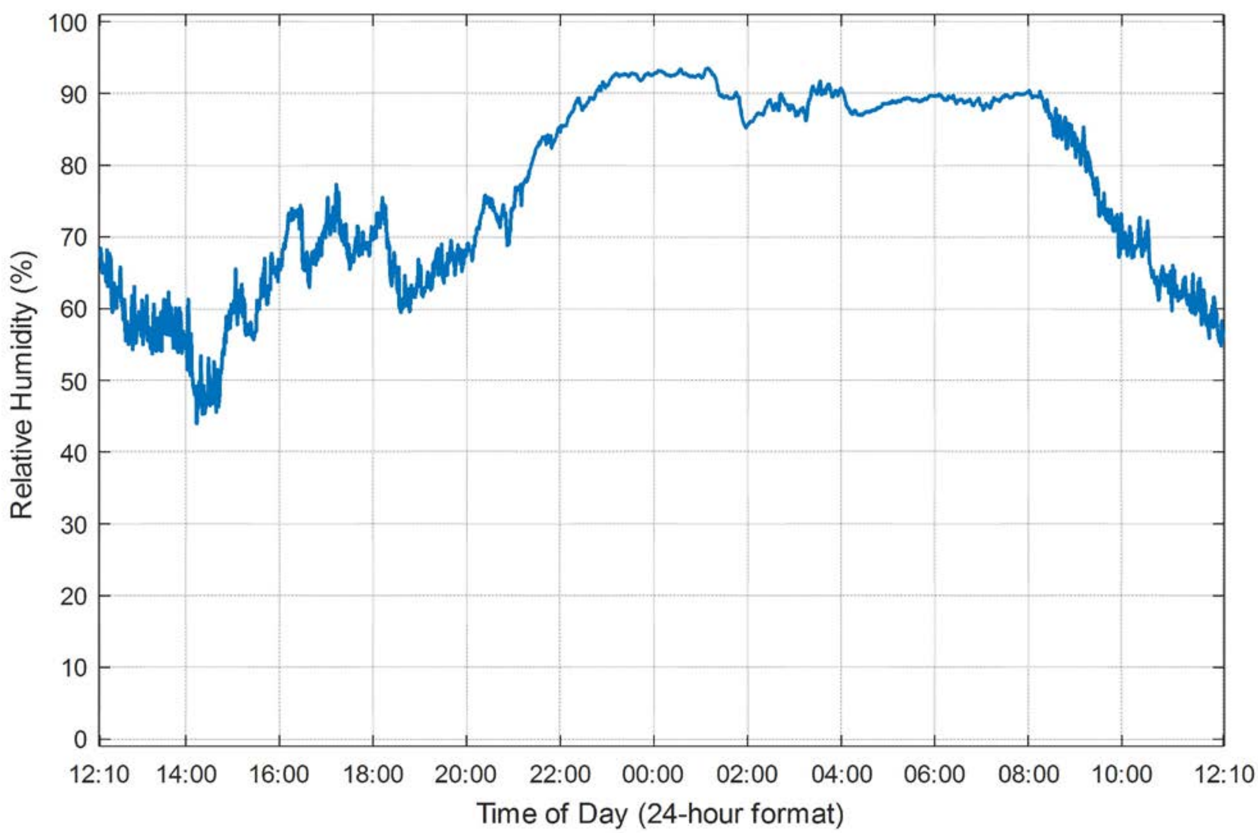
Monitored Wind Speed (August 3 – 4, 2016) at Noise Monitor Location 13



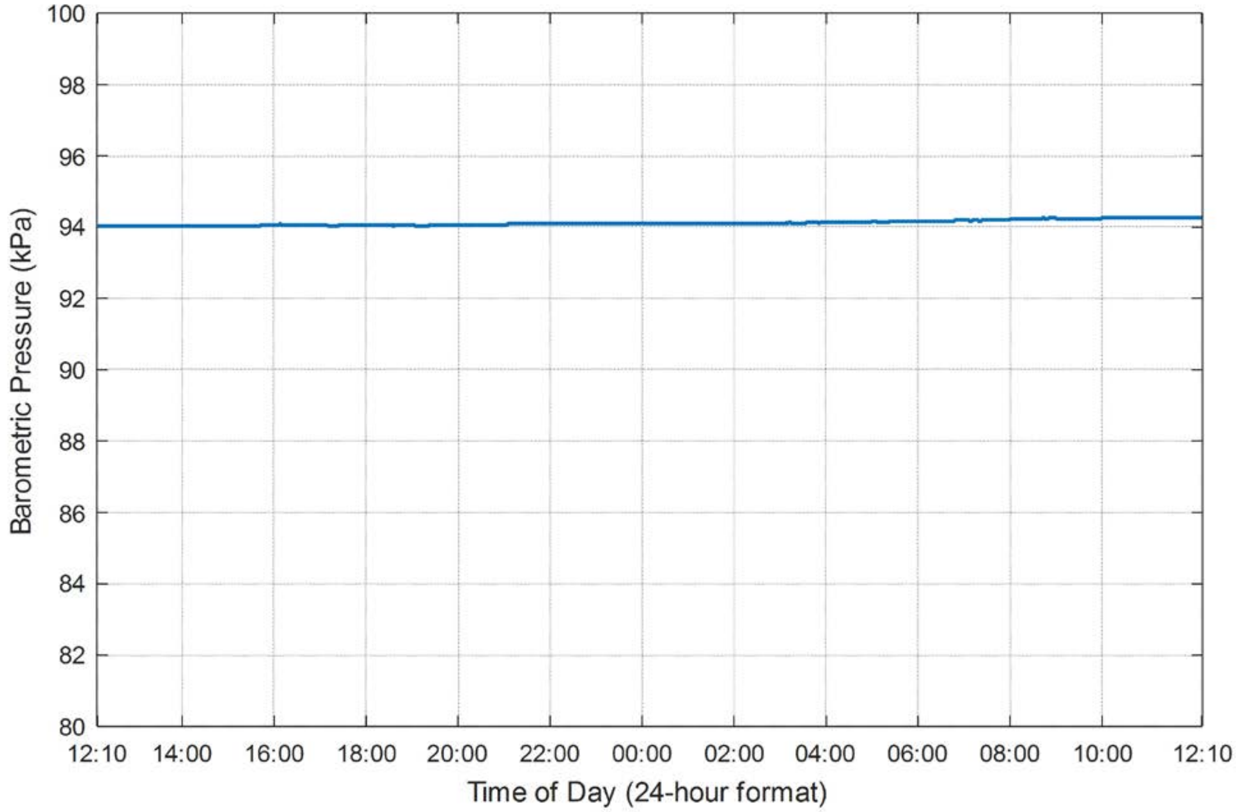
Monitored Wind Direction (August 3 – 4, 2016) at Noise Monitor Location 13



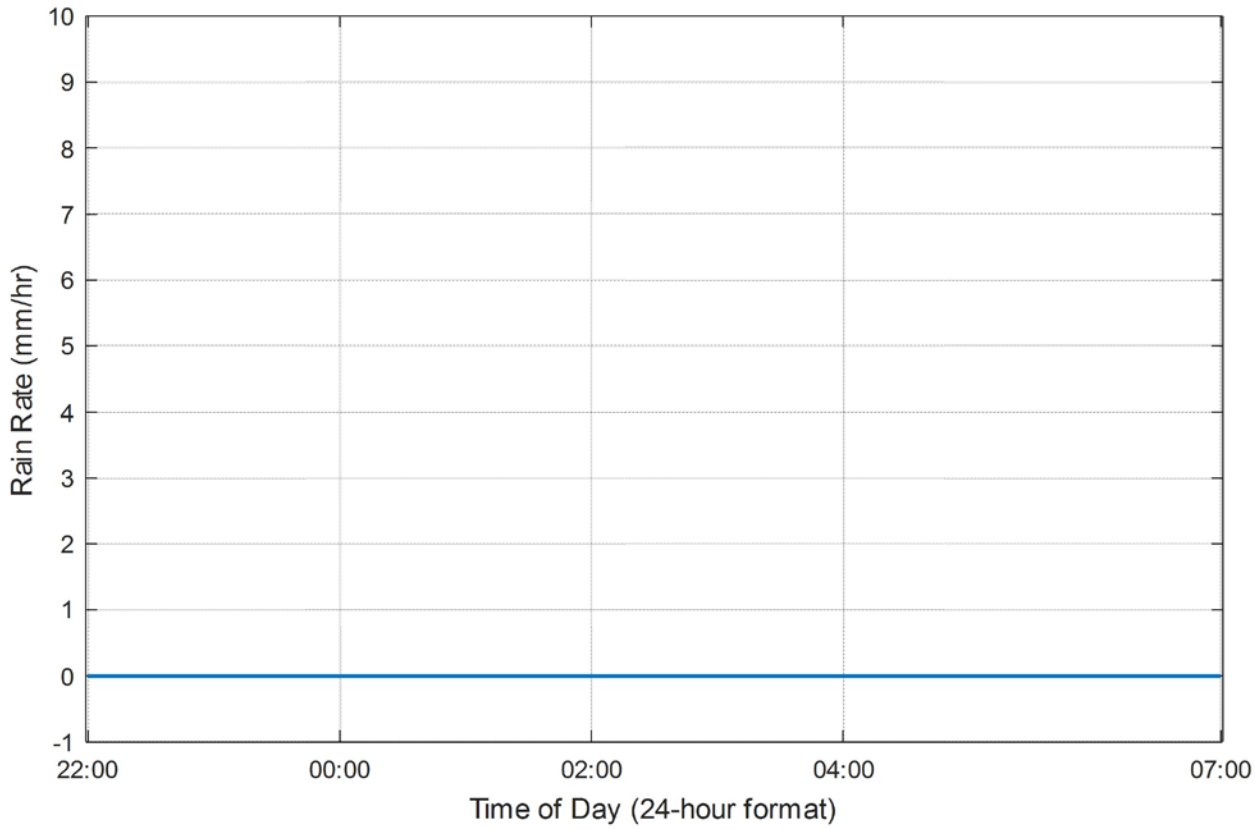
Monitored Temperature (August 3 – 4, 2016) at Noise Monitor Location 13



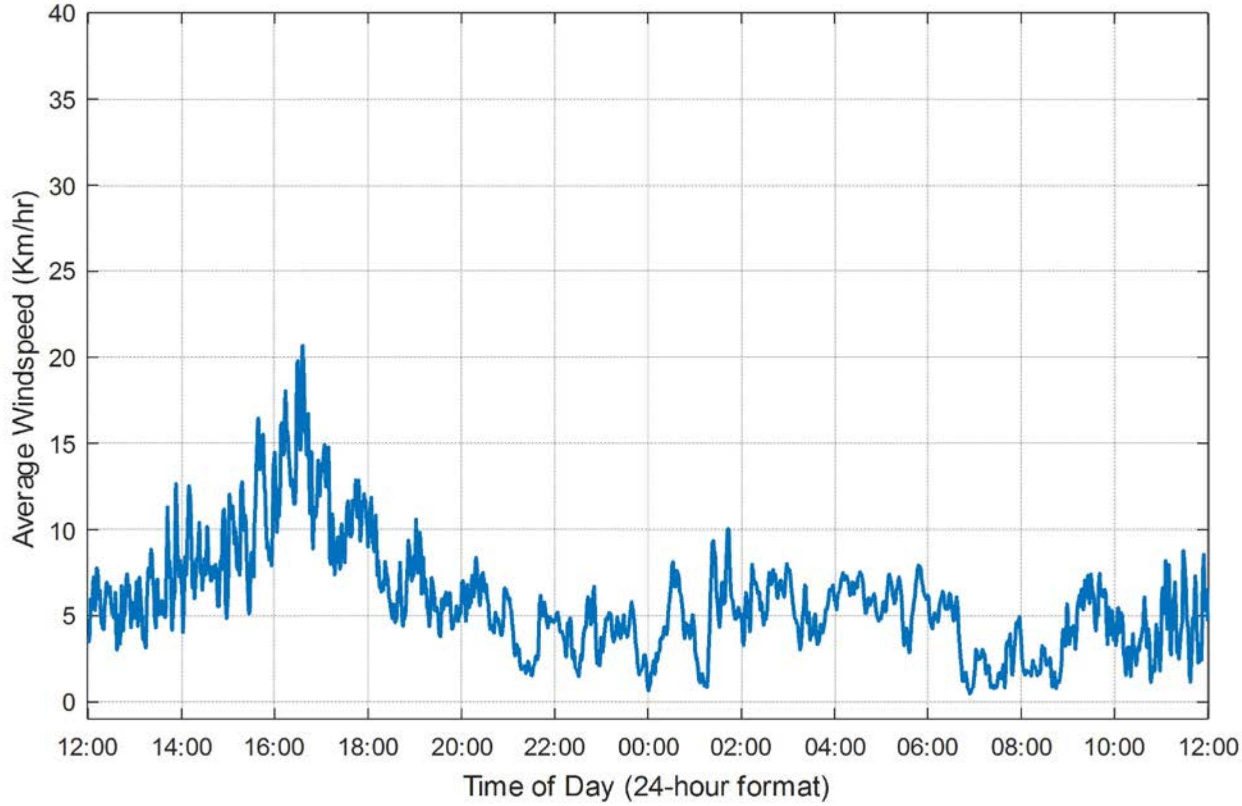
Monitored Humidity (August 3 – 4, 2016) at Noise Monitor Location 13



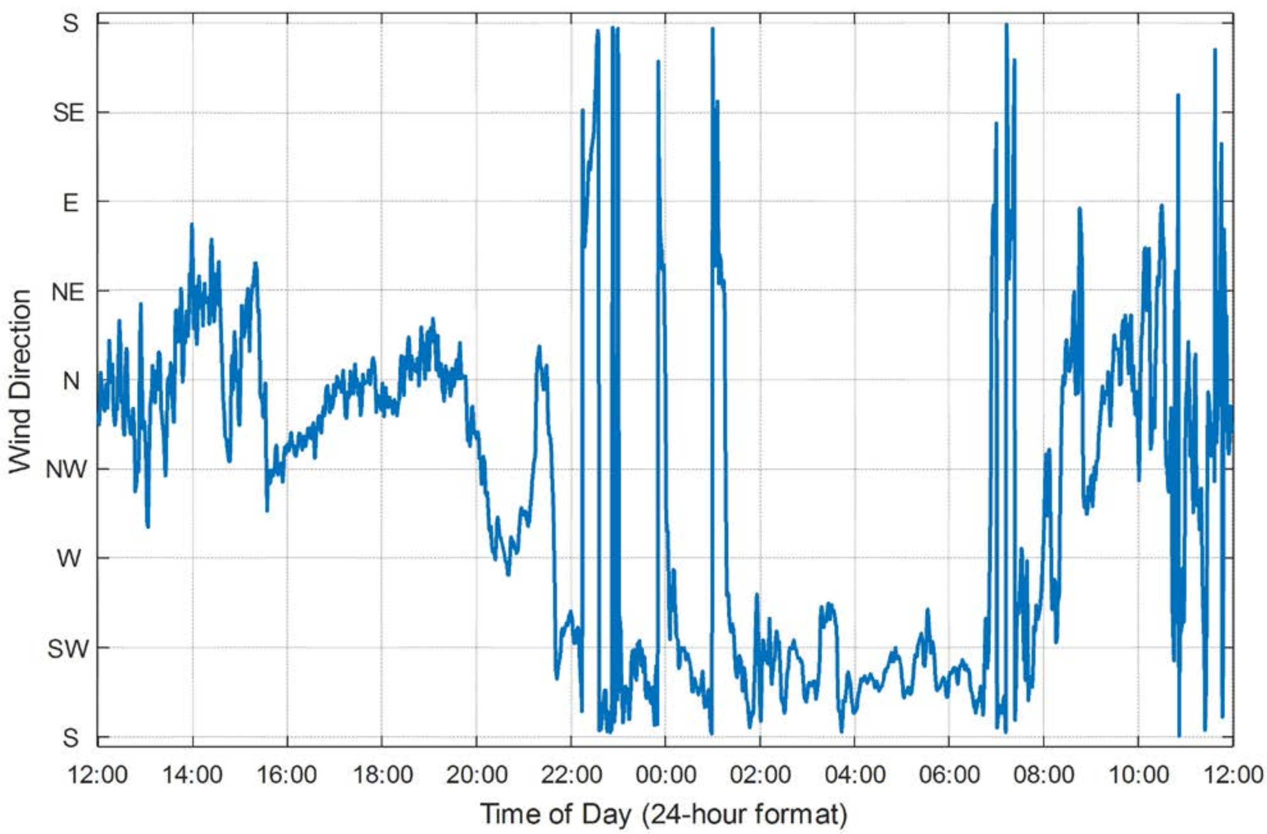
Monitored Barometric Pressure (August 3 – 4, 2016) at Noise Monitor Location 13



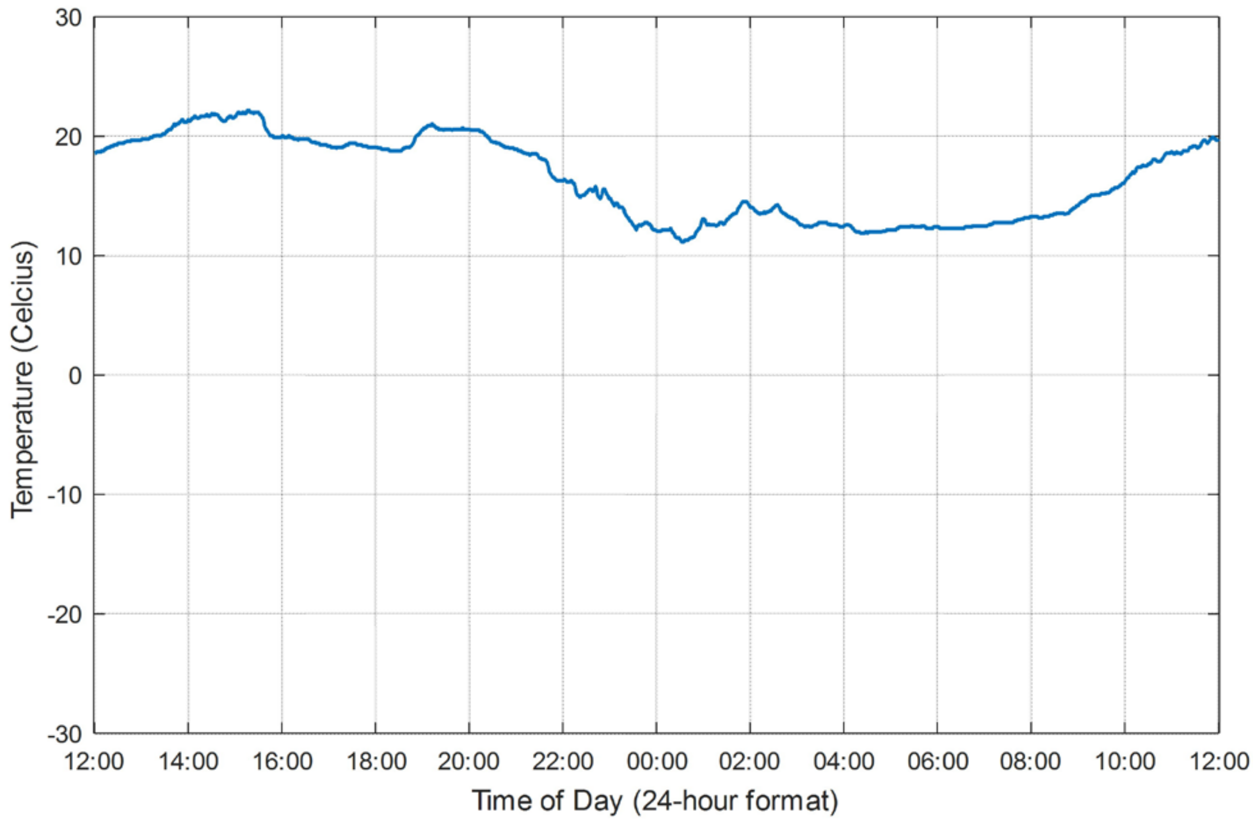
Night-time Monitored Rain Rate (August 3 – 4, 2016) at Noise Monitor Location 13



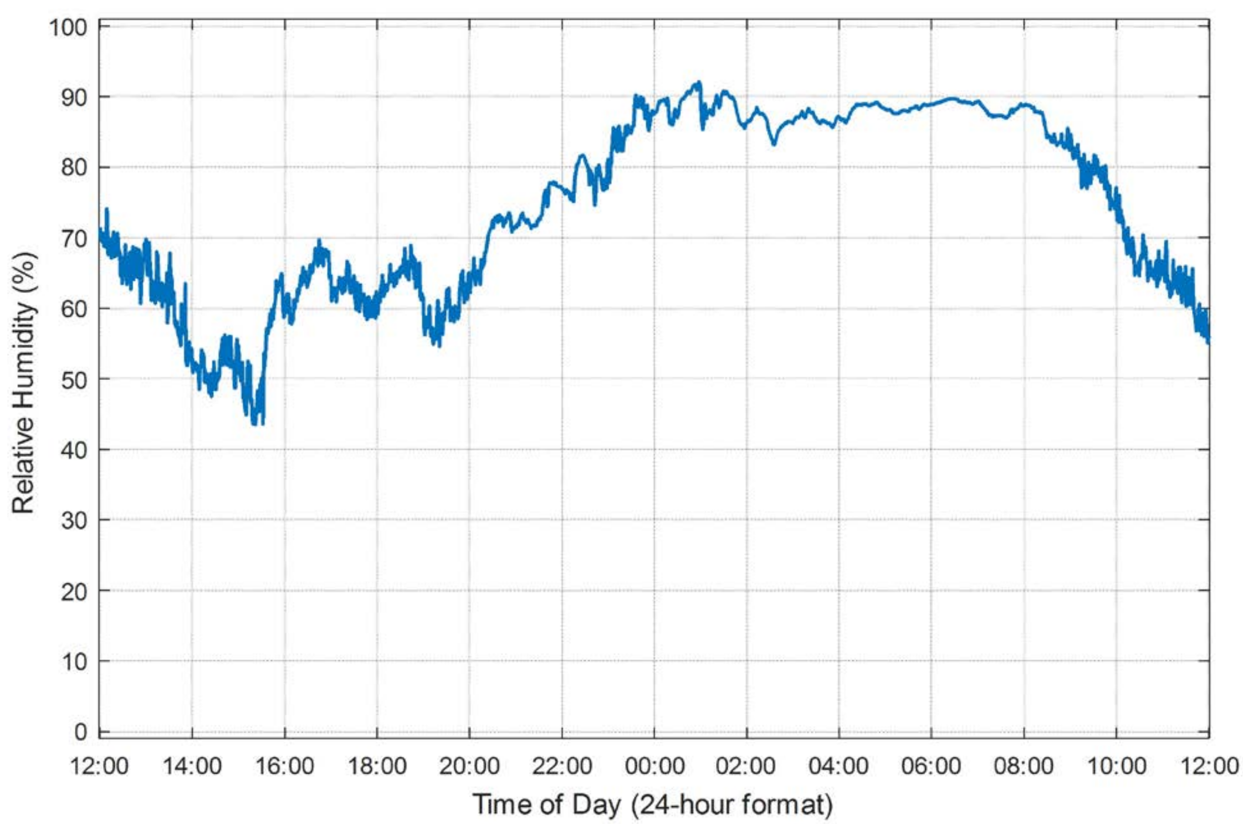
Monitored Wind Speed (August 3 – 4, 2016) at Noise Monitor Location 12



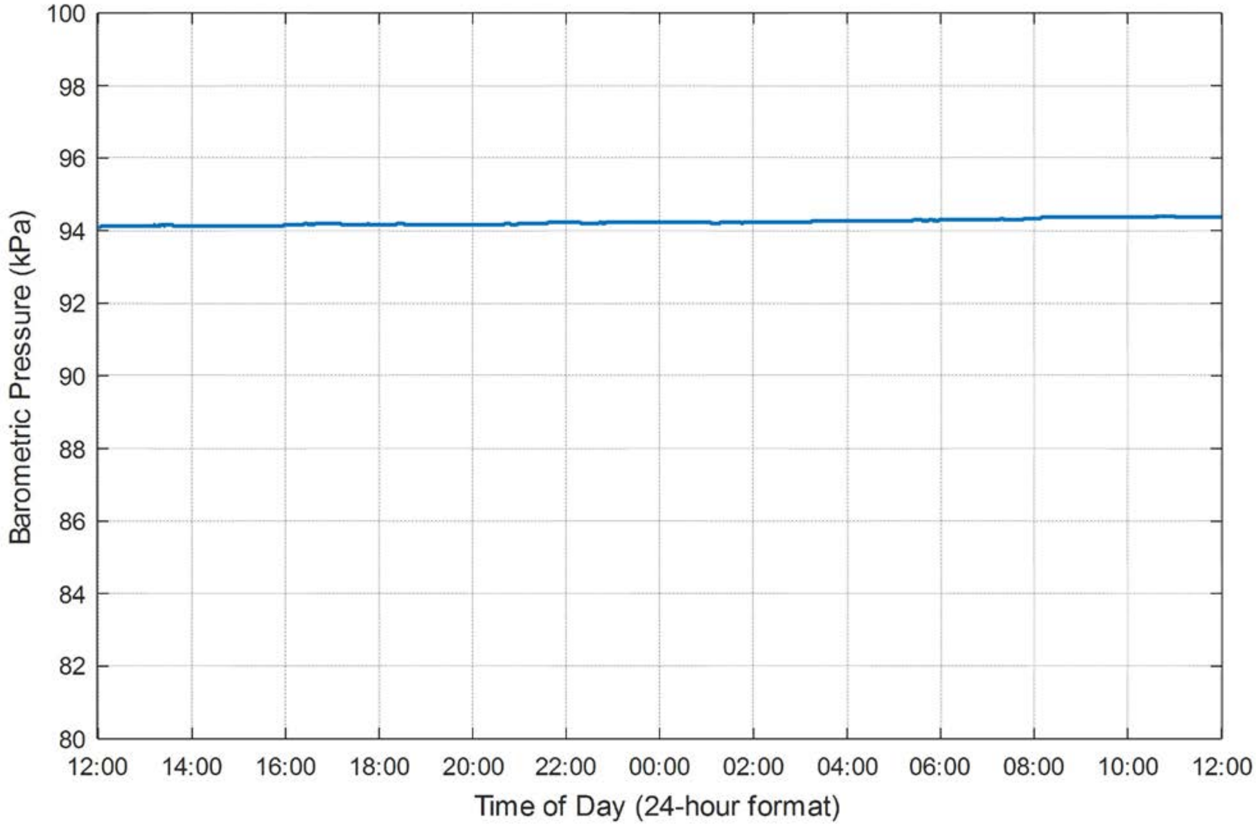
Monitored Wind Direction (August 3 – 4, 2016) at Noise Monitor Location 12



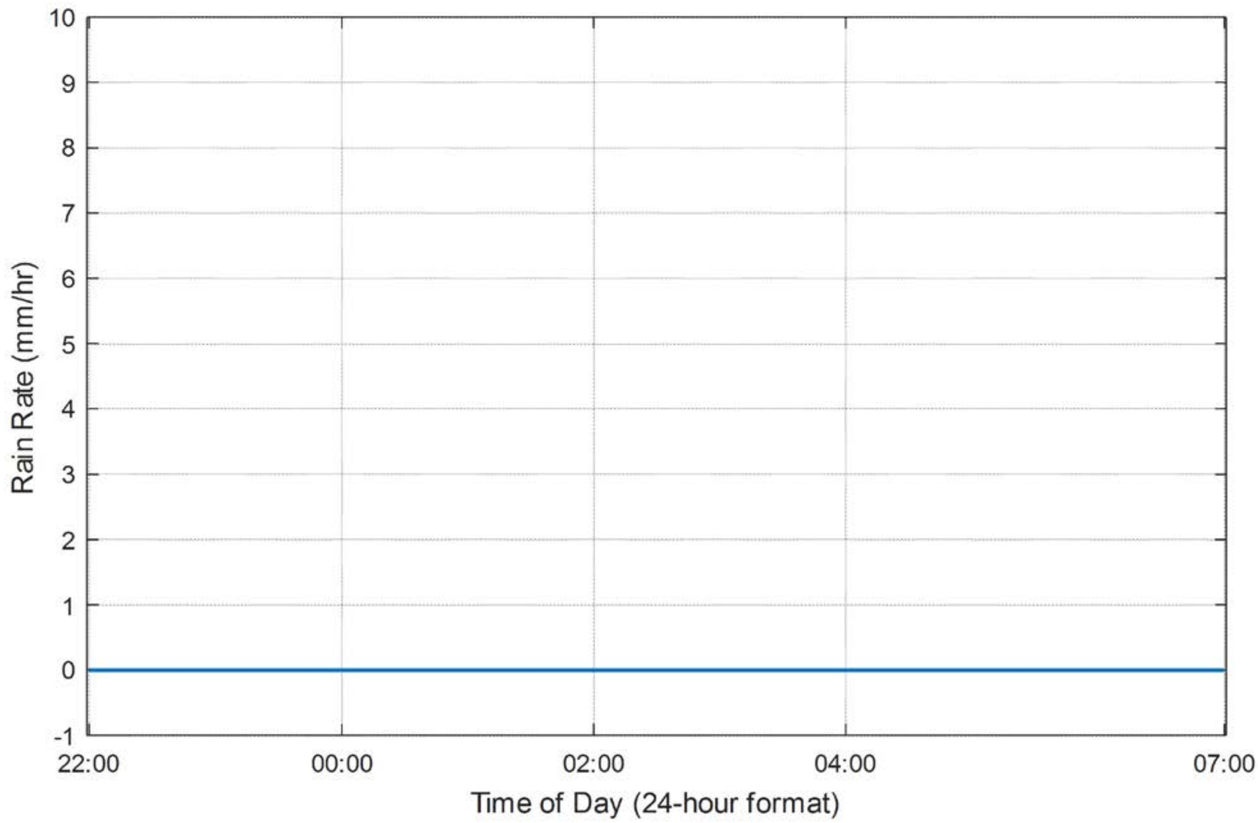
Monitored Temperature (August 3 – 4, 2016) at Noise Monitor Location 12



Monitored Humidity (August 3 – 4, 2016) at Noise Monitor Location 12



Monitored Barometric Pressure (August 3 – 4, 2016) at Noise Monitor Location 12



Night-time Monitored Rain Rate (August 3 – 4, 2016) at Noise Monitor Location 12

APPENDIX 2

NCIA MEMBER COMPANY NOISE MANAGEMENT PLAN UPDATES and REPORTS
(for 2016 Calendar Year)

Access Pipeline (Sturgeon Terminal)

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	**Member Site Comments**
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Access abides by AER's Directive 38.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	A noise monitoring was not conducted in 2016.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	N/A

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	There are no anticipated projects or improvement for 2016 that may impact noise levels.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	None.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	Access Pipeline did not receive any noise complaints for the 2016 year.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

Agrium Redwater and Fort Saskatchewan

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Agrium has documented and implemented a Noise Management Plan. The plan consists of the following documents: • ESP 3.07.01 Noise Management Overview • ESP 3.07.02 Noise Management Program • ESP 3.07.03 Noise Source List • ESP 3.07.04 Monitoring Program
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	Agrium has discontinued quarterly checks at both the Redwater and Fort Saskatchewan sites and therefore has no data summary to submit. The site Noise Management Plan remains in place and ready to be immediately executed in the event elevated noise is suspected.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	In 2016, Agrium Redwater hired SLR Consulting to complete a Noise Model Update to address 1) discrepancies in the existing Regional Noise Model and to 2) submit with the site Operating Approval Renewal Application. Approximately 50 of the over 400 noise sources in the model have been measured and updated. The most significant changes are noise from open building doors that were previously assumed closed, and the addition of the Phos 30# steam vents. The report is attached. As reported last year, there was concern over Agrium Redwater's Urea Process Unit which made some changes to the diameter of the Process Steam Vent which may have

	contributed to elevated site environmental noise level as well. The source was evaluated during the model monitoring, but results did not seem out of the norm. It is suspected that the rate of the vent varies so the elevated noise is not consistent and therefore not picked up the day of the model monitoring.
Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	In terms of the #30 Phos Steam Vents identified in the Noise Model Update, silencers are scheduled to be installed during the August / September 2017 turnaround. As stated in the 2013-2015 reports, Agrium Redwater engaged both SLR and Noise Solutions to proactively provide noise control options for both the compressor / gas turbine (CGT-902) and Utilities Boiler #2 replacement projects respectively. The motive for these assessments is primarily Occupational Hygiene, but it is anticipated that Environmental Noise will also be reduced. Worthy of noting is that implementation of these projects have been rescheduled for 2019.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	Yes. We are implementing plan improvements in 2017.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	There were no external noise complaints for either Agrium Redwater or Fort Saskatchewan in 2016.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

global environmental solutions

Agrium Redwater
2016 Noise Model Update

Draft

February 2017
SLR Project No.: 203.50100.00000

AGRIUM REDWATER FERTILIZER OPERATIONS

2016 NOISE MODEL UPDATE

SLR Project No.: 203.50100.00000

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February 8, 2017

Association of Professional Engineers and Geoscientists of Alberta
Permit to Practice P05449

Prepared by:	Reviewed by:
2017-02-08	
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Distribution: 1 copy – Agrium Inc. (pdf)
1 copy – SLR Consulting (Canada) Ltd.

EXECUTIVE SUMMARY

The Agrium Inc. (Agrium) Redwater Fertilizer Operations (RFO), located near Redwater in the Alberta Industrial Heartland, is a member company of the Northeast Capital Industrial Association (NCIA). Agrium maintains an environmental noise model of the RFO site as required by the NCIA Regional Noise Management Plan (RNMP). The noise model is used to predict and manage the environmental noise produced by industrial noise sources at the RFO site.

As part of the RNMP, the NCIA is responsible for combining all member companies' facility noise models into a single Regional Noise Model (RNM). The NCIA also conducts an annual noise monitoring program, the results of which are compared to RNM predictions. The NCIA noise monitoring program has consistently shown that the measured noise levels to the east of the RFO site (NCIA Monitoring Location 6) exceed the predicted noise levels during the nighttime. Observations at NCIA Monitoring Location 6 indicate that the measured noise level is dominated the RFO site, implying that the RFO noise model may be under-predicting the facility's environmental noise emissions. The noise model update documented in this report is motivated, in part, by the need to identify and correct this discrepancy.

Approximately 50 of the over 400 noise sources in the model have been measured and updated in the model. The most significant changes are noise from open building doors that were previously assumed closed, and the addition of the Phos 30# steam vent to the noise model. The updated model has been validated by comparison of predicted and measured noise levels on the plant roadways, which show it to be generally accurate. At two roadway locations the predicted levels were not consistent with the measured levels; these locations should be further investigated during the next model update project, but they do not invalidate the overall model.

The updated noise model was used to predict RFO noise contributions at six off-site receptor locations. These include receptors used for previous RFO site noise studies and receptors corresponding to two NCIA noise monitoring locations. The model update indicates an increase in predicted sound level contributions at five receptors and a decrease at one receptor. The greatest increase in predicted sound level is approximately 4 dBA for receptors east of the Agrium site. A sound level decrease of approximately 1 dBA is predicted for one receptor west of the site. The increase in predicted sound level on the east side of the site is primarily attributed to the Phos 30# steam vent.

This RFO noise model update indicates an increase of 3.5 dBA in RFO site noise contributions at the NCIA 6 receptor. This change in the RFO noise model predictions is expected to improve agreement between the next update to the RNM and NCIA noise monitoring results for the RFO area.

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1.0 INTRODUCTION

The Agrium Inc. (Agrium) Redwater Fertilizer Operations (RFO), located near Fort Saskatchewan in the Alberta Industrial Heartland, is shown in Figure 1. The RFO site is comprised of the Gypstack to the north, and the process units to the south. Agrium is a member company of the Northeast Capital Industrial Association (NCIA), and maintains an environmental noise model of RFO as required by the NCIA Regional Noise Management Plan (RNMP). The noise model is a tool for prediction and management of environmental noise produced by industrial noise sources at the RFO site.

As part of the RNMP, the NCIA is responsible for combining all member companies' facility noise models into a single Regional Noise Model (RNM). The NCIA also conducts an annual noise monitoring program, the results of which are compared to RNM predictions. The NCIA noise monitoring program has consistently shown that the measured noise levels at an off-site location 1.6 km east of the RFO site (NCIA Monitoring Location 6) exceed the predicted noise level during the nighttime[1]. Observations at NCIA Monitoring Location 6 indicate that the measured noise level is dominated by RFO, implying that the RFO noise model may be under-predicting the site's environmental noise emissions. This model update is motivated, in part, by the need to resolve this discrepancy.

Agrium retained SLR Consulting (Canada) Ltd. (SLR) to update the RFO noise model. The model update is designed to:

- Update the sound power level of any industrial noise sources that are known to have changed since the original model was developed in 2001 (changes include equipment added, removed, process conditions changed, or noise control implemented)
- Validate the model by comparison to current measurements of industrial noise levels on and around the RFO site
- Identify any changes in the predicted environmental noise contribution following the model update

A glossary of acoustical terms, an introduction to environmental noise descriptors, and an introduction to outdoor sound propagation are provided in Appendix F, G, and H.

[1] NCIA, *NCIA Regional Noise Management Plan (RNMP) Annual Report,* January 2016.

Figure 1: Agrium RFO

2.0 REVIEW OF PREVIOUS RFO NOISE MODEL

2.1 Environmental Noise Model Software

The existing RFO noise model is maintained in the SoundPLAN computer noise modelling platform. Updates to SoundPLAN are issued from time to time by the manufacturer to improve the software program. The current version of SoundPLAN is Version 7.4, and the 2016 noise model update includes conversion of the model to Version 7.4.

The RFO noise model calculations utilize the ISO 9613 calculation method for absorption of sound by the atmosphere, and the CONCAWE calculation method for outdoor sound propagation from industrial facilities. These calculation methods account for the following outdoor sound propagation effects:

- Geometric spreading
- Ground attenuation
- Atmospheric absorption
- Barrier attenuation.
- Wind or temperature gradients.

Meteorological parameters and ground attenuation values typical of summer seasonal conditions are used in the noise model calculations. These conditions include an air temperature of 10˚C and a relative humidity of 70%. The CONCAWE procedure allows calculations to be made for calm and downwind sound propagation from the site. The noise model results presented in this report are for downwind conditions.

The NCIA Regional Noise Model also utilizes the ISO 9613 and CONCAWE calculation methods. The temperature, humidity, ground attenuation and terrain parameters for the Agrium Redwater noise model calculations are the same as those used for the NCIA Regional Noise Model.

2.2 Previous RFO Noise Model

SLR (formerly HFP Acoustical Consultants Corp.) developed and validated the original RFO noise model in 2001[2]. Prior to this 2016 update, the noise model has not been significantly updated since it was originally developed. Between 2013 and 2015, SLR has conducted acoustical measurements and modeling related to the CGT-902 replacement project, but the results of this work were not incorporated in the environmental noise model at that time. The 2013 C-902 compressor piping noise measurements have been incorporated in this model update.

3.0 2016 FACILITY NOISE SURVEY

Mr. Chris Bibby, M.A.Sc., P.Eng., and Mr. Matthew Gaskell, C.E.T. of SLR conducted a diagnostic noise survey at RFO on August 8 and 9, 2016 by. The survey was designed to achieve the following objectives:

1. Conduct diagnostic equipment noise measurements for new equipment, and equipment that Agrium identified to have altered noise emissions, since the original noise measurements were completed in 2001.
2. Identify local areas of disagreement between the original model and the current facility noise by conducting noise level measurements on the roadways throughout the facility.
3. Conduct diagnostic equipment noise measurements, as appropriate, in plant areas where the measured roadway noise levels disagree with the predicted levels.

The sound measurement instrumentation used for the on-site noise measurements were as follows:

- Brüel & Kjær Type 2270 hand-held analyser (2)
- Brüel & Kjær Type 4189 ½” microphone (2)
- Brüel & Kjær ZC-0032 preamplifier (2)

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[2] HFP Acoustical Consultants Corp., *Facility Noise Model and Noise Source Order Ranking,* HFP File 00 C 1492-1, July 27, 2001.

- Brüel & Kjær UA-1650 wind screen (2)
- Brüel & Kjær Type 4231 calibrator (2)

Additionally, for information purposes, SLR conducted a 24-hour noise survey at the offsite NCIA Monitoring Location 6. The sound measurement instrumentation used for the offsite noise survey was as follows:

- Larson Davis 824 integrating sound level meter
- Gras TMS40AE microphone
- Brüel & Kjær UA0237 wind screen
- Marantz professional PMD 620 mp3 recorder
- Brüel & Kjær 4231 calibrator

4.0 FACILITY NOISE SOURCES AND MODEL UPDATE

Major sources of environmental noise at RFO include the following equipment:

- Compressors and compressor piping
- Control valves and process piping
- Process vessels
- Product handling equipment
- Furnace walls, fans, stacks, and ducting
- Cooling tower fan plenum outlets, fan motors, lift pumps, and watersplash
- Aerial cooler fans
- Process pumps and pump drivers
- Lube oil coolers
- Deaerator steam vents
- Process vents
- Walls, louvers, and doors of buildings housing noisy equipment
- Building ventilation and exhaust fans
- Gas turbines

Equipment that operates intermittently or in emergency situations, such as emergency flares, PSVs, and vents can emit high levels of noise. However, these sources are typically not included in environmental noise models unless the equipment operates regularly.

Equipment noise data collected during the facility noise surveys was processed to determine the octave band sound power level (PWL) of each noise source. The noise source sound power and directivity data, along with geometry and location coordinates are used to define the parameters of each noise source within the computer noise model.

Approximately 50 noise sources have been revised in this model update. The most significant changes to the noise model are as follows:

1. Open building doors that were previously assumed closed:
    a. Three 12 m tall doors on the west side of Phos. Bldg. R1001 (Figure 2)
    b. Man door and overhead door on the S.A.1 Compressor Building (figure not shown)
    c. Overhead door on the S.A.2 Compressor Building (Figure 3)
    d. Overhead doors (South and East) on Ammonium Nitrate R301 Bldg (Figure 4)

   e. Upper hoist access doors on Ammonium Plt. #1 Compressor Bldg. (Figure 5)
   f. Opening in second level wall, NE Urea Plt. #4. (Figure 6)
   g. Overhead doors, South Urea Plt. #4. (Figure 7)

2. Intermittent/Continuous operation of the Utilities and Phos. 30# steam vents (Figure 8). SLR has assumed, based on information provided by Agrium, that a typical condition for modelling purposes is one vent operating at a high flow rate (95,000 lb/hr, as measured), and the other operating at a lower flow rate (<50,000 lb/hr) such that its contribution is relatively insignificant.

A summary of RFO operating conditions over the course of the survey (provided by Agrium) are shown in Appendix A. Generally, all process units were operating normally with the exception of the Phosphoric Acid Unit, which was at reduced rates for most of the survey. Reduced Phosphoric Acid Unit production rates are responsible for the observed high steam flow rates through the Phos 30# vent. Equipment sound power level data for all major noise sources at RFO is provided in Appendix B. The pre- and post-update overall A-weighted sound power levels are listed for each source.

SLR investigated a number of additional vents that are located at high elevations (on structures or roofs). Agrium had indicated that silencers on these vents may have degraded over time, making them potentially significant environmental noise sources. It was not possible to access and measure these vents in the context of this project; however, the following observations were made:

- NH3-1 CO2 Vent: SLR observed this vent from the top platform on the associated vessel. The vent was audible, but not so loud that the silencer is suspected to have failed.
- NH3-2 CO2 Vent: SLR observed this vent from the top platform on the associated vessel. Again, the vent was audible, but not so loud that the silencer is suspected to have failed.
- NH3 Deaerator Vent: The vent is located on top of the NH3 Plant #9 building and is not accessible. SLR observed vent from an adjacent structure, but it was not audible. A vent silencer was installed on this deaerator in 2004, after the original plant noise survey and noise model development in 2001. As such, the noise level of this vent has been reduced by 10 dB in the noise model update based on the assumption that the silencer is effective. A 10 dB noise reduction is readily achievable by a vent silencer and therefore represents a conservative assumption. The NH3 deaerator vent noise should be re-measured for a future noise model update project.
- Urea Process Vent: SLR observed this vent from the top platform on the associated vessel. The vent was audible, but insignificant in comparison to other facility noise sources.

Figure 2: Three large open doors on Phos. Bldg. R1001

Figure 3: Overhead door on S.A.2 Compressor Bldg.

Figure 4: Overhead doors (South and East) on Ammonium Nitrate R301 Bldg.

Figure 5: Upper hoist access doors on Ammonium Plt. #1 Compressor Bldg.

Figure 6: Second level opening, NE Urea Plt. #4.

Figure 7: Overhead doors, South Urea Plt. #4.

Figure 8: 30# steam vents.

5.0 ON-SITE MODEL VALIDATION

The updated RFO noise model was used to predict facility sound levels at several on-site roadway measurement locations. The predicted sound levels were compared to measured sound levels to evaluate the noise model accuracy.

Details of the model validation results are shown by way of tables and figures in Appendix C. Table C-1 shows the measured sound level, predicted sound level, and difference, at each validation location. A number of measurement locations were outside of the rail yard where the line-of-sight between the plant and microphone was obscured by rail cars. Predicted levels immediately behind the rail cars are not reliable; therefore, model validation was not assessed at these points. Measured and predicted levels are provided at these locations for information purposes.

Typically good agreement is achieved when the measured and predicted sound levels are within ±3 dBA. Over three quarters of the 44 validation points show agreement to within 3 dBA. Two validation points show disagreement over 5 dBA:

- R24 (under-predicting by 10 dBA) - located near the southwest side of the Steam Water Treatment Plant #31.
- R36 (over-predicting by 8 dBA) – located north of the C-902 compressor building and piping.

These two plant areas should be investigated as part of a future noise model update. Although they represent local defects in the model, they do not invalidate the noise model as a whole. These local defects will not significantly impact the predicted facility noise contribution at off-site receptor locations.

The average difference between the measured and predicted sound levels is +0.7 dBA, indicating the model is generally accurate. Figure C-1 shows the validation locations on the site plot-plan, overlaid on top of the validation model noise map. Figure C-2 is a graphical presentation of the validation results.

6.0 OFF-SITE PREDICTED SOUND LEVELS

The RFO facility sound level contribution has been predicted at six off-site locations, which are identified in Figure 9. The distance and direction of these receptors from the RFO fence line are provided in Table 1. Five of these locations, identified as “Rxx”, are receptors for the original (2001) RFO noise model. Two of the locations, identified as “NCIA x” are NCIA RNMP 2014 noise monitoring locations. Predictions were conducted using the both the pre-update noise model (as represented in the 2014 NCIA RNM) and the post-update (2016) noise model. Corresponding noise contour maps are provided in Appendix D. All predictions correspond to downwind (7.5 km/h) summertime ground and atmospheric conditions that are consistent with the NCIA RNM.

Figure 9: RFO Noise Receptor Locations (Image © 2016 Google)

Table 1: Receptor Distance and Direction from RFO Fenceline

Receptor	Direction	Distance
NCIA 7 / R18	W	1.7 km
R29	NNW	2.0 km
R52	NE	1.9 km
NCIA 6	E	1.6 km
R58	SE	1.5 km
R21	SW	1.0 km

6.1 Comparison of Pre- and Post-Update Prediction Results

The predicted sound level contribution of the RFO site at each receptor is shown in Table 2, along with the difference between the pre- and post-update results. The updated model results in an increase in predicted sound level contributions at five of six receptors, and a decrease at one receptor. The greatest increase in predicted sound level is approximately 4 dBA for two receptors east of the site. The greatest decrease in predicted sound level is approximately 1 dBA for one receptor west of the site.

Table 2: Predicted Sound Level Contributions at each Receptor

	RFO Sound Pressure Level Contribution (dBA Leq)		
Receptor	2014 RNM	2016 Update	Difference (2016 Update - 2014 RNM)
NCIA 7 / R18	38.7	38.0	-0.7
R29	39.6	40.3	0.7
R52	38.6	42.4	3.8
NCIA 6	41.9	45.4	3.5
R58	42.7	44.2	1.5
R21	42.5	42.9	0.4

6.2 Order Ranked Lists

Appendix E provides order–ranked lists of the top 100 noise source contributions at four receptors (NCIA 7 / R18, R52, NCIA 6, and R21). These lists identify noise sources that have the highest impact at each receptor, and identify noise sources that have a significant impact in various directions from the site.

The order-ranked lists for receptors R52 and NCIA 6 show that the 30# steam vent is the dominant noise at these locations. Further, the dominance of the 30# steam vent at these locations indicates that the increase in predicted sound level to the east of the facility can be attributed primarily to the addition of this steam vent in the model. Note that the model assumes only one of the two 30# steam vents is operating at high flow rates (95,000 lb/hr).

Both 30# steam vents are equipped with silencers; however, they do not provide adequate noise attenuation. Agrium has initiated a silencer replacement project with the goal of attenuating the vent noise level to 82 dBA at 3 ft from the equipment, 5 ft above grade. If successful, this silencer replacement project will eliminate the 30# steam vents as dominant contributors to off-site noise levels.

6.3 Discussion of Updated Model with respect to NCIA Noise Monitoring Results

The 2013 and 2014 NCIA noise monitoring programs have shown that the measured noise levels to the east of the RFO site (NCIA 6) exceed those predicted by the RNM during the nighttime[3]. While it is not possible to identify the exact value of the discrepancy due to the variations in plant operating conditions and atmospheric conditions, the measured levels are higher than the pre-update RNM prediction by approximately 5 dBA. The NCIA survey results are reproduced in Table 3, along with the results of the survey conducted by SLR. These measurement results have all been processed (isolated) to remove contributions from non-industrial noise sources.

Observations at NCIA 6 indicate that the measured noise levels are dominated by noise emissions from the RFO facility. This implies that the pre-update noise model was under-predicting the environmental noise emissions from the RFO site. The model update prediction for NCIA 6 is 45.4 dBA, which is significantly closer to the noise monitoring results shown in Table 3. Future NCIA RNM predictions that incorporate the 2016 update to the RFO noise model should show improved agreement with noise monitoring results at receptor NCIA 6.

Table 3: Measured Isolated Nighttime Sound Level at Receptor NCIA 6

Measured Isolated Nighttime Sound Level Contribution (dBA Leq)				
Aug 21-22, 2013[1]	Aug 22-23, 2013[1]	Aug 13-14, 2014[2]	Aug 14-15, 2014[2]	Aug 10-11, 2016[3]
47.1	43.0	46.3	46.3	46.8

1 NCIA, *NCIA Regional Noise Management Plan (RNMP) Annual Report,* September 2014.
2 NCIA, *NCIA Regional Noise Management Plan (RNMP) Annual Report,* January 2016.
3 SLR Project No.: 203.50500.00000

7.0 CONCLUSION

Agrium is a member company of the NCIA and a participant in the NCIA RNMP. As an NCIA member, Agrium is required to provide and maintain a noise model of the RFO site for the NCIA RNM. RNM noise predictions for the RFO area have not been consistent with NCIA noise monitoring results, and suggest that measured RFO site noise contributions are higher than predicted on the east side of the site. To resolve this issue, Agrium has completed an update of the RFO noise model.

Approximately 50 of the over 400 noise sources in the model have been measured and updated in the model. The most significant changes are noise from open building doors that were previously assumed closed, and addition of the Phos 30# steam vent to the noise model. The updated model has been validated by comparison of predicted and measured noise levels on the plant roadways, which show it to be generally accurate. At two roadway locations the

3 NCIA, *NCIA Regional Noise Management Plan (RNMP) Annual Report,* January 2016.

predicted levels were not consistent with the measured levels; these locations should be further investigated during the next model update project, but they do not invalidate the overall model.

The updated noise model was used to predict the RFO facility noise contributions at six off-site receptor locations. These include receptors used for previous RFO noise studies and receptors corresponding to two NCIA noise monitoring locations. The model update indicates an increase in predicted sound level contributions at five receptors and a decrease at one receptor. The greatest increase in predicted sound level is approximately 4 dBA for receptors east of the RFO site. A sound level decrease of approximately 1 dBA is predicted for one receptor west of the site. The increase in predicted sound level on the east side of the site is primarily attributed to the Phos 30# steam vent.

The RFO noise model update indicates an increase of 3.5 dBA in RFO site noise contributions at the NCIA 6 receptor. This change in the RFO noise model predictions is expected to improve agreement between the next update to the RNM and the NCIA noise monitoring results for the RFO area.

8.0 STATEMENT OF LIMITATIONS

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CB/NM

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APPENDIX A
Plant Operating Conditions

Agrium Inc.
2016 Agrium Redwater Noise Model Update
SLR Project No.: 203.50100.00000

Environmental Noise Monitoring – Unit Operation Performance Summary
August 8-9/16 (SLR Consultants)

SOURCE IDENTIFICATION	August 8/16 (Up/Down/Rate?)	August 9/16 (Up/Down/Rate?)	Comments (Process issues, Venting, Flaring, anything contributing to elevated environmental noise, etc.)
Granulation - East Train Process Unit	Up at 90 tph of MAP Down 12:45 – 1:30 Up at 90 tph of MAP till 4:15 Rate cut to 75 tph of MAP Down 7:30 – 19:30 Up at 90 tph of MAP	Up at 90 tph of MAP Down 6:00 – 16:00 Up at 80 tph of MAP	Down times were due to build up in the granulator; washed out the granulator with minor maintenance occurring too.
Granulation - West Train Process Unit	Running at 45 tph of AS; Limited to 32-34 tph when East down	Running at 45 tph of AS; Limited to 32-34 tph when East down	Running normal.
Phosphoric Acid Process Unit	00:00-05:15, rate 1100 tpd 05:15-14:00, rate 750 tpd 14:00-23:30, rate 350 tpd 23:30-23:59, rate ramping up to 650-700 tpd	00:00-05:45, rate 650-700 tpd 05:45-18:45, rate 350 tpd 18:45-23:59, rate 400 tpd	Unit at reduced rates due to East Train Granulation down, evaporator capacity reduced and steam venting increased. Table of rates and vent rates attached below.
Sulphuric Acid I Process Units	Running at 2025 tpd	Running at 2000 tpd	Unit running steady.
Sulphuric Acid II Process Units	Running at 1215 tpd	Running at 1215 tpd	Unit running steady.
SOURCE IDENTIFICATION	**August 8/16 (Up/Down/Rate?)**	**August 9/16 (Up/Down/Rate?)**	**Comments (Process issues, Venting, Flaring, anything contributing to elevated environmental noise, etc.)**
Ammonia I Process Unit	117% to 120% to 118%	118% to 119%	Normal rate changes. No venting, flaring or other issues contributing to noise.
Ammonia II Process Unit	113% to 116% to 106% to 116%	116% to 116.5% to 111% to 115%	Normal rate changes. No venting, flaring or other issues contributing to noise.
Ammonium Nitrate Process Unit	108%	108%	Normal operation with no unusual flaring, venting, upsets, etc.
Nitric Acid Process Unit	113%	113%	Normal operation with no unusual flaring, venting, upsets, etc.
Urea Process Unit	127%	127%	Normal operation.
Utilities 30# Steam Vents	Rates changed, see comments and below	Rates changed, see comments and below	See below table and graph (see excel sheet for both 30# steam vent rates and data from the 10-11th).

Tabular relationship between Granulation East Train Process Unit (ET), Phos Acid Process Unit (PA) rate, and Phos 30# Steam Venting (A21F156).
(ET goes down reducing requirement for PA, PA reduces steam to evaporation tanks and rate, and therefore steam vent rate is increased)

	A21F156.PV	06CC664.PV
	MLBSH	TONNE/D
	30# STEAM VENT PHOS	PHOS ACID UNIT PRODUCTION RATE
Timestamp	A21F156.PV - Average	06CC664.PV - Average
8/8/2016	0.5	1100
8/8/2016 1:00	1.7	1100
8/8/2016 2:00	0.0	1100
8/8/2016 3:00	0.0	1100
8/8/2016 4:00	1.3	1007
8/8/2016 5:00	7.9	750
8/8/2016 6:00	10.7	750
8/8/2016 7:00	18.1	750
8/8/2016 8:00	53.9	750
8/8/2016 9:00	62.1	750
8/8/2016 10:00	63.5	750
8/8/2016 11:00	66.7	750
8/8/2016 12:00	76.2	750
8/8/2016 13:00	95.0	732
8/8/2016 14:00	95.0	550
8/8/2016 15:00	95.0	550
8/8/2016 16:00	95.0	372
8/8/2016 17:00	95.0	350
8/8/2016 18:00	95.0	350
8/8/2016 19:00	95.0	350
8/8/2016 20:00	89.5	350
8/8/2016 21:00	68.9	350
8/8/2016 22:00	61.7	350
8/8/2016 23:00	73.6	553
8/9/2016 0:00	80.4	650
8/9/2016 1:00	90.2	661
8/9/2016 2:00	93.3	665

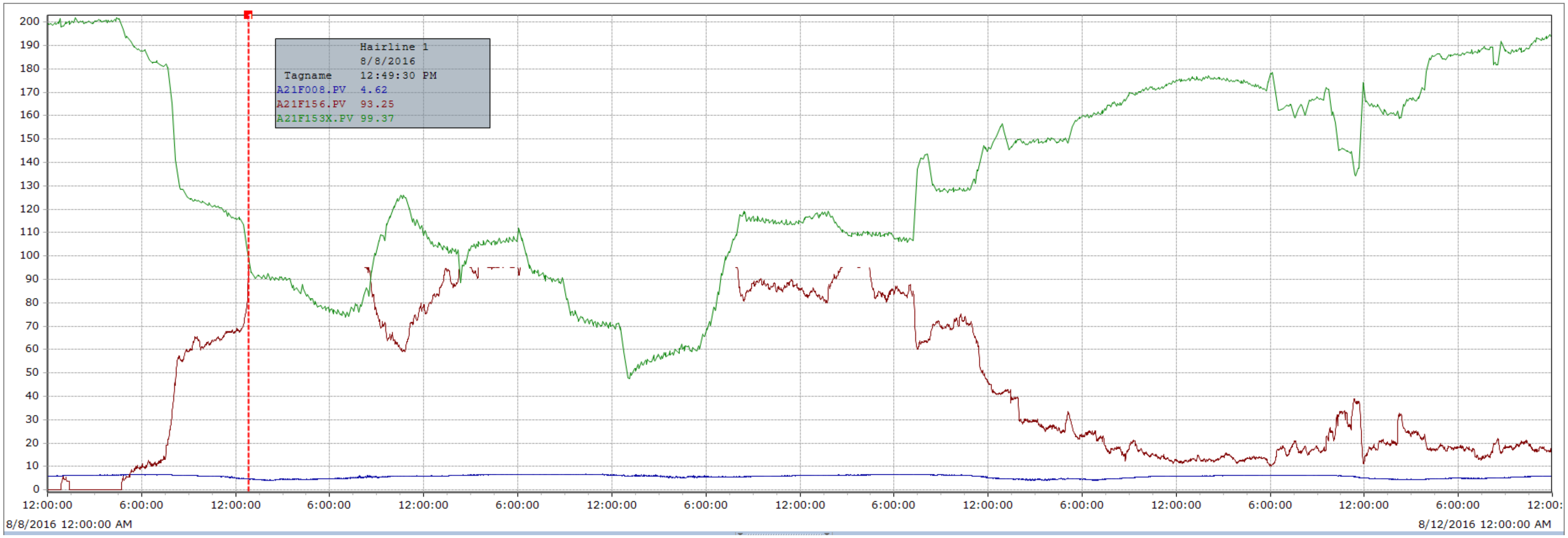
	A21F156.PV	06CC664.PV
	MLBSH	TONNE/D
	30# STEAM VENT PHOS	PHOS ACID UNIT PRODUCTION RATE
Timestamp	A21F156.PV - Average	06CC664.PV - Average
8/9/2016 3:00	94.0	685
8/9/2016 4:00	95.0	700
8/9/2016 5:00	95.0	661
8/9/2016 6:00	94.7	350
8/9/2016 7:00	95.0	350
8/9/2016 8:00	95.0	350
8/9/2016 9:00	95.0	350
8/9/2016 10:00	95.0	350
8/9/2016 11:00	95.0	350
8/9/2016 12:00	95.0	350
8/9/2016 13:00	95.0	350
8/9/2016 14:00	95.0	350
8/9/2016 15:00	95.0	350
8/9/2016 16:00	95.0	350
8/9/2016 17:00	95.0	350
8/9/2016 18:00	95.0	368
8/9/2016 19:00	95.0	386
8/9/2016 20:00	85.2	390
8/9/2016 21:00	88.5	399
8/9/2016 22:00	86.3	400
8/9/2016 23:00	87.6	400
8/10/2016 0:00	84.4	400

Graphical relationship between Granulation East Train Process Unit (ET), Phos Acid Process Unit (PA) rate, and Phos 30# Steam Venting (A21F156).
(ET goes down reducing requirement for PA, PA reduces steam to evaporation tanks and rate, and therefore steam vent rate is increased)

30# venting was at maximum measurable from:

- Aug 8: 12:52PM to 8:20PM
- Aug 9: 2:24AM to 7:56PM

Please see below trend (maroon line – main vent flow, green line – total steam flow to evaps).



APPENDIX B
Equipment Sound Power Levels

Agrium Inc.
2016 Agrium Redwater Noise Model Update
SLR Project No.: 203.50100.00000

Table B-1

Equipment Sound Power Levels

Agrium Redwater

Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB) Before Update	Updated	Change	Remarks
3201 cell 1	107.5	107.5	0.0	
3201 cell 1 motor	81.4	81.4	0.0	
3201 cell 2	107.5	107.5	0.0	
3201 cell 2 motor	81.4	81.4	0.0	
3201 cell 3	107.5	107.5	0.0	
3201 Cell 3 Drive Motor	81.4	81.4	0.0	
3201 cell 4	107.5	107.5	0.0	
3201 Cell 4 Drive Motor	81.4	81.4	0.0	
3201 cell 5	107.5	107.5	0.0	
3201 Cell 5 Drive Motor	81.4	81.4	0.0	
3201 cell 6	107.5	107.5	0.0	
3201 Cell 6 Drive Motor	81.4	81.4	0.0	
3201 Cell 7 Drive Motor	81.4	81.4	0.0	
36 drive motor Cell 1	89.1	89.1	0.0	
36 drive motor Cell 2	89.1	89.1	0.0	
36 drive motor Cell 3	89.1	89.1	0.0	
36 drive motor Cell 4	89.1	89.1	0.0	
36 drive motor Cell 5	89.1	89.1	0.0	
36 drive motor Cell 6	89.1	89.1	0.0	
36 drive motor Cell 7	89.1	89.1	0.0	
Hyd Power Pack	89.0	89.0	0.0	
09 ID Fan 01	81.4	81.4	0.0	
09 ID Fan 02	81.4	81.4	0.0	
09 ID Fan 03	81.4	81.4	0.0	
09 ID Fan 04	81.4	81.4	0.0	
Boiler 1 FD Fan	116.0	116.0	0.0	
Boiler 2 FD Fan	103.1	103.1	0.0	
Boiler 3 FD Fan	110.9	--	-110.9	Fan Insignificant
R0401 Urea A Gran Air Inlet	7.1	7.1	0.0	
R0401 Urea B Gran Air Inlet	7.1	7.1	0.0	
R0401 Urea C Gran Air Inlet	7.1	7.1	0.0	
R0401 Urea D Gran Air Inlet	7.1	7.1	0.0	
SA1 Blower Inlet Filter	105.5	124.9	19.4	Updated
3201 cell 7	107.5	107.5	0.0	
3201 cell 8 motor	81.4	81.4	0.0	
Boiler 1 Inlet	105.6	105.6	0.0	
Boiler 1 Stack	91.1	91.1	0.0	
Boiler 1 Stack	96.0	96.0	0.0	
Boiler 1 Stack	93.3	93.3	0.0	
Boiler 2 Inlet	98.5	98.5	0.0	
Boiler 3 Inlet	104.4	--	-104.4	Inlet Insignificant
01 Furnace East Face Burner 2	105.1	105.1	0.0	
01 Furnace East Face Burner 3	105.1	105.1	0.0	
01 Furnace East Face Burner 1	105.1	105.1	0.0	
01 Furnace West Face Burner 1	105.1	105.1	0.0	

Table B-1
Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB)			Remarks
	Before Update	Updated	Change	
01 Furnace West Face Burner 2	105.1	105.1	0.0	
01 Furnace West Face Burner 3	105.1	105.1	0.0	
East 09 Furnace East Face attemp	114.9	114.9	0.0	
East 09 Furnace West Face attemp	114.7	114.7	0.0	
O1 Furnace N Fan Exhaust	105.9	105.9	0.0	
O1 Furnace S Fan Exhaust	104.5	104.5	0.0	
01 Furnace Fuel Gas Pipe	106.9	106.9	0.0	
302 1st stage discharge 2	112.1	112.1	0.0	
Boiler 1 Inlet Duct	99.8	99.8	0.0	
Boiler 2 Inlet Duct	101.8	101.8	0.0	
Boiler 3 Inlet Duct	108.0	108.0	0.0	
C902 1st stage discharge	117.1	113.4	-3.7	Updated (GCT 902 Project)
C902 1st stage discharge E925 He	107.2	107.1	-0.1	Updated (GCT 902 Project)
C902 1st stage suction dn sil	108.2	109.1	0.9	Updated (GCT 902 Project)
C902 1st stage suction up sil	98.7	101.1	2.4	Updated (GCT 902 Project)
C902 2nd stage discharge	105.1	109.6	4.5	Updated (GCT 902 Project)
C902 2nd stage discharge	110.7	110.7	0.0	
C902 2nd stage suction	107.8	116.6	8.8	Updated (GCT 902 Project)
C902 3rd stage suction	113.9	111.7	-2.2	Updated (GCT 902 Project)
C902 4th stage discharge	111.5	111.5	0.0	
C902 header	95.3	95.3	0.0	
GT Exhaust Duct to Reformer 12ft	102.1	102.1	0.0	
GT Exhaust Duct to Reformer 4ft	96.0	96.0	0.0	
GT Exhaust Duct to Reformer 4ft	96.0	96.0	0.0	
GT Exhaust Duct to Reformer 4ft	96.0	96.0	0.0	
GT Exhaust Duct to Reformer 4ft	96.0	96.0	0.0	
GT Exhaust Duct to Reformer 6ft	99.1	99.1	0.0	
GT Exhaust Duct to Reformer 8ft	102.1	102.1	0.0	
GT Exhaust Duct to Reformer 8ft	102.1	102.1	0.0	
SA1 Blower Discharge	113.3	106.3	-7.0	Geometry Updated
SA2 Blower Inlet Pipe	108.1	98.1	-10.0	Updated
SA2 Blower outlet Pipe	110.1	110.1	0.0	
Gas Supply Valve	104.3	104.3	0.0	
west 09 Furnace East Face attemp	114.9	114.9	0.0	
west 09 Furnace West Face attemp	114.9	114.9	0.0	
150lb steam CV	102.7	102.7	0.0	
150lb steam CV	105.3	105.3	0.0	
150lb steam CV	108.3	108.3	0.0	
ANU Process Vent	97.8	97.8	0.0	
CO2 Vent	89.5	89.5	0.0	
CO2 Vent Am1	102.2	102.2	0.0	
Dry Vent	7.1	7.1	0.0	
Gran E Baghouse Vent	7.1	7.1	0.0	
Gran W Vap Vent	7.1	7.1	0.0	
R0401 North Mid Tall Section Ine	91.9	91.9	0.0	

Table B-1

Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB) Before Update	Updated	Change	Remarks
Urea Process Vent	84.0	84.0	0.0	
Vent 50lb steam	100.3	100.3	0.0	
Wet Vent	7.1	7.1	0.0	
Ammonia Dearator Vent	113.0	113.0	0.0	
AN Brinks	112.9	112.9	0.0	
Hyd vibrator for screw conv	108.3	108.3	0.0	
Urea Granulation L0451	86.7	86.7	0.0	
AN Prill Tower 1	104.8	104.8	0.0	
AN Prill Tower 2	104.8	104.8	0.0	
AN Prill Tower 3	104.8	104.8	0.0	
AN Prill Tower 4	104.8	104.8	0.0	
AN Prill Tower 5	104.8	104.8	0.0	
AN Prill Tower 6	104.8	104.8	0.0	
AN Prill Tower 7	104.8	104.8	0.0	
AN Prill Tower 8	104.8	104.8	0.0	
R2421 East Wall Dust Collector	89.9	89.9	0.0	
31 Tower East Face	81.0	81.0	0.0	
31 Tower North Face	84.6	84.6	0.0	
31 Tower South Face	84.6	84.6	0.0	
31 Tower West Face	81.0	81.0	0.0	
32 Water Splash	107.5	107.5	0.0	
Cooling Tower 36 Cell 1	109.2	109.2	0.0	
Cooling Tower 36 Cell 2	109.2	109.2	0.0	
Cooling Tower 36 Cell 3	109.2	109.2	0.0	
Cooling Tower 36 Cell 4	109.2	109.2	0.0	
Cooling Tower 36 Cell 5	109.2	109.2	0.0	
Cooling Tower 36 Cell 6	109.2	109.2	0.0	
Cooling Tower 36 Cell 7	109.2	109.2	0.0	
Roof 31 Tower	81.2	81.2	0.0	
SA 2 CT N Face	107.0	107.0	0.0	
SA 2 CT S Face	107.0	107.0	0.0	
SA1 CT East Face	99.3	99.3	0.0	
SA1 CT West Face	92.3	92.3	0.0	
Watersplash 36 Tower East	108.8	108.8	0.0	
Watersplash 36 Tower West	108.8	108.8	0.0	
01 Ammonia Comp Bldg East Wall	76.3	76.3	0.0	
01 Ammonia Comp Bldg East Wall	86.4	86.4	0.0	
01 Ammonia Comp Bldg East Wall	94.1	94.1	0.0	
01 Ammonia Comp Bldg N Top E	--	101.7	--	Added, Open Door
01 Ammonia Comp Bldg N Top W	--	101.7	--	Added, Open Door
01 Ammonia Comp Bldg North Wall	--	84.7	--	Added, Open Door
01 Ammonia Comp Bldg South Wall	82.7	82.7	0.0	
01 Ammonia Comp Bldg South Wall	80.8	80.8	0.0	
01 Ammonia Comp Bldg West Wall	85.5	85.5	0.0	
01 Ammonia Furnace Fan Enclosure	75.2	75.2	0.0	

Table B-1
Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB) Before Update	Updated	Change	Remarks
01 Ammonia Furnace Fan Enclosure	79.3	79.3	0.0	
01 Ammonia Furnace Fan Enclosure	102.8	102.8	0.0	
01 Ammonia Furnace Fan Enclosure	79.3	79.3	0.0	
01 Ammonia Pump Bldg North Wall	83.9	83.9	0.0	
01 Ammonia Pump Bldg South Wall	83.9	83.9	0.0	
01 Ammonia Pump Bldg West Wall	77.6	77.6	0.0	
01 Ammonia Pump Bldg West Wall	93.0	93.0	0.0	
01 Furnace East Face	111.6	111.6	0.0	
01 Furnace North Face	109.4	109.4	0.0	
01 Furnace North Face Void	101.5	101.5	0.0	
01 Furnace South Face	109.4	109.4	0.0	
01 Furnace South Face Void	101.5	101.5	0.0	
01 Furnace West Face	111.6	111.6	0.0	
09 Air Compressor Building East	92.3	92.3	0.0	
09 Air Compressor Building North	85.1	85.1	0.0	
09 Air Compressor Building South	85.1	85.1	0.0	
09 Air Compressor Building West	92.3	92.3	0.0	
09 North Building East Wall	90.7	90.7	0.0	
09 North Building North wall	87.6	87.6	0.0	
09 North Building South Wall	87.6	87.6	0.0	
09 North Building West Wall	90.7	90.7	0.0	
09 South Intermediate Building E	86.8	86.8	0.0	
09 South Intermediate Building N	81.7	81.7	0.0	
09 South Intermediate Building N	81.8	81.8	0.0	
09 South Intermediate Building S	84.7	84.7	0.0	
09 South Intermediate Building W	87.2	87.2	0.0	
09 South Intermediate Building W	76.4	76.4	0.0	
09 South Low Building East Wall	82.5	82.5	0.0	
ANU Prill Tower Opening 1	86.8	86.8	0.0	
ANU Prill Tower Opening 2	86.8	86.8	0.0	
ANU Prill Tower Opening 3	86.8	86.8	0.0	
ANU R301 South OH	--	109.7	--	Added, Open Door
ANU R301 South Wall	76.5	76.4	-0.1	Geometry Updated
ANU R301 West Wall	76.5	76.5	0.0	
ANU R301conveyor E OH	--	113.8	--	Added, Open Door
ANU R301conveyor South Wall	66.9	65.2	-1.7	Geometry Updated
ANU R301conveyor West Wall	71.5	71.5	0.0	
ANU R301West Wall	76.5	76.5	0.0	
Building 31 East Wall	83.5	83.5	0.0	
Building 31 North 1 Wall	80.2	80.2	0.0	
Building 31 North 2 Wall	86.2	86.2	0.0	
Building 31 South Wall	80.8	80.8	0.0	
Building 31 West 3 Wall	77.8	77.8	0.0	
Building 31 West Wall	78.9	78.9	0.0	
Building 31 West Wall Door	95.3	95.3	0.0	

Table B-1
Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB)			Remarks
	Before Update	Updated	Change	
Building 31 West Wall 2	78.7	78.7	0.0	
Copco Compressor Room 31 East Wa	81.1	81.1	0.0	
Copco Compressor Room 31 South W	85.1	85.1	0.0	
Copco Compressor Room 31 West Wa	81.1	81.1	0.0	
E Face Inlet 201 Turbine	--	110.0	--	Updated (refined model)
E Face Nitric Tower 201	55.2	55.2	0.0	
East 09 Furnace East Face	105.5	105.5	0.0	
East 09 Furnace North Face	101.2	101.2	0.0	
East 09 Furnace South Face	101.2	101.2	0.0	
East 09 Furnace West Face	105.5	105.5	0.0	
East Boiler 1	98.1	98.1	0.0	
East Boiler 2	98.1	98.1	0.0	
East Boiler 3	99.5	99.5	0.0	
Gran South Building East wall	94.4	94.4	0.0	
Gran South Building South wall	91.6	91.6	0.0	
Gran South Building West wall	94.3	94.3	0.0	
louvre - Gran South Building Wes	96.1	96.1	0.0	
Main Building 201 E Face	82.7	82.7	0.0	
Main Building 201 S Face	78.3	78.3	0.0	
Main Building 201 W Face	82.7	82.7	0.0	
N extension Phos Acid East Wall	80.9	80.9	0.0	
N extension Phos Acid North Wall	95.0	95.0	0.0	
N extension Phos Acid West Wall	90.5	90.5	0.0	
N Face Inlet 201 Turbine	113.2	110.0	-3.2	Updated
N Face Nitric Tower 201	56.9	56.9	0.0	
North Boiler 1	94.3	94.3	0.0	
North Boiler 2	94.3	94.3	0.0	
North Boiler 3	95.0	95.0	0.0	
North CM103 Ext east wall	78.0	78.0	0.0	
North CM103 Ext north wall	80.5	80.5	0.0	
North CM103 Ext west wall	78.0	78.0	0.0	
North Wall opening	107.2	107.2	0.0	
Phos Acid East Annex East Wall	85.9	85.9	0.0	
Phos Acid East Annex South Wall	80.9	80.9	0.0	
Phos Mid East Wall	94.7	94.7	0.0	
Phos Mid North Wall	99.3	99.3	0.0	
Phos Mid South Wall	99.3	99.3	0.0	
Phos Mid West Wall	94.7	94.7	0.0	
Phos North lower East Wall	87.8	87.8	0.0	
Phos North lower North Wall	95.4	95.4	0.0	
Phos North lower West Wall	87.8	87.8	0.0	
Phos North upper East Wall	93.1	93.1	0.0	
Phos North upper North Wall	98.0	98.0	0.0	
Phos North upper North Wall open	100.9	100.9	0.0	
Phos North upper West Wall	93.1	93.1	0.0	

Table B-1

Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB) Before Update	Updated	Change	Remarks
Phos Scrubber East Wall	87.0	87.0	0.0	
Phos Scrubber South Wall	88.1	88.1	0.0	
Phos South South Wall	98.2	98.2	0.0	
Phos South West Wall	93.1	93.1	0.0	
R0401 Mid Low Section East wall	86.1	86.1	0.0	
R0401 Mid Low Section North Wal	85.0	85.0	0.0	
R0401 Mid Low Section South wal	89.1	89.1	0.0	
R0401 Mid Low Section West wall	83.7	83.7	0.0	
R0401 Mid Low Section West Wall	82.4	82.4	0.0	
R0401 North Low Section East Wal	88.2	88.2	0.0	
R0401 North Low Section East Wal	88.2	88.2	0.0	
R0401 North Low Section North Wa	91.3	91.3	0.0	
R0401 North Low Section SouthWal	86.6	86.6	0.0	
R0401 North Low Section West Wal	83.6	83.6	0.0	
R0401 North Mid High Section Eas	89.8	89.8	0.0	
R0401 North Mid High Section Nor	89.7	89.7	0.0	
R0401 North Mid High Section Sou	80.4	80.4	0.0	
R0401 North Mid High Section Wes	84.4	84.4	0.0	
R0401 North Mid High Section Wes	88.4	88.0	-0.4	Geometry Updated
R0401 North Mid High Section Wes	84.9	84.9	0.0	
R0401 North Mid Tall Section eas	91.2	91.2	0.0	
R0401 North Mid Tall Section Nor	89.4	89.4	0.0	
R0401 North Mid Tall Section Sou	89.4	89.4	0.0	
R0401 North Mid Tall Section Wes	91.2	91.2	0.0	
R0401 opening in west wall	--	104.7	--	Added, Open Wall Section
R0401 S Mid Tall Section East Wa	86.4	86.4	0.0	
R0401 S Mid Tall Section North W	92.8	92.8	0.0	
R0401 S Mid Tall Section South W	92.8	92.8	0.0	
R0401 S Mid Tall Section West Wa	86.4	86.4	0.0	
R0401 Urea South Building East W	89.1	89.1	0.0	
R0401 Urea South Building South	--	92.2	--	Updated, Model Refined
R0401 Urea South Building W Lou	--	9.5	--	Updated, Model Refined
R0401 Urea South OH 1	--	101.1	--	Updated, Model Refined
R0401 Urea South OH 2	--	101.1	--	Updated, Model Refined
R0401 Urea South OH 3	--	101.1	--	Updated, Model Refined
R0401 Urea South OH 4	--	101.1	--	Updated, Model Refined
R2421 East Wall	105.4	105.4	0.0	
R2421 Fan Opening	107.4	107.4	0.0	
R2421 North Wall	100.2	100.2	0.0	
R2421 Roof	104.9	104.9	0.0	
R2421 South Wall	100.3	100.3	0.0	
R2421 West Wall	105.5	105.5	0.0	
R3502 Water Treatment Storage Ea	79.0	79.0	0.0	
R3502 Water Treatment Storage Ea	79.0	79.0	0.0	
R3502 Water Treatment Storage No	80.5	80.5	0.0	

Table B-1
Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB)			Remarks
	Before Update	Updated	Change	
R3502 Water Treatment Storage So	80.5	80.5	0.0	
Roof	104.6	104.6	0.0	
Roof 09 North Building	92.8	92.8	0.0	
Roof 01 Ammonia Comp Bldg	88.1	88.1	0.0	
Roof 01 Ammonia Pump Bldg	84.1	84.1	0.0	
Roof 01 Furnace	110.0	110.0	0.0	
Roof 09 Air Compressor Building	89.8	89.8	0.0	
Roof 09 South Intermediate Build	88.9	88.9	0.0	
Roof 201	81.6	81.6	0.0	
Roof 201 Tower	51.7	51.7	0.0	
Roof ANU R301	78.4	78.4	0.0	
Roof ANU R301conveyor	73.7	73.7	0.0	
Roof Building 31	90.3	90.3	0.0	
Roof Copco Compressor Room 31	85.3	85.3	0.0	
Roof East 09 Furnace	104.9	104.9	0.0	
Roof Gran South Building	94.2	94.2	0.0	
Roof N extension Phos Acid	93.2	93.2	0.0	
Roof phos acid building	87.5	87.5	0.0	
Roof Phos Mid	98.2	98.2	0.0	
Roof Phos North lower	95.2	95.2	0.0	
Roof Phos North upper	95.2	92.7	-2.5	
Roof Phos South	92.7	92.7	0.0	
Roof R0401 Mid Low Section	91.5	91.5	0.0	
Roof R0401 North Low Section	93.5	93.5	0.0	
Roof R0401 North Mid High Sectio	89.4	89.4	0.0	
Roof R0401 North Mid Tall Sectio	86.8	86.8	0.0	
Roof R0401 S Mid Tall Section	89.0	89.0	0.0	
Roof R0401 Urea South Building	93.9	93.9	0.0	
Roof R3502 Water Treatment Stora	87.7	87.7	0.0	
Roof S Annex Room 31	76.2	76.2	0.0	
Roof SA1 Blower Room	93.7	93.7	0.0	
Roof SA1 Cooling Tower Pump Hous	75.4	75.4	0.0	
Roof SA2 Blower Building	68.9	68.9	0.0	
Roof South Part Phos Building	87.5	87.5	0.0	
Roof South Part Phos Building Up	83.6	83.6	0.0	
S Annex Room 31 east Wall	67.0	67.0	0.0	
S Annex Room 31 South Wall	76.1	76.1	0.0	
S Face Inlet 201 Turbine	113.2	110.0	-3.2	Updated
S Face Nitric Tower 201	56.9	56.9	0.0	
S face Phos Building	86.1	86.1	0.0	
SA1 Blower Room E man door	--	103.2	--	Added, Open Door
SA1 Blower Room East Wall	100.6	90.0	-10.6	Updated
SA1 Blower Room North Wall	99.8	89.7	-10.1	Updated
SA1 Blower Room South Wall	99.8	89.7	-10.1	Updated
SA1 Blower Room West Dbl Dr	--	106.2	--	Added, Open Door

Table B-1
Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB) Before Update	Updated	Change	Remarks
SA1 Blower Room West Wall	100.6	90.3	-10.3	Updated
SA1 Cooling Tower Pump House Nor	73.3	73.3	0.0	
SA1 Cooling Tower Pump House Nor	71.2	71.2	0.0	
SA1 Cooling Tower Pump House Sou	75.4	75.4	0.0	
SA1 Cooling Tower Pump House Wes	72.5	72.5	0.0	
SA1 Cooling Tower Pump House Wes	68.2	68.2	0.0	
SA1 Cooling Tower Pump House Wes	70.5	70.5	0.0	
SA2 Blower Building East OH	--	101.8	--	Added, Open Door
SA2 Blower Building North Wall	66.5	66.5	0.0	
SA2 Blower Building South 1 Wall	63.1	63.1	0.0	
SA2 Blower Building South 2 Wall	63.8	63.8	0.0	
SA2 Blower Building West 1 Wall	65.5	64.4	-1.1	
SA2 Blower Building West 2 Wall	59.4	59.4	0.0	
SA2 Blower Building West Wall	66.4	66.4	0.0	
SA2 Cooling Tower Pump House Eas	78.2	78.2	0.0	
SA2 Cooling Tower Pump House Nor	79.0	79.0	0.0	
SA2 Cooling Tower Pump House Sou	79.0	79.0	0.0	
SA2 Cooling Tower Pump House Wes	78.2	78.2	0.0	
South Part Phos Building East Wa	87.7	87.7	0.0	
South Part Phos Building Upper e	84.4	84.4	0.0	
South Part Phos Building Upper S	86.4	86.4	0.0	
South Part Phos Building Upper W	94.0	94.0	0.0	
South Part Phos Building West Wa	97.3	97.3	0.0	
South wall - Urea annex West	78.8	78.8	0.0	
South Wall opening	105.4	105.4	0.0	
W Face Inlet 201 Turbine	--	110.0	--	Updated (refined model)
W Face Nitric Tower 201	55.2	55.2	0.0	
W2 face Phos Building	95.5	95.0	-0.5	Updated (refined model)
W2 Phos Building open door 1	--	111.4	--	Added, Open Door
W2 Phos Building open door 2	--	111.4	--	Added, Open Door
W2 Phos Building open door 3	--	111.4	--	Added, Open Door
west 09 Furnace East Face	105.5	105.5	0.0	
west 09 Furnace South Face	100.9	100.9	0.0	
west 09 Furnace West Face	105.5	105.5	0.0	
West 09 Furnace North Face	100.9	100.9	0.0	
West Boiler 1	98.1	98.1	0.0	
West Boiler 2	98.1	98.1	0.0	
West Boiler 3	99.5	99.5	0.0	
West wall - Urea annex West	83.2	83.2	0.0	
09 Air Compressor Building West	100.3	100.3	0.0	
Phos Mid East Wall Fan 1	105.6	105.6	0.0	
Phos Mid South Wall Fan 3	101.8	105.6	3.8	
Phos Mid West Wall Fan 4	105.6	105.6	0.0	
Phos Scrubber East Wall Vent	105.6	105.6	0.0	
R2421 Low Level fan	94.0	94.0	0.0	

Table B-1
Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB)			Remarks
	Before Update	Updated	Change	
Vent Bldg 31	101.8	101.8	0.0	
1-P-125-1	99.6	99.6	0.0	
1-P-125-2	96.9	96.9	0.0	
1-P-203-1	98.2	98.2	0.0	
1-P-204-1	97.6	97.6	0.0	
1-P-204-2	101.8	101.8	0.0	
1-P-212	98.9	98.9	0.0	
1-P-213	99.2	99.2	0.0	
1-P-213 b	105.0	105.0	0.0	
1-P-218	100.6	100.6	0.0	
3201 cell 8	107.5	107.5	0.0	
Filter Vent Expansion Stack (D67	77.8	77.8	0.0	
Gran E Dryer	94.6	94.6	0.0	
Gran E Reactor	94.9	94.9	0.0	
Gran W Dryer	93.9	93.9	0.0	
Gran W Reactor	90.3	90.3	0.0	
Nitric Acid Combuster	93.5	93.5	0.0	
P2014A	90.3	90.3	0.0	
P2014B	90.3	90.3	0.0	
P20151A	102.0	102.0	0.0	
P20151A	95.4	95.4	0.0	
P20151A	87.3	87.3	0.0	
P20151A	88.3	88.3	0.0	
P20151A	90.4	90.4	0.0	
P20151A	86.0	86.0	0.0	
P20151A	83.6	83.6	0.0	
P20151A	92.0	92.0	0.0	
P20152	87.4	87.4	0.0	
P20153	88.5	88.5	0.0	
P2105	89.2	89.2	0.0	
P2106A	92.0	92.0	0.0	
Phos Attack Tk (D665)	85.1	85.1	0.0	
Phos Filter (D1014)	93.9	93.9	0.0	
PM20154A	90.3	90.3	0.0	
PM20154B	98.7	98.7	0.0	
PV006	95.0	95.0	0.0	
PV009	95.0	95.0	0.0	
PV206	87.9	87.9	0.0	
S.A. - 2 Stack	73.3	73.3	0.0	
SA-1Stack	90.9	90.9	0.0	
SA1 Mid Cooling Cell	100.5	100.5	0.0	
SA1 North Cooling Cell	100.5	100.5	0.0	
SA1 South Cooling Cell	100.5	100.5	0.0	
SA2 East Cooling Cell	99.2	99.2	0.0	
SA2 West Cooling Cell	99.2	99.2	0.0	

Table B-1
Equipment Sound Power Levels
Agrium Redwater
Summertime Conditions

Equipment Noise Source Tag/Description	Sound Power Level (dB)			Remarks
	Before Update	Updated	Change	
Urea SV relief	7.1	7.1	0.0	
GCT 902 Fin-Fan Cooler East	--	89.3	--	Added
GCT 902 Fin-Fan Cooler North	--	86.8	--	Added
GCT 902 Fin-Fan Cooler South	--	87.3	--	Added
GCT 902 Fin-Fan Cooler West	--	89.5	--	Added
Phos 30# steam vent North	--	0.0	--	Added (not venting)
Phos 30# steam vent South	--	124.9	--	Added (venting at 95,000 lb/hr)
Redwater Site Total	**129.3**	**131.8**	**2.5**	

APPENDIX C
Model Validation Tables and Figures

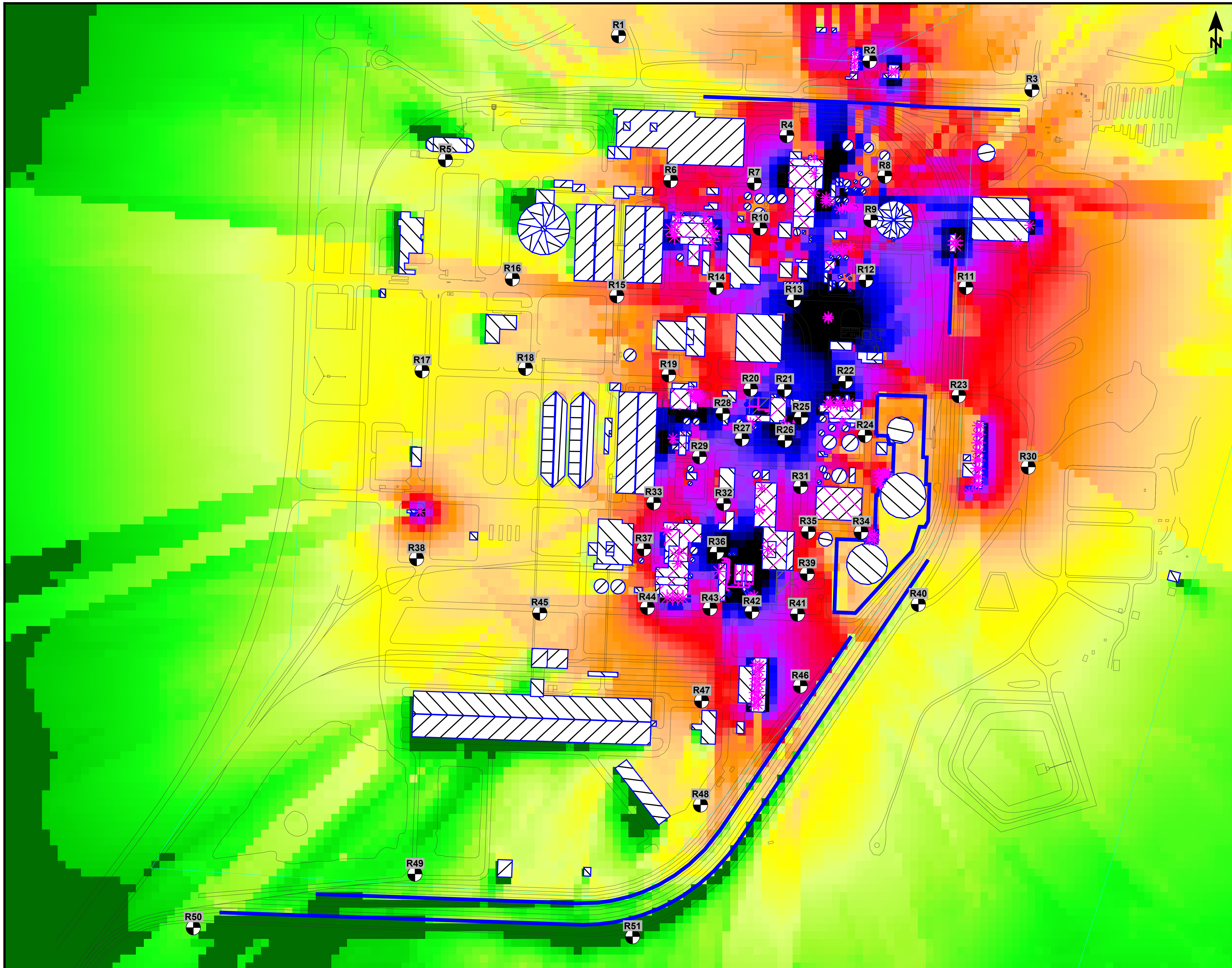
Agrium Inc.
2016 Agrium Redwater Noise Model Update
SLR Project No.: 203.50100.00000

Table C-1
Model Validation
Agrium Redwater
Summertime Conditions

Location Designation	Sound Pressure Level (dBA)			Remarks
	Measured	Predicted	Difference	
R1	56.8	56.6	-0.2	
R2	69.6	76.3		Rail cars between location and plant
R3	54.4	61.0		Rail cars between location and plant
R4	72.9	74.5	1.6	
R5	54.3	56.6	2.3	
R6	68.4	71.3	2.9	
R7	74.3	75.5	1.2	
R8	69.6	70.7	1.1	
R9	77.5	75.3	-2.2	
R10	72.2	71.7	-0.5	
R11	65.7	71.7		Rail cars between location and plant
R12	77.0	81.1	4.1	Varriable Steam Vent Level
R13	84.4	82.7	-1.7	
R14	73.0	74.2	1.2	
R15	63.6	67.3	3.7	Varriable Steam Vent Level
R16	58.3	62.5	4.2	Varriable Steam Vent Level
R17	56.1	57.5	1.4	
R18	57.4	59.0	1.6	
R19	68.1	69.6	1.5	
R20	79.1	74.8	-4.3	
R21	80.3	80.0	-0.3	
R22	81.4	80.5	-0.9	
R23	65.3	70.7		Rail cars between location and plant
R24	79.3	69.3	-10.0	Potential open door at south side of Steam Water Treatment Plt. # 31
R25	82.3	85.6	3.3	
R26	83.6	84.7	1.1	
R27	81.3	78.9	-2.4	
R28	77.8	79.5	1.7	
R29	78.2	75.2	-3.0	
R30	68.2	66.5	-1.7	

Table C-1
Model Validation
Agrium Redwater
Summertime Conditions

Location Designation	Sound Pressure Level (dBA)			Remarks
	Measured	Predicted	Difference	
R31	75.4	75.5	0.1	
R32	73.2	74.4	1.2	
R33	71.0	72.4	1.4	
R34	71.7	71.1	-0.6	
R35	71.8	71.6	-0.2	
R36	79.1	87.1	8.0	Over-predicting sound level at north side of C-902 bldg
R37	72.1	72.5	0.4	
R38	59.0	60.7	1.7	
R39	70.2	72.4	2.2	
R40	59.7	56.4	-3.3	
R41	69.5	73.4	3.9	
R42	77.7	79.2	1.5	
R43	72.4	72.4	0.1	
R44	71.0	71.7	0.7	
R46	71.9	73.6	1.7	
R47	68.9	66.8	-2.1	
R48	59.0	58.0	-1.0	
R49	50.6	50.9	0.3	
R50	46.2	51.1		Rail cars between location and plant
R51	47.1	46.5		Rail cars between location and plant
		Average Difference	**0.5**	



Legend
- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Ground effects
- Receiver
- Wall or Rail Cars

Scale 1:4800

0 50 100 200 300 m

Sound Level (dBA)

	<= 47.5
47.5 <	<= 50.0
50.0 <	<= 52.5
52.5 <	<= 55.0
55.0 <	<= 57.5
57.5 <	<= 60.0
60.0 <	<= 62.5
62.5 <	<= 65.0
65.0 <	<= 67.5
67.5 <	<= 70.0
70.0 <	<= 72.5
72.5 <	<= 75.0
75.0 <	<= 77.5
77.5 <	<= 80.0
80.0 <	<= 82.5
82.5 <	<= 85.0
85.0 <	

Redwater Facility
Model Validation Locations and Noise Map
Summertime Modeling Conditions

Agrium Redwater Facility
2016 Noise Model Update
SLR Project No. 203.50100.00000

Figure C-1	Rev. 0	10/25/2016

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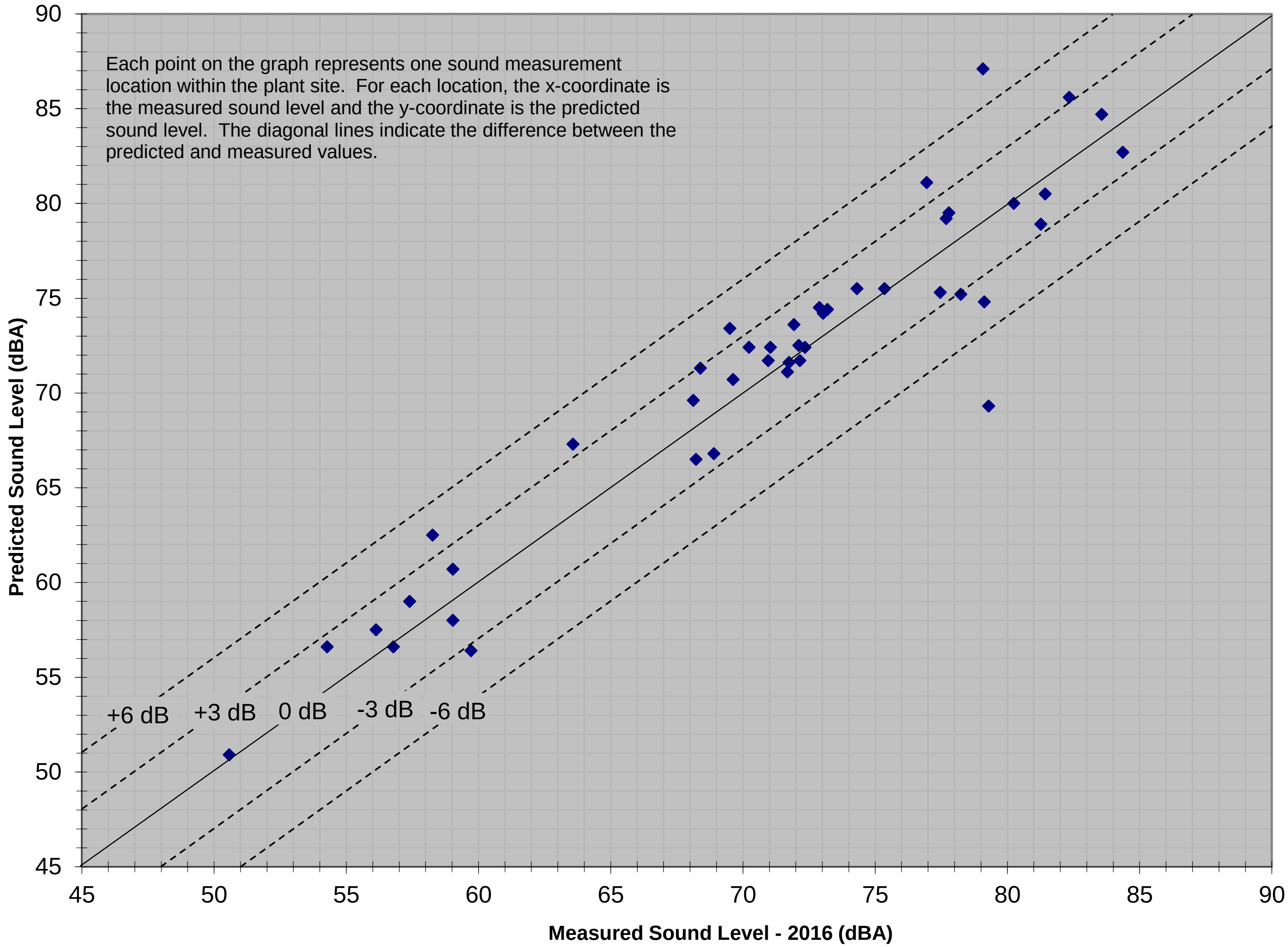
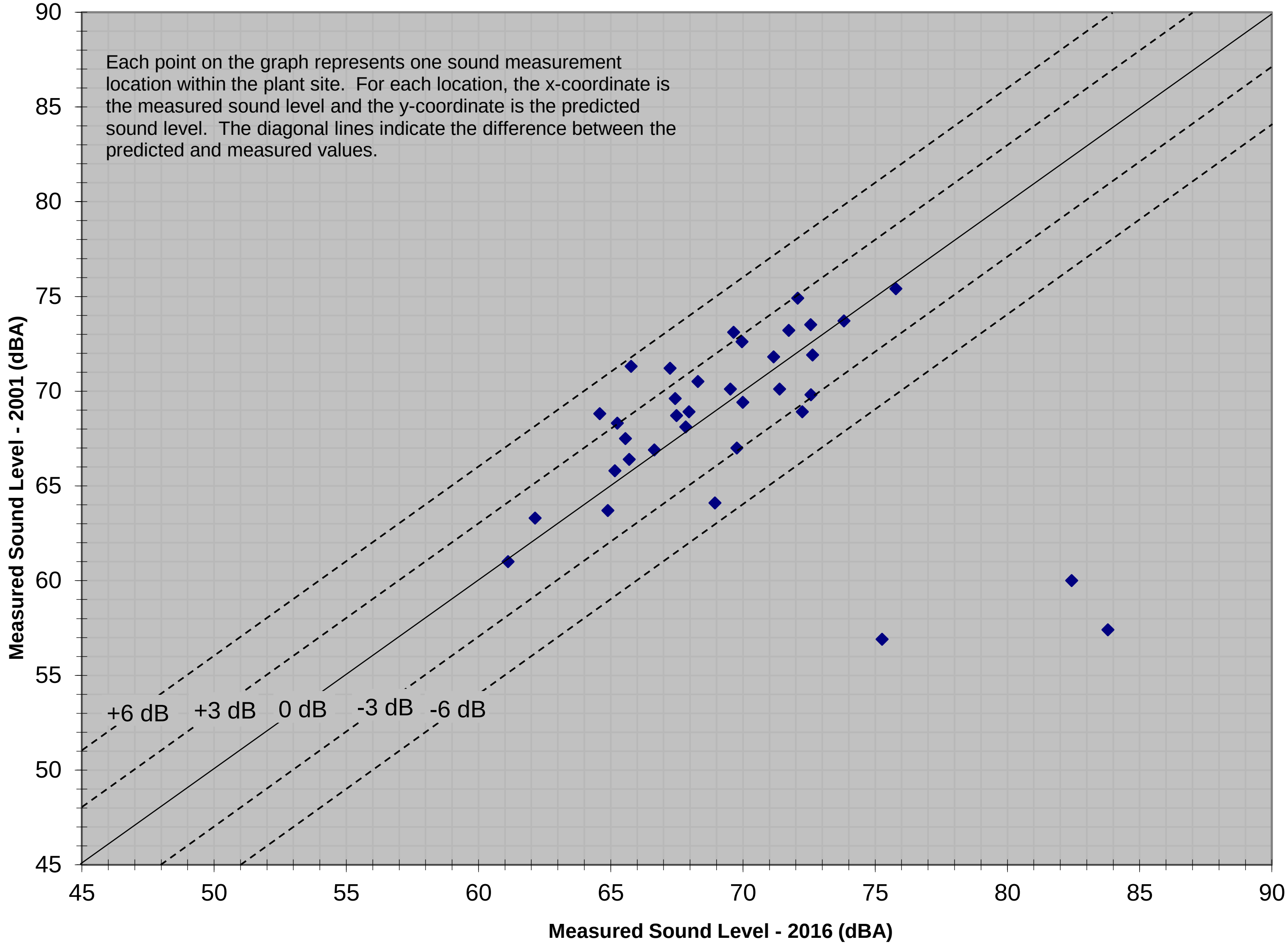
Figure C-2
Agrium Rewater
Comparison of 2016 Measured Sound Levels to Predicted Sound Levels

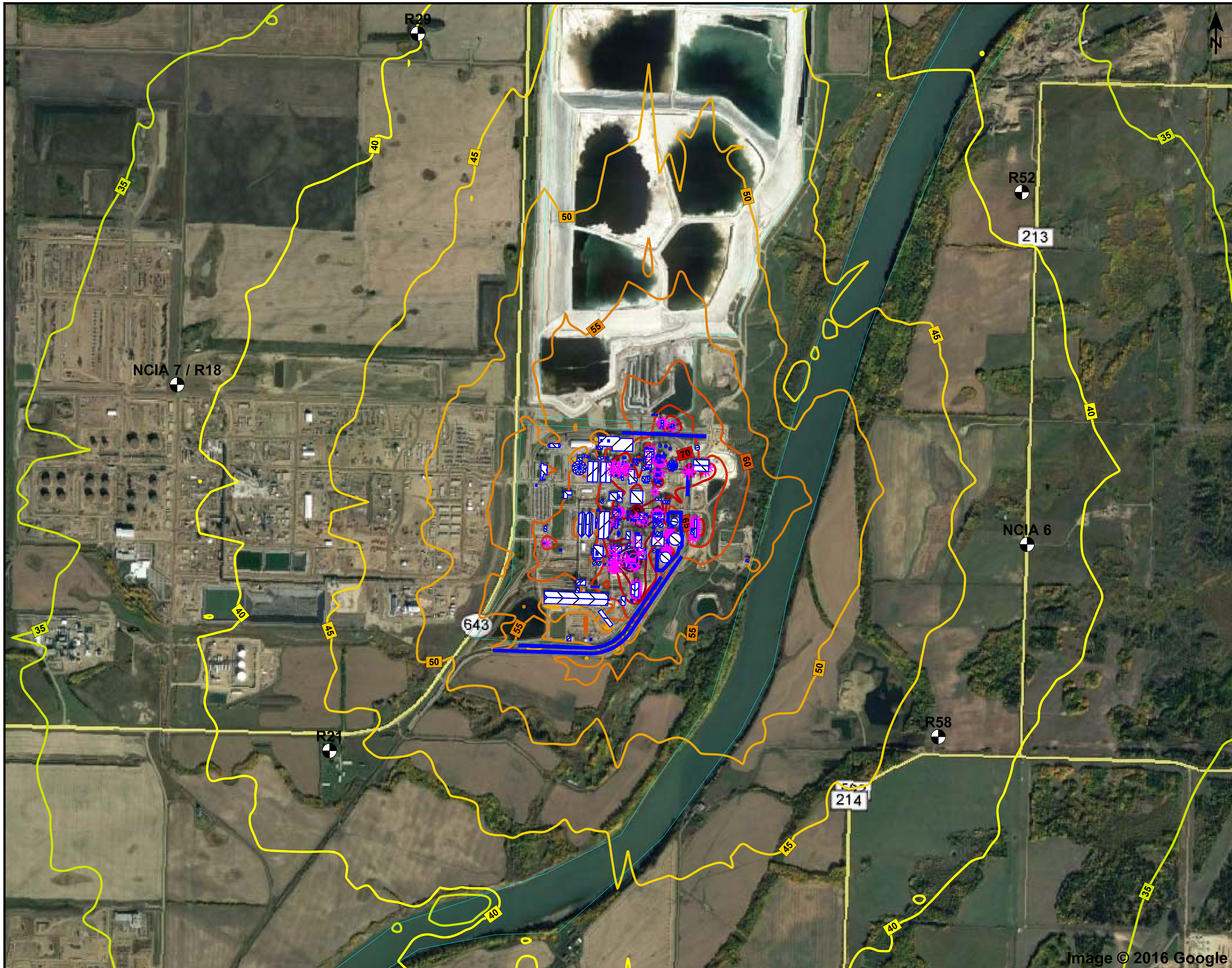


Dont use! Figure C-1C
Redwater
Comparison of 2016 Measured Sound Levels to 2001 Measured Sound Levels



APPENDIX D
Environmental Noise Contour Figures

Agrium Inc.
2016 Agrium Redwater Noise Model Update
SLR Project No.: 203.50100.00000



Legend
- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Ground effects
- Receiver
- Wall or Rail Cars

Scale 1:18000

0 250 500 1000 m

Sound Level (dBA)

	<= 20.0
20.0 <	<= 25.0
25.0 <	<= 30.0
30.0 <	<= 35.0
35.0 <	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	<= 95.0
95.0 <	

Agrium Redwater Facility
Predicted Sound Level Contours
Pre-Update Noise Model
Summertime Conditions, Down Wind

Agrium Inc. Redwater Facility
2016 Noise Model Update
SLR Project No. 203.50100.00000

Figure D-1	Rev. 0	10/25/2016

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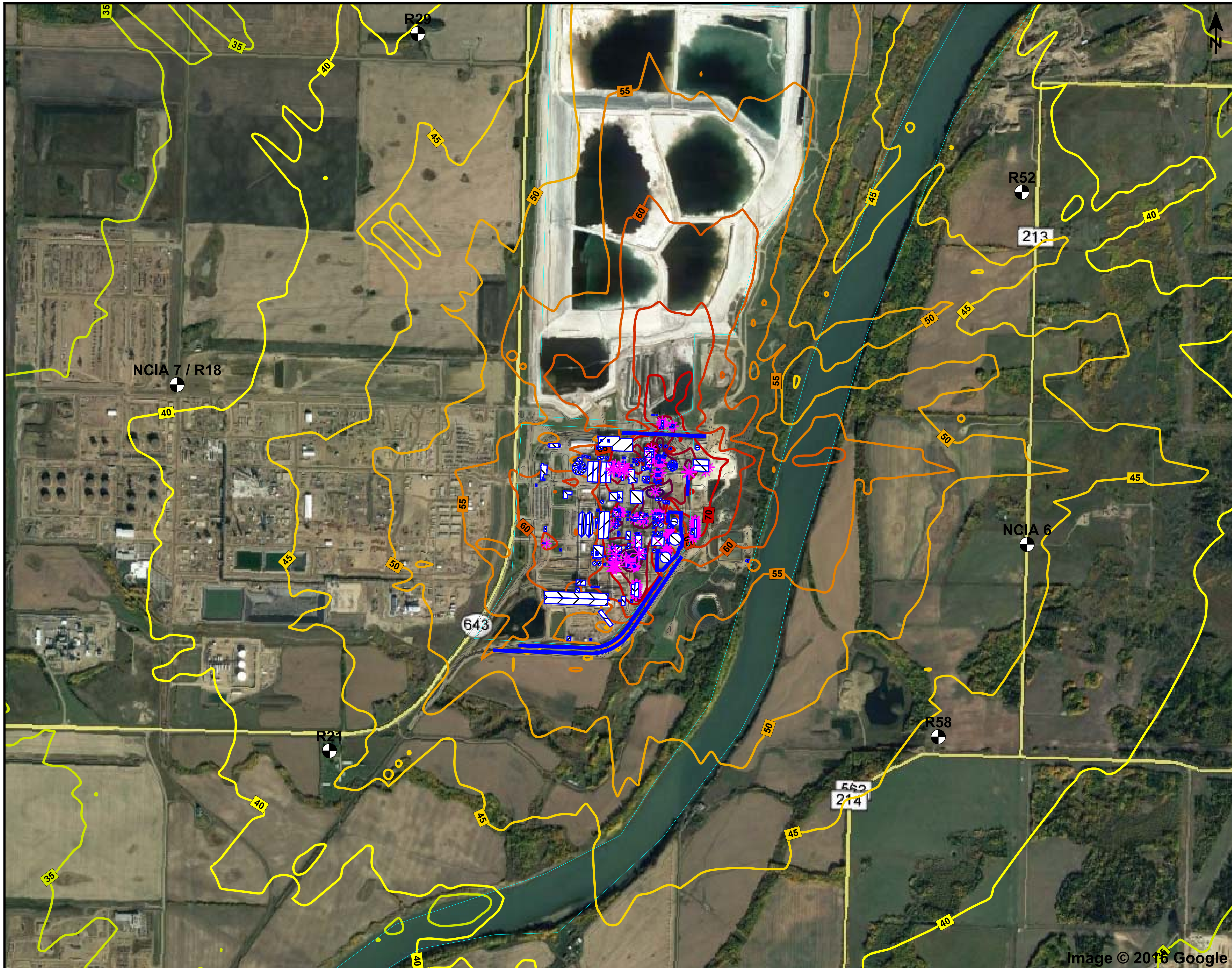

Legend
- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Ground effects
- Receiver
- Wall or Rail Cars

Scale 1:18000

0 250 500 1000 m

Sound Level (dBA)

	<= 20.0
20.0 <	<= 25.0
25.0 <	<= 30.0
30.0 <	<= 35.0
35.0 <	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	<= 95.0
95.0 <	

Agrium Redwater Facility
Predicted Sound Level Contours
Updated Noise Model
Summertime Conditions, Down Wind

Agrium Inc. Redwater Facility
2016 Noise Model Update
SLR Project No. 203.50100.00000

Figure D-2	Rev. 0	10/25/2016

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APPENDIX E
Order-Ranked Lists

Agrium Inc.
2016 Agrium Redwater Noise Model Update
SLR Project No.: 203.50100.00000

Order-ranked lists are provided in Tables E-1 through E-4, corresponding to Receptors NCIA 7 / R018, R52, NCIA 6, and R21 respectively.

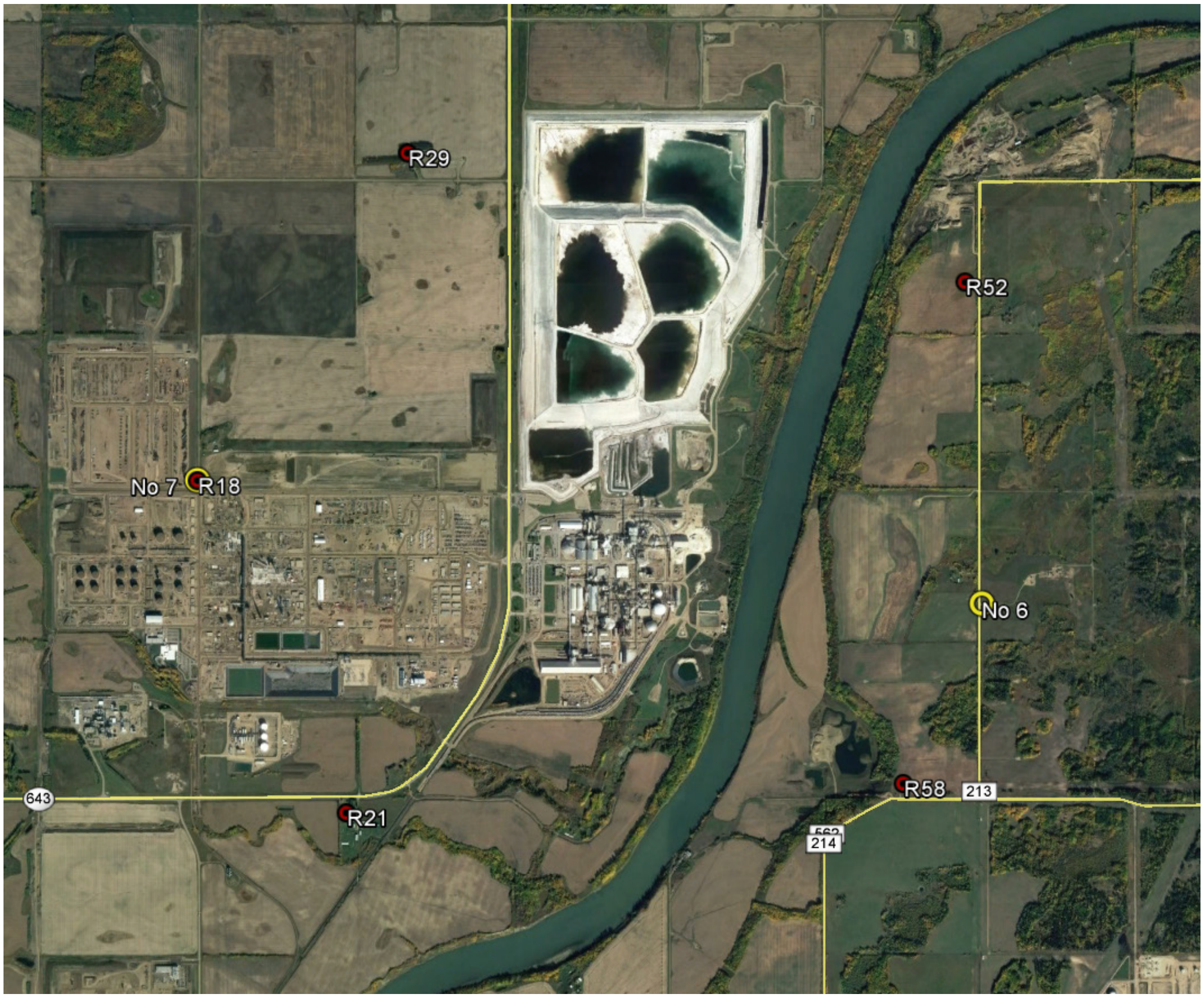

Figure E-1 Agrium Redwater Noise Receptor Locations.

Table E-1

Order-Ranked Sound Level Contributions at Receptor NCIA 7 / R18
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	AN Brinks	28.0
2	01 Furnace East Face	27.9
3	Phos 30# steam vent South	27.4
4	Boiler 3 Inlet Duct	24.3
5	SA1 Blower Inlet Filter	24.1
6	R0401 opening in west wall	23.6
7	Boiler 1 Inlet	23.4
8	Ammonia Dearator Vent	23.3
9	Phos North upper North Wall open	21.7
10	O1 Furnace S Fan Exhaust	20.6
11	O1 Furnace N Fan Exhaust	20.5
12	Roof 01 Furnace	19.9
13	AN Prill Tower 1	19.8
14	AN Prill Tower 7	19.7
15	AN Prill Tower 6	19.6
16	Boiler 1 FD Fan	19.5
17	AN Prill Tower 8	19.3
18	AN Prill Tower 5	18.7
19	Phos North upper North Wall	18.4
20	West 09 Furnace North Face	18.4
21	AN Prill Tower 4	18.0
22	01 Furnace East Face Burner 3	17.8
23	Gas Supply Valve	17.7
24	AN Prill Tower 2	17.4
25	AN Prill Tower 3	17.3
26	3201 cell 8	17.3
27	Roof Phos Mid	17.2
28	CO2 Vent Am1	17.0
29	West Boiler 1	16.8
30	South Part Phos Building West Wa	16.8
31	3201 cell 2	16.7
32	Boiler 2 Inlet Duct	16.7
33	Boiler 2 Inlet	16.3
34	Watersplash 36 Tower West	15.9
35	3201 cell 1	15.6
36	ANU Process Vent	15.4
37	Cooling Tower 36 Cell 7	15.0
38	Cooling Tower 36 Cell 5	15.0
39	Cooling Tower 36 Cell 6	15.0
40	Cooling Tower 36 Cell 4	15.0
41	Cooling Tower 36 Cell 3	15.0
42	Cooling Tower 36 Cell 2	15.0
43	Cooling Tower 36 Cell 1	15.0
44	ANU R301conveyor E OH	14.6
45	W2 face Phos Building	14.4

Table E-1

Order-Ranked Sound Level Contributions at Receptor NCIA 7 / R18
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Nitric Acid Combuster	14.2
47	Boiler 1 Stack	14.2
48	Boiler 1 Inlet Duct	14.0
49	R0401 North Low Section North Wa	13.9
50	Gran W Dryer	13.8
51	North Boiler 2	13.6
52	SA1 CT West Face	13.5
53	South Part Phos Building Upper W	13.5
54	North Boiler 3	13.4
55	Phos North upper West Wall	13.2
56	Gran E Dryer	13.2
57	R0401 North Mid Tall Section Wes	13.1
58	Phos South West Wall	13.1
59	SA 2 CT N Face	13.1
60	Phos Filter (D1014)	13.0
61	01 Furnace West Face	12.9
62	N extension Phos Acid North Wall	12.8
63	North Boiler 1	12.8
64	C902 2nd stage suction	12.6
65	R2421 West Wall	12.3
66	01 Furnace East Face Burner 2	12.2
67	Roof East 09 Furnace	12.1
68	01 Furnace South Face	12.0
69	1-P-218	11.6
70	Roof	11.5
71	West Boiler 3	11.4
72	01 Furnace North Face	11.3
73	Phos Mid West Wall	11.2
74	west 09 Furnace East Face	11.1
75	R2421 East Wall	10.9
76	SA1 Mid Cooling Cell	10.8
77	SA1 North Cooling Cell	10.8
78	Roof R0401 North Low Section	10.7
79	Boiler 1 Stack	10.7
80	N extension Phos Acid West Wall	10.7
81	Roof N extension Phos Acid	10.5
82	Gran W Reactor	10.3
83	Boiler 2 FD Fan	10.2
84	R2421 Roof	10.2
85	SA2 Blower outlet Pipe	9.9
86	SA1 South Cooling Cell	9.8
87	Roof Phos North upper	9.8
88	Roof Phos South	9.8
89	01 Furnace East Face Burner 1	9.7
90	North Wall opening	9.6

Table E-1

Order-Ranked Sound Level Contributions at Receptor NCIA 7 / R18
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	W2 Phos Building open door 2	9.4
92	W2 Phos Building open door 1	9.4
93	W2 Phos Building open door 3	9.4
94	East 09 Furnace North Face	9.3
95	ANU R301 South OH	9.3
96	Phos South South Wall	9.2
97	R0401 North Mid High Section Wes	9.2
98	West Boiler 2	9.0
99	R0401 North Mid High Section Nor	8.9
100	Roof 09 North Building	8.8
	Sum of all noise contrubutions above (1 to 100)	37.8
	Sum of all remaining noise sources (101 to 413)	25.3
	Total Sound Pressure Level	**38.0**

Table E-2

Order-Ranked Sound Level Contributions at Receptor R52
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Phos 30# steam vent South	39.2
2	SA1 Blower Inlet Filter	34.4
3	Boiler 3 Inlet Duct	27.9
4	AN Brinks	27.5
5	01 Furnace North Face	25.5
6	Hyd vibrator for screw conv	25.5
7	Boiler 1 FD Fan	23.1
8	01 Furnace West Face	22.0
9	Phos North upper North Wall open	21.5
10	SA 2 CT N Face	21.0
11	O1 Furnace S Fan Exhaust	20.8
12	O1 Furnace N Fan Exhaust	20.6
13	Phos North upper North Wall	20.5
14	Boiler 2 Inlet Duct	20.5
15	East Boiler 3	19.3
16	AN Prill Tower 4	19.1
17	AN Prill Tower 3	19.1
18	AN Prill Tower 5	19.0
19	SA2 Blower outlet Pipe	19.0
20	Boiler 2 Inlet	18.5
21	AN Prill Tower 2	18.3
22	3201 cell 5	18.2
23	3201 cell 6	18.2
24	3201 cell 7	18.2
25	3201 cell 8	18.1
26	3201 cell 4	18.1
27	AN Prill Tower 6	18.1
28	Roof 01 Furnace	18.1
29	P20151A	18.0
30	ANU R301conveyor E OH	17.9
31	3201 cell 3	17.9
32	3201 cell 2	17.7
33	Gran E Reactor	17.5
34	01 Furnace North Face Void	17.3
35	32 Water Splash	17.2
36	AN Prill Tower 7	17.2
37	AN Prill Tower 1	17.1
38	AN Prill Tower 8	16.9
39	3201 cell 1	16.5
40	CO2 Vent Am1	16.5
41	N extension Phos Acid North Wall	16.3
42	01 Ammonia Comp Bldg N Top W	16.1
43	Phos North lower North Wall	15.9
44	SA1 CT East Face	15.3
45	01 Ammonia Comp Bldg N Top E	14.9

Table E-2

Order-Ranked Sound Level Contributions at Receptor R52
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Cooling Tower 36 Cell 6	14.8
47	Cooling Tower 36 Cell 5	14.8
48	Cooling Tower 36 Cell 4	14.7
49	Cooling Tower 36 Cell 3	14.7
50	ANU Process Vent	14.7
51	Cooling Tower 36 Cell 1	14.7
52	Cooling Tower 36 Cell 2	14.7
53	Phos North upper East Wall	14.7
54	Cooling Tower 36 Cell 7	14.6
55	R2421 East Wall	14.4
56	01 Furnace East Face	14.2
57	North Boiler 3	14.2
58	01 Furnace West Face Burner 3	14.0
59	Phos Filter (D1014)	13.9
60	01 Furnace South Face	13.9
61	Phos Mid West Wall	13.9
62	Nitric Acid Combuster	13.5
63	Boiler 1 Inlet	13.2
64	R2421 West Wall	13.2
65	Boiler 2 FD Fan	13.1
66	Gran W Dryer	13.1
67	Gran E Dryer	13.0
68	Boiler 1 Inlet Duct	12.8
69	Phos Mid East Wall	12.7
70	R0401 S Mid Tall Section North W	12.3
71	Phos Mid West Wall Fan 4	12.2
72	01 Furnace West Face Burner 2	12.2
73	SA1 North Cooling Cell	11.9
74	SA1 Mid Cooling Cell	11.8
75	SA1 South Cooling Cell	11.8
76	Roof Phos Mid	11.6
77	Roof R0401 North Low Section	11.6
78	C902 2nd stage suction	11.4
79	Boiler 1 Stack	11.3
80	R0401 North Mid Tall Section eas	11.2
81	P20151A	11.1
82	Watersplash 36 Tower East	10.8
83	09 North Building East Wall	10.6
84	R2421 North Wall	10.5
85	Vent Bldg 31	10.0
86	Boiler 1 Stack	9.9
87	SA-1Stack	9.7
88	R2421 Roof	9.6
89	Gran W Reactor	9.4
90	Phos Mid East Wall Fan 1	9.2

Table E-2

Order-Ranked Sound Level Contributions at Receptor R52
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	East Boiler 2	9.2
92	R0401 North Low Section North Wa	9.2
93	ANU R301 South OH	9.2
94	Boiler 1 Stack	9.0
95	Roof Phos South	8.9
96	South Part Phos Building East Wa	8.9
97	Roof N extension Phos Acid	8.9
98	west 09 Furnace West Face	8.9
99	Roof Phos North upper	8.9
100	R2421 Fan Opening	8.7
	Sum of all noise contrubutions above (1 to 100)	42.3
	Sum of all remaining noise sources (101 to 413)	26.0
	Total Sound Pressure Level	**42.4**

Table E-3

Order-Ranked Sound Level Contributions at Receptor NCIA 6
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Phos 30# steam vent South	42.1
2	SA1 Blower Inlet Filter	36.3
3	R2421 East Wall	30.8
4	R2421 Fan Opening	30.7
5	AN Brinks	29.8
6	SA2 Blower outlet Pipe	29.7
7	Hyd vibrator for screw conv	29.0
8	South Wall opening	29.0
9	Boiler 1 Inlet	26.5
10	R2421 South Wall	25.8
11	Watersplash 36 Tower East	25.1
12	SA1 Blower Discharge	24.9
13	ANU R301conveyor E OH	23.7
14	01 Furnace West Face	23.4
15	R2421 Roof	23.1
16	32 Water Splash	22.8
17	SA 2 CT S Face	22.6
18	SA2 Blower Building East OH	21.7
19	Vent 50lb steam	21.6
20	AN Prill Tower 3	21.5
21	AN Prill Tower 2	21.3
22	AN Prill Tower 4	21.3
23	3201 cell 8	21.1
24	3201 cell 7	21.1
25	3201 cell 6	21.1
26	3201 cell 5	21.1
27	3201 cell 4	21.0
28	Phos South South Wall	20.8
29	01 Furnace South Face	20.7
30	3201 cell 3	20.7
31	AN Prill Tower 1	20.5
32	P20151A	20.4
33	AN Prill Tower 5	20.3
34	3201 cell 2	20.3
35	CO2 Vent Am1	20.0
36	North Wall opening	20.0
37	Boiler 1 FD Fan	19.8
38	Roof	19.6
39	AN Prill Tower 8	19.5
40	O1 Furnace S Fan Exhaust	19.5
41	AN Prill Tower 6	19.3
42	3201 cell 1	19.3
43	Boiler 3 Inlet Duct	19.3
44	AN Prill Tower 7	19.2
45	O1 Furnace N Fan Exhaust	19.1

Table E-3

Order-Ranked Sound Level Contributions at Receptor NCIA 6
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Roof East 09 Furnace	18.5
47	ANU R301 South OH	18.1
48	SA2 Blower Inlet Pipe	18.0
49	01 Furnace North Face	17.8
50	R2421 North Wall	17.7
51	Boiler 2 Inlet	17.7
52	Boiler 1 Stack	17.6
53	ANU Process Vent	17.5
54	Roof 01 Furnace	17.3
55	East 09 Furnace East Face	17.3
56	R2421 West Wall	17.2
57	Cooling Tower 36 Cell 6	17.2
58	SA1 Blower Room West Dbl Dr	17.2
59	Cooling Tower 36 Cell 7	17.1
60	Cooling Tower 36 Cell 5	17.1
61	Cooling Tower 36 Cell 4	17.1
62	Cooling Tower 36 Cell 3	17.1
63	Cooling Tower 36 Cell 1	17.0
64	Cooling Tower 36 Cell 2	17.0
65	01 Furnace East Face	16.8
66	Phos Mid South Wall	16.5
67	Gran South Building East wall	16.3
68	R2421 Low Level fan	16.2
69	C902 2nd stage suction	16.0
70	Gran E Reactor	16.0
71	Nitric Acid Combuster	16.0
72	P20151A	15.9
73	Phos Filter (D1014)	15.7
74	west 09 Furnace East Face	15.5
75	Boiler 2 Inlet Duct	15.1
76	Gran W Dryer	15.1
77	East 09 Furnace West Face	15.0
78	Gran E Dryer	14.9
79	Boiler 1 Inlet Duct	14.6
80	Gas Supply Valve	14.6
81	Boiler 1 Stack	14.4
82	west 09 Furnace West Face	14.4
83	Phos Scrubber East Wall Vent	14.3
84	01 Furnace West Face Burner 3	14.1
85	R2421 East Wall Dust Collector	13.9
86	R0401 S Mid Tall Section North W	13.8
87	01 Ammonia Comp Bldg N Top E	13.7
88	Gran South Building South wall	13.6
89	01 Furnace West Face Burner 2	13.2
90	Phos Mid East Wall	13.0

Table E-3

Order-Ranked Sound Level Contributions at Receptor NCIA 6
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	01 Ammonia Comp Bldg N Top W	13.0
92	Roof N extension Phos Acid	12.9
93	Phos South West Wall	12.5
94	Roof R0401 North Low Section	12.4
95	Hyd Power Pack	12.4
96	Gran W Reactor	12.3
97	R0401 North Mid Tall Section eas	12.3
98	01 Ammonia Furnace Fan Enclosure	12.2
99	C902 1st stage discharge	12.2
100	Boiler 1 Stack	12.1
	Sum of all noise contrubutions above (1 to 100)	45.3
	Sum of all remaining noise sources (101 to 413)	29.7
	Total Sound Pressure Level	**45.4**

Table E-4

Order-Ranked Sound Level Contributions at Receptor R21
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	01 Furnace South Face	34.2
2	Phos 30# steam vent South	32.7
3	AN Brinks	31.6
4	01 Furnace East Face	31.3
5	R2421 West Wall	31.1
6	South Wall opening	28.3
7	SA1 Blower Inlet Filter	26.9
8	SA2 Blower outlet Pipe	26.3
9	01 Furnace South Face Void	26.1
10	R2421 South Wall	25.9
11	01 Furnace North Face	25.3
12	O1 Furnace S Fan Exhaust	25.0
13	O1 Furnace N Fan Exhaust	24.9
14	Roof 01 Furnace	24.3
15	AN Prill Tower 8	23.3
16	AN Prill Tower 7	23.2
17	AN Prill Tower 1	23.2
18	R2421 Roof	23.1
19	ANU R301conveyor E OH	23.0
20	Boiler 1 Inlet	22.9
21	R0401 opening in west wall	22.8
22	Gas Supply Valve	22.6
23	W2 Phos Building open door 3	22.4
24	AN Prill Tower 6	22.4
25	Ammonia Dearator Vent	22.3
26	AN Prill Tower 4	22.2
27	AN Prill Tower 5	22.1
28	AN Prill Tower 2	22.0
29	AN Prill Tower 3	21.9
30	South Part Phos Building West Wa	21.6
31	CO2 Vent Am1	21.3
32	W2 Phos Building open door 2	21.2
33	Phos South South Wall	21.2
34	01 Furnace East Face Burner 3	20.9
35	W2 Phos Building open door 1	20.8
36	01 Ammonia Furnace Fan Enclosure	19.7
37	P20151A	19.4
38	ANU Process Vent	19.3
39	Gran South Building West wall	19.3
40	Cooling Tower 36 Cell 7	19.0
41	Cooling Tower 36 Cell 4	19.0
42	Cooling Tower 36 Cell 3	19.0
43	Cooling Tower 36 Cell 5	19.0
44	Cooling Tower 36 Cell 1	19.0
45	Cooling Tower 36 Cell 6	19.0

Table E-4

Order-Ranked Sound Level Contributions at Receptor R21
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Cooling Tower 36 Cell 2	18.9
47	01 Furnace West Face	18.9
48	R0401 North Mid Tall Section Wes	18.8
49	C902 2nd stage suction	18.5
50	Boiler 1 Stack	18.5
51	Nitric Acid Combuster	18.2
52	Phos Scrubber East Wall Vent	18.0
53	Boiler 1 FD Fan	17.5
54	Phos South West Wall	17.4
55	Boiler 2 Inlet	17.0
56	Watersplash 36 Tower West	16.9
57	R2421 East Wall	16.8
58	Gran South Building South wall	16.8
59	East 09 Furnace West Face	16.6
60	01 Furnace East Face Burner 2	16.6
61	W2 face Phos Building	16.3
62	3201 cell 8	16.1
63	1-P-218	16.0
64	louvre - Gran South Building Wes	16.0
65	Gran W Dryer	15.9
66	Roof Phos Mid	15.8
67	west 09 Furnace East Face	15.6
68	ANU R301 South OH	15.4
69	R0401 S Mid Tall Section South W	15.4
70	Gran E Dryer	15.3
71	1-P-204-1	15.3
72	Boiler 1 Stack	14.9
73	East 09 Furnace South Face	14.8
74	C902 1st stage discharge	14.7
75	Phos Filter (D1014)	14.6
76	1-P-125-2	14.5
77	SA2 Blower Inlet Pipe	14.4
78	01 Furnace East Face Burner 1	14.4
79	Roof Gran South Building	14.4
80	Phos Mid West Wall	14.3
81	09 Air Compressor Building West	14.2
82	R0401 North Mid Tall Section Sou	14.2
83	302 1st stage discharge 2	13.7
84	R0401 North Mid High Section Wes	13.6
85	Phos North upper West Wall	13.5
86	E Face Inlet 201 Turbine	12.8
87	N Face Inlet 201 Turbine	12.8
88	west 09 Furnace West Face	12.8
89	Boiler 1 Stack	12.7
90	Boiler 2 Inlet Duct	12.4

Table E-4

Order-Ranked Sound Level Contributions at Receptor R21
Agrium - Redwater
Summertime Conditions, Down Wind

Order Rank #	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Gran W Reactor	12.3
92	Vent Bldg 31	12.3
93	36 drive motor Cell 1	12.2
94	S Face Inlet 201 Turbine	12.1
95	W Face Inlet 201 Turbine	12.1
96	C902 3rd stage suction	12.1
97	Roof Phos South	12.0
98	East 09 Furnace East Face	12.0
99	1-P-204-2	11.8
100	North Wall opening	11.8
	Sum of all noise contrubutions above (1 to 100)	42.7
	Sum of all remaining noise sources (101 to 413)	28.5
	Total Sound Pressure Level	**42.8**

APPENDIX F
Glossary

Agrium Inc.
2016 Agrium Redwater Noise Model Update
SLR Project No.: 203.50100.00000

Appendix F – Glossary of Acoustical Terms

A-WEIGHTED SOUND LEVEL OR dBA: A measurement of overall Sound Pressure Level which accounts for the frequency content of the measured sound and assesses it with a frequency response similar to that of the human ear.

AMBIENT OR BACKGROUND NOISE: The noise in the environment, other than the noise from the source of interest.

ATMOSPHERIC ATTENUATION: The effect of sound absorption by moisture in the air.

ATTENUATION: A reduction in sound level that occurs with sound propagation over distance by means of physical dissipation or absorption mechanisms, or a reduction in sound level that occurs by means of noise control measures applied to a sound source.

BARRIER DIFFRACTION OR ATTENUATION: The effect of an acoustical shadow created by building or landform interposed between a source and a receiver.

BROADBAND NOISE: A noise with frequency components distributed over a broad frequency range, e.g. noise from distant road traffic.

C-WEIGHTED SOUND LEVEL OR dBC: A measurement of overall Sound Pressure Level with a frequency response that has essentially no filtering of sound between 50 and 5000 Hz. C-weighted sound levels are a better indicator of the presence of low frequency sound than A-weighted sound levels.

COMPREHENSIVE SOUND LEVEL: A measurement of the overall Sound Pressure Level at a location which includes the effects of all noise sources affecting the location.

DISTANCE DISSIPATION: The natural attenuation of sound with distance caused by geometrical spreading of sound waves.

EQUIVALENT CONTINUOUS SOUND LEVEL OR L_{eq}: A single number descriptor commonly used for environmental noise measurements and criteria. It is used to quantify sound which constantly varies over time, such as that commonly occurring in outdoor environments. It is defined as the average Sound Pressure Level over a specific time period that has the same acoustic energy as the actual fluctuating Sound Pressure Levels during the same time period. Time periods commonly used for L_{eq} measurements and criteria are the daytime (07:00 - 22:00 hrs) and nighttime (22:00 - 07:00 hrs) periods.

FREE SOUND FIELD (FREE FIELD): A sound field in which the effects of obstacles or boundaries on propagating sound are negligible.

FREQUENCY: The number of wave oscillations per second (hertz) of an acoustic pressure wave propagating through the air. The same as the pitch, or highness or lowness of a sound.

GROUND ATTENUATION: The effect of sound absorption by the ground separating the source and receiver.

INCREASE IN SOUND LEVEL: The perceived increase in loudness of a sound does not correspond directly to numerical increases in dBA values. Typically, an increase of less than 3 dBA is barely noticeable, an increase of 5 dBA is noticeable, an increase of 10 dBA is perceived as a doubling in apparent loudness, and an increase of 20 dBA is perceived as a four-fold increase in apparent loudness.

NARROW-BAND: A segment of the frequency spectrum which spans a few hertz or tenths of hertz.

NARROW-BAND SOUND PRESSURE LEVEL: The total Sound Pressure Level of sound components in a specific narrow-band frequency segment. Narrow-band Sound Pressure Levels are used to identify the presence of tonal components in a sound.

OCTAVE: The interval in frequency between two sounds having a frequency ratio of two.

OCTAVE BAND: A segment of the frequency spectrum which spans one octave.

OCTAVE BAND SOUND PRESSURE LEVEL: The total sound pressure level of sound components in a specific octave band.

PINK NOISE: A broadband noise characterized by a spectrum that uniformly decreases by 3 dB/octave with increasing octave band frequency. This noise is characterized by a “hushing” sound.

SOUND LEVEL CONTRIBUTION: The contribution of noise from one or more sources to the overall sound level from all sources affecting a particular location.

SOUND POWER LEVEL: A measurement of the acoustic energy of a sound source, which utilizes a logarithmic scale and which is normally calculated from Sound Pressure Level measurements near the source. The reference sound power is 10^{-12} watts.

SOUND PRESSURE LEVEL: A physical measurement of sound, which utilizes a logarithmic scale and which quantifies the amplitude or volume of acoustic pressure waves propagating through the air. The reference sound pressure is 20 µPa.

SPECTRUM: The quantification of the components of a sound as a function of frequency.

STATISTICAL SOUND LEVEL OR L_n: The proportion of time a sound of interest is present at a specific level. Statistical sound levels are expressed as L_n values, which is the sound level exceeded N percent of the time.

THIRD-OCTAVE: The interval in frequency between two sounds having a ratio of 2 to the one-third power, or approximately 1.26.

THIRD-OCTAVE BAND: A segment of the frequency spectrum which spans one-third octave.

THIRD-OCTAVE BAND SOUND PRESSURE LEVEL: The total sound pressure level of sound components in a specific one-third octave band.

URBAN HUM: The more or less steady, continuous background noise in or near an urban area caused by distant road traffic and urban activity.

APPENDIX G
Environmental Noise Descriptors

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SLR Project No.: 203.50100.00000

Appendix G – Environmental Noise Descriptors

Environmental noise is typically not steady and continuous, but varies over time. In a rural area, there is usually continuous background noise from distant traffic and community sources that slowly varies with time of day and with changes in atmospheric and/or ground cover conditions. Along with this continuous background noise there are also intermittent, fluctuating, higher-level noises. These are usually associated with local road traffic, nearby community and agricultural activity, and natural sounds.

To account for the time-varying nature of environmental noise, a single number descriptor known as equivalent continuous sound level (L_{eq}) is typically used. This descriptor quantifies sound that varies over time, such as that commonly occurring in outdoor environments. L_{eq} is the average sound level (based on acoustical energy) of time varying sound measured over a specific time period. Time periods commonly used for L_{eq} sound levels are 1-hour, daytime (07:00 to 22:00), nighttime (22:00 to 07:00) and 24-hours. L_{eq} is generally accepted and used for environmental noise measurements and criteria.

Sound is acoustic pressure waves that propagate through air. Because the range of audible sound pressures is very wide, sound is measured on a logarithmic scale in units of decibels (dB). The logarithmic scale compresses the range of audible sound pressures into a range that approximately corresponds to human hearing perception. When comparing sound level values, the following rule of thumb may be used:

- A difference in sound level of 3 dB is barely perceptible to human hearing
- A difference of 5 dB is noticeable
- A difference of 10 dB corresponds to a halving or doubling in perceived loudness
- A difference of 20 dB corresponds to a four-fold difference in perceived loudness.

Sound level values for environmental noise are normally A-weighted and expressed in units of A-weighted decibels (dBA). The A-weighting accounts for the frequency content of the sound and assesses it with a frequency response similar to that of human hearing. Figure A1 shows examples of typical A-weighted sound levels for a variety of noise sources ranging from very quiet to extremely loud.

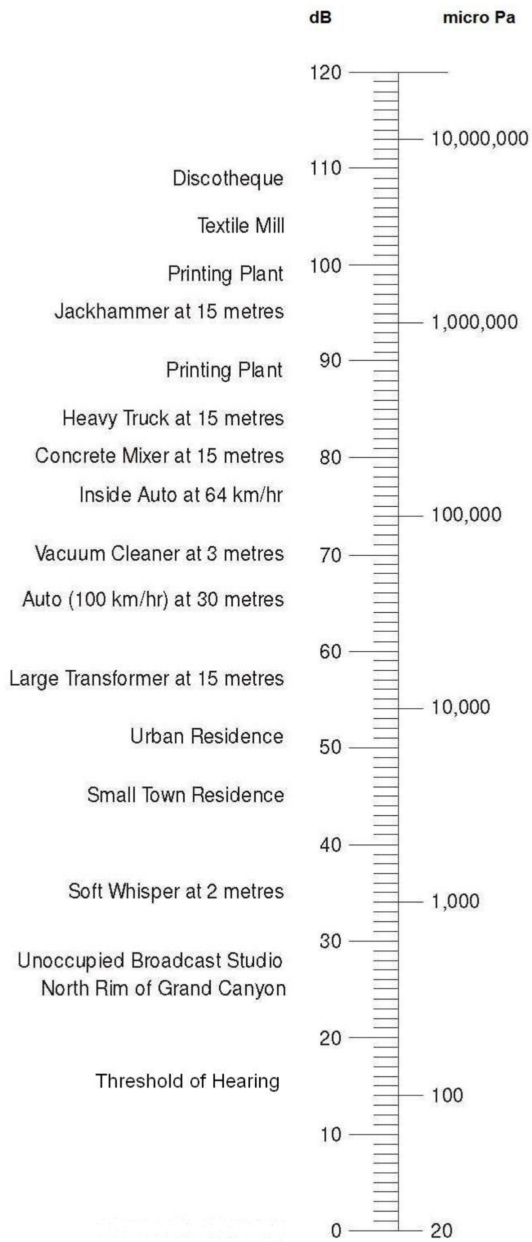
In environmental noise assessments, the daytime and nighttime periods are normally differentiated, especially for areas where ambient sound levels may be affected by community or traffic noise sources. Ambient sound levels are typically higher during the daytime as a result of increased community and traffic activity. During the nighttime, ambient sound levels are usually lower because community and traffic activity is reduced. In order to understand range of sound levels typically occurring in outdoor environments, Table A1 shows examples of sound level measured at various outdoor locations ranging from a rural setting to an urban environment.

Table A1: Examples of Sound Levels Measured at Various Outdoor Locations

Location Description	Sound Level (dBA)	
	Daytime	Nighttime
Farm in Valley	35 - 45	29 - 37
Suburban Residential at City Outskirts	42 - 58	35 - 45
Urban Residential	48 - 59	45 - 57

(Harris, C.M., ed., Handbook of Noise Control, Second Edition, McGraw-Hill, 1979, p. 35-11)

Figure A1: Typical A-weighted Sound Levels for Various Noise Sources



Relation between sound pressure in pascals and Sound Pressure Level in decibels re 20 micropascals. Also shown are typical values of A-weighted sound level of various sources of noise.

(Harris, C.M., ed., Handbook of Noise Control, Second Edition, McGraw-Hill, 1979, p. 2-10)

APPENDIX H
Outdoor Sound Propagation

Agrium Inc.
2016 Agrium Redwater Noise Model Update
SLR Project No.: 203.50100.00000

Appendix H – Outdoor Sound Propagation

Outdoor sound propagation between a sound source and a receptor is affected by several sound attenuation mechanisms. These include the following:

- Distance dissipation: sound naturally decreases with increasing distance from a source
- Ground attenuation: sound is absorbed by the ground that it passes over
- Atmospheric attenuation: sound is absorbed by the atmosphere it passes through
- Barrier attenuation: sound can be blocked by physical barriers (e.g. buildings or hills)
- Sound is affected by wind gradients: a distant noise source will be louder under downwind conditions than it will be under calm conditions; a distant source will be quieter under upwind conditions than it will be under calm conditions.
- Sound is affected by temperature gradients: a distant noise source will be louder under atmospheric inversion conditions than it will be under neutral conditions; a distant source will be quieter under atmospheric lapse conditions than it will be under neutral conditions.

Temperature and relative humidity do have effects on some of these sound attenuation mechanisms, however they do not have specific sound propagation effects associated with them.

Off-site ground cover in the study area is rough fields. This type of ground cover would be moderately sound-absorptive during summer conditions. However during the winter, variations in the sound absorption may occur with different ground surface conditions (*e.g.* frozen ground or crusty snow - reflective; soft, fresh snow - absorptive).

On-site ground cover consists of hard sound-reflective ground (asphalt and concrete), and sound barrier/screening objects such as buildings, vessels, structures, and equipment. The barrier/screening objects can provide significant sound attenuation if they block the line of sight between the source and receptor.

The effects of wind gradients on outdoor sound propagation can cause variations in the sound level of a distant facility. Similar effects are caused by temperature gradients in the atmosphere. The sound level variations caused by wind and temperature gradients are most pronounced for large source/receptor distances. Sound from a distant facility which propagates in a downwind direction (and/or during atmospheric inversion conditions) results in higher sound levels at a receptor than for calm conditions and a neutral atmosphere. This effect is caused by downward refraction of sound rays as they propagate through the atmosphere. Conversely, sound propagating in an upwind direction (and/or during lapse conditions in the atmosphere) is refracted upwards, which results in lower sound levels at the receptor. Sound propagating in a crosswind direction (and a neutral atmosphere) does not exhibit refraction effects and is essentially the same as sound propagation during calm conditions and a neutral atmosphere.

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Prince George, BC V2N 1W9
Canada
Tel: (250) 562-4452
Fax: (250) 562-4458

Regina, SK
1048 Winnipeg Street
Regina, SK S4R 8P8
Canada
Tel: (306) 525-4690
Fax (306) 525-4691

Saskatoon, SK
620-3530 Millar Avenue
Saskatoon, SK S7P 0B6
Canada
Tel: (306) 374-6800
Fax: (306) 374-6077

Vancouver, BC (Head Office)
200-1620 West 8th Avenue
Vancouver, BC V6J 1V4
Canada
Tel: (604) 738-2500
Fax: (604) 738-2508

Victoria, BC
6-40 Cadillac Avenue
Victoria, BC V8Z 1T2
Canada
Tel: (250) 475-9595
Fax: (250) 475-9596

Winnipeg, MB
1353 Kenaston Boulevard
Winnipeg, MB R3P 2P2
Canada
Tel: (204) 477-1848
Fax: (204) 475-1649

Whitehorse, YT
6131 6th Avenue
Whitehorse, YT Y1A 1N2
Canada
Tel: (867) 689-2021

Yellowknife, NT
Unit 44, 5022 49 Street
Yellowknife, NT X1A 3R8
Canada
Tel: (867) 765-5695

Air Liquide

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Signs have been posted to inform of double hearing protection required within plant areas. Annual review of Standard Operating Procedures SFD/CGN-06-101 Hearing Conservation Program to ensure compliance.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	Noise survey conducted in July 2013 and provided as attached. No additional equipment/process was added since then.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	Continue with Winterization with insulation on critical equipment including outside equipment. No change was made in equipment/process that warrant a new site noise model

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	Maintain current program.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	A self-audit conducted on the Hearing Protection and Conservative Program. This is reviewed by senior leader in plant every 2 years. Next audit will be conducted in Q3 2017.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	None

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

AIR LIQUIDE

Hearing Protection and Conservation Program
Self-Audit Checklist

Location: Scotford
Date: 25-Sept-2015
Audit Performed by: Josie Doll

		Y	N	NA	COMMENTS
A. Sources of Noise					
1	Equipment capable of producing more than 85 dBA have been identified and monitored for noise level	√			**Noise survey completed 2013**
2	High noise areas posted with warning signs.	√			
3	A report of the noise survey findings is available for review	√			
B. Noise Reduction					
1	Major noise sources and options for engineering noise control have been identified	√			
2	Where practicable, engineering controls in place or considered to reduce noise	√			
3	Variety of hearing protectors available to employees	√			
4	Reusable hearing protectors are clean and in good condition	√			Responsibility of owner
5	Hearing protectors worn where needed	√			
C. Audiometric Testing					
1	Individuals working in high noise areas receive audiometric (hearing) testing at frequency determined in the Hearing Conservation and Protection Program	√			Hearing test completed every two years, SOP reviewed annually
2	Employees transferred and/or hired into a job where there is potential of exposure to noise levels exceeding 85 dBA Lex receive baseline audiogram within 70 days.	√			
3	Individuals reassigned out of a hearing hazardous job or leaving receive a follow-up test or end-of-employment audiogram.		√		Unsure if this task is being completed.
4	Workers are advised to bring their hearing protection with them to the hearing test.	√			
5	Use and care of hearing protection is reviewed by audiologist with each worker.	√			Completed by supplier (Judy's Safety)
D. Education and Training					
Noise exposed workers have received education on:					
1	The results of noise exposure measurements	√			Reviewed SOP annually; completed during safety meetings
2	Effects of noise on hearing	√			Hearing conservation training is due to be completed for 2015 by Dec 30.
3	Proper use and maintenance of hearing protection	√			
4	Purpose of hearing testing	√			

ATCO Power Canada Ltd.:

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	ATCO Power has one facility operating in the Alberta Industrial Heartland: Scotford Cogeneration Plant. The Scotford Cogeneration Plant is located on the Shell Upgrader site and is included in the Shell Upgrader Noise Management Plan. In 2016, ATCO Power did not have any other sites that would be subject to the NCIA Noise Management Plan BMP requirements.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	ATCO Power did not conduct any noise monitoring/assessments in 2016.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	Not applicable.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	Not applicable.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	Not applicable.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	Not applicable.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

NCIA Northeast Capital Industrial Association	NCIA Standards and Guidelines	Document Number 2010-003	
Noise Management Plan Reporting Requirements as per Section 5.4 of this Standard		Rev. Date 31-March 2016	Rev. 0

Aux Sable Canada LP:

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Aux Sable has implemented a best management practice to address environmental noise and has retained Patching Associates Acoustical Engineering Ltd. to conduct noise measurements at the site in May 2016. This assessment was completed and a report prepared to meet standard 2010-003 31-Mar-16. An up to date electronic copy of the plot plan will be provided with the noise model submission in 2018.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	There were no noise measurements completed outside the facility fence line in 2016. Noise measurements at the facility fence line were completed in 2016, these showed no significant changes from previous fence line measurements.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	There were no changes to the facility in 2016. A noise assessment using field measurements was completed in May 2016 and the facility noise model was updated. Aux Sable will work with SLR Consulting through 2017/2018 in order to incorporate the current facility noise model into the NCIA Regional Noise Model.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	There are no improvements or planned projects that will impact the noise levels in 2017.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	A sound study was completed in May 2016. This study found that there were no significant changes to the facility and was reviewed by senior site leaders. Full documentation available on request.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	There were no noise complaints received in 2016.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

Bruderheim Energy Terminal Ltd. (Cenovus)

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Based on the current activity at the Terminal (i.e., rail transloading), a best management practice to address environmental noise at the Terminal has not been developed. If and when circumstances change that affect environmental noise this will be reviewed and a best management practice developed accordingly.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	No monitoring was completed in 2016.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	No improvements or corrective actions have been implemented in 2016.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	No improvements or projects are proposed for 2017 that would impact noise levels.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	No audit/self assessment evaluation was completed.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	There were no noise complaints in 2016.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

NCIA Northeast Capital Industrial Association	NCIA Standards and Guidelines	Document Number 2010-003	
Noise Management Plan Reporting Requirements as per Section 5.4 of this Standard		Rev. Date 14-Apr-14	Rev. 2

Insert your Company Name here: Chemtrade Ft Sask. Sulphides and CSC locations

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Both Fort Saskatchewan facilities (CSC and Sulphides) have implemented a management program to address environmental noise as per NCIA Noise Management Plan Standard 2010-001. This is outlined in the Environmental Noise Management and Control procedure CHE-FSK-ESH-001.
Attach results of any monitoring/assessments (fence line outward) completed in 2015. Note, you are not required to conduct any off-site monitoring, however if you did, please provide those results electronically to NCIA.	Off-site monitoring was not conducted during the year, due to prioritization of tasks necessitated by the EHS Supervisor being out on extended leave. Monitoring will be done next year.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	No changes that would impact the noise level have been made in 2016.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	A change is planned for the first quarter of 2018 that may impact noise level output. A Sodium Bi-Sulfite truck loading operation scrubber will be installed. The site noise model will then be updated by the second quarter of 2018.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan.	Submitted to the NCIA with this report on September 6, 2017. Signed by Neil Moon, Regional Manager.
Provide a Noise Complaint summary for all noise complaints received in 2014 including any actions taken to address them.	No complaints have been received in 2016 or to this point in 2017.

This information is being collected as per the NMP Standard 2010-003 Document, section 5.4. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

CHEMTRADE

NCIA office, Fort Saskatchewan
#204 9902-102 Street
Fort Saskatchewan, AB
Attn.: Dr. Laurie J. Danielson, P. Chem.
Executive Director, Northeast Capital Industrial Association

September 6, 2017

RE: Annual self-assessment of Chemtrade's Environmental Noise Management program for the Fort Saskatchewan CSC and Sulphides sites

As per Chemtrade's Environmental Noise Monitoring and Control Procedure CHE-FSK-ESH-001, Neil Moon (Regional Manager), Jason Giebelhaus (Plant Manager, CSC), and Renee Westlund (EHS Manager) have performed an annual self-assessment of our program. The following items have been examined and corrective actions have been noted below:

Items examined:

1. Noise survey results from 2015
2. Review of any noise complaints and their follow-up
3. Review of worker training records (Initiafy)
4. Review of capital projects and changes made which may impact environmental noise from either facility
5. General review of the procedure

No corrective actions are required, both plants are in compliance.

If there are any questions concerning this assessment, please contact Renee Westlund (360) 610-3861.

Yours truly,

Neil Moon

Neil Moon
Regional Manager

Dow Chemical Canada ULC
Bag 16, Highway 15
Fort Saskatchewan, Alberta
T8L 2P4, Canada

June 9, 2017

Northeast Capital Industrial Association
Laurie Danielson, Executive Director
#204, 9902 - 102 Street
Fort Saskatchewan, AB T8L 2C3

Dear Dr. Danielson,

Subject: 2016 Noise Management Annual Report
Dow Chemical Canada ULC (Dow) Fort Saskatchewan Site

Please find attached Dow Chemical Canada ULC (Dow) input into the NCIA Regional Noise Management Plan report to the Alberta Energy Regulator (AER) for the Dow Fort Saskatchewan Industrial Site. MEGlobal Canada ULC (MEGlobal) operates a production facility within the Dow Site and is included in this submission.

Please call Marcella deJong at 780 - 992 - 8529 or myself at 780 - 998 - 8325 if you require any further information or clarification.

Yours truly,

Jacint Domenech
Responsible Care Director
Dow Alberta Operations

Copy: Pravind Ramdial, Responsible Care Leader MEGlobal Canada ULC

Dow Fort Saskatchewan Site
2016 Noise Management Annual Report
Prepared for Northeast Capital Industrial Association (NCIA)

This report provides Dow and MEGlobal's 2016 input to the NCIA Regional Noise Management Plan report to be submitted to the AER in June 2017. Based on AER licensed assets on the Fort Saskatchewan Site, Dow is required to follow AER Noise Directive 38 and provide input into the NCIA report. The Dow power plant is governed by the Alberta utilities Commission Rule 012: Noise Control. MEGlobal participates in the Noise Management Plan and provides this information on a voluntary basis.

Input Description	Dow and MEGlobal Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference.	A Noise Management Plan was developed by Dow and MEGlobal for submission to NCIA for inclusion in the 2011 NCIA report to the AER. A copy of the most recent version is included with this report. Noise management is done on a site wide basis without separation of which facilities are required to follow AER Directive 38 and AUC Rule 012.
Attach results of any monitoring / assessments (fenceline outward) completed in 2016. *Note, you are not required to conduct any off-site monitoring.*	No noise monitoring (fenceline outward) was completed in 2016. The site noise model was updated in 2014 for all sources (other than on-site transportation) within the Dow Fort Saskatchewan Site, including MEGlobal. Recent updates to the Dow site model have been incorporated into the NCIA regional noise model.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). *Did those changes result in a requirement to update your site noise model?* *If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?*	Changes were made to a Dow site steam turbine in 2012 which has resulted in significantly less venting of a seasonally operated steam vent during the summer season. Since the spring 2012 turnaround, we have seen a significant decrease in the number of days that this steam vent has been open. However, the intensity of the venting remains similar to prior to the turnaround. This source was removed from the NCIA regional noise model during the most recent update but remains in the Dow site model as part of a worst case.
Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). *Will these changes result in a requirement to update your site noise model?* *If so, when do you anticipate having an updated site model available?*	In 2017, Dow will continue track the frequency of time that the steam vent is operated as well as the valve position to ensure that the frequency remains reduced from pre-turnaround and will plan for field monitoring only if the intensity of the sound when the vent is operating changes over time.

Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	The noise management plan falls within the Pollution Prevention section of Dow and MEGlobal's Operating Discipline Management System (ODMS). A site management system review was most recently conducted in November 2014 by the site leader. No actions or gaps were identified related to the Noise Management Plan. In March 2014, the AER conducted an audit of the Dow Site Noise Management Plan. Dow participated fully in the audit and provided all requested information to the AER auditor including, most recently, an updated source order ranking for each residence near the Dow site in January 2015. No additional self assessments were completed in 2016.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	There were no noise complaints in 2016 related to Dow or MEGlobal operations at the site.

Dow Fort Saskatchewan Site Noise Management Plan

Policy

The Dow Chemical Canada ULC Fort Saskatchewan site follows the Operating Discipline Management System (ODMS) of the Dow Chemical Company to manage environmental noise and hearing conservation.

MEGlobal Canada ULC (MEGlobal) Operations on the Dow Fort Saskatchewan Site follows ODMS and is included in this Noise Management Plan.

Scope

This document is created to define how the Dow Chemical Canada ULC Fort Saskatchewan site complies with the ODMS requirements concerning Noise Minimization and Hearing Conservation outlined in:

- Section E (noise minimization to meet community expectations and applicable government requirements) of 06.07 L1 Pollution Prevention
- Section C14 (employee hearing conservation) of 06.05 L1 Employee Health and Safety
- Section A2 (all equipment must be designed to control noise levels) of 06.03 EH&S Engineering Design and Control

Purpose

This document summarizes how the Dow Fort Saskatchewan Site meets the Northeast Capital Industrial Association (NCIA) requirement for a Noise Management Plan including identification, evaluation and control of noise impacts at this site.

This Noise Management Plan meets the requirements of NCIA Standard and Guideline #2010-003, as amended.

Based on AER licensed assets on the Fort Saskatchewan Site, Dow is required to follow AER Noise Directive 38 and provide input into the NCIA report. The Dow power plant is governed by the Alberta Utilities Commission Rule 012: Noise Control.

Goals / Objectives

Dow and MEGlobal, as Responsible Care® Companies will:

- Minimize, to the extent possible, noise levels impacting on the environment including minimizing nighttime and low frequency noise
- Maintain a noise monitoring program to reduce the likelihood of noise impacts on the environment
- Assign employees to manage the site noise monitoring, mitigation and continuous improvement.
- Ensure employees associated with noise sources are aware of the impact on the environment and the processes in place to control
- Design new and modified equipment to minimize noise.

Training Requirements

Workers are educated on noise through:

- All workers receive initial and three year recurring Environmental Training (Instructor led or online), which includes environmental noise.
- Noise exposed workers receive training on hearing conservation.
- Personnel conducting noise monitoring receive training from the Industrial Hygiene specialists.
- Personnel delivering unit industrial hygiene programs receive training on these programs.
- Training is tracked in a corporate web based system.

Abatement Strategies	New facilities and modifications to existing facilities are designed and built to control noise levels. Engineering controls are addressed through the Management of Change process and ODMS 06.03 EH&S Design and Control. All projects are reviewed by EH&S regulatory personnel opposite the Alberta Operations Project Regulatory Review Checklist, which includes noise abatement and models. The Dow Management of Change system includes a similar review for changes to site facilities.
Onsite / Offsite Monitoring Requirements	Dow and MEGlobal follow ODMS and AER regulatory requirements for noise monitoring on site. Offsite noise monitoring is addressed through the NCIA regional noise model. Dow has a current Noise Model prepared by SLR Consulting Ltd. which includes all significant site sources within the fenceline other than on-site transportation sources. The site noise model is updated if equipment is added or removed from the site that would significantly impact noise levels. The regional noise model is validated periodically by NCIA. If any discrepancies are noted during NCIA field validation related to the Dow site, Dow will work toward resolving the discrepancy and may validate the Dow noise model with field measurements if required. Dow responds to external noise complaints appropriately, including monitoring if necessary. Dispatch Noise Complaint Procedure EH&S On-Call Noise Complaint Procedure EH&S On-Call Noise Complaint Logsheet Individual production units do their own noise surveys at least every five years, or when equipment is added, modified or removed. The onsite noise monitoring program is managed as per in ODMS 06.05.C14 Personal noise dosimetry is done periodically on a frequency depending on exposure.
Site Noise Sources	Site noise sources are detailed in the site Noise Model and included in the NCIA regional noise model. In addition, each unit has an area noise map.
Audit / Self Assessment Requirements	Intensive EH&S ODMS based integrated audits are conducted at 3 to 5 year frequencies for all site units/departments and include ODMS elements related to noise and hearing conservation. Periodic self-assessments are conducted by unit/department ODMS element owners and results are reviewed with leaders at unit and department management system reviews. Results of unit, department and site self-assessments are reviewed by the Site Leader at the annual site management system review. These self-assessments include environmental noise and hearing conservation. The hearing conservation program is designed to minimize job induced hearing loss and meets the Alberta OH&S Code as well as Dow corporate requirements for a noise exposure and control program. This program is reviewed annually. This Noise Management Plan is reviewed once per year by the Responsible Care Leader.

Reporting Requirements	Annual reports will be generated for the NCIA. This report will include the following information for the calendar year: • Confirmation that the site has implemented a Noise Management Program and that it has been reviewed/updated as required. • Results of any monitoring / assessments (fenceline outward) • Improvements/Corrective Actions implemented • Improvement / projects that have resulted in changed noise levels on the site • Audit/Self-Assessment evaluation • Information on any external noise complaints received and actions taken
Ownership	The AER Regulatory Specialist manages the Noise Management Program and reports to NCIA as required.

Revision History

Approval

Approved by Date: January 2012

Carol Moen (Dow Responsible Care Leader)

Pravind Ramdial (MEGlobal Responsible Care Leader)

Review History

The following documents the review history for this file.

Date	Reviewed By	Position
April 2013	Mike Dziarmaga	Dow Responsible Care Leader
May 2014	Mike Dziarmaga	Dow Responsible Care Leader
August 2015	Mike Dziarmaga	Dow Responsible Care Leader
June 2016	Mike Dziarmaga	Dow Responsible Care Leader
June 2017	Jacint Domenech	Dow Responsible Care Leader

Revision History

The following information documents at least the last 3 changes to this document, with all the changes listed for the last 6 months.

Date	Revised By	Changes
January 2012	Marcella deJong	New document.
April 2013	Marcella deJong	Updated Reporting Requirements to match with updated NCIA NMP Standard dated 5-Mar-13.
May 2014	Marcella deJong	Updated with clarifications suggested during AER audit of the Noise Management Plan and to meet the current NCIA standard revised in April 2014.
May 2016	Marcella deJong	Updated MEGlobal Canada Inc. to MEGlobal Canada ULC. Updated HFP to SLR.
June 2017	Marcella deJong	Replaced “MyLearning” with “online”.

Enbridge Pipelines Inc.

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	yes
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	No monitoring was schedule
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	Operation did not changed in 2016

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	N/A
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	No complaint

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

<table>
<tr><td rowspan="1">NCIA Northeast Capital Industrial Association</td><td>NCIA Standards and Guidelines</td><td colspan="2">Document Number
2010-003</td></tr>
<tr><td colspan="2">Noise Management Plan Reporting Requirements as per Section 5.4 of this Standard</td><td>Rev. Date
31-March 2016</td><td>Rev.
0</td></tr>
</table>

Evonik Canada Inc.

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Confirmed. Relevant Evonik site policy was provided in 2014 and has remained unchanged since then.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	No monitoring or assessment required or carried out in 2016.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	None to disclose at this time.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	None to disclose at this time.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	2016 assessment and evaluation conducted by Evonik ESHQ/OH experts. Suitable report excerpt available upon request.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	No complaints.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

<table>
<tr><td rowspan="2"></td><td rowspan="2">NCIA Standards and Guidelines</td><td colspan="2">Document Number
2010-003</td></tr>
<tr></tr>
<tr><td colspan="2">Noise Management Plan Reporting Requirements as per Section 5.4 of this Standard</td><td>Rev. Date
31-March 2016</td><td>Rev.
0</td></tr>
</table>

<u>Insert your Company Name here:</u> KEYERA ENERGY LTD.

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Confirmed. The site has a noise management plan based on the current NCIA standard. The document is called KFS Site Noise Management Plan. NCIA has a copy of the current plan.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	No off-site monitoring was completed in 2016.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	Construction of a second Fractionation unit also took place during 2015, with commissioning and operation commencing in the spring of 2016. The noise modeling was completed as part of the engineering, design and approval part of the project in 2015. The was completed by SLR.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	No improvements or projects are approved or have been completed to date in 2017.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your *site noise management pla*n in 2016.	No audit/self-assessments were completed for our *site noise management pla*n in 2016.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	There were no noise complaints received in 2016.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

<table>
<tr><td rowspan="1">NCIA Northeast Capital Industrial Association</td><td>NCIA Standards and Guidelines</td><td colspan="2">Document Number
2010-003</td></tr>
<tr><td colspan="2">Noise Management Plan Reporting Requirements as per Section 5.4 of this Standard</td><td>Rev. Date
31-March 2016</td><td>Rev.
0</td></tr>
</table>

Access Pipeline (Stonefell Terminal – Operating on Behalf of MEG Energy)

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	**Member Site Comments**
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Access abides by AER's Directive 38.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	A noise monitoring was not conducted in 2016.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	N/A

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	There are no anticipated projects or improvement for 2016 that may impact noise levels.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	None.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	Access Pipeline did not receive any noise complaints for the 2016 year.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

North West Redwater Partnership

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Throughout 2016 NWR has been in construction mode related to the first phase of the Sturgeon Refinery. Construction activity will remain ongoing throughout 2017, with certain pre-commissioning activities occurring in H2 2017. The Noise Management Plan adopted by NWR and as reflected in its model is to purchase equipment with noise characteristics as required for OH&S compliance, and to perform in accordance with model expectations.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	As there has been no operational period whatsoever for the NWR facility, there have been no tests of actual vs modelled performance. Such tests will follow early operations periods, likely in 2018.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	There have been no notable updates to the Noise Model built by SLR Consulting (and their predecessor) and currently incorporated into the NCIA regional noise model. NWR has provided all required permissions to SLR and NCIA regarding use of data and model results into the regional model. A copy of the NWR-specific noise model was submitted to the AER (predecessor – EUB/ERCB) and accepted (circa 2007~2008).

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	N/A
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	N/A
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	None.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

NCIA Northeast Capital Industrial Association	NCIA Standards and Guidelines	Document Number 2010-003	
Noise Management Plan Reporting Requirements as per Section 5.4 of this Standard		Rev. Date 31-March 2016	Rev. 0

Oerlikon Metco (Canada)

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Yes and a copy had been provided
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	None conducted
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	No improvements or corrective actions conducted

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	No improvement projects
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	No audit or self-assessment conducted
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	No noise complaints received

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

NCIA Northeast Capital Industrial Association	NCIA Standards and Guidelines	Document Number 2010-003	
Noise Management Plan Reporting Requirements as per Section 5.4 of this Standard		Rev. Date 31-March 2016	Rev. 0

Pembina NGL Corporation – Redwater Facilities (I & II)

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Pembina Redwater facilities have a Noise Management Program, which includes implementation of Best Management Practices to address environmental noise as per the NCIA Noise Management Plan.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	None completed.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	No improvements or corrective actions were implemented in 2016.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	The following projects are approved for construction, and will become operational in 2017 (or shortly thereafter): 1) RFS III Fractionation plant: A mirror image of RFS II to increase fractionation capacity. The site noise model was updated to include this expansion. 2) South Rail Yard Expansion project: The south rail yard is being expanded to increase rail car storage capacity on-site. Overall objective is to increase loading/unloading efficiencies, and to support the new diesel rail loading facility being constructed for NWR.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan.	None completed.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	None received.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

Plains Midstream Canada:

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	The Facility has an Environmental Noise Management Practice. The practice is part of the site ISO 14001 certified management system (FSK-P-36-00-12).
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	No monitoring/assessments were completed in 2016.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	Construction activities continued on with the Phase 1 & 2 Expansion project in 2016. This development began with the final construction of a new facility brine pond, washing of storage caverns, operation of associated infrastructure to support the cavern development, construction of new NGL storage facility, and infrastructure installation for a new truck off-loading terminal. The expansion has resulted in the site conducting a noise impact assessment which was subsequently used to update the Regional Noise Model in 2014. SLR Consulting conducted the NIA and updated the model with the information.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	The Facility will be continuing on with the Phase 1, 2 & 3 expansion plans in 2017. This will include the commissioning of a new facility brine pond, washing and development of underground storage caverns, construction of additional infrastructure (Merox Plant) at the fractionation plant, and additional earthworks to facilitate required surface water drainage upgrades. These activities may result in changes that require the facility to update the Regional Noise Model. This will be evaluated as we proceed with expansion activities.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	No audits or self-assessment evaluations were completed in 2016.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	No noise complaints were received by the Facility in 2016.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

Shell Scotford Site

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	**Member Site Comments**
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14 (attached), including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	In 2014, Shell Scotford amalgamated individual (Refinery, Chemicals, and Upgrader) Site NMPs into one document. It is called the Shell Scotford Site Noise Management Plan (SUG.HSSE.ENV.AIR.NOIS.M.002). Document attached. SUG.HSSE.ENV.NOIS .M.002_Site_Noise_M
Attach results of any monitoring/assessments (fenceline outward) completed in 2016. Note, you are not required to conduct any off-site monitoring, however if you did, please provide those results electronically to NCIA.	No monitoring/assessments completed in 2016
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	Site model update was done for Quest in 2016 . Site model update was done for Chemical Plant in 2016.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	Debottleneck Project will require our site model update. This will happen in 2018.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan.	Internal audit will be conducted is 2017.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	No noise complaints received in 2016.

This information is being collected as per the NMP Standard 2010-003 Document attached, section 5.4. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

Shell Scotford Site Noise Management Plan

Document Review and Approval		
Reviewed By		
Elaine Rippon		
Maurice Ouellet		
Wendy Konsorada		
Michael Frigge		
Achim Schempp		
APPROVED BY	**DATE**	**SIGNATURE**

Version 2

27-November-2014

	Area: Noise Monitoring	Document Number: SUG.HSSE.ENV.AIR.NOIS.M.002
Scotford Upgrader	**Title: Shell Scotford Site Noise Management Plan**	Rev No: 2 Date: Nov 27-14
Document Owner: Environment Manager	Document Focal: Noise Focal	

CONTENTS

Scotford Upgrader	**Area: Noise Monitoring**	Document Number: SUG.HSSE.ENV.AIR.NOIS.M.002
	Title: Shell Scotford Site Noise Management Plan	Rev No: 2 Date: Nov 27-14
Document Owner: Environment Manager	Document Focal: Noise Focal	

1 POLICY

Royal Dutch Shell's Commitment and Policy on Health, Security, Safety, the Environment and Social Performance demonstrates commitment for reducing environmental and social impacts resulting from our operations. For Shell Scotford, noise is actively managed by instituting controls, and measures up front when designing or changing parts of the process that generate noise, and by also measuring and monitoring to ensure controls are effective. This Site Noise Management Plan is part of the Scotford's ongoing commitment to the environment, our neighbours, and social performance. The Scotford Leadership Teams are committed to controlling noise and support the contents of this Site Noise Management Plan.

2 NOISE MANAGEMENT PROGRAM

2.1 Goals and Objectives

2.1.1 Regulatory Compliance

Noise is regulated by the Alberta Energy and Resources Conservation Board (ERCB), Directive 038, "Noise Control Directive – User Guide" and applies to all facilities where the ERCB has issued a permit to operate. Section 5.1 of the Noise Control Directive states,

> "A facility is in compliance if a CSL (comprehensive sound level) survey conducted at representative conditions has results equal to or lower than the established PSL (permissible sound level), taking into consideration any LFN (low frequency noise). Alternatively, if the ERCB agrees that a CSL survey is not practical, a detailed Noise Management Plan (NMP) approved by the ERCB may be used."

The Industrial Heartland is considered an area where a CSL survey is not practical due to the large industrial base in a relatively small area. As such, all NCIA (Northeast Capital Industrial Association) member companies in the Industrial Heartland are mandated to participate in the Regional Noise Management Plan developed by the NCIA. The RNMP is designed with the intent of minimizing, to the extent practical, the noise levels impacting on the environment from member companies and their associated industrial facilities. The RNMP ensures that NCIA member companies adopt best practices and principles in noise management and that each member company will implement a Site NMP (noise management plan) independently. Each NMP must include:

- identification of noise sources,
- assessment of current noise mitigation programs,
- performance effectiveness of noise control devices,
- methods of noise measurement,
- best practices programs, and
- continuous improvement programs

Compliance with D-38 is to be demonstrated through conformance with the RNMP on the basis of due diligence for noise control (taking all reasonable steps to reduce a given impact). Key expectations with respect to compliance are as follows:

1. Conformance with individual facility programs – implementing best practices in monitoring, abatement, self audit, annual reporting and other program details.
2. Complaint Resolution – partnership with regulator to determine adequate resources to manage complaints to a “workable resolution”.
3. Readiness for potential management system (Site NMP) audit – similar to other regulated activities under current monitoring and enforcement rules.
4. Participation in development and maintenance of a Regional Noise Model – the model provides a baseline for industrial noise and allows for an empirical assessment of potential problem area and sources.
5. Tracking noise management initiatives and providing an annual status to NCIA to facilitate a comprehensive annual report to the ERCB.

Companies that do not demonstrate conformance with the plan would default to Permissible Sound Level (PSL) compliance under Directive 038.

2.1.2 Noise Control Objectives

Shell recognizes that it is not practical or possible to eliminate all sources of noise. However, it is expected that wherever possible, noise control practices and mitigation will be in place to minimize noise, for example, maintaining a noise standard when procuring new equipment or taking into consideration possible noise impacts when instituting plant process changes. It also includes how Shell operates including employing the use of silencers and mufflers, or simply keeping doors on buildings closed.

Shell takes a proactive approach for activities that could have an environmental impact such as noise. When planning work that could generate excessive noise, such as boiler blow downs or flaring for example, it is important to assess the community impact and communicate with stakeholders as required. It is also Shell's approach to avoid practices that create excessive noise during evening hours and weekends whenever possible.

If despite proactive measures a resident expresses concern that they are impacted by plant operation, Shell will immediately initiate a complaint protocol and work in collaboration with the resident to attain resolution.

2.1.3 Continuous Improvement and Best Practices

For Shell, continuous improvement from a noise perspective means to examine noise sources to discover and eliminate problems. Examination of noise sources is accomplished through Industrial Hygiene (IH) noise surveys, noise modelling, and offsite noise surveys. When any of these tools identifies a potential unacceptable noise level, mitigation plans are implemented.

Shell educates and trains their staff on the Noise Management Plan during Operations Compliance Training.

Shell stays current by attending the bi-annual noise conference (hosted by the Alberta Acoustics & Noise Association) and having active representation on the NCIA Noise Best Practices Sub-committee. In the way Shell will be aware of the latest technology and advancements in the noise field and institute best practices accordingly.

2.1.4 Facility Communication Strategies

Where noise has been identified as a potential issue with the community, Shell will notify stakeholders in advance of the activity by utilizing the NRCAER line.

If a noise concern is received from a stakeholder, then SDP11021 Public Concern Response Practice is activated and followed and the SUG.HSSE.ENV.NOIS.P.001 Noise Sampling Practice is initiated and followed. All relevant information is entered in the SDF11021 Public Concern Form and the SUG.HSSE.ENV.NOIS.TO.001 Fenceline Noise Monitoring Form along with an incident report being entered into FIM (Fountain Incident Management).

2.2 Roles and Responsibilities

Department or Title	**Roles**
Community Affairs	• Notification to neighbours for planned activities. • Reactive communications to neighbours concern. • Monitor operations response to public concern.
Shift Supervisor or Designate	• Initiate investigation for public concern for operating units • Perform fence-line noise surveys. • If required follow-up with concern in off-hours (PA during normal hours).
Environment Department	• Support to Operations for investigation of noise concern, conducting fence-line noise surveys & regulatory notifications. • Data analysis and external noise surveys. • Maintain site noise model.
Industrial Hygiene	• Primary support for onsite noise monitoring.
Security	• Initial contact for public concern.

2.3 Monitoring and Measuring

2.3.1 Fenceline Monitoring

When a public concern is received and the SDP 11021 Public Concern Response Practice is activated, as stated in 2.1.4, or activities on site create the need to monitor noise levels, fenceline noise measurements are conducted.

Fenceline measurements are conducted as per SUG.HSSE.ENV.NOIS.P.001 Noise Sampling Practice and results are recorded on SUG.HSSE.ENV.NOIS.TO.001 Fenceline Noise Monitoring Form.

If the need arises for any other type of noise monitoring, a request can be submitted through SUG.HSSE.ENV.NOIS.TO.002 Request for Non-Routine Noise Sampling.

2.3.2 Industrial Hygiene (IH) Surveys

IH Surveys are done on a request basis, or at a minimum a unit noise survey is conducted every 4 years. All results and reports are stored in Livelink.

Shell is regulated under the Alberta OH&S Code and participates in the Hearing Conversation Program set forth in the code. IH is responsible to ensure that workers get noise dosimeter testing done every 2 years as part of this program.

2.3.3 Noise Modelling

A detailed noise model was developed for the Shell Scotford Upgrader in 2006 and can be viewed here 2006 Noise Model. The model identifies all noise sources within the base Upgrader.

The Upgrader Expansion started operations in June 2011. It is Shell's intent to update the original 2006 Model to include the Expansion facilities, and to identify any changes to the existing Base plant, by the end of 2014.

2.3.4 Routine Monitoring

There is currently no routine monitoring being done at Shell Scotford, due to the fact there has not been a residence complaint since 2004 and the results of the 2005 Noise Model demonstrated satisfactory offsite noise levels.

An offsite noise survey of the Shell facilities will be completed in 2014 to determine the offsite CSL's post Expansion project start up.

The results of this survey along with the information obtained from the upcoming model will determine what, if any, routine monitoring will be conducted.

2.4 Noise Control

Proactively ensuring mitigative measures and controls are considered in order to minimize the impact of noise when implementing facility design changes or purchasing new equipment is a key principle of noise control. When implementing a change at Shell Scotford, whether it's new equipment or a modification to existing equipment, the MOC (Management of Change) process must be followed. For the Upgrader, Shell's definition of a plant change can be found in SUG.CON.MOC.C.001 Definition of Plant Change. For Manufacturing, changes that do not require following the MOC process are listed in SCM-MOC-SP-01 Changes Not Requiring Management of Change (MOC).

The Management of Change Quality Assurance Manual describes the work process for all managed changes within the Shell Scotford Upgrader. The SCM-MOC-PR-01 Management of Change (MOC) Procedure describes the work process for all managed changes within Shell Scotford Manufacturing. Any change that may increase noise as per SUG.CON.MOC.G.001 Environmental Guideline for Noise Producing Equipment.needs to be reviewed and signed off by both the Environment department and Industrial Hygiene as per SUG.CON.MOC.C.003 Discipline Review Parties Matrix for the Upgrader, and the SCM-MOC-G-06 Discipline Reviewer Matrix for Manufacturing

3 AUDIT/SELF ASSESSMENT

Noise is included in the scope of ongoing ISO 14001 audits and the HSSE MS internal audits under social performance. Audit findings are recorded in Fountain Assurance Management (FAM) with related action items assigned to individuals. Audit findings are reviewed by Upgrader Leadership Team.

An internal audit specific to the Site NMP against the NCIA Standards and Guidelines will be done every 3 years.

Audit results and findings will be included in the annual summary to NCIA to be included in the NCIA Annual Noise Report to ERCB.

4 REPORTING

All routine sampling results, non-routine sampling results, monitoring surveys, and modelling results are stored in Shell's Livelink and/or Sharepoint system.

Shell has the responsibility to provide input into the Annual Regional Noise Management Plan report, which is submitted to the ERCB by NCIA. Information to be provided is as follows:

- Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-001 issued 3-Sep-10.
- Procedure/Practice/Standard reference (i.e. SOP-AG-RW-200-002)
- Results of any monitoring/assessments (fenceline outward) completed in the reporting year.
- Improvements implemented for the reporting year.
- Changes that have resulted in increased noise levels on your site for the year reporting on.

- Noise Complaints received and follow up actions taken to address them.

- Planned improvements to noise management practice, noise abatement work or noise model work for the upcoming year.

global environmental solutions

Addendum to the 2015 Shell Scotford Noise Model Update on issues related to the Chemicals Plant model validation

Rev 0

November 2016
SLR Project No.: 203.50049.00004

ADDENDUM

TO THE 2015 SHELL SCOTFORD NOISE MODEL UPDATE

ON ISSUES RELATED TO THE CHEMICALS PLANT MODEL VALIDATION

SLR Project No.: 203.50049.00004

Prepared by
SLR Consulting (Canada) Ltd.
1185 – 10201 Southport Road
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for

Shell Canada LTD.
55522 Range Road 214
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November 28, 2016

Prepared by:

2016-11-29

Chris Bibby, M.A.Sc., P.Eng.
Intermediate Engineer

Reviewed by:

Nigel Maybee, M.A.Sc
Principal Scientist

CONFIDENTIAL

Distribution: 1 copy – Shell Canada Ltd. (pdf)
1 copy – SLR Consulting (Canada) Ltd.

EXECUTIVE SUMMARY

The Shell Canada (Shell) Scotford Complex is comprised of Refinery, Base Upgrader, Expansion Upgrader, and Chemicals sites. Shell maintains a computer noise model of these sites, as required by the Northeast Capital Industrial Association (NCIA) Regional Noise Management Plan (RNMP). SLR Consulting (Canada) Ltd. (SLR) recently updated the Scotford noise model, as documented in the 2015 Noise Model Update report.

The 2015 Noise Model Update included validation of all Scotford plant sites by comparing predicted sound levels to measured sound levels on roadways throughout the Complex. The Chemicals site model was shown to over-predict the measured level in specific areas. The noise sources with the highest predicted sound level contribution in these areas were identified.

This addendum documents work completed to improve the accuracy of the Chemicals site noise model.

Diagnostic sound level measurements were conducted on key pieces of Chemicals site equipment identified in the 2015 Shell Scotford Noise Model Update report. The measurement results were processed to determine equipment sound power levels, which were then updated in the Chemicals site noise model. Revisions to the model include 21 added sources, 56 updated sources, and 9 removed sources. Model validation was improved considerably; at the 39 validation locations, all predicted sound levels were within 3 dBA of the measured level and the average difference between the predicted and measured levels was 0.9 dBA.

The revisions documented in this addendum resulted in a 0.1 to 1.0 dBA decrease in the overall Shell Scotford Complex sound level contributions at all environmental receptor locations.

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APPENDICES

1.0 INTRODUCTION

The Shell Canada (Shell) Scotford Complex is comprised of Refinery, Base Upgrader, Expansion Upgrader, and Chemicals sites. Shell maintains a computer noise model of these sites, as required by the Northeast Capital Industrial Association (NCIA) Regional Noise Management Plan (RNMP). SLR Consulting (Canada) Ltd. (SLR) recently updated the Scotford noise model, as documented in the 2015 Noise Model Update report[1].

The 2015 Noise Model Update included validation of all Scotford sites by comparing predicted sound levels to measured sound levels on roadways throughout the Complex. The Chemicals site model was shown to over-predict the measured level in specific areas. The noise sources with the highest predicted sound level contribution in these areas were identified.

This addendum documents work completed to improve the Chemicals site model accuracy, including measurements, noise model revisions, and updated sound level predictions.

2.0 EQUIPMENT NOISE MEASUREMENTS

A diagnostic noise survey was conducted by Mr. Chris Bibby, M.A.Sc., and Mr. Matthew Gaskell, C.E.T., of SLR on August 11, 2016. The noise survey was designed to obtain current noise data for key Chemicals site noise sources identified in the 2015 Noise Model Update report. Additionally, SLR conducted measurements of all fin-fan coolers in the MEG unit because VFDs (variable speed drives) have been installed since they were last measured in 2002. VFDs allow the fan speeds to be varied, which will change the noise level produced by the fans.

Operations personnel indicated all Chemicals site equipment was operating normally at the time of the measurements, with the exception of the O_2 Blower (building BY3005) which was not operating. BY3005 was not included in the measurement scope, and the blower operating state is not expected to have impacted the measured noise levels.

The sound measurement instrumentation used for the equipment noise measurements were as follows:

- Brüel & Kjær Type 2270 hand-held analyser
- Brüel & Kjær Type 4189 ½” microphone
- Brüel & Kjær ZC-0032 preamplifier
- Brüel & Kjær UA-1650 wind screen
- Brüel & Kjær Type 4231 calibrator

3.0 EQUIPMENT NOISE LEVELS

86 noise sources in the Chemicals site noise model were modified based on the results of the noise survey conducted in August, 2016, including: 21 added sources, 56 updated sources, and 9 removed sources. Details of the modifications for each source are provided in Appendix A. The resulting effect of these changes on the overall sound power levels of the Chemicals units

[1] SLR Consulting (Canada) Ltd., *2015 Shell Scotford Noise Model Update*, SLR Project No.: 203.50049.00001/203.50049.00002, January 18, 2016.

are summarized in Table 1. The total sound power level of the Styrene unit decreased by 0.8 dBA because the HS219 furnace level was reduced and the HS102 furnace was removed[2]. Total sound power level of the MEG unit increased by 3.5 dBA, primarily due to noise from additional and updated fin fan coolers. Total sound power of the Utilities unit decreased by 1.5 dBA due to a reduction in the LP steam header noise levels. The total Chemicals site sound power level increased by 1.5 dBA.

Table 1 Total Sound Power Levels by Unit

Site	Unit	Sound Power Level, dBA		
		Before Update	Updated	Change
Chemicals	Styrene	120.8	119.9	-0.8
Chemicals	MEG	123.2	126.7	3.5
Chemicals	Utilities	120.8	119.3	-1.5
Chemicals	**All Units**	**126.5**	**128.2**	**1.6**

4.0 ON-SITE MODEL VALIDATION

The Chemicals model was validated at 39 locations on the roadways around the site. Validation measurement sound levels around the Styrene and Utilities units are the values utilized in the 2015 Noise Model Update report. Validation measurements around the MEG unit were retaken during the August 2016 measurements to ensure the fin-fan cooler operation was typical of summertime conditions.

Chemicals site model validation results are provided in Appendix B. Table B-1 and Figure B-2 show that the predicted sound levels are within ±3 dBA of the measured levels, which is a very good validity margin for industrial facility noise models. On average, the predicted sound level is 0.9 dBA higher than the measured sound level.

5.0 OFF-SITE PREDICTED SOUND LEVELS

The Shell Scotford sound level contribution has been predicted at 20 off-site locations (identified in Figure 1) using the updated noise model. These receptor locations are identical to those presented in the 2015 Shell Scotford Noise Model Update report. The corresponding noise contour map for these sound level predictions is provided in Appendix C.

The predictions have been calculated using the updated noise source and geometry definitions for the Chemicals site. All predictions correspond to summertime ground and atmospheric conditions with calm winds. The predicted sound level contribution of the Chemicals site and overall Shell Scotford complex before and after the 2016 Chemicals site updates are shown in Table 2.

[2] Unit operators stated that HS102 only operates during plant start-up and shutdown.

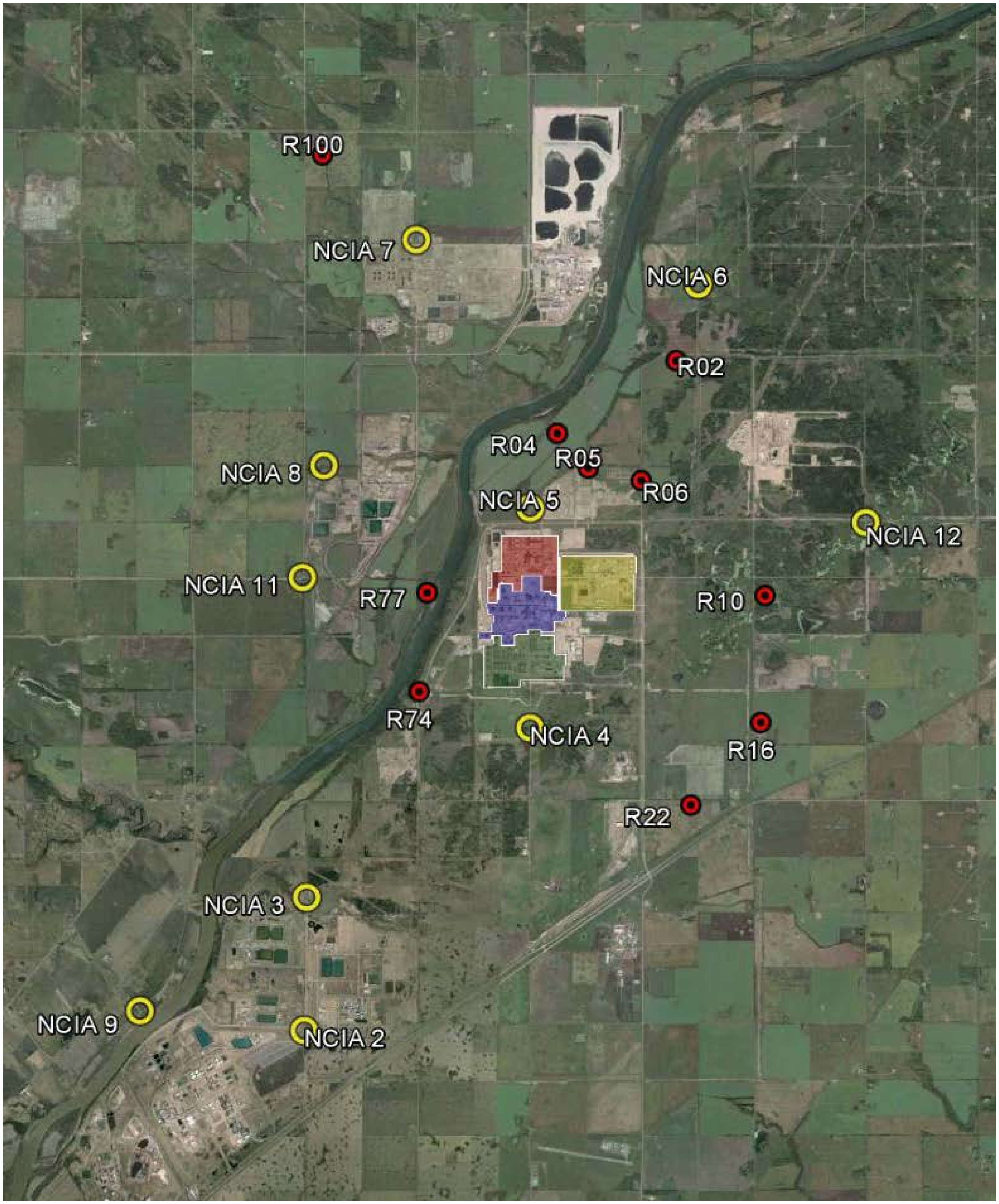

Figure 1 Shell Scotford Noise Receptor Locations

Table 2 Predicted Sound Levels

Receptor	Sound Pressure Level, dBA Leq					
	Chemicals Site			Shell Scotford Total		
	2015 Update	2016 Addendum	Change	2015 Update	2016 Addendum	Change
R02	29.8	27.5	-2.3	34.4	33.7	-0.7
R04	36.1	34.9	-1.2	43.5	43.3	-0.2
R05	42.4	40.8	-1.6	47.4	46.9	-0.5
R06	41.9	40.0	-1.9	45.4	44.7	-0.8
R10	34.6	34.3	-0.4	38.4	38.3	-0.1
R16	31.5	29.3	-2.1	36.5	36.0	-0.5
R22	29.4	27.6	-1.8	36.6	36.3	-0.3
R74	34.3	31.8	-2.5	46.5	46.4	-0.1
R77	37.8	36.2	-1.6	50.2	50.1	-0.1
R100	18.6	15.8	-2.9	23.5	22.7	-0.8
NCIA 2	18.3	14.8	-3.5	24.0	23.3	-0.7
NCIA 3	21.9	18.3	-3.6	28.8	28.3	-0.5
NCIA 4	38.4	36.6	-1.7	51.0	51.0	-0.1
NCIA 5	44.1	42.6	-1.5	54.2	54.0	-0.1
NCIA 6	25.1	22.1	-3.0	29.8	29.1	-0.7
NCIA 8	26.9	25.3	-1.6	36.6	36.5	-0.1
NCIA 9	16.3	11.7	-4.5	21.2	20.1	-1.0
NCIA 11	27.9	26.2	-1.6	36.7	36.5	-0.1
NCIA 12	27.1	26.2	-0.9	30.5	30.1	-0.4

While Table 1 shows that the overall site sound power level has increased, this increase is predominantly due to updates to the fin-fan coolers. Fin-fan coolers are directional noise sources with a predominantly vertical sound radiation pattern. This noise model update includes appropriate directivity corrections applied to all fin-fan coolers, including those previously modeled as omni-directional noise sources. The net increase in fin-fan cooler noise, coupled with these directivity corrections, is offset by reductions in noise from other sources such as piping, vessels, eductors, valves, and furnaces. As a result, changes to the Chemicals site model resulted in a net decrease in predicted sound level at the receptors of up to 4 dBA (Table 2). The reduction in Chemicals site sound level contribution resulted in a reduction in the Shell Scotford complex noise level of up to 1.0 dBA.

5.1 Order Ranked Lists

Appendix C provides revised order–ranked lists of the top 100 noise source contributors at the receptor locations. These lists are an update to those presented in the 2015 noise model report, incorporating the Chemicals site revisions documented in this addendum.

6.0 CONCLUSION

The Chemicals site noise model has been revised to improve model accuracy. Diagnostic sound level measurements were conducted on key pieces of equipment identified in the 2015 Shell Scotford Noise Model Update report. The measurement results were processed to determine equipment sound power levels, which were then updated in the Chemicals site noise model. Revisions to the model include 21 added sources, 56 updated sources, and 9 removed sources. Model validation has improved considerably; at the 39 validation locations, all predicted sound levels were within 3 dBA of the measured level, and the average difference between the predicted and measured levels was 0.9 dBA.

The revisions documented in this addendum resulted in a 0.1 to 1.0 dBA decrease in the overall Shell Scotford Complex sound level contributions at all environmental receptor locations.

7.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Shell Canada, hereafter referred to as the “Client”. It is intended for the sole and exclusive use of Shell Canada. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLR.

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APPENDIX A
Chemicals Site Equipment Sound Power Levels

Shell Canada Ltd.
Shell Scotford Refinery, Upgrader, and Chemicals Plants
Addendum to the 2015 Shell Scotford Noise Model Update
SLR Project No.: 203.50049.00004

Table A-1

Equipment Sound Power Levels

Shell Scotford Chemicals

Summertime Conditions

Site	Unit	Tag/Description	Sound Power Level (dBA)			Remarks
			2015 Update	Addendum	Change	
Chemicals	Styrene	FD Air Inlet for HS 104	78.8	78.8	0.0	
Chemicals	Styrene	FD Air Inlet for HS 104	82.8	82.8	0.0	
Chemicals	Styrene	FD Air Inlet for HS 104	78.8	78.8	0.0	
Chemicals	Styrene	FD Air Inlet for HS 104	82.8	82.8	0.0	
Chemicals	Styrene	FD fan moter of HS104	97.4	97.4	0.0	
Chemicals	Styrene	FD fan of HS104	93.1	93.1	0.0	
Chemicals	Styrene	ID fan motor of HS104	96.6	96.6	0.0	
Chemicals	Styrene	Burner of HS 104	87.9	87.9	0.0	
Chemicals	Styrene	Burner of HS 104	87.1	87.1	0.0	
Chemicals	Styrene	Burner of HS 104	87.6	87.6	0.0	
Chemicals	Styrene	Burner of HS 104	86.9	86.9	0.0	
Chemicals	Styrene	Burner of HS 104	87.7	87.7	0.0	
Chemicals	Styrene	Burner of HS 104	87.1	87.1	0.0	
Chemicals	Styrene	Burner of HS 104	87.0	87.0	0.0	
Chemicals	Styrene	Burner of HS 104	88.2	88.2	0.0	
Chemicals	Styrene	Pipe FD fan duct of HS104	97.5	94.5	-3.0	Updated
Chemicals	Styrene	Pipe ID fan duct of HS104	100.3	89.4	-10.9	Updated
Chemicals	Styrene	Cmpr Bldg in NE of EB - wall Eas	96.0	96.0	0.0	
Chemicals	Styrene	Cmpr Bldg in NE of EB - wall nor	95.0	95.0	0.0	
Chemicals	Styrene	Cmpr Bldg in NE of EB - wall sou	95.0	95.0	0.0	
Chemicals	Styrene	Cmpr Bldg in NE of EB - wall wes	96.0	96.0	0.0	
Chemicals	Styrene	INHIB building in NW of EB - ea	83.3	83.3	0.0	
Chemicals	Styrene	INHIB building in NW of EB - no	80.7	80.7	0.0	
Chemicals	Styrene	INHIB building in NW of EB - Ro	83.2	83.2	0.0	
Chemicals	Styrene	INHIB building in NW of EB - so	80.7	80.7	0.0	
Chemicals	Styrene	INHIB building in NW of EB - we	83.3	83.3	0.0	
Chemicals	Styrene	NE Of EB Cmprs Bldg Roof	96.6	96.6	0.0	
Chemicals	Styrene	OMP building in NW of EB - east	91.3	91.3	0.0	
Chemicals	Styrene	OMP building in NW of EB - nort	90.4	90.4	0.0	
Chemicals	Styrene	OMP building in NW of EB - Roof	94.2	94.2	0.0	

Site	Unit	Tag/Description	Sound Power Level (dBA)			Remarks
			2015 Update	Addendum	Change	
Chemicals	Styrene	OMP building in NW of EB - sout	90.4	90.4	0.0	
Chemicals	Styrene	OMP building in NW of EB - west	91.3	91.3	0.0	
Chemicals	Styrene	Bottom of HS 103	91.5	91.5	0.0	
Chemicals	Styrene	Bottom of HS 105	97.0	97.0	0.0	
Chemicals	Styrene	FT1007	103.1	103.1	0.0	
Chemicals	Styrene	FT1118	94.0	94.0	0.0	
Chemicals	Styrene	FV1005	102.5	102.5	0.0	
Chemicals	Styrene	FV1006	105.0	105.0	0.0	
Chemicals	Styrene	FV1017	107.9	107.9	0.0	
Chemicals	Styrene	FV1018	105.9	105.9	0.0	
Chemicals	Styrene	GZ348CPA1P	102.4	102.4	0.0	
Chemicals	Styrene	HS 102 East side	105.8	--	--	Removed - Regen heater, HS 102 used for startup/shutdown only
Chemicals	Styrene	HS 102 North side	106.4	--	--	
Chemicals	Styrene	HS 102 South side	106.4	--	--	
Chemicals	Styrene	HS 102 West side	105.8	--	--	
Chemicals	Styrene	MOV3S	99.5	99.5	0.0	
Chemicals	Styrene	MOV5S	100.0	100.0	0.0	
Chemicals	Styrene	MOV7S	99.1	99.1	0.0	
Chemicals	Styrene	PP103A 1M	101.8	101.8	0.0	
Chemicals	Styrene	PP103B 1M	102.4	102.4	0.0	
Chemicals	Styrene	PP109A 1M	100.0	100.0	0.0	
Chemicals	Styrene	PP110A	98.3	98.3	0.0	
Chemicals	Styrene	PP112S	104.5	104.5	0.0	
Chemicals	Styrene	PP114S	100.0	100.0	0.0	
Chemicals	Styrene	PP141S 1M	99.9	99.9	0.0	
Chemicals	Styrene	PP145A	99.4	99.4	0.0	
Chemicals	Styrene	PP147B	98.0	98.0	0.0	
Chemicals	Styrene	PP148A	98.7	98.7	0.0	
Chemicals	Styrene	PP151S	97.7	97.7	0.0	
Chemicals	Styrene	PP215S	104.0	104.0	0.0	
Chemicals	Styrene	PP370S	100.6	100.6	0.0	
Chemicals	Styrene	PP387S	102.9	102.9	0.0	
Chemicals	Styrene	PT1010	95.9	95.9	0.0	
Chemicals	Styrene	TV 1002	91.5	91.5	0.0	

Site	Unit	Tag/Description	Sound Power Level (dBA) 2015 Update	Addendum	Change	Remarks
Chemicals	Styrene	HS-101 stack outlet	78.0	--	--	Removed - Regen heater, HS 102 used for startup/shutdown only
Chemicals	Styrene	HS-103 stack outlet	80.3	80.3	0.0	
Chemicals	Styrene	HS-219 stack outlet	64.2	64.2	0.0	
Chemicals	Styrene	HS-219 North face	106.4	101.0	-5.4	Updated
Chemicals	Styrene	HS-219 South face	106.4	101.0	-5.4	Updated
Chemicals	Styrene	HS-219 West face	104.7	99.2	-5.5	Updated
Chemicals	Styrene	HS 219 Base	--	107.5	--	Added
Chemicals	Styrene	Pipe FURN MR201BASE	103.9	103.9	0.0	
Chemicals	Styrene	Pipe FURN MR201C BASE	97.8	97.8	0.0	
Chemicals	Styrene	Pipe FV2003 LINE	104.4	104.4	0.0	
Chemicals	Styrene	Pipe FV2019	90.7	90.7	0.0	
Chemicals	Styrene	Pipe MR 201D Base	100.1	100.1	0.0	
Chemicals	Styrene	Pipe under toilet paper role in	83.1	83.1	0.0	
Chemicals	Styrene	Styrene CWR pipe	100.8	100.8	0.0	
Chemicals	Styrene	Tanks PP416A VV & 6M PIPE	99.9	99.9	0.0	
Chemicals	Styrene	Steam Mixer GA-224	98.6	98.6	0.0	
Chemicals	Styrene	FF2019 V	98.7	98.7	0.0	
Chemicals	Styrene	FV 7003	107.6	107.6	0.0	
Chemicals	Styrene	GZ 348E	104.4	104.4	0.0	
Chemicals	Styrene	LV 2001	104.0	104.0	0.0	
Chemicals	Styrene	P202S B	98.5	98.5	0.0	
Chemicals	Styrene	p203A	99.0	99.0	0.0	
Chemicals	Styrene	P204A M	99.1	99.1	0.0	
Chemicals	Styrene	P205S M	105.7	105.7	0.0	
Chemicals	Styrene	P206S M	98.1	98.1	0.0	
Chemicals	Styrene	P208S M	93.8	93.8	0.0	
Chemicals	Styrene	P209S M	99.3	99.3	0.0	
Chemicals	Styrene	P210A M	98.2	98.2	0.0	
Chemicals	Styrene	P220A M	100.8	100.8	0.0	
Chemicals	Styrene	P224S M	97.3	97.3	0.0	
Chemicals	Styrene	P231A M	95.4	95.4	0.0	
Chemicals	Styrene	P242A M	99.0	99.0	0.0	
Chemicals	Styrene	P243A M	91.6	91.6	0.0	

Site	Unit	Tag/Description	Sound Power Level (dBA)			Remarks
			2015 Update	Addendum	Change	
Chemicals	Styrene	P244S M	99.3	99.3	0.0	
Chemicals	Styrene	P281A M	100.0	100.0	0.0	
Chemicals	Styrene	P282A M	100.7	100.7	0.0	
Chemicals	Styrene	PD211S M	97.2	97.2	0.0	
Chemicals	Styrene	Tanks GZ348H	104.6	104.6	0.0	
Chemicals	Styrene	Tanks PP402A	95.4	95.4	0.0	
Chemicals	Styrene	Tanks PP416A	104.2	104.2	0.0	
Chemicals	Styrene	Tanks PP417A	98.9	98.9	0.0	
Chemicals	Styrene	Tanks PP418S	97.8	97.8	0.0	
Chemicals	MEG	MEG Compressor Discharge after PVD-32011	111.0	111.0	0.0	
Chemicals	MEG	MEG Compressor Discharge before PVD-32011	81.0	81.0	0.0	
Chemicals	MEG	MEG Compressor Suction	107.8	107.8	0.0	
Chemicals	MEG	MEG pipe "A"	109.5	109.5	0.0	
Chemicals	MEG	MEG Pipe BY 3201	110.4	110.4	0.0	
Chemicals	MEG	MEG pipe from TT3101	110.6	110.6	0.0	
Chemicals	MEG	MEG pipe FV-32021	97.6	97.6	0.0	
Chemicals	MEG	MEG pipe PY-3401-T1 CONDEN	108.4	108.4	0.0	
Chemicals	MEG	MEG PIPE SH2800 TO AS3401 CONCEN	95.8	95.8	0.0	
Chemicals	MEG	MEG PP-3217A PIPE	103.7	103.7	0.0	
Chemicals	MEG	MEG PP-3401S PIPE	96.4	96.4	0.0	
Chemicals	MEG	MEG CO2 Vent	99.9	99.9	0.0	
Chemicals	MEG	Aerial Cooler Fan E 3203A-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3203A-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3203B-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3203B-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3206A-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3206A-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3206B-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3206B-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3206C-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3206C-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3206D-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3206D-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3209A-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3209A-2	--	107.3	--	Added

Site	Unit	Tag/Description	Sound Power Level (dBA)			Remarks
			2015 Update	Addendum	Change	
Chemicals	MEG	Aerial Cooler Fan E 3209B-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3209B-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3209C-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3209C-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3209D-1	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3209D-2	--	107.3	--	Added
Chemicals	MEG	Aerial Cooler Fan E 3209E-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209E-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209F-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209F-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209G-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209G-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209H-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209H-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209I-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209I-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209J-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3209J-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3213-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3213-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3301A-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3301A-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3301B-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3301B-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3301C-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3301C-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410A-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410A-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410B-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410B-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410C-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410C-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410D-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410D-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410E-1	87.2	107.3	20.1	Updated

Site	Unit	Tag/Description	Sound Power Level (dBA)			Remarks
			2015 Update	Addendum	Change	
Chemicals	MEG	Aerial Cooler Fan E 3410E-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410F-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3410F-2	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3504-1	87.2	107.3	20.1	Updated
Chemicals	MEG	Aerial Cooler Fan E 3504-2	87.2	107.3	20.1	Updated
Chemicals	MEG	MEG compressor Bldg - E wall	88.8	88.8	0.0	
Chemicals	MEG	MEG compressor Bldg - N louvers	101.9	101.9	0.0	
Chemicals	MEG	MEG compressor Bldg - N wall	88.5	88.5	0.0	
Chemicals	MEG	MEG compressor Bldg - S louvers	93.4	93.4	0.0	
Chemicals	MEG	MEG compressor Bldg - S louvers	92.1	92.1	0.0	
Chemicals	MEG	MEG compressor Bldg - S wall	88.8	88.8	0.0	
Chemicals	MEG	MEG compressor Bldg - W louvers	97.3	97.3	0.0	
Chemicals	MEG	MEG compressor Bldg - W wall	88.7	88.7	0.0	
Chemicals	MEG	MEG Vessel TT3406 east face	99.3	99.3	0.0	
Chemicals	MEG	MEG Vessel TT3406 north face	97.9	97.9	0.0	
Chemicals	MEG	MEG Vessel TT3406 south face	100.3	100.3	0.0	
Chemicals	MEG	MEG Vessel TT3406 west face	99.3	99.3	0.0	
Chemicals	MEG	MEG Vessel TT3503A Roof	94.3	94.3	0.0	
Chemicals	MEG	MEG Vessel TT3503A	97.1	97.1	0.0	
Chemicals	MEG	MEG Vessel TT3503A	96.3	87.9	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503A	99.3	90.9	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503A	97.4	89.0	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503A	95.8	87.4	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503A	99.3	90.9	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503A	96.0	87.6	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503A	97.6	89.2	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B	96.3	87.9	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B	100.0	91.6	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B	98.7	90.3	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B	99.5	91.1	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B	98.4	90.0	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B	98.2	89.8	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B	98.7	90.3	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B	99.8	91.4	-8.4	Updated
Chemicals	MEG	MEG Vessel TT3503B Roof	96.7	96.7	0.0	

Site	Unit	Tag/Description	Sound Power Level (dBA) 2015 Update	Addendum	Change	Remarks
Chemicals	MEG	TT 3101 Vessel1	101.1	101.1	0.0	
Chemicals	MEG	TT 3101 Vessel2	100.5	100.5	0.0	
Chemicals	MEG	TT 3101 Vessel3	100.0	100.0	0.0	
Chemicals	MEG	TT 3101 Vessel4	100.5	100.5	0.0	
Chemicals	MEG	TT 3101 Vessel5	100.2	100.2	0.0	
Chemicals	MEG	TT 3101 Vessel6	101.1	101.1	0.0	
Chemicals	MEG	TT 3101 Vessel7	100.9	100.9	0.0	
Chemicals	MEG	TT 3101 Vessel8	101.5	101.5	0.0	
Chemicals	MEG	MEG PP-3205A piping	97.0	97.0	0.0	
Chemicals	MEG	MEG PP-3205S	105.7	105.7	0.0	
Chemicals	MEG	MEG PP-3301S M	97.0	97.0	0.0	
Chemicals	MEG	MEG TT3408AR vessel discharge	97.0	97.0	0.0	
Chemicals	MEG	MEG FV-34049 VALVE	95.6	95.6	0.0	
Chemicals	MEG	MEG FV-35003 V	99.2	99.2	0.0	
Chemicals	MEG	MEG FV-35011 VALVE	106.1	--	--	Oberved to be Insinificant
Chemicals	MEG	MEG FV-35032 V	106.8	--	--	Oberved to be Insinificant
Chemicals	MEG	MEG FV32001	102.3	102.3	0.0	
Chemicals	MEG	MEG FV34010	102.2	102.2	0.0	
Chemicals	MEG	MEG GFV34043	104.0	104.0	0.0	
Chemicals	MEG	MEG LV34006A	107.4	--	--	Oberved to be Insinificant
Chemicals	MEG	MEG PP-3101A M	100.5	100.5	0.0	
Chemicals	MEG	MEG PP-3101B M	99.0	99.0	0.0	
Chemicals	MEG	MEG PP-3201A M	103.0	103.0	0.0	
Chemicals	MEG	MEG PP-3203S M	98.5	98.5	0.0	
Chemicals	MEG	MEG PP-3204B M	100.1	100.1	0.0	
Chemicals	MEG	MEG PP-3208S M	92.4	92.4	0.0	
Chemicals	MEG	MEG PP-3214A M	100.4	100.4	0.0	
Chemicals	MEG	MEG PP-3217A M	102.7	102.7	0.0	
Chemicals	MEG	MEG PP-3303S M	94.9	94.9	0.0	
Chemicals	MEG	MEG PP-3304A M	97.6	97.6	0.0	
Chemicals	MEG	MEG PP-3401S M	100.4	100.4	0.0	
Chemicals	MEG	MEG PP-3402A M	99.4	99.4	0.0	
Chemicals	MEG	MEG PP-3403A M	96.5	96.5	0.0	

Site	Unit	Tag/Description	Sound Power Level (dBA)			Remarks
			2015 Update	Addendum	Change	
Chemicals	MEG	MEG PP-3404S M	95.0	95.0	0.0	
Chemicals	MEG	MEG PP-3405S M	93.1	93.1	0.0	
Chemicals	MEG	MEG PP-3406A M	100.5	100.5	0.0	
Chemicals	MEG	MEG PP-3407A M	92.6	92.6	0.0	
Chemicals	MEG	MEG PP-3408S M	95.5	95.5	0.0	
Chemicals	MEG	MEG PP-3502A M	94.8	94.8	0.0	
Chemicals	MEG	MEG PP-3503S M	96.7	96.7	0.0	
Chemicals	MEG	MEG PP-3505S M	94.9	94.9	0.0	
Chemicals	MEG	MEG PP-3506A M	97.9	97.9	0.0	
Chemicals	MEG	MEG PP-3507A M	99.6	99.6	0.0	
Chemicals	MEG	MEG PP-3508A M	93.5	93.5	0.0	
Chemicals	MEG	MEG PP-3509S M	99.9	99.9	0.0	
Chemicals	MEG	MEG PP-3510S M	99.1	99.1	0.0	
Chemicals	MEG	MEG PP-3513S M	99.6	99.6	0.0	
Chemicals	MEG	MEG PV-32001A V	97.5	97.5	0.0	
Chemicals	MEG	MEG SH-2800 piping	92.1	92.1	0.0	
Chemicals	MEG	MEG SL 30019 line (pt src)	103.9	--	--	Oberved to be Insinificant
Chemicals	MEG	MEG UV-35001 V	100.8	100.8	0.0	
Chemicals	MEG	MEG VALVE ON TT3408AR	102.3	102.3	0.0	
Chemicals	MEG	PP3001A	98.3	98.3	0.0	
Chemicals	MEG	O2 blower bldg S door	98.0	98.0	0.0	
Chemicals	MEG	O2 blower bldg W door	100.7	100.7	0.0	
Chemicals	MEG	pipe SH-2800 desuperheater	92.9	92.9	0.0	
Chemicals	MEG	pipes near AS-3203	106.7	106.7	0.0	
Chemicals	MEG	PY-3401 Eductor	106.6	107.2	0.6	Updated
Chemicals	MEG	O2 mixbox inlet	95.7	95.7	0.0	
Chemicals	MEG	O2 mixbox outlet	105.7	105.7	0.0	
Chemicals	MEG	piping RCG to TT-3101	95.5	95.5	0.0	
Chemicals	MEG	TT3101 piping	101.2	101.2	0.0	
Chemicals	MEG	TT3101 piping	97.0	97.0	0.0	
Chemicals	MEG	TT3101 piping	98.6	98.6	0.0	
Chemicals	MEG	PT-32003	115.9	115.9	0.0	
Chemicals	MEG	Comp. Disch. Ball valve	96.0	96.0	0.0	
Chemicals	MEG	TT-3506 vessel top	108.7	108.7	0.0	

Site	Unit	Tag/Description	Sound Power Level (dBA)			Remarks
			2015 Update	Addendum	Change	
Chemicals	Utilities	Center boiler intake VFD	108.2	108.2	0.0	
Chemicals	Utilities	centre boiler FD fan casing	96.6	96.6	0.0	
Chemicals	Utilities	HB-301C stack outlet	94.1	94.1	0.0	
Chemicals	Utilities	north boiler FD fan casing	96.6	96.6	0.0	
Chemicals	Utilities	North boiler intake VFD	101.7	101.7	0.0	
Chemicals	Utilities	south boiler FD fan casing	96.6	96.6	0.0	
Chemicals	Utilities	South boiler intake VFD	102.5	102.5	0.0	
Chemicals	Utilities	Utilities Boiler Air Intake (mid	98.0	98.0	0.0	
Chemicals	Utilities	Utilities Boiler Air Intake (Nor	103.4	103.4	0.0	
Chemicals	Utilities	Utilities Boiler Air Intake (Sou	103.7	103.7	0.0	
Chemicals	Utilities	Utilities Flare Blower	101.9	101.9	0.0	
Chemicals	Utilities	HB-301A stack outlet	94.1	94.1	0.0	
Chemicals	Utilities	HB-301B stack outlet	94.1	94.1	0.0	
Chemicals	Utilities	Pipe BEFORE MP-LP LETDOWN	97.3	97.3	0.0	
Chemicals	Utilities	Pipe LP EXST STM RECYKLE	96.9	96.9	0.0	
Chemicals	Utilities	Pipe LP STEAM EXAUET	102.4	102.4	0.0	
Chemicals	Utilities	Pipe LP STM HEADER	104.5	104.5	0.0	
Chemicals	Utilities	Utilities HP STM VALVE	89.2	89.2	0.0	
Chemicals	Utilities	Utilities De-airator vent	111.3	111.3	0.0	
Chemicals	Utilities	Cooling Tower fan #1 (1-8 W-E)	102.8	102.8	0.0	
Chemicals	Utilities	Cooling Tower fan #2 (1-8 W-E)	102.8	102.8	0.0	
Chemicals	Utilities	Cooling Tower fan #3 (1-8 W-E)	102.8	102.8	0.0	
Chemicals	Utilities	Cooling Tower fan #4 (1-8 W-E)	102.8	102.8	0.0	
Chemicals	Utilities	Cooling Tower fan #5 (1-8 W-E)	102.8	102.8	0.0	
Chemicals	Utilities	Cooling Tower fan #6 (1-8 W-E)	102.8	102.8	0.0	
Chemicals	Utilities	Cooling Tower fan #7 (1-8 W-E)	102.8	102.8	0.0	
Chemicals	Utilities	Cooling Tower fan #8 (1-8 W-E)	102.8	102.8	0.0	
Chemicals	Utilities	Utilities Cooling Tower North Sp	108.4	108.4	0.0	
Chemicals	Utilities	Utilities Cooling Tower South Sp	108.4	108.4	0.0	
Chemicals	Utilities	Main Utilites Building	110.4	110.4	0.0	
Chemicals	Utilities	Main Utilites Building	94.4	94.4	0.0	
Chemicals	Utilities	Main Utilites Building	83.2	83.2	0.0	
Chemicals	Utilities	Main Utilites Building	89.6	89.6	0.0	
Chemicals	Utilities	Main Utilites Building	88.7	88.7	0.0	
Chemicals	Utilities	Main Utilites Building	92.7	92.7	0.0	

Site	Unit	Tag/Description	Sound Power Level (dBA)			Remarks
			2015 Update	**Addendum**	**Change**	
Chemicals	Utilities	Main Utilites Building Roof	98.5	98.5	0.0	
Chemicals	Utilities	Utilities LP Steam Header	116.0	105.9	-10.1	Updated
Chemicals	Utilities	centre boiler FD duct	97.9	97.9	0.0	
Chemicals	Utilities	north boiler FD duct	97.9	97.9	0.0	
Chemicals	Utilities	south boiler FD duct	97.9	97.9	0.0	
Totals						
Chemicals	Styrene		120.8	119.9	-0.8	
Chemicals	MEG		123.2	126.7	3.5	
Chemicals	Utilities		120.8	119.3	-1.5	
Chemicals	**All Units**		**126.5**	**128.2**	**1.6**	

APPENDIX B
Model Validation Tables and Figures

Shell Canada Ltd.
Shell Scotford Refinery, Upgrader, and Chemicals Plants
Addendum to the 2015 Shell Scotford Noise Model Update
SLR Project No.: 203.50049.00004

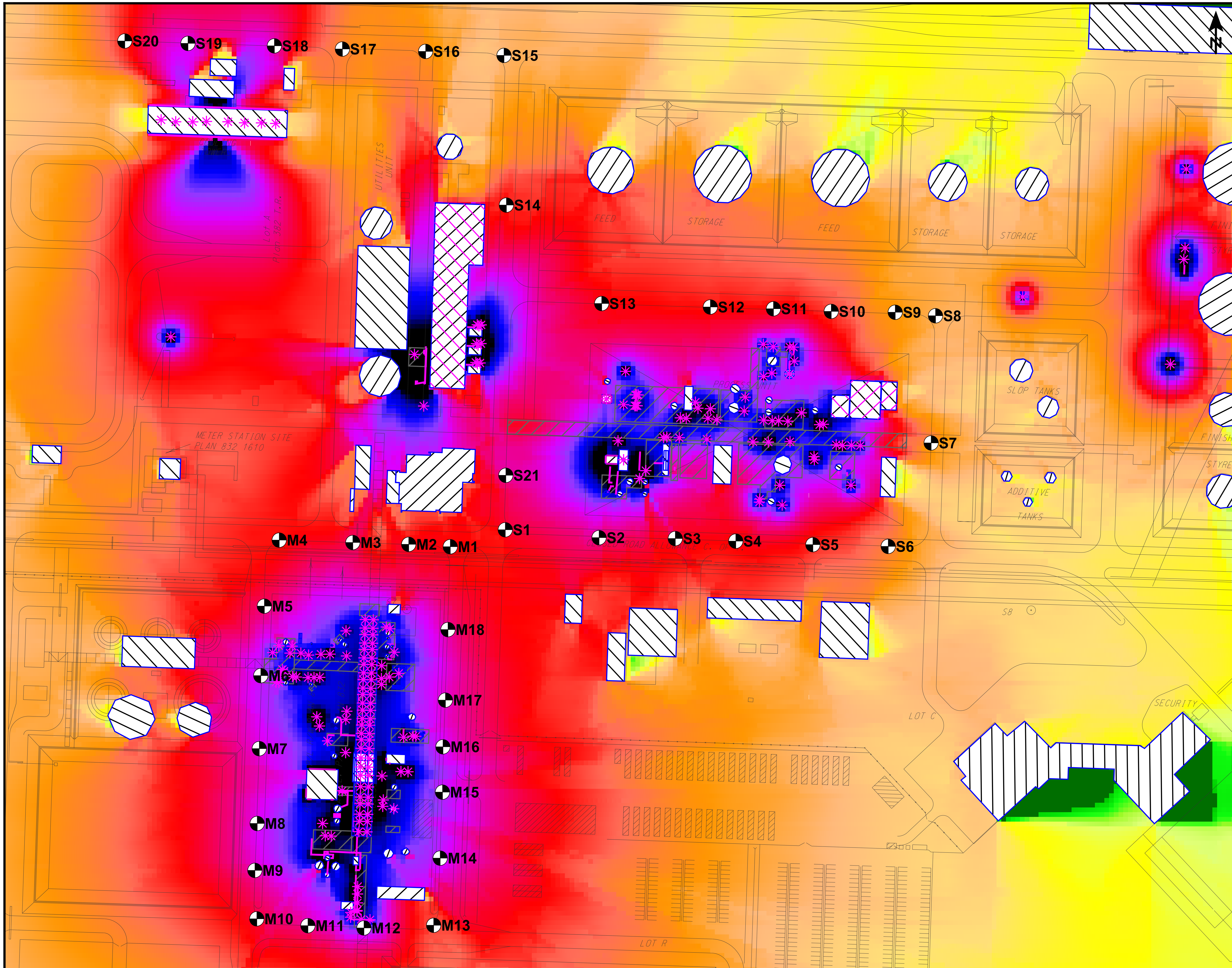
Table B-1

Model Validation
Shell Scotford Chemicals
Summertime Conditions

Site	Unit	Location Designation	Sound Pressure Level (dBA) Measured	Predicted	Difference	Remarks
Chemicals	MEG	M1	68.5	70.4	+1.3	August 2016 measurement
Chemicals	MEG	M2	68.5	69.9	+0.8	August 2016 measurement
Chemicals	MEG	M3	69.9	72.1	+1.4	August 2016 measurement
Chemicals	MEG	M4	67.9	69.7	+1.3	August 2016 measurement
Chemicals	MEG	M5	70.6	72.4	+1.4	August 2016 measurement
Chemicals	MEG	M6	75.9	75.7	-0.7	August 2016 measurement
Chemicals	MEG	M7	76.1	74.5	-2.2	August 2016 measurement
Chemicals	MEG	M8	74.2	74.9	+0.4	August 2016 measurement
Chemicals	MEG	M9	70.9	73.5	+2.2	August 2016 measurement
Chemicals	MEG	M10	69.6	71.1	+1	August 2016 measurement
Chemicals	MEG	M11	71.6	72.9	+0.7	August 2016 measurement
Chemicals	MEG	M12	78.0	77.7	-0.8	August 2016 measurement
Chemicals	MEG	M13	68.8	68.5	-1.5	August 2016 measurement
Chemicals	MEG	M14	73.7	75.7	+1.7	August 2016 measurement
Chemicals	MEG	M15	74.6	76.6	+1.5	August 2016 measurement
Chemicals	MEG	M16	73.0	75.0	+1.3	August 2016 measurement
Chemicals	MEG	M17	72.4	74.1	+1.2	August 2016 measurement
Chemicals	MEG	M18	71.8	73.4	+1.2	August 2016 measurement
Chemicals	Styrene	S1	68.0	70.0	+2	December 2014 measurement
Chemicals	Styrene	S2	72.6	71.7	-0.9	December 2014 measurement
Chemicals	Styrene	S3	72.6	70.5	-2.1	December 2014 measurement
Chemicals	Styrene	S4	70.0	68.7	-1.3	December 2014 measurement
Chemicals	Styrene	S5	69.5	67.9	-1.6	December 2014 measurement
Chemicals	Styrene	S6	65.3	64.5	-0.8	December 2014 measurement
Chemicals	Styrene	S7	64.9	64.1	-0.8	December 2014 measurement
Chemicals	Styrene	S8	61.1	61.5	+0.4	December 2014 measurement
Chemicals	Styrene	S9	62.1	63.5	+1.4	December 2014 measurement
Chemicals	Styrene	S10	65.2	67.3	+2.1	December 2014 measurement
Chemicals	Styrene	S11	66.7	69.2	+2.6	December 2014 measurement
Chemicals	Styrene	S12	67.8	68.7	+0.9	December 2014 measurement

Table B-1
Model Validation
Shell Scotford Chemicals
Summertime Conditions

Site	Unit	Location Designation	Sound Pressure Level (dBA)			Remarks
			Measured	Predicted	Difference	
Chemicals	Styrene	S13	67.5	69.7	+2.2	December 2014 measurement
Chemicals	Styrene	S14 -venting nearb	68.9	69.1	+0.2	December 2014 measurement
Chemicals	Styrene	S15 -venting nearb	75.3	62.1	N/A	Steam leak in measurement (December 2014)
Chemicals	Styrene	S16 -venting nearb	83.8	64.6	N/A	Steam leak in measurement (December 2014)
Chemicals	Styrene	S17 -venting nearb	82.4	66.1	N/A	Steam leak in measurement (December 2014)
Chemicals	Styrene	S18	81.8	73.7	N/A	Steam leak in measurement (December 2014)
Chemicals	Styrene	S19	72.4	74.5	+2.1	December 2014 measurement
Chemicals	Styrene	S20	69.8	69.3	-0.5	December 2014 measurement
Chemicals	Styrene	S21	69.7	72.3	+2.6	December 2014 measurement
				Average	**+0.9**	



Legend

- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Foliage
- Industrial site
- Ground effects
- Receiver

Scale 1:2400

0 20 40 80 120 m

Sound Level (dBA)

		<= 47.5
47.5	<	<= 50.0
50.0	<	<= 52.5
52.5	<	<= 55.0
55.0	<	<= 57.5
57.5	<	<= 60.0
60.0	<	<= 62.5
62.5	<	<= 65.0
65.0	<	<= 67.5
67.5	<	<= 70.0
70.0	<	<= 72.5
72.5	<	<= 75.0
75.0	<	<= 77.5
77.5	<	<= 80.0
80.0	<	<= 82.5
82.5	<	<= 85.0
85.0	<	

Chemicals Site
Model Validation Locations and Noise Map
Summertime Modeling Conditions

Shell Canada Ltd. Scotford Facility
Addendum to 2015 Noise Model Update
SLR Project No. 203.50049.00004

Figure B-1	Rev. 0	11/21/2016

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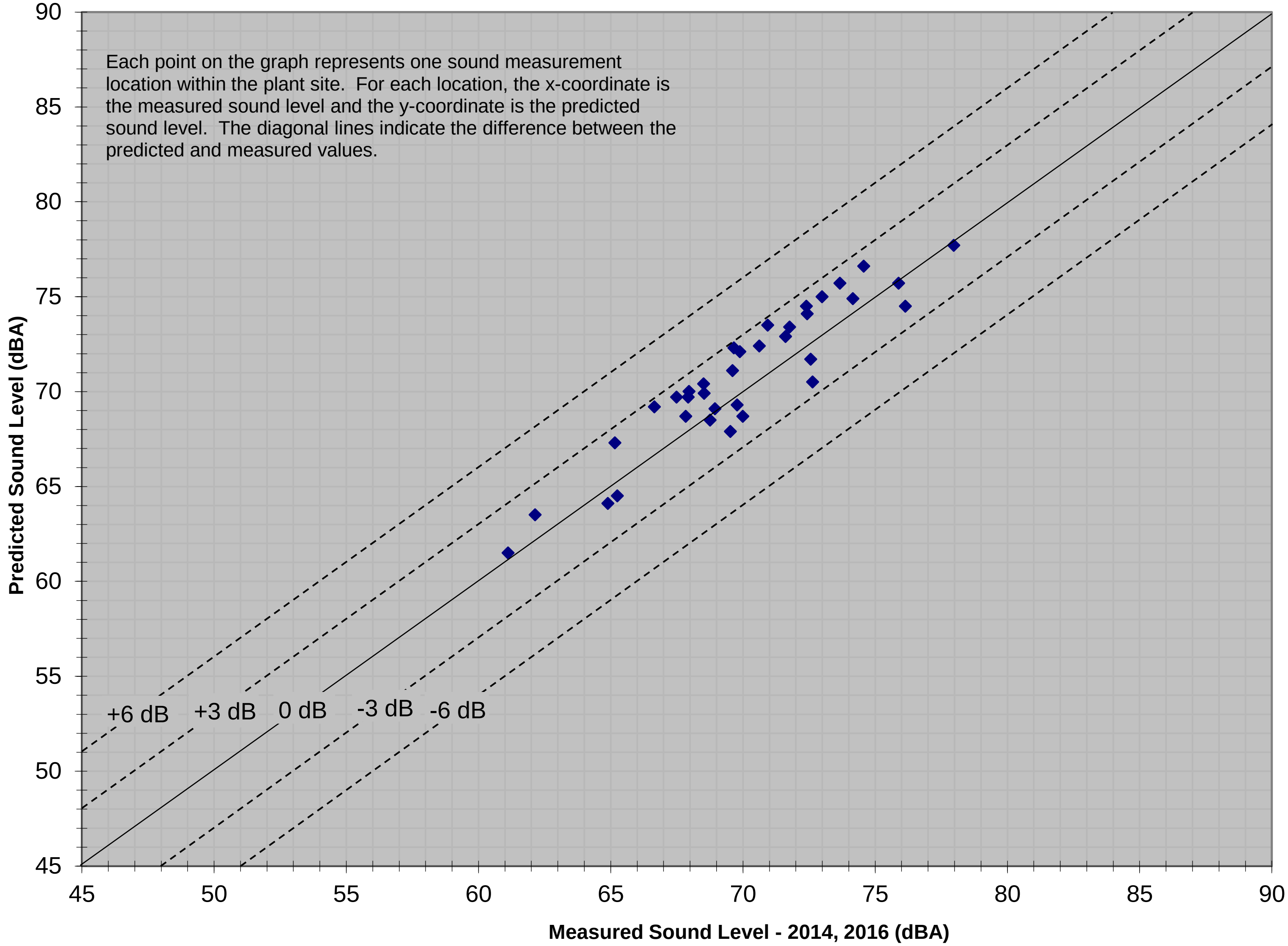
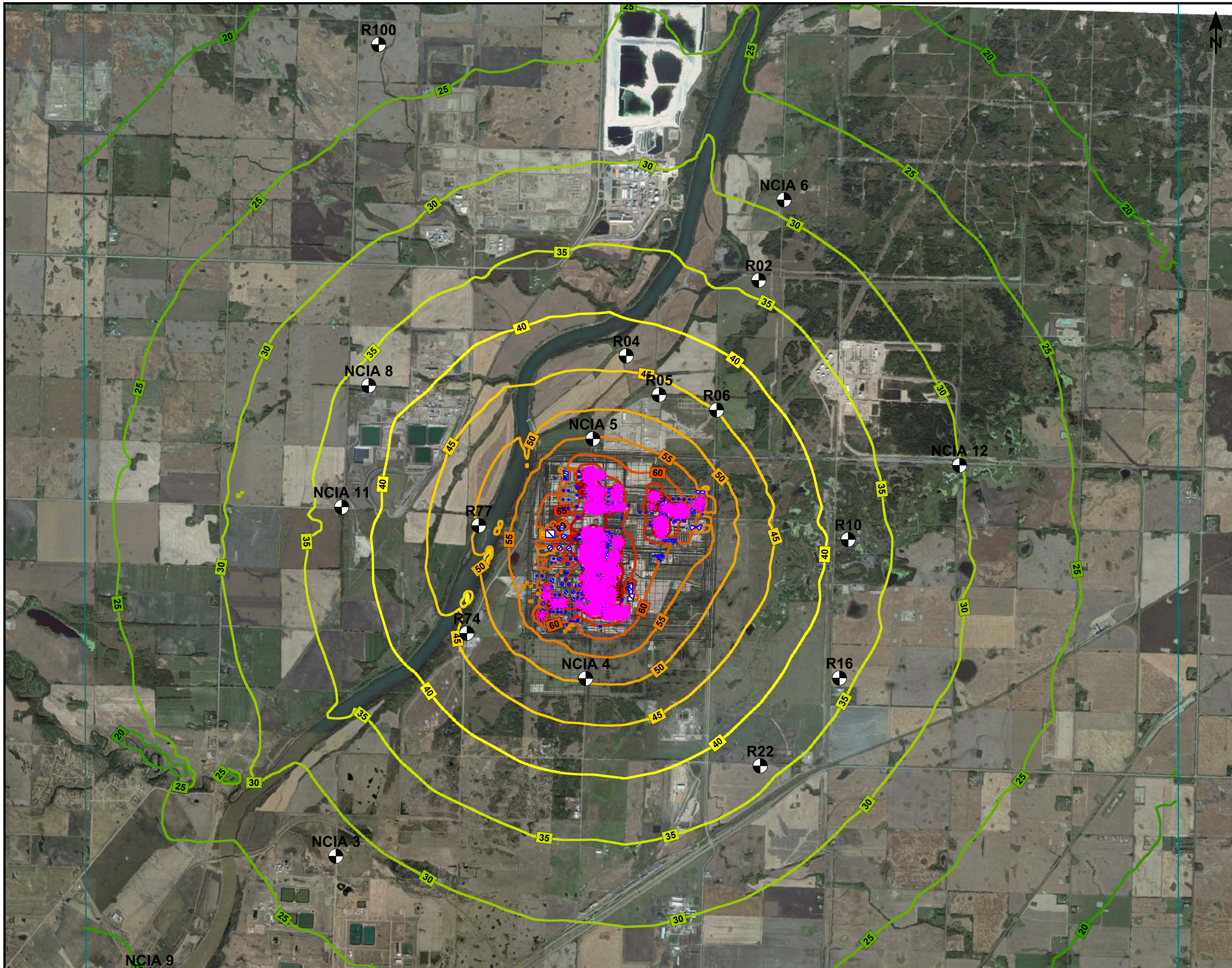
Figure B-2
Shell Scotford Chemicals
Comparison of Measured Sound Levels to Predicted Sound Levels



APPENDIX C
Environmental Noise Contour Figures

Shell Canada Ltd.
Shell Scotford Refinery, Upgrader, and Chemicals Plants
Addendum to the 2015 Shell Scotford Noise Model Update
SLR Project No.: 203.50049.00004



Legend

- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Foliage
- Industrial site
- Ground effects
- Receiver

Scale 1:50000

0 500 1000 2000 3000 m

Sound Level (dBA)

	<= 20.0
20.0 <	<= 25.0
25.0 <	<= 30.0
30.0 <	<= 35.0
35.0 <	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	<= 95.0
95.0 <	

Shell Scotford Facility
Predicted Sound Level Contours
Updated Noise Model
Summertime Conditions, Calm Wind

Shell Canada Ltd. Scotford Facility
Addendum to 2015 Noise Model Update
SLR Project No. 203.50049.00004

Figure C-1	Rev. 0	11/22/2016

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APPENDIX D
Order-Ranked Lists

Shell Canada Ltd.
Shell Scotford Refinery, Upgrader, and Chemicals Plants
Addendum to the 2015 Shell Scotford Noise Model Update
SLR Project No.: 203.50049.00004

Order-ranked lists are provided in Tables E-1 through E-4, corresponding to Receptors R04, R10, NCIA 4, and NCIA 11 respectively.

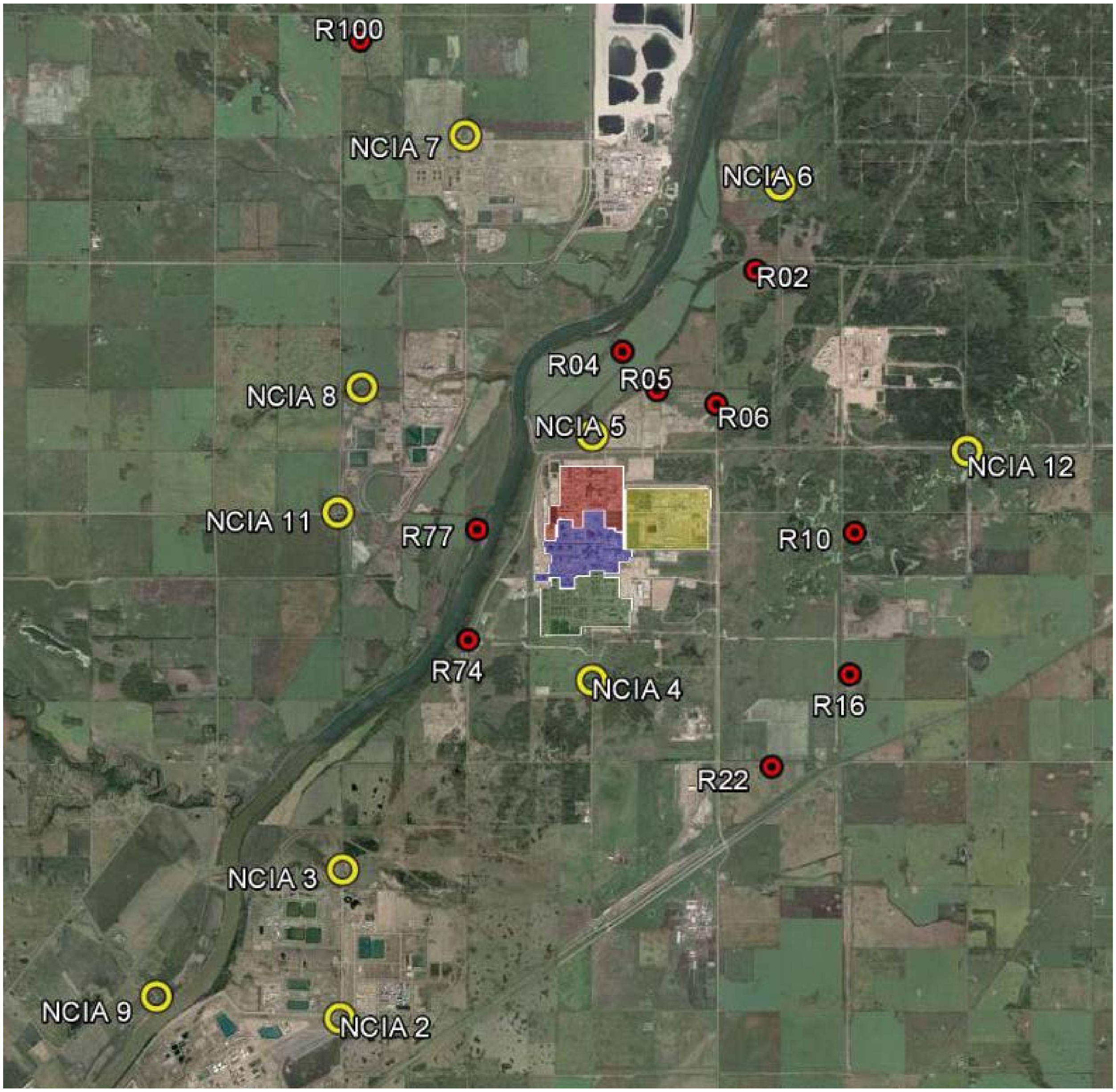

Figure D-1 Shell Scotford Noise Receptor Locations.

Table D-1

Order-Ranked Sound Level Contributions at Receptor R04
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Base Upgrader	A&V	A&V I-21103B Stg1 Disch 42in Pip	37.0
2	Base Upgrader	A&V	A&V I-21103A Stg1 Disch 42in Pip	36.3
3	Chemicals	Utilities	SHut-38_Utilities Cooling Tower North S	28.3
4	Refinery	Unit 61	Flare	26.0
5	Base Upgrader	A&V	A&V I-21103B	25.1
6	Chemicals	Utilities	SHut-21_Utilities De-airator vent	24.5
7	Expansion Upgrader	A&V	A&V E-41124 (1st stage condenser	24.4
8	Expansion Upgrader	RHC	RHC Feed Mixing Deck	23.9
9	Base Upgrader	CTWR	CTWR Cooling Tower E Splash	23.3
10	Expansion Upgrader	HMU	HMU S-44103	23.2
11	Expansion Upgrader	A&V	A&V E-41125 (2nd stage condenser	23.2
12	Expansion Upgrader	RHC	RHC P-42601B	23.1
13	Expansion Upgrader	A&V	A&V Pipe support from I-41102A	22.1
14	Base Upgrader	COGEN	CGN HRSG Stack	22.1
15	Base Upgrader	SRU	SRU Incin Stack Outlet	22.0
16	Expansion Upgrader	A&V	A&V P-41106A	21.4
17	Base Upgrader	A&V	A&V I-21104A Stg2 Disch 18in Pip	20.7
18	Base Upgrader	RHC	RHC PSA V-22783	20.6
19	Chemicals	Styrene	HS 219 Styrene Furnace Base	20.5
20	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
21	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
22	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
23	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
24	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
25	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
26	Expansion Upgrader	A&V	A&V set 40943	19.5
27	Expansion Upgrader	A&V	A&V set 40912	19.0
28	Expansion Upgrader	A&V	A&V set 40943	19.0
29	Base Upgrader	A&V	A&V I-21104B Stg2 Disch 18in Pip	18.9
30	Base Upgrader	A&V	A&V I-21104B Stg2 Disch Pipe Sup	18.9
31	Expansion Upgrader	SRC	SRC V-41706 E (Incinerator)	18.8
32	Expansion Upgrader	HMU	HMU PSA Header	18.8
33	Expansion Upgrader	SRC	SRC S-41705 Incinerator stack ou	18.6
34	Base Upgrader	A&V	A&V I-21105 Stg3 Disch 12in Pipe	18.6
35	Chemicals	Utilities	SHut-37_Cooling Tower fan #1 (1-8 W-E	18.6
36	Chemicals	Styrene	Tanks PP416A	18.6
37	Chemicals	Utilities	SHut-37_Cooling Tower fan #2 (1-8 W-E	18.6
38	Chemicals	Utilities	SHut-37_Cooling Tower fan #3 (1-8 W-E	18.5
39	Base Upgrader	A&V	A&V I-21104A Stg2 Disch Pipe Sup	18.5
40	Chemicals	Utilities	SHut-37_Cooling Tower fan #4 (1-8 W-E	18.5
41	Chemicals	Utilities	SHut-37_Cooling Tower fan #5 (1-8 W-E	18.5
42	Chemicals	Utilities	SHut-37_Cooling Tower fan #6 (1-8 W-E	18.5
43	Chemicals	Utilities	SHut-37_Cooling Tower fan #7 (1-8 W-E	18.5
44	Chemicals	Utilities	SHut-37_Cooling Tower fan #8 (1-8 W-E	18.4
45	Base Upgrader	COGEN	CGN N-S Pipe Rack	18.3

Table D-1

Order-Ranked Sound Level Contributions at Receptor R04
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Chemicals	Styrene	FV1018	18.2
47	Expansion Upgrader	CTWR	CTWR mtr 54201A	18.0
48	Refinery	Unit 22	Unit 22 Common H Comp E Opening	17.9
49	Expansion Upgrader	CTWR	CTWR mtr54201B	17.8
50	Expansion Upgrader	CTWR	CTWR mtr54201C	17.8
51	Expansion Upgrader	CTWR	CTWR mtr54201D	17.8
52	Expansion Upgrader	RHC	RHC FV-461901	17.4
53	Expansion Upgrader	A&V	A&V I-41103A (3rd stage ejector)	17.4
54	Expansion Upgrader	RHC	RHC Membrane RVS Deck	17.3
55	Expansion Upgrader	RHC	RHC West Mixing Deck	17.2
56	Base Upgrader	HMU	HMU S-24203 Stack Outlet	17.2
57	Base Upgrader	RHC	RHC PSA V-22883	17.1
58	Base Upgrader	HMU	HMU S-24103 Stack Outlet	16.9
59	Expansion Upgrader	A&V	A&V P-41112B	16.7
60	Refinery	Unit 31/32	Unit 30 Comp Bldg N Opening	16.6
61	Expansion Upgrader	A&V	A&V FV-411217	16.6
62	Base Upgrader	COGEN	CGN Deair Stm E Vent 1	16.6
63	Base Upgrader	COGEN	CGN Deair Stm W Vent 1	16.6
64	Refinery	Unit 25	E 2509-A1	16.1
65	Expansion Upgrader	RHC	RHC BBQ Deck	16.1
66	Expansion Upgrader	RHC	RHC Structure H	16.1
67	Chemicals	Styrene	P205S M	16.1
68	Expansion Upgrader	A&V	A&V C-41111 (FD fan)	16.0
69	Base Upgrader	COGEN	CGN Rect Roof Fan 1	15.7
70	Chemicals	Utilities	SHut-10_Utilities Flare Blower	15.7
71	Expansion Upgrader	A&V	A&V support 41009	15.5
72	Base Upgrader	HMU	HMU PSA V-24411	15.4
73	Refinery	Unit 24	E2416-2	15.3
74	Base Upgrader	COGEN	CGN Turb Bldg E Wall	15.2
75	Expansion Upgrader	CTWR	CTWR 54201A	15.1
76	Refinery	Unit 21	H2101 heater wall	15.1
77	Base Upgrader	SRU	SRU PM-21307	15.1
78	Refinery	Unit 24	E2416-1	15.1
79	Chemicals	MEG	MEG CO2 Vent	15.1
80	Base Upgrader	COGEN	CGN E-W Pipe Rack	15.0
81	Expansion Upgrader	A&V	A&V S-41106 (Vac exhaust stack)	15.0
82	Base Upgrader	COGEN	CGN Turb Bldg N Wall	14.9
83	Chemicals	MEG	MEG Compressor Suction	14.8
84	Chemicals	Styrene	FT1007	14.8
85	Base Upgrader	SRU	SRU C-21702 Incin FD Fan Inlet	14.8
86	Refinery	Unit 21	Unit 21 Deaerator	14.6
87	Base Upgrader	COGEN	CGN Rect Roof Fan 2	14.6
88	Base Upgrader	COGEN	CGN Rect Roof Fan 3	14.6
89	Base Upgrader	HMU	HMU PSA V-24411	14.6
90	Expansion Upgrader	RHC	RHC R-421001 Equip Door	14.6

Table D-1

Order-Ranked Sound Level Contributions at Receptor R04
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Refinery	Unit 25	C2501 - compressor building N op	14.5
92	Base Upgrader	HMU	HMU C-24201 Air Inlet	14.5
93	Expansion Upgrader	A&V	A&V P-41189A	14.4
94	Expansion Upgrader	HMU	HMU H-44101 E (Heat Columns)	14.4
95	Expansion Upgrader	CTWR	CTWR 54201B	14.3
96	Expansion Upgrader	A&V	A&V S-41107 (Atmos exhaust stack	14.3
97	Base Upgrader	RHC	RHC FV-224008	14.3
98	Expansion Upgrader	CTWR	CTWR 54201C	14.3
99	Expansion Upgrader	CTWR	CTWR 54201D	14.2
100	Expansion Upgrader	HMU	HMU H-44101 E (Heat Columns)	14.2
			Sum of all noise contrubutions above (1 to 100)	42.4
			Sum of all remaining noise sources (101 to 2151)	35.8
			Total Sound Pressure Level	**43.3**

Table D-2

Order-Ranked Sound Level Contributions at Receptor R10
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Base Upgrader	A&V	A&V I-21103A Stg1 Disch 42in Pip	30.4
2	Chemicals	MEG	PT-32003	26.1
3	Chemicals	MEG	MEG Compressor Discharge after	23.0
4	Expansion Upgrader	RHC	RHC R-421001 South Wall	22.8
5	Chemicals	Utilities	SHut-21_Utilities De-airator vent	21.8
6	Refinery	Unit 61	Flare	21.8
7	Base Upgrader	COGEN	CGN HRSG Stack	19.8
8	Chemicals	MEG	TT 3101 Vessel6	19.1
9	Base Upgrader	SRU	SRU Incin Stack Outlet	18.8
10	Chemicals	MEG	MEG Compressor Suction	18.8
11	Base Upgrader	A&V	A&V I-21103A	18.7
12	Chemicals	MEG	TT 3101 Vessel4	18.5
13	Chemicals	MEG	TT 3101 Vessel5	18.3
14	Chemicals	MEG	O2 mixbox outlet	18.3
15	Chemicals	MEG	TT 3101 Vessel3	18.0
16	Chemicals	Styrene	Tanks PP416A	17.3
17	Base Upgrader	CTWR	CTWR Cooling Tower E Splash	17.0
18	Base Upgrader	A&V	A&V I-21103B Stg1 Disch 42in Pip	16.6
19	Expansion Upgrader	HMU	HMU S-44103	16.5
20	Refinery	Unit 21	C2104 fan Inlet	16.1
21	Base Upgrader	RHC	RHC PSA V-22883	15.5
22	Chemicals	Styrene	Tanks GZ348H	15.1
23	Chemicals	Utilities	SHut-37_Cooling Tower fan #8 (1-8 W-E	15.0
24	Chemicals	Utilities	SHut-37_Cooling Tower fan #7 (1-8 W-E	15.0
25	Expansion Upgrader	CTWR	CTWR 54201 E water splash	14.9
26	Chemicals	Utilities	SHut-37_Cooling Tower fan #6 (1-8 W-E	14.9
27	Chemicals	Utilities	SHut-37_Cooling Tower fan #5 (1-8 W-E	14.9
28	Chemicals	Utilities	SHut-37_Cooling Tower fan #4 (1-8 W-E	14.8
29	Chemicals	Utilities	SHut-37_Cooling Tower fan #3 (1-8 W-E	14.8
30	Chemicals	Utilities	SHut-37_Cooling Tower fan #2 (1-8 W-E	14.7
31	Chemicals	MEG	TT 3101 Vessel7	14.7
32	Base Upgrader	SRU	SRU CM-21401 Degasser Motor	14.7
33	Chemicals	Utilities	SHut-37_Cooling Tower fan #1 (1-8 W-E	14.7
34	Chemicals	Utilities	SHut-38_Utilities Cooling Tower South S	14.5
35	Base Upgrader	A&V	A&V I-21104A Stg2 Disch 18in Pip	14.5
36	Chemicals	MEG	MEG CO2 Vent	14.5
37	Base Upgrader	COGEN	CGN Turb Bldg E Wall	14.4
38	Base Upgrader	HMU	HMU S-24203 Stack Outlet	14.3
39	Chemicals	MEG	MEG pipe "A" support 6	14.3
40	Base Upgrader	RHC	RHC PSA V-22783	14.2
41	Chemicals	MEG	TT3101 piping	14.0
42	Chemicals	MEG	MEG PP-3201A M	13.8
43	Base Upgrader	HMU	HMU S-24103 Stack Outlet	13.6
44	Chemicals	MEG	TT3101 piping	13.4
45	Chemicals	MEG	TT 3101 Vessel2	13.3

Table D-2

Order-Ranked Sound Level Contributions at Receptor R10
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Refinery	Unit 20	E-2012 compressor coolant cooler	13.3
47	Chemicals	Styrene	Styrene CWR pipe	13.3
48	Refinery	Unit 31/32	Unit 30 Comp Bldg N Opening	13.1
49	Refinery	Unit 11	Fan Casing C1101	13.0
50	Refinery	Unit 31/32	Regen Blower Fan case	13.0
51	Chemicals	Styrene	P220A M	13.0
52	Chemicals	Utilities	North boiler intake VFD	12.9
53	Base Upgrader	HMU	HMU PSA V-24411	12.9
54	Base Upgrader	COGEN	CGN Deair Stm E Vent 1	12.9
55	Base Upgrader	COGEN	CGN Deair Stm W Vent 1	12.9
56	Refinery	Unit 21	C2103 Inlet	12.9
57	Chemicals	Styrene	GZ348CPA1P	12.8
58	Base Upgrader	HMU	HMU PSA V-24411	12.8
59	Base Upgrader	COGEN	CGN N-S Pipe Rack	12.8
60	Expansion Upgrader	SRC	SRC S-41705 Incinerator stack ou	12.6
61	Refinery	Unit 24	C2401 Comp Bldg N open	12.6
62	Chemicals	MEG	TT 3101 Vessel1	12.5
63	Chemicals	MEG	TT 3101 Vessel8	12.4
64	Chemicals	MEG	pipes near AS-3203	12.3
65	Base Upgrader	HMU	HMU PSA V-24411	12.3
66	Base Upgrader	HMU	HMU PSA V-24411	12.2
67	Chemicals	MEG	MEG Vessel TT3406 south face	12.2
68	Chemicals	Styrene	Tanks PP417A	12.2
69	Base Upgrader	HMU	HMU PSA V-24311	12.1
70	Chemicals	MEG	MEG PP-3204B M	12.1
71	Base Upgrader	HMU	HMU S-24301 PSA Bldg Ridge Vent	12.0
72	Chemicals	MEG	MEG pipe "A" support 5	11.9
73	Chemicals	MEG	TT3101 piping	11.9
74	Refinery	Unit 42	Unit 42 Comp Bldg N opening	11.9
75	Chemicals	Styrene	PP215S	11.8
76	Base Upgrader	HMU	HMU PSA V-24411	11.7
77	Base Upgrader	COGEN	CGN Turb Bldg N Wall	11.7
78	Refinery	Unit 21	H2101 heater wall	11.6
79	Base Upgrader	HMU	HMU PSA V-24411	11.6
80	Refinery	Unit 21	H2102 heater wall	11.6
81	Base Upgrader	HMU	HMU PSA V-24311	11.6
82	Chemicals	MEG	MEG PP-3214A M	11.6
83	Chemicals	Styrene	FT1007	11.4
84	Base Upgrader	CTWR	UPGR Cooling Water Pumphouse OH D	11.3
85	Base Upgrader	CTWR	UPGR Cooling Water Pumphouse OH D	11.3
86	Base Upgrader	HMU	HMU PSA V-24311	11.3
87	Chemicals	Utilities	north boiler FD fan casing	11.3
88	Base Upgrader	CTWR	UPGR Cooling Water Pumphouse OH D	11.3
89	Refinery	Unit 21	Unit 21 Deaerator	11.2
90	Chemicals	Styrene	Cmpr Bldg in NE of EB - wall sou	11.2

Table D-2

Order-Ranked Sound Level Contributions at Receptor R10
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Refinery	Unit 22	Unit 22 Common H Comp E Opening	11.2
92	Chemicals	MEG	MEG PP-3101A M	11.1
93	Refinery	Unit 51	Util Bldg roof NE Deairerator	11.1
94	Refinery	Unit 24	E2416-2	11.0
95	Refinery	Unit 24	E2416-1	11.0
96	Expansion Upgrader	HMU	HMU C44102 ID Fan	10.9
97	Chemicals	Styrene	FV1006	10.8
98	Chemicals	Styrene	P242A M	10.7
99	Base Upgrader	RHC	RHC E-22512-2	10.7
100	Refinery	Unit 25	C2501 - compressor building N op	10.7
			Sum of all noise contrubutions above (1 to 100)	36.7
			Sum of all remaining noise sources (101 to 2151)	33.1
			Total Sound Pressure Level	**38.3**

Table D-3

Order-Ranked Sound Level Contributions at Receptor NCIA 4
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Base Upgrader	A&V	A&V I-21103A Stg1 Disch 42in Pip	42.8
2	Base Upgrader	A&V	A&V I-21103B Stg1 Disch 42in Pip	41.8
3	Refinery	Unit 61	Flare	37.6
4	Refinery	Unit 31/32	Unit 30 steam vent	35.7
5	Refinery	Unit 31/32	Regen Blower Fan case	34.6
6	Refinery	Unit 61	P6303	33.1
7	Base Upgrader	A&V	A&V I-21103A	32.7
8	Refinery	Unit 51	Util Bldg roof NE Deairerator	31.9
9	Refinery	Unit 61	P6301	30.4
10	Base Upgrader	A&V	A&V I-21103B	30.3
11	Refinery	Unit 22	P2201A Motor	29.9
12	Refinery	Unit 31/32	H3251 blower fan case	29.5
13	Refinery	Unit 21	Unit 21 Deaerator	29.3
14	Base Upgrader	SRU	SRU Incin Stack Outlet	29.1
15	Expansion Upgrader	RHC	RHC R-421001 South Wall	28.8
16	Chemicals	Utilities	SHut-38_Utilities Cooling Tower South S	28.8
17	Refinery	Unit 24	E2416-1	28.1
18	Refinery	Unit 24	E2416-2	27.8
19	Base Upgrader	RHC	RHC PSA V-22883	27.7
20	Refinery	Unit 61	P6147	27.7
21	Base Upgrader	COGEN	CGN HRSG Stack	27.7
22	Base Upgrader	A&V	A&V I-21104B Stg2 Disch 18in Pip	27.7
23	Chemicals	MEG	PT-32003	27.3
24	Base Upgrader	A&V	A&V I-21104B Stg2 Disch Pipe Sup	27.2
25	Refinery	Unit 61	P6140	27.1
26	Refinery	Unit 31/32	H3251 blower motor	27.1
27	Refinery	Unit 61	P6152	27.1
28	Base Upgrader	A&V	A&V I-21104A Stg2 Disch 18in Pip	27.0
29	Refinery	Unit 11	E1119-A1	27.0
30	Refinery	Unit 22	P2201B Motor	27.0
31	Base Upgrader	RHC	RHC Pipe 12in Lagd After HV-2236	27.0
32	Refinery	Unit 41	E4103-5	26.7
33	Base Upgrader	A&V	A&V I-21105 Stg3 Disch 12in Pipe	26.7
34	Refinery	Unit 26	Unit 26 Comp Bldg S wall Vent 2	26.6
35	Refinery	Unit 26	Unit 26 Comp Bldg S wall Vent 5	26.6
36	Refinery	Unit 11	E1122-A2	26.6
37	Refinery	Unit 26	Unit 26 Comp Bldg S wall Vent 4	26.4
38	Base Upgrader	RHC	RHC Pipe 12in Lagd After HV-2226	26.4
39	Base Upgrader	HMU	HMU S-24301 PSA Bldg Ridge Vent	26.4
40	Refinery	Unit 31/32	FV32003	26.3
41	Refinery	Unit 12	E1208-A2	26.1
42	Base Upgrader	HMU	HMU S-24401 PSA Bldg Ridge Vent	26.0
43	Refinery	Unit 11	P1106B Motor	26.0
44	Refinery	Unit 15	C1501 fan inlet	25.9
45	Refinery	Unit 41	E4103-2	25.8

Table D-3

Order-Ranked Sound Level Contributions at Receptor NCIA 4
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Refinery	Unit 21	C2103 Inlet	25.8
47	Refinery	Unit 21	H2102 heater wall	25.8
48	Refinery	Unit 11	E1124-A2	25.7
49	Base Upgrader	COGEN	CGN Deair Stm W Vent 1	25.7
50	Base Upgrader	COGEN	CGN Deair Stm E Vent 1	25.7
51	Base Upgrader	RHC	RHC E-22512-2	25.7
52	Base Upgrader	HMU	HMU PSA V-24311	25.6
53	Base Upgrader	SRU	SRU PM-21405B	25.6
54	Refinery	Unit 61	PS4 CV's group 1	25.5
55	Refinery	Unit 22	P2201A Gbox	25.4
56	Base Upgrader	HMU	HMU PSA V-24411	25.3
57	Refinery	Unit 22	P2201B Gbox	25.2
58	Refinery	Unit 24	E2422-1	25.1
59	Base Upgrader	SRU	SRU Blower Bldg S Mtr Cool 1	25.1
60	Refinery	Unit 31/32	Regen Blower Motor	25.1
61	Refinery	Unit 61	P6302A	25.1
62	Refinery	Unit 61	P6153	25.0
63	Base Upgrader	A&V	A&V I-21104A Stg2 Disch Pipe Sup	25.0
64	Refinery	Unit 12	E1208-C2	25.0
65	Refinery	Unit 11	E1119-A2	25.0
66	Refinery	Unit 42	H4201 A burner to S	25.0
67	Refinery	Unit 42	H4201 A burner to W	25.0
68	Base Upgrader	HMU	HMU PSA V-24311	24.8
69	Refinery	Unit 42	H4201 B burner to W	24.8
70	Refinery	Unit 12	E1208-C1	24.7
71	Refinery	Unit 11	P1107A	24.7
72	Refinery	Unit 43	P-4103B Extractor charge pump	24.6
73	Refinery	Unit 41	E4123-2	24.5
74	Refinery	Unit 41	E4103-3	24.4
75	Refinery	Unit 12	E1208-A1	24.3
76	Refinery	Unit 61	P6124A	24.3
77	Refinery	Unit 41	E4123-3	24.3
78	Refinery	Unit 51	Util Building W wall Equip door	24.3
79	Base Upgrader	HMU	HMU PSA V-24411	24.3
80	Base Upgrader	HMU	HMU S-24103 Stack Outlet	24.2
81	Base Upgrader	CTWR	CTWR C-2714C Motor	24.1
82	Base Upgrader	CTWR	CTWR C-2714A Motor	24.1
83	Base Upgrader	RHC	RHC PSA V-22783	24.1
84	Base Upgrader	RHC	RHC E-22512-1	24.0
85	Refinery	Unit 15	Fan Casing C1501	24.0
86	Refinery	Unit 41	P4109A	23.9
87	Base Upgrader	HMU	HMU PSA V-24411	23.9
88	Base Upgrader	HMU	HMU PSA V-24411	23.9
89	Refinery	Unit 11	E1121-2	23.8
90	Refinery	Unit 11	E1127-C1	23.8

Table D-3

Order-Ranked Sound Level Contributions at Receptor NCIA 4
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Refinery	Unit 22	P2201C Motor	23.8
92	Refinery	Unit 41	E4123-4	23.7
93	Refinery	Unit 11	P1108 middle circ reflux Motor	23.6
94	Refinery	Unit 41	E4123-1	23.6
95	Chemicals	Utilities	SHut-45_Utilities LP Steam Header	23.6
96	Base Upgrader	HMU	HMU S-24203 Stack Outlet	23.6
97	Base Upgrader	HMU	HMU PSA V-24311	23.5
98	Base Upgrader	HMU	HMU PSA V-24411	23.5
99	Refinery	Unit 11	E1124-A1	23.4
100	Refinery	Unit 22	P2201B Pump	23.3
Sum of all noise contrubutions above (1 to 100)				49.5
Sum of all remaining noise sources (101 to 2151)				45.4
Total Sound Pressure Level				**51.0**

Table D-4

Order-Ranked Sound Level Contributions at Receptor NCIA 11
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Base Upgrader	A&V	A&V I-21103B Stg1 Disch 42in Pip	30.5
2	Refinery	Unit 61	Flare	23.3
3	Base Upgrader	A&V	A&V I-21103A Stg1 Disch 42in Pip	22.7
4	Expansion Upgrader	RHC	RHC R-421001 South Wall	21.6
5	Base Upgrader	SRU	SRU Incin Stack Outlet	19.2
6	Base Upgrader	A&V	A&V I-21103B	18.8
7	Base Upgrader	COGEN	CGN HRSG Stack	18.6
8	Base Upgrader	A&V	A&V I-21103A	17.6
9	Refinery	Unit 61	P6303	17.1
10	Base Upgrader	A&V	A&V I-21104A Stg2 Disch 18in Pip	16.9
11	Base Upgrader	RHC	RHC Pipe 12in Lagd After HV-2226	16.9
12	Chemicals	MEG	TT 3101 Vessel8	15.6
13	Refinery	Unit 61	P6109A	15.5
14	Base Upgrader	RHC	RHC PSA V-22883	15.2
15	Chemicals	MEG	TT 3101 Vessel1	15.1
16	Chemicals	MEG	TT 3101 Vessel7	14.9
17	Base Upgrader	RHC	RHC PSA V-22783	14.9
18	Base Upgrader	A&V	A&V I-21104A Stg2 Disch Pipe Sup	14.6
19	Refinery	Unit 24	C2401 Comp Bldg N open	14.5
20	Chemicals	MEG	TT 3101 Vessel2	14.5
21	Expansion Upgrader	RHC	RHC Feed Mixing Deck	14.4
22	Refinery	Unit 31/32	Regen Blower Fan case	14.4
23	Base Upgrader	A&V	A&V I-21104B Stg2 Disch 18in Pip	14.2
24	Expansion Upgrader	HMU	HMU S-44103	14.1
25	Base Upgrader	HMU	HMU S-24203 Stack Outlet	13.8
26	Base Upgrader	HMU	HMU S-24103 Stack Outlet	13.8
27	Refinery	Unit 31/32	Unit 30 Comp Bldg N Opening	13.8
28	Expansion Upgrader	RHC	RHC P-42601B	13.7
29	Refinery	Unit 31/32	H-3201 duct sources	13.5
30	Base Upgrader	RHC	RHC Pipe 12in Lagd After HV-2236	13.4
31	Chemicals	Utilities	SHut-21_Utilities De-airator vent	13.3
32	Refinery	Unit 61	P6140	13.0
33	Expansion Upgrader	SRC	SRC S-41705 Incinerator stack ou	13.0
34	Expansion Upgrader	SRC	SRC V-41706 W (Incinerator)	12.8
35	Base Upgrader	CTWR	CTWR Cooling Tower W Splash	12.7
36	Refinery	Unit 31/32	C-3204A FD Fan Casing	12.3
37	Expansion Upgrader	A&V	A&V support 40949	12.3
38	Refinery	Unit 31/32	C-3204A FD Fan Inlet	12.2
39	Expansion Upgrader	A&V	A&V support 41162	12.2
40	Chemicals	MEG	TT3101 piping	12.0
41	Chemicals	MEG	MEG Compressor Discharge after	11.9
42	Base Upgrader	SRU	SRU PM-21405B	11.8
43	Base Upgrader	SRU	SRU PM-21307	11.4
44	Refinery	Unit 61	P6147	11.3
45	Expansion Upgrader	RHC	RHC East Mixing Deck	11.3

Table D-4

Order-Ranked Sound Level Contributions at Receptor NCIA 11
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Expansion Upgrader	CTWR	CTWR Pkg Blr Bldg W OH Door	11.3
47	Base Upgrader	HMU	HMU C-24101 Air Inlet	11.1
48	Base Upgrader	HMU	HMU TK-24101 LO Skid	11.1
49	Refinery	Unit 25	C2501 - compressor building N op	11.0
50	Expansion Upgrader	CTWR	CTWR 54201 W water splash	11.0
51	Base Upgrader	HMU	HMU S-24401 PSA Bldg Ridge Vent	10.8
52	Base Upgrader	A&V	A&V I-21104B Stg2 Disch Pipe Sup	10.6
53	Base Upgrader	HMU	HMU PSA V-24411	10.5
54	Refinery	Unit 42	Unit 42 Comp Bldg N opening	10.5
55	Expansion Upgrader	A&V	A&V E-41124 (1st stage condenser	10.4
56	Base Upgrader	SRU	SRU Blower Bldg E Mtr Cool 1	10.3
57	Base Upgrader	HMU	HMU PSA V-24411	10.2
58	Expansion Upgrader	CTWR	CTWR mtr54201D	10.2
59	Expansion Upgrader	A&V	A&V E-41125 (2nd stage condenser	10.2
60	Expansion Upgrader	CTWR	CTWR mtr54201C	10.2
61	Expansion Upgrader	CTWR	CTWR mtr54201B	10.2
62	Base Upgrader	HMU	HMU PSA V-24411	9.9
63	Expansion Upgrader	A&V	A&V support 41070	9.9
64	Expansion Upgrader	A&V	A&V support 41100	9.9
65	Expansion Upgrader	A&V	A&V support 41131	9.8
66	Expansion Upgrader	A&V	A&V support 40978	9.8
67	Expansion Upgrader	A&V	A&V support 40918	9.8
68	Base Upgrader	HMU	HMU PSA V-24411	9.8
69	Expansion Upgrader	A&V	A&V support 41192	9.8
70	Base Upgrader	HMU	HMU PSA V-24411	9.8
71	Refinery	Unit 22	C2202 Compressor Building N Open	9.8
72	Refinery	Unit 21	Unit 21 Deaerator	9.7
73	Refinery	Unit 25	E 2509-A1	9.7
74	Base Upgrader	HMU	HMU PSA V-24411	9.7
75	Base Upgrader	COGEN	CGN Deair Stm W Vent 1	9.7
76	Base Upgrader	COGEN	CGN Deair Stm E Vent 1	9.6
77	Expansion Upgrader	A&V	A&V C-41111 (FD fan)	9.6
78	Refinery	Unit 21	H2102 heater wall	9.6
79	Base Upgrader	HMU	HMU C-24201 Air Inlet	9.6
80	Base Upgrader	RHC	RHC E-22512-2	9.6
81	Expansion Upgrader	A&V	A&V C-41113 (FD fan)	9.5
82	Refinery	Unit 61	P6301	9.5
83	Chemicals	MEG	TT3101 piping	9.4
84	Refinery	Unit 31/32	H3251 blower fan case	9.4
85	Base Upgrader	COGEN	CGN Turb Bldg Rect Roof Fan 1	9.3
86	Base Upgrader	COGEN	CGN Turb Bldg Rect Roof Fan 2	9.2
87	Expansion Upgrader	A&V	A&V Pipe support from I-41102A	9.1
88	Expansion Upgrader	A&V	A&V P-41112B	9.0
89	Chemicals	Utilities	SHut-37_Cooling Tower fan #1 (1-8 W-E	9.0
90	Chemicals	Utilities	SHut-37_Cooling Tower fan #2 (1-8 W-E	8.9

Table D-4

Order-Ranked Sound Level Contributions at Receptor NCIA 11
Shell Canada Ltd. - Scotford
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Refinery	Unit 21	H2101 heater wall	8.9
92	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	8.9
93	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	8.9
94	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	8.9
95	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	8.9
96	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	8.9
97	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	8.9
98	Refinery	Unit 31/32	Unit 30 steam vent	8.9
99	Base Upgrader	A&V	A&V I-21105 Stg3 Disch 12in Pipe	8.8
100	Chemicals	Utilities	SHut-37_Cooling Tower fan #7 (1-8 W-E	8.7
			Sum of all noise contrubutions above (1 to 100)	35.3
			Sum of all remaining noise sources (101 to 2151)	30.4
			Total Sound Pressure Level	**36.5**

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Quest Noise Model Development
Shell Scotford Quest Carbon Capture and Storage Facility

December 2016
SLR Project No.: 203.50049.00004

QUEST NOISE MODEL DEVELOPMENT

SHELL SCOTFORD QUEST CARBON CAPTURE AND STORAGE FACILITY

SLR Project No.: 203.50049.00004

Prepared by
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Distribution: 1 copy – Shell Canada Ltd. (pdf)
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EXECUTIVE SUMMARY

The Shell Canada (Shell) Scotford Complex is comprised of Refinery, Upgrader (Base and Expansion), and Chemicals sites. Shell maintains computer a noise models of the Scotford Complex, as required by the Northeast Capital Industrial Association (NCIA) Regional Noise Management Plan (RNMP). The noise models are used to predict the environmental noise produced by industrial noise sources on the Scotford site.

In 2015 Shell started up the Quest carbon capture and storage project (CCS). Quest collects CO_2 from the Upgrader Hydrogen Manufacturing Units (HMU), compresses and cools the CO_2 into a liquid state, and transfers the liquid CO_2 by pipeline to offsite wells where it is injected into the ground. Shell retained SLR Consulting (Canada) Ltd. (SLR) to develop a noise model of the Quest unit and integrate it into the Shell Scotford complex noise model.

SLR conducted equipment noise and model validation measurements for the Quest unit in August 2016. The measurement data was used to develop a 3D noise model of the facility, which was validated by comparison of measured and predicted noise levels at 17 locations around the unit. The model was shown to be accurate to within ±3 dBA at all the locations.

The Quest unit noise model has been incorporated into the existing Shell Scotford noise model and used to predict the facility noise contributions at 19 environmental receptor locations. These locations include receptor locations used for previous Shell Scotford site noise studies, and receptor locations corresponding to the NCIA 2014 noise monitoring locations. Addition of the Quest unit resulted in an increase of 0.0 to 0.3 dBA in the total Shell Scotford complex noise contribution at these receptors. This slight increase will not perceptibly change the overall industrial noise in the Scotford site vicinity.

The off-site noise predictions were used to determine the impact of each equipment noise source at four receptor locations, in different directions from the Scotford site. For each of these four receptors, order-ranked lists have been prepared that identify the 100 equipment noise sources with the highest noise contribution. The equipment noise source(s) with the highest noise contribution are the sources for which noise control treatment would have the largest impact on the overall Scotford site noise contribution. Quest sources appear in the top 100 sources for all four receptors; however, Quest sources are not dominant noise sources at any receptor. The Quest noise source with the greatest contribution is the CO_2 compressor (C-42701) 1st stage discharge piping. Shell may consider acoustical treatment of the CO_2 compressor discharge piping for a future noise control project.

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1.0 INTRODUCTION

The Shell Canada (Shell) Scotford Complex, shown in Figure 1, is comprised of Refinery, Upgrader (Base and Expansion), and Chemicals sites. Shell maintains computer a noise models of the Scotford Complex, as required by the Northeast Capital Industrial Association (NCIA) Regional Noise Management Plan (RNMP). The noise models are used to predict the environmental noise produced by industrial noise sources on the Scotford site.

In 2015 Shell started up the Quest carbon capture and storage project (CCS). Quest collects CO_2 from the Upgrader Hydrogen Manufacturing Units (HMU), compresses and cools the CO_2 into a liquid state, and transfers the liquid CO_2 by pipeline to offsite wells where it is injected into the ground. Shell retained SLR Consulting (Canada) Ltd. (SLR) to develop a noise model of the Quest unit and integrate it into the Shell Scotford complex noise model. The objectives of this work are:

- identify significant sources of environmental noise associated with the Quest unit,
- conduct diagnostic noise measurements of identified equipment to determine equipment sound power levels,
- construct a 3D noise model of the Quest unit,
- validate noise model by comparing measured and predicted noise levels,
- calculate the noise contribution of the Quest unit at environmental receptor locations, and
- identify the Quest unit noise sources that have the greatest contribution to environmental noise.

A glossary of acoustical terms, an introduction to environmental noise descriptors, and an introduction to outdoor sound propagation are provided in Appendix E, F, and G.

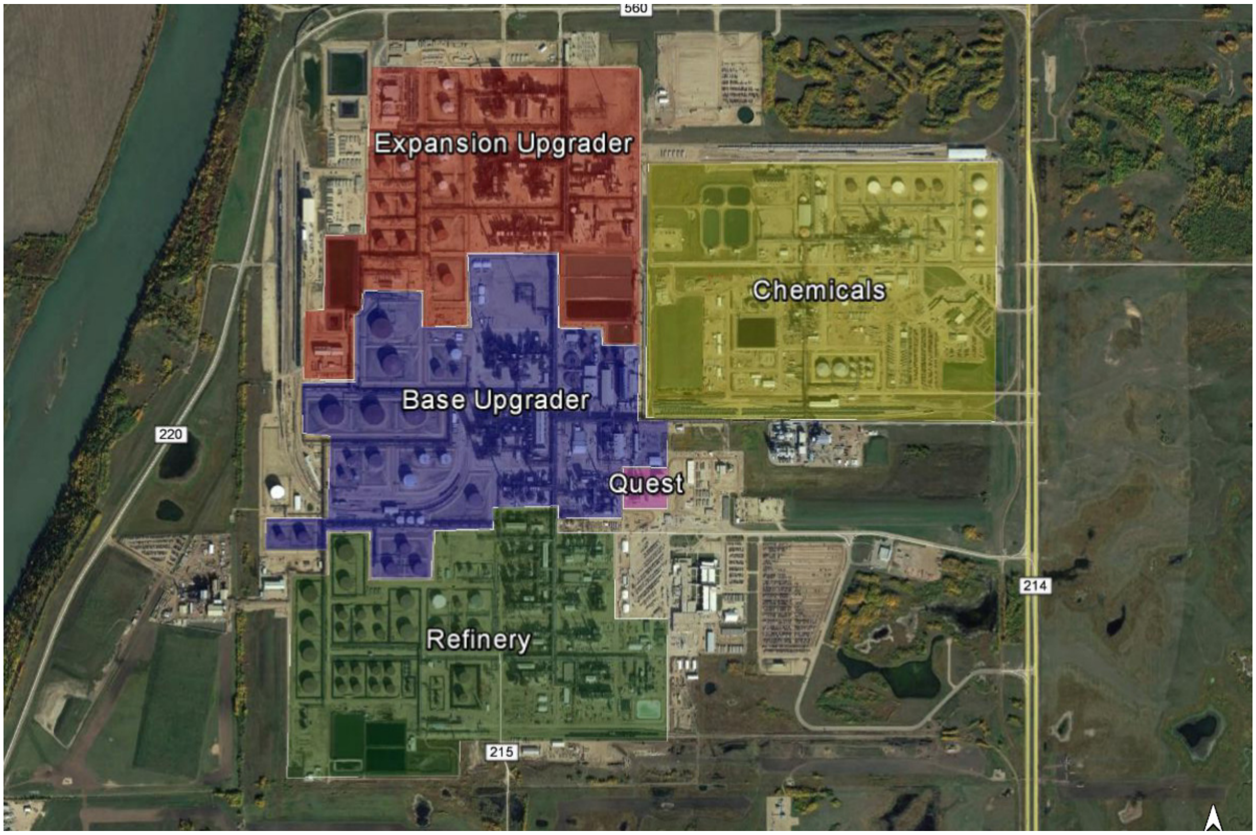

Figure 1: Shell Scotford Complex (Image ©2016 Google)

Figure 2: Quest CCS Facility[1]

[1]Image: Alberta Energy [2016]. Retrieved from "http://www.energy.alberta.ca/CCS/3822.asp"

2.0 REVIEW OF THE SHELL SCOTFORD NOISE MODEL

2.1 Environmental Noise Model Software

The Shell Scotford Complex noise model is maintained in the SoundPLAN computer noise modelling platform. Updates to SoundPLAN are issued from time to time by the manufacturer to improve the software program. The current version of SoundPLAN is Version 7.4, and the Scotford noise model exists in this most recent version.

The Shell Scotford noise model calculations utilize the ISO 9613 calculation method for absorption of sound by the atmosphere, and the CONCAWE calculation method for outdoor sound propagation from industrial facilities. These calculation methods account for the following outdoor sound propagation effects:

- Geometric spreading
- Ground attenuation
- Atmospheric absorption
- Barrier attenuation.
- Wind or temperature gradients.

Meteorological parameters and ground attenuation values typical of summer seasonal conditions are used in the noise model calculations. These conditions include an air temperature of 10˚C and a relative humidity of 70%. The CONCAWE procedure allows calculations to be made for calm and downwind sound propagation from the site. The noise model results presented in this report are for calm winds.

The NCIA Regional Noise Model also utilizes the ISO 9613 and CONCAWE calculation methods. The temperature, humidity, ground attenuation and terrain parameters for the Shell Scotford noise model calculations are also the same as those used for the NCIA Regional Noise Model.

3.0 PREVIOUS SHELL SCOTFORD NOISE MODEL

Figure 1 shows the Shell Scotford Complex sites and individual process areas. A major update of the Shell Scotford noise model was completed in 2015 which brought the noise models for all process areas up to date. The 2015 noise model update was thoroughly validated by comparing measured and predicted noise levels throughout the facility. The Quest unit was not included in the 2015 model update as it was not operating during the field work phase of the update project.

The 2015 model update report[2] contains a detailed log of past noise-related projects at Scotford including noise modeling projects, noise impact assessments, and noise control projects. The historical log will not be reproduced in this report; interested readers should refer back to the 2015 model update report. An addendum to the 2015 model update report was issued in 2016 to address issues related to the Chemicals site model validation[3].

[2] SLR Consulting (Canada) Ltd., *2015 Shell Scotford Noise Model Update,* SLR Project No.: 203.50049.00001, 203.50049.00002, January 18, 2016.

[3] SLR Consulting (Canada) Ltd., Addendum to the *2015 Shell Scotford Noise Model Update,* SLR Project No.: 203.50049.00004, November 28, 2016.

4.0 FACILITY NOISE SURVEY

An initial site visit was conducted by Pascal Everton, P.Eng., and Chris Bibby, M.A.Sc., P.Eng., of SLR on April 26, 2016, to discuss the unit operation with Quest engineering personnel and identify all equipment noise sources. A subsequent diagnostic noise survey was conducted by Chris Bibby, M.A.Sc., P.Eng., and Matt Gaskell, C.E.T., of SLR on August 10 and 11, 2016, to collect data required to determine the sound power levels of individual equipment noise sources associated with the Quest unit.

The sound measurement instrumentation used for the on-site noise measurements were as follows:

- Brüel & Kjær Type 2270 hand-held analyser (2)
- Brüel & Kjær Type 4189 ½" microphone (2)
- Brüel & Kjær ZC-0032 preamplifier (2)
- Larson Davis 2541 ½" microphone
- Larson Davis PRM900B preamplifier
- Brüel & Kjær UA-1650 wind screen (2)
- SLR Acoustical Pipe Box
- Brüel & Kjær Type 4231 calibrator (2)
- PCB 308B Accelerometer
- Brüel & Kjær Type 4294-002 shaker (accelerometer calibrator)

All major noise sources in the Quest unit were measured, including the following equipment:

- FGR fans (located in the Upgrader HMU units)
- Various pumps and pump motors
- Valves
- Steam piping
- CO_2 centrifugal compressor, gear box, and motor
- Compressor piping
- CO_2 compressor building rooftop ventilation and exhaust fans
- CO_2 compressor building air handling unit (AHU)
- Fin-fan (aerial) coolers

The CO_2 suction piping was not measured as it was insulated (mineral wool with aluminum jacket). The acoustic attenuation provided by this insulation resulted in the CO2 suction piping being an insignificant source of noise.

Equipment that operates intermittently or in emergency situations such as emergency flares, PSV valves, and vents can emit high levels of noise. However, unless the equipment operates regularly, these sources are typically not included in environmental noise models.

Additional sound pressure level measurements were conducted on the roadways around the Quest unit for model validation purposes.

4.1 Measurement Methods and Sound Power Level Calculation

SLR utilizes a variety of measurement techniques and calculation methods to determine equipment sound power levels. Equipment noise measurements are conducted according to standardized methods, to the extent practicable, however strict conformance to the standards is typically not achieved. The following procedures and methods were used for the Quest noise study:

- ISO 3744-10(2015) *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane*
  - Used to determine equipment sound power levels in the presence of low background noise levels
- ASTM E1124 -10(2016) *Standard Test Method for Field Measurement of Sound Power Level by the Two-Surface Method*
  - Used to determine equipment sound power levels in the presence of high background noise levels
- ISO/TS 7849-1:2009 *Acoustics - Determination of airborne sound power levels emitted by machinery using vibration measurement - Part 1: Survey method using a fixed radiation factor*
  - Used to determine pipe sound power levels in the presence of high background noise levels
- SLR Acoustical Pipe Box – SLR-developed technique that uses a small acoustical enclosure with an internal microphone to isolate a pipe segment from the ambient noise environment. SLR has determined correction factors to calibrate for the acoustical effect of the enclosure.
  - Used to determine pipe sound power levels in the presence of high background noise levels

Equipment noise data collected during the noise survey were processed to determine the octave band sound power levels (PWL) of each noise source. The noise source sound power level data, along with noise source geometry and directivity information were used to define the acoustical energy and location coordinates of each noise source within the computer noise model.

The CO_2 compressor building (R-24701) sound power could not be determined from sound pressure level measurements of the building exterior because the noise transmitted through the building envelope is well below the exterior ambient noise level. The compressor building sound power was estimated from measurements of the interior sound pressure levels and theoretical values for the sound transmission loss of the building envelope elements. The estimated sound power of the compressor building was found to be very small in comparison to other noise sources in the Quest unit; therefore, uncertainty in this estimation does not significantly increase the uncertainty in the total facility sound power.

Equipment sound power level data for the Quest noise sources are provided in Appendix A. Note that the Quest project includes three FGR fans installed in the Upgrader HMU units (C-24103, C-24203, and C-44103). Additionally, noise source sound power levels for the Base Upgrader HMU PSA vessels have been revised to improve model accuracy.

5.0 QUEST NOISE MODEL

A 3D model of the Quest unit was developed, including all major buildings, structures, vessels, and noise sources in the unit. A plan view of the model is shown in Figure 3. A 3D view of the model in provided in Figure 4; the structures have been suppressed in this figure.

A summary of the overall sound power of the various equipment groups in the Quest unit is provided in Table 1. This table shows that the total sound power level of the Quest unit is dominated by CO_2 compressor piping noise. The fin-fan coolers, pumps, and motors also produce significant contributions, but are well below that of the compressor piping. The total sound power level of the Quest unit is compared to the sound power level of other sites in the Scotford Complex in Table 2. The Quest unit sound power level is about 11 dBA below the total sound power level of the Shell Scotford complex. Addition of the Quest unit increased the total Shell Scotford complex sound power level by 0.3 dBA.

Table 1 Quest Sound Power Levels Summary

Equipment Group	Sound Power Level, dBA	Remarks
Compressor Building	106.1	Includes AHU and rooftop fans
CO2 piping	123.6	
Steam Piping	104.4	
Fin-fan coolers	115.1	
Pumps and motors	113.1	
Quest Unit Total	**124.1**	

Table 2 Total Sound Power Levels by Site

Site	Unit	Sound Power Level (dBA)	Remarks
Chemicals	All Units	126.5	
Refinery	All Units	129.6	
Upgrader	All Other Units	133.0	w/o Quest
Upgrader	Quest	124.1	
Shell Scotford Total w/o Quest		**135.3**	
Shell Scotford Total w Quest		**135.6**	

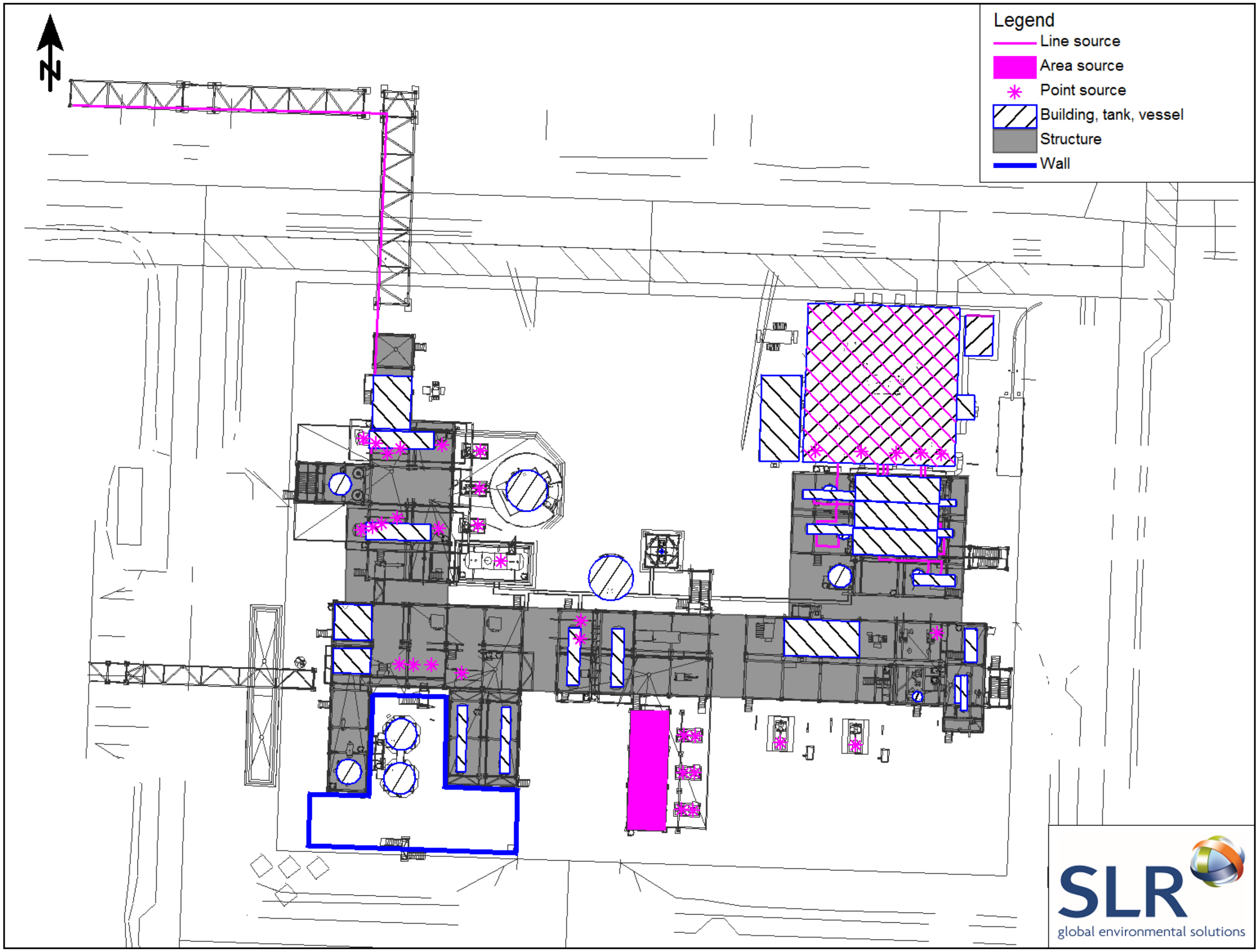

Figure 3 Quest Noise Model – Plan View

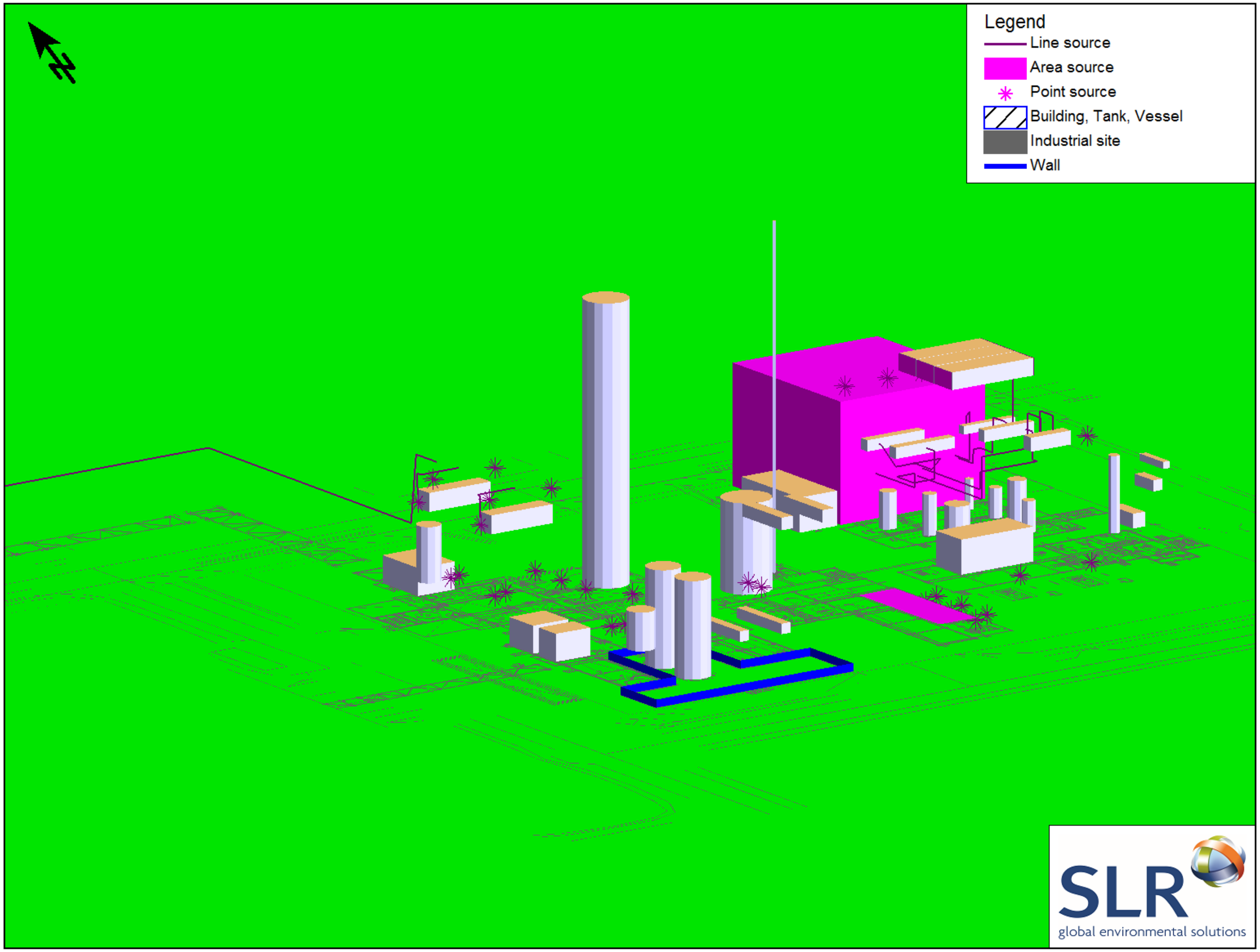

Figure 4 Quest Noise Model – 3D View (Structures Not Shown)

6.0 ON-SITE MODEL VALIDATION

The Quest unit noise model was used to predict facility sound levels at measurement locations around the unit. The predicted sound levels were compared to measured sound levels to evaluate the noise model accuracy.

Details of the model validation results are shown by way of tables and figures in Appendix B. Table B-1 shows the measured sound level, predicted sound level, and difference, at each validation location. The predicted sound levels are within ±3 dBA of the measured levels at all locations, which is a very good validity margin for industrial facility noise models. On average, the predicted sound level is 0.2 dBA higher than the measured sound level. Figures B-1 shows the validation location on the site plot-plan, overlaid on top of the validation model noise map. Figure B-2 is a graphical presentation of the validation results.

7.0 OFF-SITE PREDICTED SOUND LEVELS

The Quest unit sound level contribution has been predicted at 19 off-site locations, which are identified in Figure 5, using the validated noise model. All predictions correspond to summertime ground and atmospheric conditions, with calm winds. Ten of these receptor locations, identified as “Rxx”, correspond to the locations used for previous Shell Scotford site noise impact assessments. Nine other receptor locations, identified as “NCIA x” correspond to NCIA RNMP 2014 noise monitoring locations. The distance and direction of these receptors from the Scotford fence line are provided in Table 2. These receptors are identical to those used in the 2015 Shell Scotford Noise Model Update report.

The predicted sound level contributions of the Quest unit at these receptors are shown in Table 3, along with the total Shell Scotford complex sound level contribution with and without the Quest unit. The results in Table 3 show that the addition of the Quest unit to the site increases the total Scotford complex noise contribution by 0.0 to 0.3 dBA at the receptors. This slight increase is substantially lower than the commonly accepted just noticeable difference for human hearing (3 dB)[4] and represents an imperceptible change in the overall Scotford noise contributions within the study area.

Appendix C presents noise contour maps that show the predicted noise contributions of Quest and the Scotford complex in the vicinity the Scotford site.

7.1 Order Ranked Lists

Appendix D provides order–ranked lists of the top 100 noise source contributions at four receptor locations. Order ranked lists are provided for Receptor location R04, R10, NCIA 4, and NCIA 11, which are located north, east, south, and west of the Scotford complex, respectively. These lists are useful to identify the noise sources that have the highest impact at a given receptor location, and identify noise sources that have a significant impact in all directions from the Scotford complex.

Quest sources appear in the top 100 sources for all four receptors; however, they are not dominant noise contributors at any receptor. The Quest noise source with the greatest

[4] Crocker, M. (2007) Handbook of Noise and Vibration Control. Hoboken, NJ: John Wiley & Sons.

contribution is the CO_2 compressor (C-42701) 1st stage discharge piping. Treating these sections of compressor piping with acoustical lagging would be an effective and low-cost noise control project. However, Shell should consider that the acoustical pipe lagging would increase thermal retention along the pipe sections, potentially increasing the load on the inter-stage coolers.

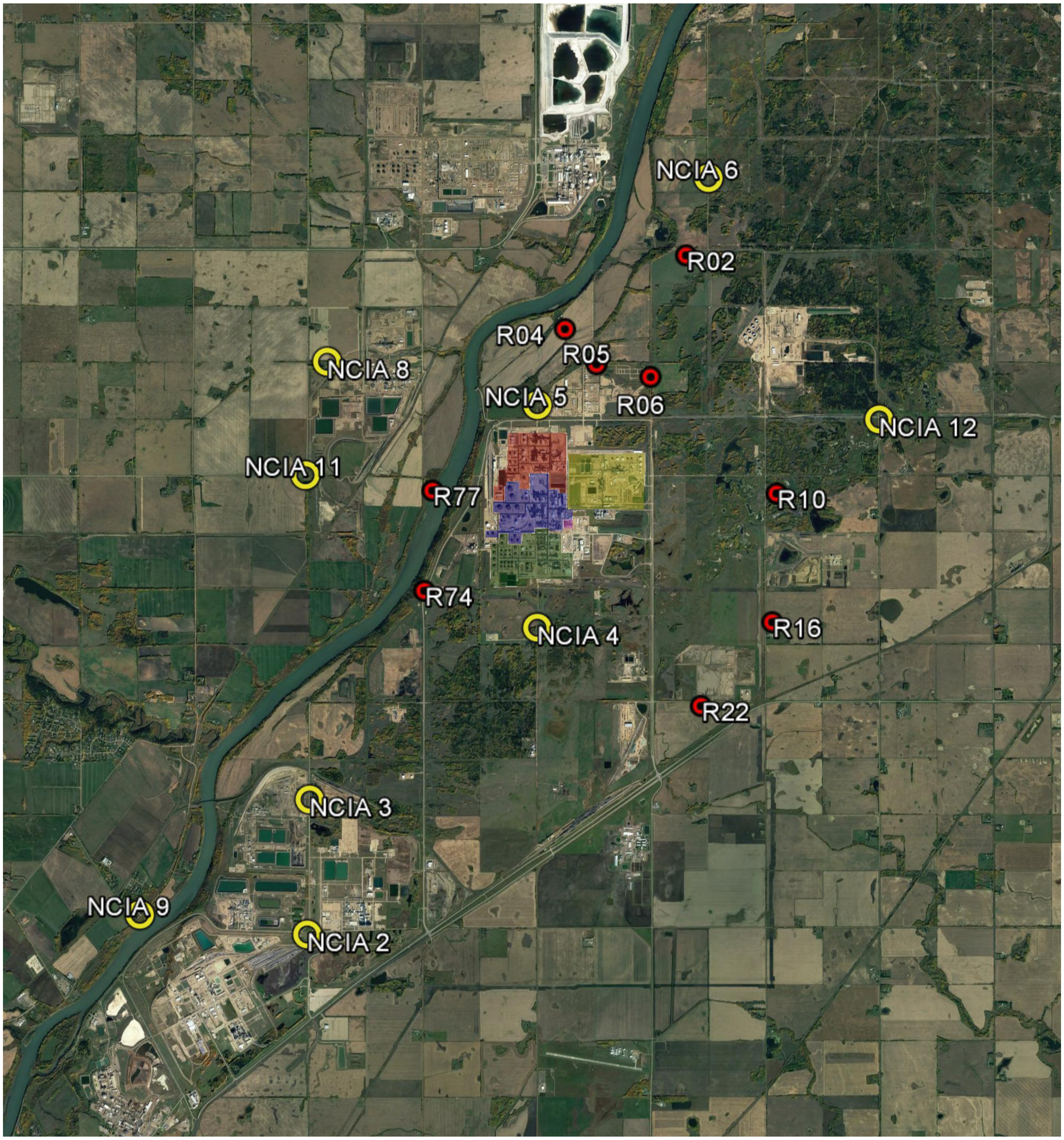

Figure 5 Shell Scotford Noise Receptor Locations (Image © GoogleEarth)

Table 3 Receptor Distance and Direction from Scotford Fenceline

Receptor	Direction	Distance
NCIA 2	SSW	5.6 km
NCIA 3	SW	4.0 km
NCIA 4	S	0.6 km
NCIA 5	N	0.3 km
NCIA 6	NNE	4.0 km
NCIA 8	WNW	2.6 km
NCIA 9	SW	6.0 km
NCIA 11	W	2.6 km
NCIA 12	E	3.4 km
R02	NNE	3.0 km
R04	N	1.4 km
R05	NNE	1.2 km
R06	NE	1.1 km
R10	E	2.0 km
R16	ESE	3.0 km
R22	SE	2.7 km
R74	SW	1.0 km
R77	W	0.7 km
R100	NNW	6.0 km

Table 4 Predicted Sound Level Contribution at each Receptor

	Predicted Sound Pressure Level, dBA Leq			
		Shell Scotford Total		
Receptor	Quest	Without Quest	With Quest	Change
NCIA 2	10.2	23.3	23.5	+ 0.2
NCIA 3	15.5	28.3	28.5	+ 0.2
NCIA 4	37.2	51.0	51.1	+ 0.1
NCIA 5	35.4	54.0	54.1	+ 0.1
NCIA 6	15.2	29.1	29.2	+ 0.1
NCIA 8	21.1	36.5	36.5	0
NCIA 9	7.4	20.1	20.3	+ 0.2
NCIA 11	21.8	36.5	36.7	+ 0.2
NCIA 12	19.2	30.1	30.4	+ 0.3
R02	20.2	33.7	33.9	+ 0.2
R04	25.1	43.3	43.3	0
R05	29.2	46.9	47.0	+ 0.1
R06	31.1	44.7	44.9	+ 0.2
R10	27.3	38.3	38.6	+ 0.3
R16	25.4	36.0	36.3	+ 0.3
R22	24.6	36.3	36.6	+ 0.3
R74	31.0	46.4	46.5	+ 0.1
R77	31.7	50.1	50.1	0
R100	7.7	22.7	22.8	+ 0.1

8.0 CONCLUSION

The Shell Scotford complex is a member of the NCIA, and participates in the Regional Noise Management Plan. To ensure accuracy of the Shell Scotford noise contributions within the RNM, Shell retained SLR to incorporate the Quest CCS facility into the Scotford noise model. All other components of the Shell Scotford noise model were updated in 2015 and 2016.

SLR conducted equipment noise and model validation measurements for the Quest unit in August 2016 when the unit was operating normally. The measurement data has been used to develop a 3D noise model of the facility.

The Quest unit noise model was validated by comparison of measured and predicted noise levels at 17 locations around the unit. Agreement between the measured and predicted values is within ±3 dBA at all the validation locations.

The Quest unit noise model has been incorporated into the existing Shell Scotford noise model and used to predict the facility noise contributions at 19 environmental receptor locations. These include receptor locations used for previous Shell Scotford site noise studies, and receptor locations corresponding to the NCIA 2014 noise monitoring locations. Addition of the Quest unit to the Shell site has resulted in an increase of 0.0 to 0.3 dBA in the total Shell Scotford complex noise contribution at these receptors. This slight increase will not perceptibly change the overall industrial noise in the Scotford site vicinity.

The off-site noise predictions were used to determine the impact of each equipment noise source at four different receptor locations, in different directions from the Scotford site. For each of these four receptors, order-ranked lists have been prepared that identify the 100 equipment noise sources with the highest noise contribution. The equipment noise source(s) with the highest noise contribution are the sources for which noise control treatment would have the largest impact on the overall Scotford site noise contribution. Quest sources appear in the top 100 sources for all four receptors; however, Quest sources are not dominant noise sources at any receptor. The Quest noise source with the greatest contribution is the CO_2 compressor (C-42701) 1st stage discharge piping. Shell may consider acoustical treatment of the CO_2 compressor discharge piping for a future noise control project.

9.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Shell Canada, hereafter referred to as the “Client”. It is intended for the sole and exclusive use of Shell Canada. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLR.

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CB/NM

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APPENDIX A
Quest Unit Equipment Sound Power Levels

Shell Canada Ltd.
Shell Scotford Quest Carbon Capture and Storage Facility
Quest Noise Model Development
SLR Project No.: 203.50049.00004

Table A-1

Equipment Sound Power Levels

Shell Scotford Quest

Summertime Conditions

Site	Unit	Tag/Description	Sound Power Level (dBA)	Remarks
Upgrader	Quest	C-24701 1st Discharge Sect 2a	114.9	
Upgrader	Quest	C-24701 1st Discharge Sect 2b	114.9	
Upgrader	Quest	C-24701 1st Discharge Sect 2c	119.9	
Upgrader	Quest	C-24701 2nd Discharge	111.1	
Upgrader	Quest	C-24701 3rd Discharge	113.4	
Upgrader	Quest	C-24701 4th Discharge	111.4	
Upgrader	Quest	C-24701 5th Discharge	109.8	
Upgrader	Quest	C-24701 6th Discharge	109.9	
Upgrader	Quest	Comp Bldg AHU vent	93.1	
Upgrader	Quest	E-24603A	95.9	
Upgrader	Quest	E-24603B	95.9	
Upgrader	Quest	E-24706-1	104.8	
Upgrader	Quest	E-24706-2	104.8	
Upgrader	Quest	E-24706-3	104.8	
Upgrader	Quest	E-24707A-1	105.9	
Upgrader	Quest	E-24707A-2	105.9	
Upgrader	Quest	E-24707A-3	105.9	
Upgrader	Quest	E-24707B-1	105.9	
Upgrader	Quest	E-24707B-2	105.9	
Upgrader	Quest	E-24707B-3	105.9	
Upgrader	Quest	FN-24703A	--	Not Operating
Upgrader	Quest	FN-24703B	103.8	
Upgrader	Quest	FN-24703C	--	Not Operating
Upgrader	Quest	FN-24704A	97.5	
Upgrader	Quest	FN-24704A	97.5	
Upgrader	Quest	FV-246005 downstream pipe	92.0	
Upgrader	Quest	FV-246005 downstream pipe	91.9	
Upgrader	Quest	FV-246005 East dummy leg 1	92.5	
Upgrader	Quest	FV-246005 East dummy leg 2	92.5	
Upgrader	Quest	FV-246005 West dummy leg 1	95.9	
Upgrader	Quest	FV-246005 West dummy leg 2	95.9	
Upgrader	Quest	Lean Amine Pump Deck	96.7	
Upgrader	Quest	P-24601A	108.1	
Upgrader	Quest	P-24601B	108.1	
Upgrader	Quest	P-24601C	--	Not Operating
Upgrader	Quest	P-24602A Motor	100.3	
Upgrader	Quest	P-24602A Pump	99.7	
Upgrader	Quest	P-24602B Motor	100.3	
Upgrader	Quest	P-24602B Pump	99.7	
Upgrader	Quest	P-24602C Motor	--	Not Operating
Upgrader	Quest	P-24602C Pump	--	Not Operating
Upgrader	Quest	P-24603A	88.5	
Upgrader	Quest	P-24603B	--	Not Operating
Upgrader	Quest	P-24604	--	Not Operating

Site	Unit	Tag/Description	Sound Power Level (dBA)	Remarks
Upgrader	Quest	P-24605	90.0	
Upgrader	Quest	P-24607	--	Not Operating
Upgrader	Quest	P-24608A	99.8	
Upgrader	Quest	P-24608B	--	Not Operating
Upgrader	Quest	P-24609A	97.3	
Upgrader	Quest	P-24609B	--	Not Operating
Upgrader	Quest	P-24610A	98.0	
Upgrader	Quest	P-24610B	98.0	
Upgrader	Quest	P-24611A	94.1	
Upgrader	Quest	P-24611B	94.1	
Upgrader	Quest	R-24701 East Wall	88.5	
Upgrader	Quest	R-24701 North Wall	88.3	
Upgrader	Quest	R-24701 Roof	90.0	
Upgrader	Quest	R-24701 South Wall	88.3	
Upgrader	Quest	R-24701 West Wall	88.5	
Upgrader	Quest	Steam Pipe from CoGen	97.0	
Upgrader	Quest	TV-248001	85.3	
Upgrader	HMU	HMU C-24103 Motor (FGR fan)	87.7	
Upgrader	HMU	HMU C-24203 Motor (FGR fan)	91.3	
Upgrader	HMU	HMU C-44103 Motor (FGR fan)	88.3	
Total			124.6	

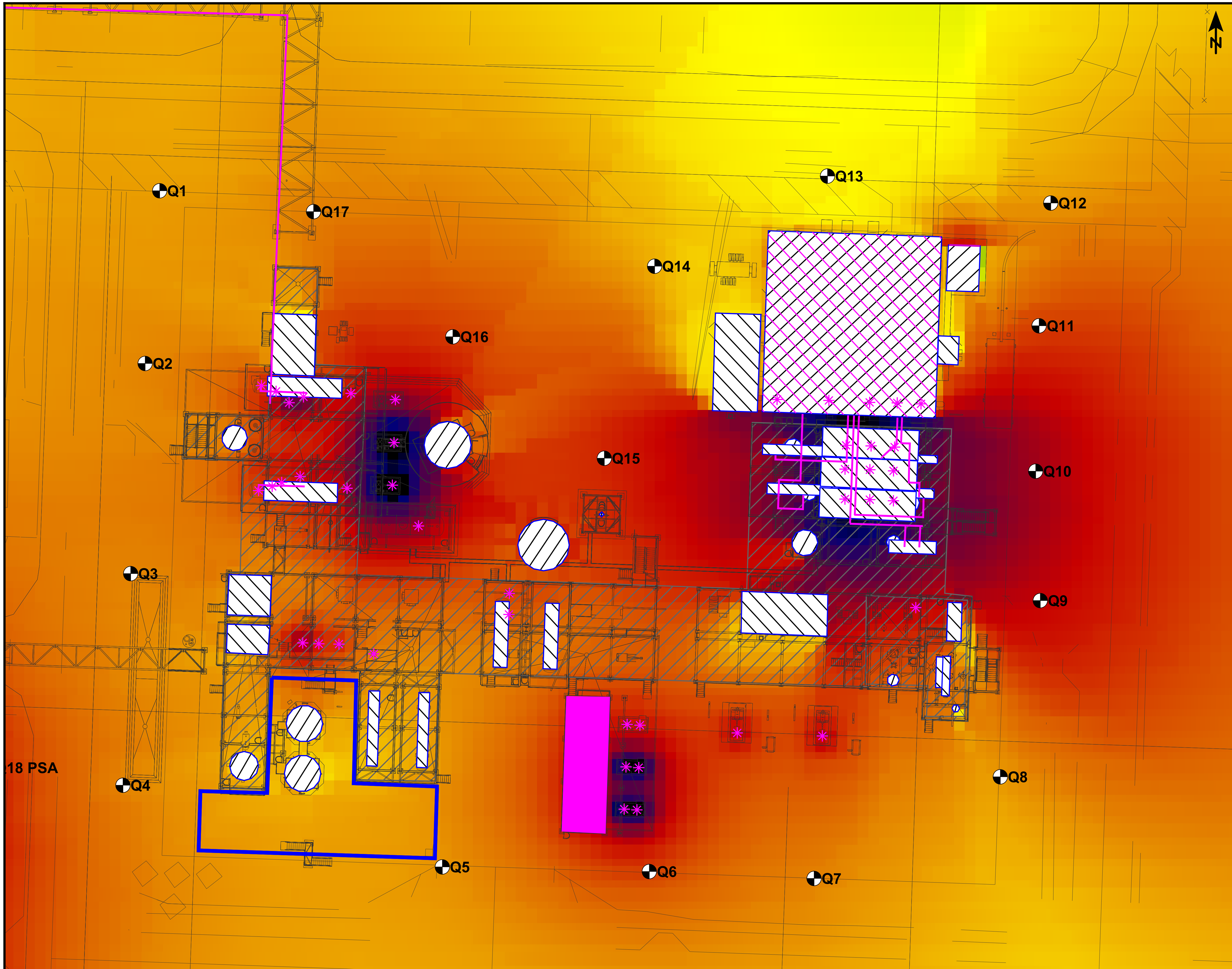
APPENDIX B
Model Validation Tables and Figures

Shell Canada Ltd.
Shell Scotford Quest Carbon Capture and Storage Facility
Quest Noise Model Development
SLR Project No.: 203.50049.00004

Table B-1

Model Validation
Shell Scotford Quest
Summertime Conditions

Site	Unit	Location Designation	Sound Pressure Level (dBA)			Remarks
			Measured	Predicted	Difference	
Upgrader	Quest	+0.5	72.8	73.3	0.5	August 2016 measurement
Upgrader	Quest	+1.4	73.4	74.8	1.4	August 2016 measurement
Upgrader	Quest	+0.8	74.0	74.8	0.8	August 2016 measurement
Upgrader	Quest	+2	73.0	75.0	2.0	August 2016 measurement
Upgrader	Quest	+1.3	72.7	74.0	1.3	August 2016 measurement
Upgrader	Quest	+1.1	77.7	78.8	1.1	August 2016 measurement
Upgrader	Quest	+1.3	73.6	74.9	1.3	August 2016 measurement
Upgrader	Quest	+2.1	71.6	73.8	2.1	August 2016 measurement
Upgrader	Quest	-2.5	85.3	82.8	-2.5	August 2016 measurement
Upgrader	Quest	-1.5	85.8	84.3	-1.5	August 2016 measurement
Upgrader	Quest	-1	79.8	78.7	-1.0	August 2016 measurement
Upgrader	Quest	-1.6	75.6	74.0	-1.6	August 2016 measurement
Upgrader	Quest	+0.2	68.1	68.3	0.2	August 2016 measurement
Upgrader	Quest	+0.4	72.1	72.4	0.4	August 2016 measurement
Upgrader	Quest	-2.3	82.7	80.4	-2.3	August 2016 measurement
Upgrader	Quest	-0.2	79.5	79.3	-0.2	August 2016 measurement
Upgrader	Quest	+1.3	73.9	75.2	1.3	August 2016 measurement
				Average	**+0.2**	



Legend

- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Foliage
- Structure
- Wall
- Receiver

Scale 1:527

0 5 10 20 30 m

Sound Level (dBA)

		<= 57.5
57.5 <		<= 60.0
60.0 <		<= 62.5
62.5 <		<= 65.0
65.0 <		<= 67.5
67.5 <		<= 70.0
70.0 <		<= 72.5
72.5 <		<= 75.0
75.0 <		<= 77.5
77.5 <		<= 80.0
80.0 <		<= 82.5
82.5 <		<= 85.0
85.0 <		<= 87.5
87.5 <		<= 90.0
90.0 <		<= 92.5
92.5 <		<= 95.0
95.0 <		

Quest Facility
Model Validation Locations and Noise Map
Summertime Modeling Conditions

Shell Canada Ltd. Scotford Facility
Quest Noise Model Development
SLR Project No. 203.50049.00004

Figure B-1	Rev. 0	11/28/2016

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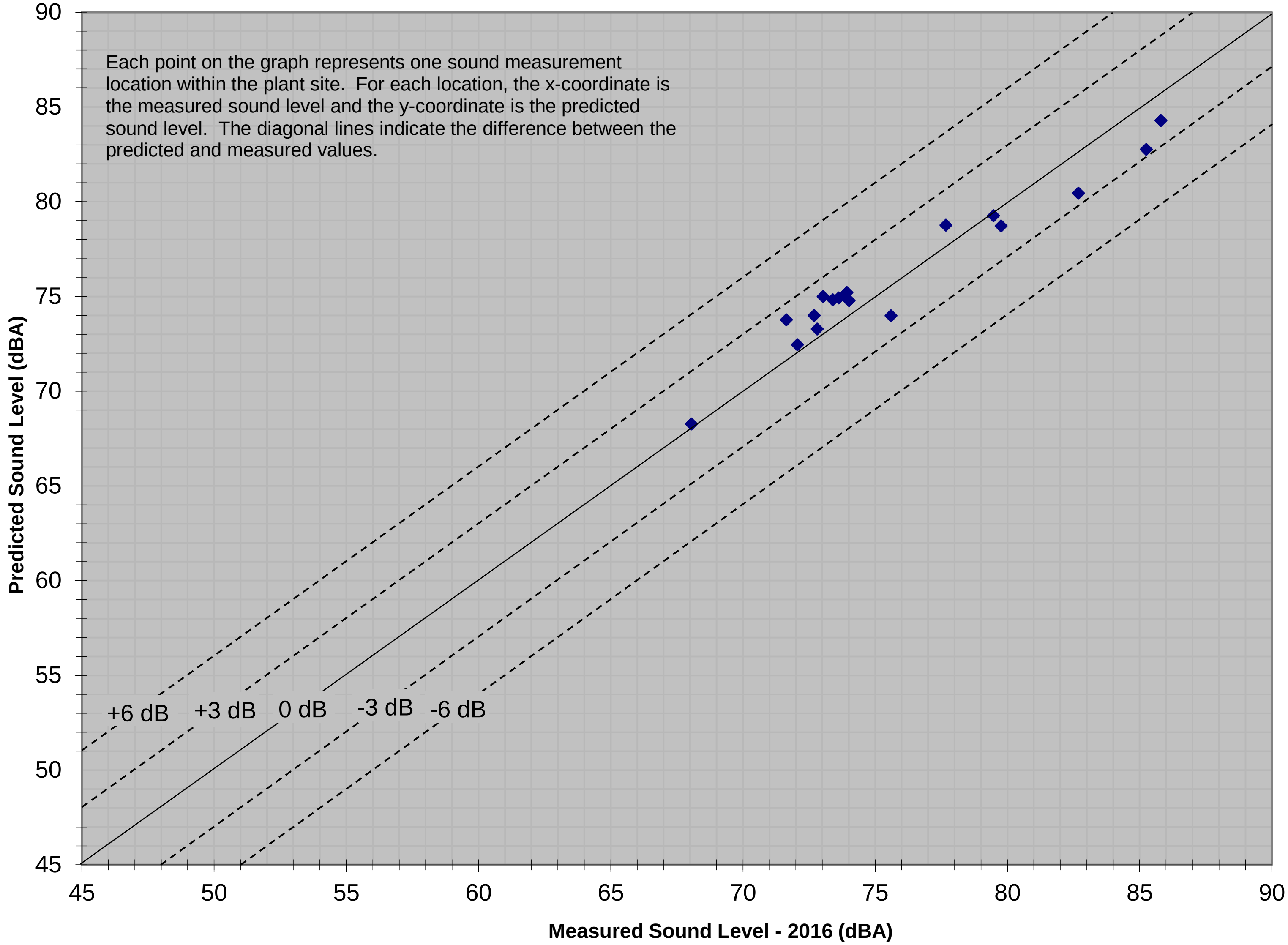
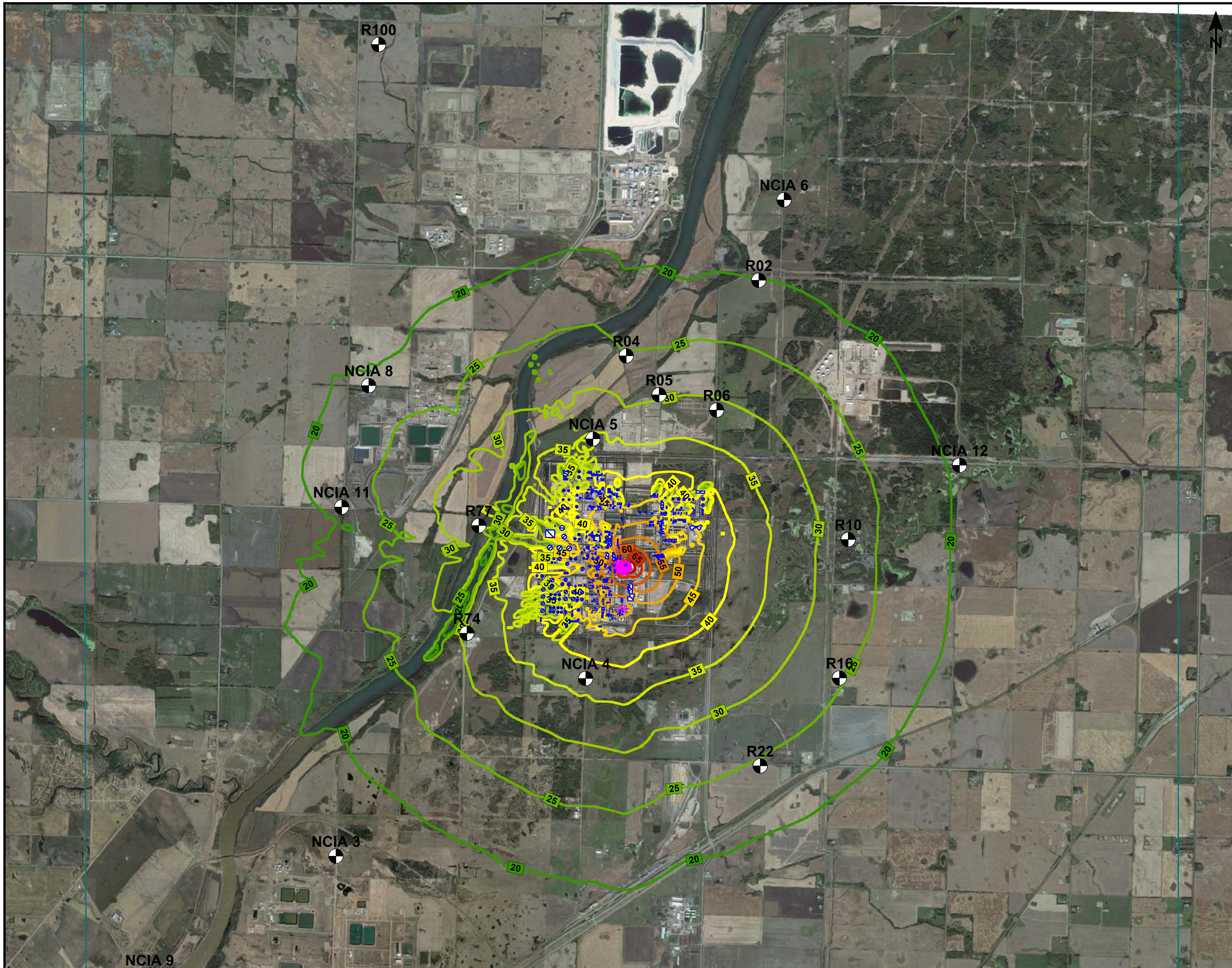
Figure B-2
Shell Scotford Quest
Comparison of Measured Sound Levels to Predicted Sound Levels



APPENDIX C
Environmental Noise Contour Figures

Shell Canada Ltd.
Shell Scotford Quest Carbon Capture and Storage Facility
Quest Noise Model Development
SLR Project No.: 203.50049.00004



Legend

- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Foliage
- Industrial site
- Ground effects
- Receiver

Scale 1:50000

0 500 1000 2000 3000 m

Sound Level (dBA)

	<= 20.0
20.0 <	<= 25.0
25.0 <	<= 30.0
30.0 <	<= 35.0
35.0 <	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	<= 95.0
95.0 <	

Shell Scotford Facility
Predicted Sound Level Contours
Quest Unit Noise Sources
Summertime Conditions, Calm Wind

Shell Canada Ltd. Scotford Facility
Quest Noise Model Development
SLR Project No. 203.50049.00004

Figure C-1	Rev. 0	11/28/2016

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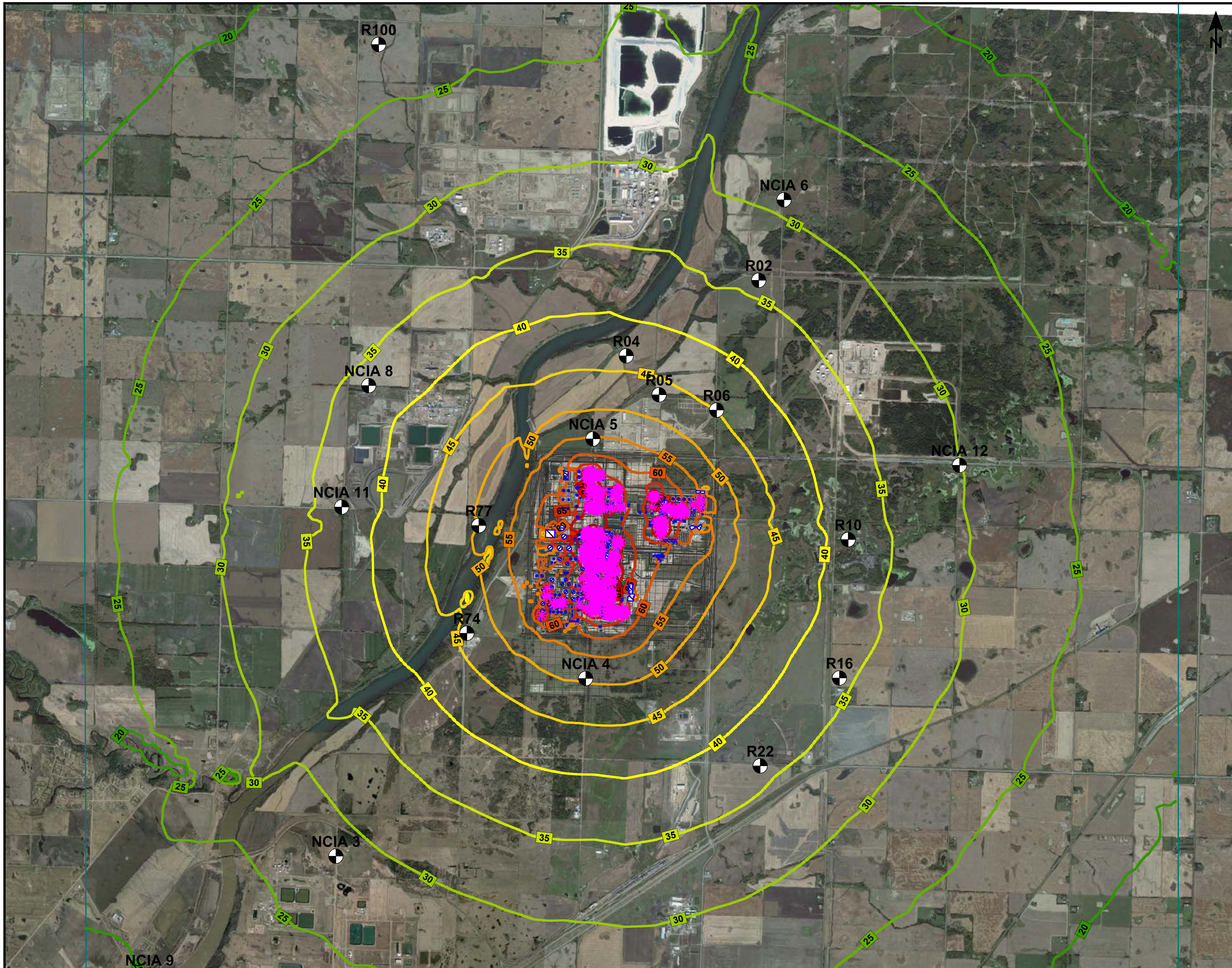

Legend
- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Foliage
- Industrial site
- Ground effects
- Receiver

Scale 1:50000

0 500 1000 2000 3000 m

Sound Level (dBA)

	<= 20.0
20.0 <	<= 25.0
25.0 <	<= 30.0
30.0 <	<= 35.0
35.0 <	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	<= 95.0
95.0 <	

Shell Scotford Facility
Predicted Sound Level Contours
Shell Scotford without Quest
Summertime Conditions, Calm Wind

Shell Canada Ltd. Scotford Facility
Quest Noise Model Development
SLR Project No. 203.50049.00004

Figure C-2	Rev. 0	11/28/2016

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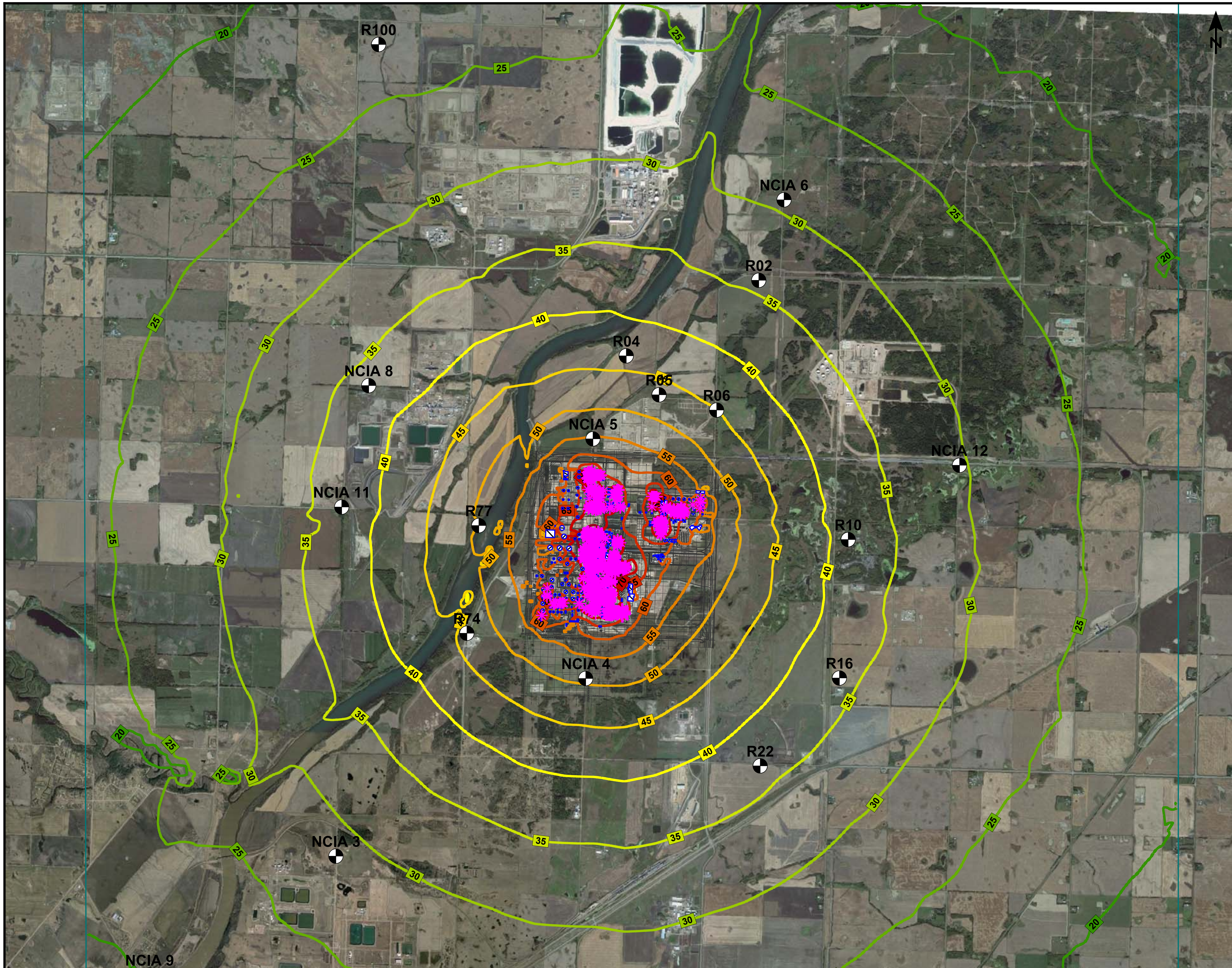

Legend
- Line source
- Area source
- Point source
- Building, Tank, Vessel
- Foliage
- Industrial site
- Ground effects
- Receiver

Scale 1:50000

0 500 1000 2000 3000 m

Sound Level (dBA)

<= 20.0
20.0 < <= 25.0
25.0 < <= 30.0
30.0 < <= 35.0
35.0 < <= 40.0
40.0 < <= 45.0
45.0 < <= 50.0
50.0 < <= 55.0
55.0 < <= 60.0
60.0 < <= 65.0
65.0 < <= 70.0
70.0 < <= 75.0
75.0 < <= 80.0
80.0 < <= 85.0
85.0 < <= 90.0
90.0 < <= 95.0
95.0 <

Shell Scotford Facility
Predicted Sound Level Contours
Shell Scotford with Quest
Summertime Conditions, Calm Wind

Shell Canada Ltd. Scotford Facility
Quest Noise Model Development
SLR Project No. 203.50049.00004

Figure C-3	Rev. 0	11/28/2016

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APPENDIX D
Order-Ranked Lists

Shell Canada Ltd.
Shell Scotford Quest Carbon Capture and Storage Facility
Quest Noise Model Development
SLR Project No.: 203.50049.00004

Order-ranked lists are provided in Tables D-1 through D-4, corresponding to Receptors R04, R10, NCIA 4, and NCIA 11 respectively.

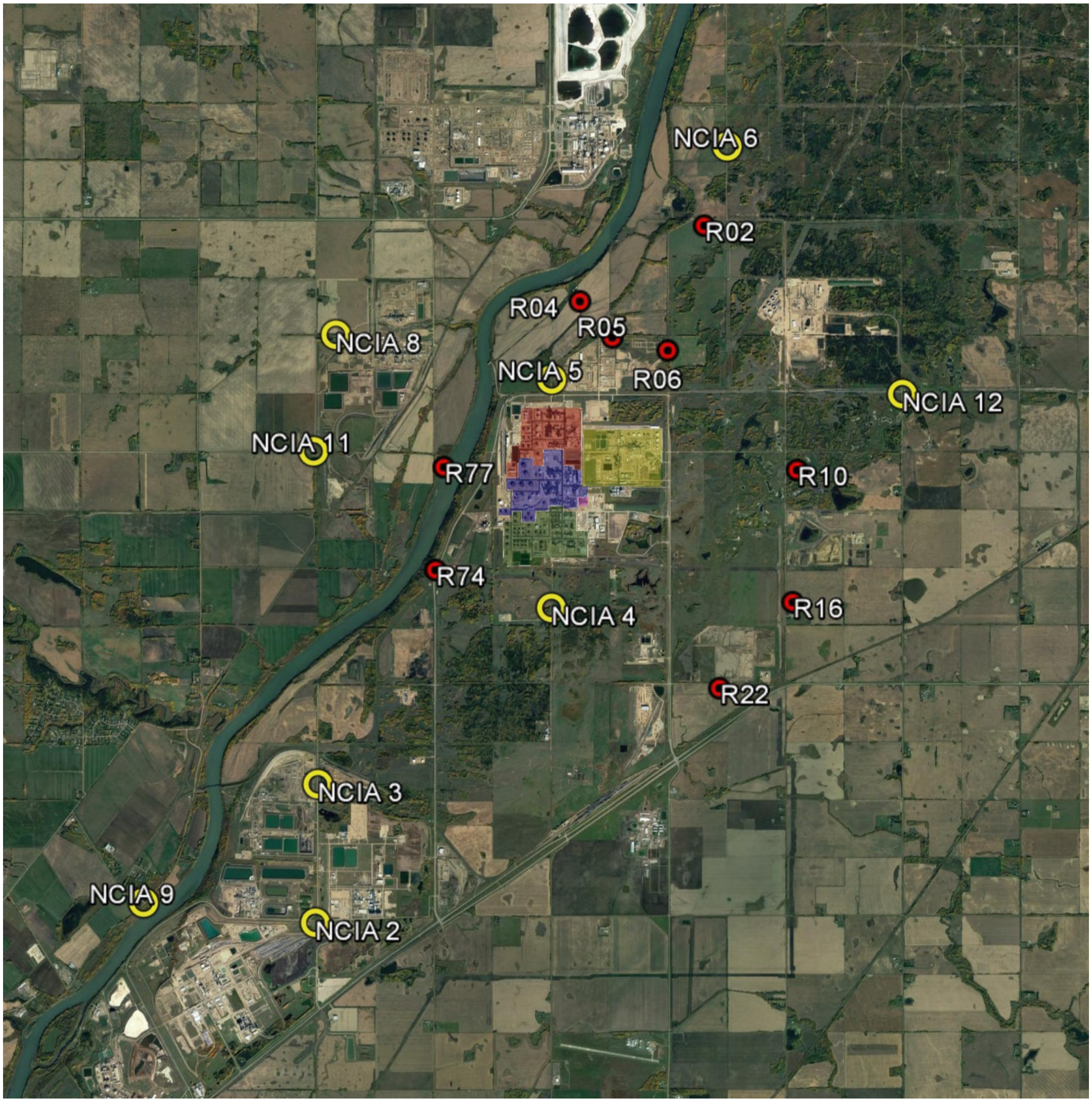


Figure D-1 Shell Scotford Noise Receptor Locations (Image © GoogleEarth).

Table D-1

Order-Ranked Sound Level Contributions at Receptor R04
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Base Upgrader	A&V	A&V I-21103B Stg1 Disch 42in Pip	37.0
2	Base Upgrader	A&V	A&V I-21103A Stg1 Disch 42in Pip	36.3
3	Chemicals	Utilities	Utilities Cooling Tower North Sp	28.3
4	Refinery	Unit 61	Flare	26.0
5	Base Upgrader	A&V	A&V I-21103B	25.1
6	Chemicals	Utilities	Utilities De-airator vent	24.5
7	Expansion Upgrader	A&V	A&V E-41124 (1st stage condenser	24.4
8	Expansion Upgrader	RHC	RHC Feed Mixing Deck	23.9
9	Base Upgrader	CTWR	CTWR Cooling Tower E Splash	23.3
10	Expansion Upgrader	HMU	HMU S-44103	23.2
11	Expansion Upgrader	A&V	A&V E-41125 (2nd stage condenser	23.2
12	Expansion Upgrader	RHC	RHC P-42601B	23.1
13	Expansion Upgrader	A&V	A&V Pipe support from I-41102A	22.1
14	Base Upgrader	COGEN	CGN HRSG Stack	22.1
15	Base Upgrader	SRU	SRU Incin Stack Outlet	22.0
16	Expansion Upgrader	A&V	A&V P-41106A	21.4
17	Base Upgrader	A&V	A&V I-21104A Stg2 Disch 18in Pip	20.7
18	Base Upgrader	RHC	RHC PSA V-22783	20.6
19	Chemicals	Styrene	HS 219 Styrene Furnace Base	20.5
20	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
21	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
22	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
23	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
24	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
25	Expansion Upgrader	HMU	HMU V-44315 PSA Off Gas Drum	19.8
26	Expansion Upgrader	A&V	A&V set 40943	19.5
27	Expansion Upgrader	A&V	A&V set 40912	19.0
28	Expansion Upgrader	A&V	A&V set 40943	19.0
29	Base Upgrader	A&V	A&V I-21104B Stg2 Disch 18in Pip	18.9
30	Base Upgrader	A&V	A&V I-21104B Stg2 Disch Pipe Sup	18.9
31	Expansion Upgrader	SRC	SRC V-41706 E (Incinerator)	18.8
32	Expansion Upgrader	HMU	HMU PSA Header	18.8
33	Expansion Upgrader	SRC	SRC S-41705 Incinerator stack ou	18.6
34	Base Upgrader	A&V	A&V I-21105 Stg3 Disch 12in Pipe	18.6
35	Chemicals	Utilities	Cooling Tower fan #1 (1-8 W-E)	18.6
36	Chemicals	Styrene	Tanks PP416A	18.6
37	Chemicals	Utilities	Cooling Tower fan #2 (1-8 W-E)	18.6
38	Chemicals	Utilities	Cooling Tower fan #3 (1-8 W-E)	18.5
39	Base Upgrader	A&V	A&V I-21104A Stg2 Disch Pipe Sup	18.5
40	Chemicals	Utilities	Cooling Tower fan #4 (1-8 W-E)	18.5
41	Chemicals	Utilities	Cooling Tower fan #5 (1-8 W-E)	18.5
42	Chemicals	Utilities	Cooling Tower fan #6 (1-8 W-E)	18.5
43	Chemicals	Utilities	Cooling Tower fan #7 (1-8 W-E)	18.5
44	Chemicals	Utilities	Cooling Tower fan #8 (1-8 W-E)	18.4
45	Base Upgrader	COGEN	CGN N-S Pipe Rack	18.3

Table D-1

Order-Ranked Sound Level Contributions at Receptor R04
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Chemicals	Styrene	FV1018	18.2
47	Expansion Upgrader	CTWR	CTWR mtr 54201A	18.0
48	Refinery	Unit 22	Unit 22 Common H Comp E Opening	17.9
49	Expansion Upgrader	CTWR	CTWR mtr54201B	17.8
50	Expansion Upgrader	CTWR	CTWR mtr54201C	17.8
51	Expansion Upgrader	CTWR	CTWR mtr54201D	17.8
52	Expansion Upgrader	RHC	RHC FV-461901	17.4
53	Expansion Upgrader	A&V	A&V I-41103A (3rd stage ejector)	17.4
54	Expansion Upgrader	RHC	RHC Membrane RVS Deck	17.3
55	Expansion Upgrader	RHC	RHC West Mixing Deck	17.2
56	Base Upgrader	HMU	HMU S-24203 Stack Outlet	17.2
57	Base Upgrader	RHC	RHC PSA V-22883	17.1
58	Base Upgrader	HMU	HMU S-24103 Stack Outlet	16.9
59	Expansion Upgrader	A&V	A&V P-41112B	16.7
60	Refinery	Unit 31/32	Unit 30 Comp Bldg N Opening	16.6
61	Expansion Upgrader	A&V	A&V FV-411217	16.6
62	Base Upgrader	COGEN	CGN Deair Stm E Vent 1	16.6
63	Base Upgrader	COGEN	CGN Deair Stm W Vent 1	16.6
64	Refinery	Unit 25	E 2509-A1	16.1
65	Expansion Upgrader	RHC	RHC BBQ Deck	16.1
66	Expansion Upgrader	RHC	RHC Structure H	16.1
67	Chemicals	Styrene	P205S M	16.1
68	Expansion Upgrader	A&V	A&V C-41111 (FD fan)	16.0
69	Base Upgrader	COGEN	CGN Rect Roof Fan 1	15.7
70	Chemicals	Utilities	Utilities Flare Blower	15.7
71	Expansion Upgrader	A&V	A&V support 41009	15.5
72	Base Upgrader	HMU	HMU PSA V-24411	15.4
73	Refinery	Unit 24	E2416-2	15.3
74	Base Upgrader	COGEN	CGN Turb Bldg E Wall	15.2
75	Expansion Upgrader	CTWR	CTWR 54201A	15.1
76	Refinery	Unit 21	H2101 heater wall	15.1
77	Base Upgrader	SRU	SRU PM-21307	15.1
78	Refinery	Unit 24	E2416-1	15.1
79	Chemicals	MEG	MEG CO2 Vent	15.1
80	Base Upgrader	COGEN	CGN E-W Pipe Rack	15.0
81	Expansion Upgrader	A&V	A&V S-41106 (Vac exhaust stack)	15.0
82	Base Upgrader	COGEN	CGN Turb Bldg N Wall	14.9
83	Chemicals	MEG	MEG Compressor Suction	14.8
84	Chemicals	Styrene	FT1007	14.8
85	Base Upgrader	SRU	SRU C-21702 Incin FD Fan Inlet	14.8
86	Refinery	Unit 21	Unit 21 Deaerator	14.6
87	Base Upgrader	COGEN	CGN Rect Roof Fan 2	14.6
88	Base Upgrader	COGEN	CGN Rect Roof Fan 3	14.6
89	Base Upgrader	HMU	HMU PSA V-24411	14.6
90	Expansion Upgrader	RHC	RHC R-421001 Equip Door	14.6

Table D-1

Order-Ranked Sound Level Contributions at Receptor R04
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Refinery	Unit 25	C2501 - compressor building N op	14.5
92	Base Upgrader	HMU	HMU C-24201 Air Inlet	14.5
93	Expansion Upgrader	A&V	A&V P-41189A	14.4
94	Expansion Upgrader	HMU	HMU H-44101 E (Heat Columns)	14.4
95	Expansion Upgrader	CTWR	CTWR 54201B	14.3
96	Expansion Upgrader	A&V	A&V S-41107 (Atmos exhaust stack	14.3
97	Base Upgrader	RHC	RHC FV-224008	14.3
98	Expansion Upgrader	CTWR	CTWR 54201C	14.3
99	Upgrader	Quest	E-24707B-1	14.2
100	Expansion Upgrader	CTWR	CTWR 54201D	14.2
Sum of all noise contrubutions above (1 to 100)				42.4
Sum of all remaining noise sources (101 to 2213)				36.1
Total Sound Pressure Level				**43.3**

Table D-2

Order-Ranked Sound Level Contributions at Receptor R10
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Base Upgrader	A&V	A&V I-21103A Stg1 Disch 42in Pip	30.4
2	Chemicals	MEG	PT-32003	26.1
3	Chemicals	MEG	MEG Compressor Discharge after	23.0
4	Chemicals	Utilities	Utilities De-airator vent	21.8
5	Refinery	Unit 61	Flare	21.8
6	Expansion Upgrader	RHC	RHC R-421001 South Wall	21.8
7	Upgrader	Quest	C-24701 1st Discharge Sect 2c	20.8
8	Base Upgrader	COGEN	CGN HRSG Stack	19.8
9	Chemicals	MEG	TT 3101 Vessel6	19.1
10	Upgrader	Quest	C-24701 1st Discharge Sect 2b	19.0
11	Base Upgrader	SRU	SRU Incin Stack Outlet	18.8
12	Chemicals	MEG	MEG Compressor Suction	18.8
13	Base Upgrader	A&V	A&V I-21103A	18.7
14	Upgrader	Quest	C-24701 1st Discharge Sect 2a	18.5
15	Chemicals	MEG	TT 3101 Vessel4	18.5
16	Chemicals	MEG	TT 3101 Vessel5	18.3
17	Chemicals	MEG	O2 mixbox outlet	18.3
18	Chemicals	MEG	TT 3101 Vessel3	18.0
19	Chemicals	Styrene	Tanks PP416A	17.3
20	Base Upgrader	CTWR	CTWR Cooling Tower E Splash	17.0
21	Base Upgrader	A&V	A&V I-21103B Stg1 Disch 42in Pip	16.6
22	Expansion Upgrader	HMU	HMU S-44103	16.5
23	Refinery	Unit 21	C2104 fan Inlet	16.1
24	Base Upgrader	RHC	RHC PSA V-22883	15.5
25	Chemicals	Styrene	Tanks GZ348H	15.1
26	Chemicals	Utilities	Cooling Tower fan #8 (1-8 W-E)	15.0
27	Chemicals	Utilities	Cooling Tower fan #7 (1-8 W-E)	15.0
28	Expansion Upgrader	CTWR	CTWR 54201 E water splash	14.9
29	Chemicals	Utilities	Cooling Tower fan #6 (1-8 W-E)	14.9
30	Chemicals	Utilities	Cooling Tower fan #5 (1-8 W-E)	14.9
31	Chemicals	Utilities	Cooling Tower fan #4 (1-8 W-E)	14.8
32	Chemicals	Utilities	Cooling Tower fan #3 (1-8 W-E)	14.8
33	Chemicals	Utilities	Cooling Tower fan #2 (1-8 W-E)	14.7
34	Chemicals	MEG	TT 3101 Vessel7	14.7
35	Base Upgrader	SRU	SRU CM-21401 Degasser Motor	14.7
36	Chemicals	Utilities	Cooling Tower fan #1 (1-8 W-E)	14.7
37	Chemicals	Utilities	Utilities Cooling Tower South Sp	14.5
38	Base Upgrader	A&V	A&V I-21104A Stg2 Disch 18in Pip	14.5
39	Chemicals	MEG	MEG CO2 Vent	14.5
40	Base Upgrader	COGEN	CGN Turb Bldg E Wall	14.4
41	Base Upgrader	HMU	HMU S-24203 Stack Outlet	14.3
42	Chemicals	MEG	MEG pipe "A" support 6	14.3
43	Base Upgrader	RHC	RHC PSA V-22783	14.2
44	Chemicals	MEG	TT3101 piping	14.0
45	Chemicals	MEG	MEG PP-3201A M	13.8

Table D-2

Order-Ranked Sound Level Contributions at Receptor R10
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Base Upgrader	HMU	HMU S-24103 Stack Outlet	13.6
47	Chemicals	MEG	TT3101 piping	13.4
48	Chemicals	MEG	TT 3101 Vessel2	13.3
49	Refinery	Unit 20	E-2012 compressor coolant cooler	13.3
50	Chemicals	Styrene	Styrene CWR pipe	13.3
51	Refinery	Unit 31/32	Unit 30 Comp Bldg N Opening	13.1
52	Refinery	Unit 11	Fan Casing C1101	13.0
53	Refinery	Unit 31/32	Regen Blower Fan case	13.0
54	Chemicals	Styrene	P220A M	13.0
55	Chemicals	Utilities	North boiler intake VFD	12.9
56	Base Upgrader	HMU	HMU PSA V-24411	12.9
57	Upgrader	Quest	FN-24703B	12.9
58	Base Upgrader	COGEN	CGN Deair Stm E Vent 1	12.9
59	Base Upgrader	COGEN	CGN Deair Stm W Vent 1	12.9
60	Refinery	Unit 21	C2103 Inlet	12.9
61	Chemicals	Styrene	GZ348CPA1P	12.8
62	Base Upgrader	HMU	HMU PSA V-24411	12.8
63	Base Upgrader	COGEN	CGN N-S Pipe Rack	12.8
64	Expansion Upgrader	SRC	SRC S-41705 Incinerator stack ou	12.6
65	Refinery	Unit 24	C2401 Comp Bldg N open	12.6
66	Upgrader	Quest	E-24706-1	12.6
67	Chemicals	MEG	TT 3101 Vessel1	12.5
68	Upgrader	Quest	E-24707B-1	12.4
69	Chemicals	MEG	TT 3101 Vessel8	12.4
70	Upgrader	Quest	E-24707A-1	12.3
71	Chemicals	MEG	pipes near AS-3203	12.3
72	Upgrader	Quest	C-24701 3rd Discharge	12.3
73	Base Upgrader	HMU	HMU PSA V-24411	12.3
74	Base Upgrader	HMU	HMU PSA V-24411	12.2
75	Upgrader	Quest	C-24701 6th Discharge	12.2
76	Chemicals	MEG	MEG Vessel TT3406 south face	12.2
77	Upgrader	Quest	E-24706-2	12.2
78	Chemicals	Styrene	Tanks PP417A	12.2
79	Base Upgrader	HMU	HMU PSA V-24311	12.1
80	Chemicals	MEG	MEG PP-3204B M	12.1
81	Base Upgrader	HMU	HMU S-24301 PSA Bldg Ridge Vent	12.0
82	Chemicals	MEG	MEG pipe "A" support 5	11.9
83	Chemicals	MEG	TT3101 piping	11.9
84	Upgrader	Quest	E-24706-3	11.9
85	Refinery	Unit 42	Unit 42 Comp Bldg N opening	11.9
86	Chemicals	Styrene	PP215S	11.8
87	Upgrader	Quest	E-24707B-2	11.8
88	Base Upgrader	HMU	HMU PSA V-24411	11.7
89	Upgrader	Quest	E-24707A-2	11.7
90	Base Upgrader	COGEN	CGN Turb Bldg N Wall	11.7

Table D-2

Order-Ranked Sound Level Contributions at Receptor R10
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Refinery	Unit 21	H2101 heater wall	11.6
92	Base Upgrader	HMU	HMU PSA V-24411	11.6
93	Refinery	Unit 21	H2102 heater wall	11.6
94	Base Upgrader	HMU	HMU PSA V-24311	11.6
95	Chemicals	MEG	MEG PP-3214A M	11.6
96	Upgrader	Quest	C-24701 4th Discharge	11.5
97	Chemicals	Styrene	FT1007	11.4
98	Upgrader	Quest	E-24707B-3	11.4
99	Base Upgrader	CTWR	UPGR Cooling Water Pumphouse OH D	11.3
100	Upgrader	Quest	E-24707A-3	11.3
Sum of all noise contrubutions above (1 to 100)				36.9
Sum of all remaining noise sources (101 to 2213)				33.5
Total Sound Pressure Level				**38.6**

Table D-3

Order-Ranked Sound Level Contributions at Receptor NCIA 4
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Base Upgrader	A&V	A&V I-21103A Stg1 Disch 42in Pip	42.8
2	Base Upgrader	A&V	A&V I-21103B Stg1 Disch 42in Pip	41.7
3	Refinery	Unit 61	Flare	37.6
4	Refinery	Unit 31/32	Unit 30 steam vent	35.7
5	Refinery	Unit 31/32	Regen Blower Fan case	34.6
6	Refinery	Unit 61	P6303	33.1
7	Base Upgrader	A&V	A&V I-21103A	32.7
8	Refinery	Unit 51	Util Bldg roof NE Deairerator	31.9
9	Upgrader	Quest	C-24701 1st Discharge Sect 2c	31.0
10	Refinery	Unit 61	P6301	30.4
11	Base Upgrader	A&V	A&V I-21103B	30.3
12	Refinery	Unit 22	P2201A Motor	29.9
13	Refinery	Unit 31/32	H3251 blower fan case	29.5
14	Refinery	Unit 21	Unit 21 Deaerator	29.3
15	Base Upgrader	SRU	SRU Incin Stack Outlet	29.1
16	Chemicals	Utilities	Utilities Cooling Tower South Sp	28.8
17	Refinery	Unit 24	E2416-1	28.1
18	Refinery	Unit 24	E2416-2	27.8
19	Expansion Upgrader	RHC	RHC R-421001 South Wall	27.8
20	Base Upgrader	RHC	RHC PSA V-22883	27.7
21	Refinery	Unit 61	P6147	27.7
22	Base Upgrader	COGEN	CGN HRSG Stack	27.7
23	Base Upgrader	A&V	A&V I-21104B Stg2 Disch 18in Pip	27.7
24	Chemicals	MEG	PT-32003	27.3
25	Base Upgrader	A&V	A&V I-21104B Stg2 Disch Pipe Sup	27.2
26	Refinery	Unit 61	P6140	27.1
27	Refinery	Unit 31/32	H3251 blower motor	27.1
28	Refinery	Unit 61	P6152	27.1
29	Base Upgrader	A&V	A&V I-21104A Stg2 Disch 18in Pip	27.0
30	Refinery	Unit 11	E1119-A1	27.0
31	Refinery	Unit 22	P2201B Motor	27.0
32	Base Upgrader	RHC	RHC Pipe 12in Lagd After HV-2236	27.0
33	Refinery	Unit 41	E4103-5	26.7
34	Base Upgrader	A&V	A&V I-21105 Stg3 Disch 12in Pipe	26.7
35	Refinery	Unit 26	Unit 26 Comp Bldg S wall Vent 2	26.6
36	Refinery	Unit 26	Unit 26 Comp Bldg S wall Vent 5	26.6
37	Refinery	Unit 11	E1122-A2	26.6
38	Refinery	Unit 26	Unit 26 Comp Bldg S wall Vent 4	26.4
39	Base Upgrader	RHC	RHC Pipe 12in Lagd After HV-2226	26.4
40	Base Upgrader	HMU	HMU S-24301 PSA Bldg Ridge Vent	26.4
41	Refinery	Unit 31/32	FV32003	26.3
42	Refinery	Unit 12	E1208-A2	26.1
43	Base Upgrader	HMU	HMU S-24401 PSA Bldg Ridge Vent	26.0
44	Refinery	Unit 11	P1106B Motor	26.0
45	Refinery	Unit 15	C1501 fan inlet	25.9

Table D-3
Order-Ranked Sound Level Contributions at Receptor NCIA 4
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Refinery	Unit 41	E4103-2	25.8
47	Refinery	Unit 21	C2103 Inlet	25.8
48	Refinery	Unit 21	H2102 heater wall	25.8
49	Refinery	Unit 11	E1124-A2	25.7
50	Base Upgrader	COGEN	CGN Deair Stm W Vent 1	25.7
51	Base Upgrader	COGEN	CGN Deair Stm E Vent 1	25.7
52	Base Upgrader	RHC	RHC E-22512-2	25.7
53	Base Upgrader	HMU	HMU PSA V-24311	25.6
54	Base Upgrader	SRU	SRU PM-21405B	25.6
55	Refinery	Unit 61	PS4 CV's group 1	25.5
56	Refinery	Unit 22	P2201A Gbox	25.4
57	Base Upgrader	HMU	HMU PSA V-24411	25.3
58	Refinery	Unit 22	P2201B Gbox	25.2
59	Refinery	Unit 24	E2422-1	25.1
60	Base Upgrader	SRU	SRU Blower Bldg S Mtr Cool 1	25.1
61	Refinery	Unit 31/32	Regen Blower Motor	25.1
62	Refinery	Unit 61	P6302A	25.1
63	Refinery	Unit 61	P6153	25.0
64	Base Upgrader	A&V	A&V I-21104A Stg2 Disch Pipe Sup	25.0
65	Refinery	Unit 12	E1208-C2	25.0
66	Refinery	Unit 11	E1119-A2	25.0
67	Refinery	Unit 42	H4201 A burner to S	25.0
68	Refinery	Unit 42	H4201 A burner to W	25.0
69	Base Upgrader	HMU	HMU PSA V-24311	24.8
70	Refinery	Unit 42	H4201 B burner to W	24.8
71	Upgrader	Quest	C-24701 1st Discharge Sect 2a	24.8
72	Refinery	Unit 12	E1208-C1	24.7
73	Refinery	Unit 11	P1107A	24.7
74	Refinery	Unit 41	P-4103B Extractor charge pump	24.6
75	Refinery	Unit 41	E4123-2	24.5
76	Refinery	Unit 41	E4103-3	24.4
77	Refinery	Unit 12	E1208-A1	24.3
78	Refinery	Unit 61	P6124A	24.3
79	Refinery	Unit 41	E4123-3	24.3
80	Refinery	Unit 51	Util Building W wall Equip door	24.3
81	Base Upgrader	HMU	HMU PSA V-24411	24.3
82	Base Upgrader	HMU	HMU S-24103 Stack Outlet	24.2
83	Base Upgrader	CTWR	CTWR C-2714C Motor	24.1
84	Base Upgrader	CTWR	CTWR C-2714A Motor	24.1
85	Base Upgrader	RHC	RHC PSA V-22783	24.1
86	Base Upgrader	RHC	RHC E-22512-1	24.0
87	Refinery	Unit 15	Fan Casing C1501	24.0
88	Refinery	Unit 41	P4109A	23.9
89	Base Upgrader	HMU	HMU PSA V-24411	23.9
90	Base Upgrader	HMU	HMU PSA V-24411	23.9

Table D-3

Order-Ranked Sound Level Contributions at Receptor NCIA 4
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Refinery	Unit 11	E1121-2	23.8
92	Refinery	Unit 11	E1127-C1	23.8
93	Refinery	Unit 22	P2201C Motor	23.8
94	Refinery	Unit 41	E4123-4	23.7
95	Refinery	Unit 11	P1108 middle circ reflux Motor	23.6
96	Upgrader	Quest	C-24701 3rd Discharge	23.6
97	Refinery	Unit 41	E4123-1	23.6
98	Chemicals	Utilities	Utilities LP Steam Header	23.6
99	Base Upgrader	HMU	HMU S-24203 Stack Outlet	23.6
100	Base Upgrader	HMU	HMU PSA V-24311	23.5
Sum of all noise contrubutions above (1 to 100)				49.6
Sum of all remaining noise sources (101 to 2213)				45.9
Total Sound Pressure Level				**51.1**

Table D-4

Order-Ranked Sound Level Contributions at Receptor NCIA 11
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
1	Base Upgrader	A&V	A&V I-21103B Stg1 Disch 42in Pip	30.5
2	Refinery	Unit 61	Flare	23.3
3	Base Upgrader	A&V	A&V I-21103A Stg1 Disch 42in Pip	22.7
4	Expansion Upgrader	RHC	RHC R-421001 South Wall	20.6
5	Base Upgrader	SRU	SRU Incin Stack Outlet	19.2
6	Base Upgrader	A&V	A&V I-21103B	18.8
7	Base Upgrader	COGEN	CGN HRSG Stack	18.6
8	Base Upgrader	A&V	A&V I-21103A	17.6
9	Refinery	Unit 61	P6303	17.1
10	Base Upgrader	A&V	A&V I-21104A Stg2 Disch 18in Pip	16.9
11	Base Upgrader	RHC	RHC Pipe 12in Lagd After HV-2226	16.9
12	Chemicals	MEG	TT 3101 Vessel8	15.6
13	Refinery	Unit 61	P6109A	15.5
14	Base Upgrader	RHC	RHC PSA V-22883	15.2
15	Chemicals	MEG	TT 3101 Vessel1	15.1
16	Chemicals	MEG	TT 3101 Vessel7	14.9
17	Base Upgrader	RHC	RHC PSA V-22783	14.9
18	Base Upgrader	A&V	A&V I-21104A Stg2 Disch Pipe Sup	14.6
19	Refinery	Unit 24	C2401 Comp Bldg N open	14.5
20	Chemicals	MEG	TT 3101 Vessel2	14.5
21	Expansion Upgrader	RHC	RHC Feed Mixing Deck	14.4
22	Refinery	Unit 31/32	Regen Blower Fan case	14.4
23	Base Upgrader	A&V	A&V I-21104B Stg2 Disch 18in Pip	14.2
24	Expansion Upgrader	HMU	HMU S-44103	14.1
25	Base Upgrader	HMU	HMU S-24203 Stack Outlet	13.8
26	Base Upgrader	HMU	HMU S-24103 Stack Outlet	13.8
27	Refinery	Unit 31/32	Unit 30 Comp Bldg N Opening	13.8
28	Expansion Upgrader	RHC	RHC P-42601B	13.7
29	Refinery	Unit 31/32	H-3201 duct sources	13.5
30	Base Upgrader	RHC	RHC Pipe 12in Lagd After HV-2236	13.4
31	Chemicals	Utilities	Utilities De-airator vent	13.3
32	Upgrader	Quest	C-24701 1st Discharge Sect 2c	13.1
33	Refinery	Unit 61	P6140	13.0
34	Expansion Upgrader	SRC	SRC S-41705 Incinerator stack ou	13.0
35	Expansion Upgrader	SRC	SRC V-41706 W (Incinerator)	12.8
36	Base Upgrader	CTWR	CTWR Cooling Tower W Splash	12.7
37	Refinery	Unit 31/32	C-3204A FD Fan Casing	12.3
38	Expansion Upgrader	A&V	A&V support 40949	12.3
39	Refinery	Unit 31/32	C-3204A FD Fan Inlet	12.2
40	Expansion Upgrader	A&V	A&V support 41162	12.2
41	Chemicals	MEG	TT3101 piping	12.0
42	Chemicals	MEG	MEG Compressor Discharge after	11.9
43	Base Upgrader	SRU	SRU PM-21405B	11.8
44	Base Upgrader	SRU	SRU PM-21307	11.4
45	Refinery	Unit 61	P6147	11.3

Table D-4

Order-Ranked Sound Level Contributions at Receptor NCIA 11
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
46	Expansion Upgrader	RHC	RHC East Mixing Deck	11.3
47	Expansion Upgrader	CTWR	CTWR Pkg Blr Bldg W OH Door	11.3
48	Base Upgrader	HMU	HMU C-24101 Air Inlet	11.1
49	Base Upgrader	HMU	HMU TK-24101 LO Skid	11.1
50	Refinery	Unit 25	C2501 - compressor building N op	11.0
51	Expansion Upgrader	CTWR	CTWR 54201 W water splash	11.0
52	Base Upgrader	HMU	HMU S-24401 PSA Bldg Ridge Vent	10.8
53	Base Upgrader	A&V	A&V I-21104B Stg2 Disch Pipe Sup	10.6
54	Upgrader	Quest	C-24701 3rd Discharge	10.5
55	Base Upgrader	HMU	HMU PSA V-24411	10.5
56	Refinery	Unit 42	Unit 42 Comp Bldg N opening	10.5
57	Expansion Upgrader	A&V	A&V E-41124 (1st stage condenser	10.4
58	Base Upgrader	SRU	SRU Blower Bldg E Mtr Cool 1	10.3
59	Base Upgrader	HMU	HMU PSA V-24411	10.2
60	Expansion Upgrader	CTWR	CTWR mtr54201D	10.2
61	Expansion Upgrader	A&V	A&V E-41125 (2nd stage condenser	10.2
62	Expansion Upgrader	CTWR	CTWR mtr54201C	10.2
63	Expansion Upgrader	CTWR	CTWR mtr54201B	10.2
64	Upgrader	Quest	E-24707B-3	10.1
65	Upgrader	Quest	FN-24703B	10.1
66	Upgrader	Quest	E-24707A-3	10.1
67	Upgrader	Quest	E-24706-3	9.9
68	Base Upgrader	HMU	HMU PSA V-24411	9.9
69	Expansion Upgrader	A&V	A&V support 41070	9.9
70	Expansion Upgrader	A&V	A&V support 41100	9.9
71	Expansion Upgrader	A&V	A&V support 41131	9.8
72	Expansion Upgrader	A&V	A&V support 40978	9.8
73	Expansion Upgrader	A&V	A&V support 40918	9.8
74	Base Upgrader	HMU	HMU PSA V-24411	9.8
75	Expansion Upgrader	A&V	A&V support 41192	9.8
76	Base Upgrader	HMU	HMU PSA V-24411	9.8
77	Refinery	Unit 21	Unit 21 Deaerator	9.7
78	Refinery	Unit 25	E 2509-A1	9.7
79	Upgrader	Quest	E-24706-2	9.7
80	Base Upgrader	HMU	HMU PSA V-24411	9.7
81	Upgrader	Quest	E-24706-1	9.7
82	Base Upgrader	COGEN	CGN Deair Stm W Vent 1	9.7
83	Base Upgrader	COGEN	CGN Deair Stm E Vent 1	9.6
84	Expansion Upgrader	A&V	A&V C-41111 (FD fan)	9.6
85	Refinery	Unit 21	H2102 heater wall	9.6
86	Base Upgrader	HMU	HMU C-24201 Air Inlet	9.6
87	Base Upgrader	RHC	RHC E-22512-2	9.6
88	Expansion Upgrader	A&V	A&V C-41113 (FD fan)	9.5
89	Upgrader	Quest	E-24707B-2	9.5
90	Upgrader	Quest	E-24707A-2	9.5

Table D-4

Order-Ranked Sound Level Contributions at Receptor NCIA 11
Shell Canada Ltd. - Scotford with Quest
Summertime Conditions, Calm Wind

Order Rank #	Site	Unit	Equipment Noise Source Description or Tag	Sound Pressure Level (dBA)
91	Refinery	Unit 61	P6301	9.5
92	Chemicals	MEG	TT3101 piping	9.4
93	Refinery	Unit 31/32	H3251 blower fan case	9.4
94	Upgrader	Quest	E-24707B-1	9.4
95	Upgrader	Quest	E-24707A-1	9.4
96	Base Upgrader	COGEN	CGN Turb Bldg Rect Roof Fan 1	9.3
97	Base Upgrader	COGEN	CGN Turb Bldg Rect Roof Fan 2	9.2
98	Expansion Upgrader	A&V	A&V Pipe support from I-41102A	9.1
99	Expansion Upgrader	A&V	A&V P-41112B	9.0
100	Chemicals	Utilities	Cooling Tower fan #1 (1-8 W-E)	9.0
			Sum of all noise contrubutions above (1 to 100)	35.3
			Sum of all remaining noise sources (101 to 2213)	30.8
			Total Sound Pressure Level	**36.7**

APPENDIX E
Glossary

Shell Canada Ltd.
Shell Scotford Quest Carbon Capture and Storage Facility
Quest Noise Model Development
SLR Project No.: 203.50049.00004

Appendix E – Glossary of Acoustical Terms

A-WEIGHTED SOUND LEVEL OR dBA: A measurement of overall Sound Pressure Level which accounts for the frequency content of the measured sound and assesses it with a frequency response similar to that of the human ear.

AMBIENT OR BACKGROUND NOISE: The noise in the environment, other than the noise from the source of interest.

ATMOSPHERIC ATTENUATION: The effect of sound absorption by moisture in the air.

ATTENUATION: A reduction in sound level that occurs with sound propagation over distance by means of physical dissipation or absorption mechanisms, or a reduction in sound level that occurs by means of noise control measures applied to a sound source.

BARRIER DIFFRACTION OR ATTENUATION: The effect of an acoustical shadow created by building or landform interposed between a source and a receiver.

BROADBAND NOISE: A noise with frequency components distributed over a broad frequency range, e.g. noise from distant road traffic.

C-WEIGHTED SOUND LEVEL OR dBC: A measurement of overall Sound Pressure Level with a frequency response that has essentially no filtering of sound between 50 and 5000 Hz. C-weighted sound levels are a better indicator of the presence of low frequency sound than A-weighted sound levels.

COMPREHENSIVE SOUND LEVEL: A measurement of the overall Sound Pressure Level at a location which includes the effects of all noise sources affecting the location.

DISTANCE DISSIPATION: The natural attenuation of sound with distance caused by geometrical spreading of sound waves.

EQUIVALENT CONTINUOUS SOUND LEVEL OR L_{eq}: A single number descriptor commonly used for environmental noise measurements and criteria. It is used to quantify sound which constantly varies over time, such as that commonly occurring in outdoor environments. It is defined as the average Sound Pressure Level over a specific time period that has the same acoustic energy as the actual fluctuating Sound Pressure Levels during the same time period. Time periods commonly used for L_{eq} measurements and criteria are the daytime (07:00 - 22:00 hrs) and nighttime (22:00 - 07:00 hrs) periods.

FREE SOUND FIELD (FREE FIELD): A sound field in which the effects of obstacles or boundaries on propagating sound are negligible.

FREQUENCY: The number of wave oscillations per second (hertz) of an acoustic pressure wave propagating through the air. The same as the pitch, or highness or lowness of a sound.

GROUND ATTENUATION: The effect of sound absorption by the ground separating the source and receiver.

INCREASE IN SOUND LEVEL: The perceived increase in loudness of a sound does not correspond directly to numerical increases in dBA values. Typically, an increase of less than 3 dBA is barely noticeable, an increase of 5 dBA is noticeable, an increase of 10 dBA is perceived as a doubling in apparent loudness, and an increase of 20 dBA is perceived as a four-fold increase in apparent loudness.

NARROW-BAND: A segment of the frequency spectrum which spans a few hertz or tenths of hertz.

NARROW-BAND SOUND PRESSURE LEVEL: The total Sound Pressure Level of sound components in a specific narrow-band frequency segment. Narrow-band Sound Pressure Levels are used to identify the presence of tonal components in a sound.

OCTAVE: The interval in frequency between two sounds having a frequency ratio of two.

OCTAVE BAND: A segment of the frequency spectrum which spans one octave.

OCTAVE BAND SOUND PRESSURE LEVEL: The total sound pressure level of sound components in a specific octave band.

PINK NOISE: A broadband noise characterized by a spectrum that uniformly decreases by 3 dB/octave with increasing octave band frequency. This noise is characterized by a “hushing” sound.

SOUND LEVEL CONTRIBUTION: The contribution of noise from one or more sources to the overall sound level from all sources affecting a particular location.

SOUND POWER LEVEL: A measurement of the acoustic energy of a sound source, which utilizes a logarithmic scale and which is normally calculated from Sound Pressure Level measurements near the source.

SOUND PRESSURE LEVEL: A physical measurement of sound, which utilizes a logarithmic scale and which quantifies the amplitude or volume of acoustic pressure waves propagating through the air.

SPECTRUM: The quantification of the components of a sound as a function of frequency.

STATISTICAL SOUND LEVEL OR L_n: The proportion of time a sound of interest is present at a specific level. Statistical sound levels are expressed as L_n values, which is the sound level exceeded N percent of the time.

THIRD-OCTAVE: The interval in frequency between two sounds having a ratio of 2 to the one-third power, or approximately 1.26.

THIRD-OCTAVE BAND: A segment of the frequency spectrum which spans one-third octave.

THIRD-OCTAVE BAND SOUND PRESSURE LEVEL: The total sound pressure level of sound components in a specific one-third octave band.

URBAN HUM: The more or less steady, continuous background noise in or near an urban area caused by distant road traffic and urban activity.

APPENDIX F
Environmental Noise Descriptors

Shell Canada Ltd.
Shell Scotford Quest Carbon Capture and Storage Facility
Quest Noise Model Development
SLR Project No.: 203.50049.00004

Appendix F – Environmental Noise Descriptors

Environmental noise is typically not steady and continuous, but varies over time. In an rural area, there is usually continuous background noise from distant traffic and community sources that slowly varies with time of day and with changes in atmospheric and/or ground cover conditions. Along with this continuous background noise there are also intermittent, fluctuating, higher-level noises. These are usually associated with local road traffic, nearby community and agricultural activity, and natural sounds.

To account for the time-varying nature of environmental noise, a single number descriptor known as equivalent continuous sound level (L_{eq}) is typically used. This descriptor quantifies sound that varies over time, such as that commonly occurring in outdoor environments. L_{eq} is the average sound level (based on acoustical energy) of time varying sound measured over a specific time period. Time periods commonly used for L_{eq} sound levels are 1-hour, daytime (07:00 to 22:00), nighttime (22:00 to 07:00) and 24-hours. L_{eq} is generally accepted and used for environmental noise measurements and criteria.

Sound is acoustic pressure waves that propagate through air. Because the range of audible sound pressures is very wide, sound is measured on a logarithmic scale in units of decibels (dB). The logarithmic scale compresses the range of audible sound pressures into a range that approximately corresponds to human hearing perception. When comparing sound level values, the following rule of thumb may be used:

- A difference in sound level of 3 dB is barely perceptible to human hearing
- A difference of 5 dB is noticeable
- A difference of 10 dB corresponds to a halving or doubling in perceived loudness
- A difference of 20 dB corresponds to a four-fold difference in perceived loudness.

Sound level values for environmental noise are normally A-weighted and expressed in units of A-weighted decibels (dBA). The A-weighting accounts for the frequency content of the sound and assesses it with a frequency response similar to that of human hearing. Figure F1 shows examples of typical A-weighted sound levels for a variety of noise sources ranging from very quiet to extremely loud.

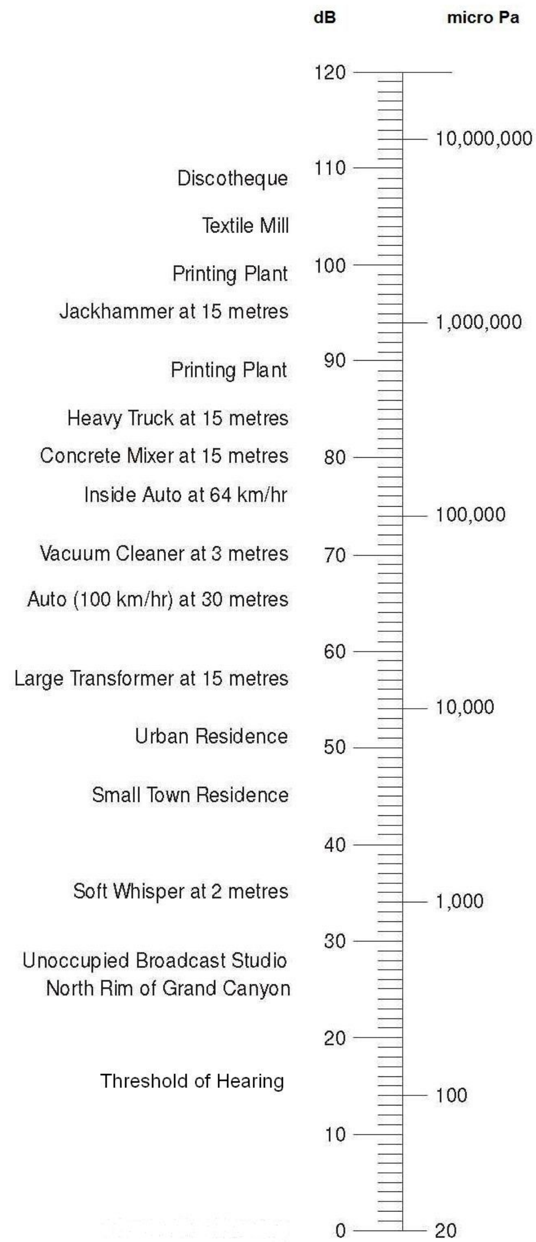
In environmental noise assessments, the daytime and nighttime periods are normally differentiated, especially for areas where ambient sound levels may be affected by community or traffic noise sources. Ambient sound levels are typically higher during the daytime as a result of increased community and traffic activity. During the nighttime, ambient sound levels are usually lower because community and traffic activity is reduced. In order to understand range of sound levels typically occurring in outdoor environments, Table F1 shows examples of sound level measured at various outdoor locations ranging from a rural setting to an urban environment.

Table F1: Examples of Sound Levels Measured at Various Outdoor Locations

Location Description	Sound Level (dBA)	
	Daytime	Nighttime
Farm in Valley	35 - 45	29 - 37
Suburban Residential at City Outskirts	42 - 58	35 - 45
Urban Residential	48 - 59	45 - 57

(Harris, C.M., ed., Handbook of Noise Control, Second Edition, McGraw-Hill, 1979, p. 35-11)

Figure F1: Typical A-weighted Sound Levels for Various Noise Sources



Relation between sound pressure in pascals and Sound Pressure Level in decibels re 20 micropascals. Also shown are typical values of A-weighted sound level of various sources of noise.

(Harris, C.M., ed., Handbook of Noise Control, Second Edition, McGraw-Hill, 1979, p. 2-10)

APPENDIX G
Outdoor Sound Propagation

Shell Canada Ltd.
Shell Scotford Quest Carbon Capture and Storage Facility
Quest Noise Model Development
SLR Project No.: 203.50049.00004

Appendix G – Outdoor Sound Propagation

Outdoor sound propagation between a sound source and a receptor is affected by several sound attenuation mechanisms. These include the following:

- Distance dissipation: sound naturally decreases with increasing distance from a source
- Ground attenuation: sound is absorbed by the ground that it passes over
- Atmospheric attenuation: sound is absorbed by the atmosphere it passes through
- Barrier attenuation: sound can be blocked by physical barriers (e.g. buildings or hills)
- Sound is affected by wind gradients: a distant noise source will be louder under downwind conditions than it will be under calm conditions; a distant source will be quieter under upwind conditions than it will be under calm conditions.
- Sound is affected by temperature gradients: a distant noise source will be louder under atmospheric inversion conditions than it will be under neutral conditions; a distant source will be quieter under atmospheric lapse conditions than it will be under neutral conditions.

Temperature and relative humidity do have effects on some of these sound attenuation mechanisms, however they do not have specific sound propagation effects associated with them.

Off-site ground cover in the study area is rough fields. This type of ground cover would be moderately sound-absorptive during summer conditions. However during the winter, variations in the sound absorption may occur with different ground surface conditions (*e.g.* frozen ground or crusty snow - reflective; soft, fresh snow - absorptive).

On-site ground cover consists of hard sound-reflective ground (asphalt and concrete), and sound barrier/screening objects such as buildings, vessels, structures, and equipment. The barrier/screening objects can provide significant sound attenuation if they block the line of sight between the source and receptor.

The effects of wind gradients on outdoor sound propagation can cause variations in the sound level of a distant facility. Similar effects are caused by temperature gradients in the atmosphere. The sound level variations caused by wind and temperature gradients are most pronounced for large source/receptor distances. Sound from a distant facility which propagates in a downwind direction (and/or during atmospheric inversion conditions) results in higher sound levels at a receptor than for calm conditions and a neutral atmosphere. This effect is caused by downward refraction of sound rays as they propagate through the atmosphere. Conversely, sound propagating in an upwind direction (and/or during lapse conditions in the atmosphere) is refracted upwards, which results in lower sound levels at the receptor. Sound propagating in a crosswind direction (and a neutral atmosphere) does not exhibit refraction effects and is essentially the same as sound propagation during calm conditions and a neutral atmosphere.

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NCIA Northeast Capital Industrial Association	NCIA Standards and Guidelines	Document Number **2010-003**	
Noise Management Plan Reporting Requirements as per Section 5.4 of this Standard		Rev. Date **31-March 2016**	Rev. **0**

Sherritt International

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	The site has implemented this standard and Code of Practice and has previously been submitted to the NCIA. There have been no updates to the Code of Practice in 2016
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	No fence line monitoring completed in 2016.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	None in 2016.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	None completed.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	No noise complaints received in 2016.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

Umicore Canada:

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	**Member Site Comments**
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Code of Practice (COP-323-7) Noise Exposure Management Plan included in the Umicore Canada Inc. Management System. Reference to 'environmental noise' included in the Umicore Canada Inc. Air Quality Management Program (COP-319-2)
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	Not applicable – noise monitoring conducted inside the plant from an industrial hygiene perspective
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	Management of Change (MOC) program includes elements to identify potential changes/ impacts with respect to noise exposure. Nitrogen Generation Skid commissioned and in service with average db levels of 76.9 in an enclosed room. No other changes made in 2016 that would impact noise levels.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	None to disclose at this time.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	Not applicable – noise monitoring conducted inside the plant from an industrial hygiene perspective
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	Did not receive any noise complaints in 2016

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.

Value Creation Inc.

Note, please provide as much detail as you can for the following, attaching any clarifying or required documents with your submission.

If you have any questions, please call Laurie Danielson @ 780.992.1463

Input Description	Member Site Comments
Confirmation that site has implemented a best management practice to address environmental noise as per NCIA Noise Management Plan Standard 2010-003 issued 3-Sep-10, revised 5-Mar-13, revised 14-Apr-14, revised 31-Mar-16 including the Procedure/Practice/Standard reference. Note, if you have not provided an electronic copy of your site plan to NCIA, please do so.	Not applicable. There was no construction or operations during 2016.
Provide a summary of any monitoring (fence line outward completed in 2016. Note, you are not required to conduct any off-site monitoring.	Not applicable.
Disclose any improvements/corrective actions implemented in 2016 or status thereof that would impact the noise level output for your site (either up or down). Did those changes result in a requirement to update your site noise model? If so, have you provided your updated site model to SLR Consulting for incorporation into the NCIA Regional Noise Model as per the process outlined for this purpose?	Not applicable.

Disclose any improvements/projects that are approved for 2017 that would impact the noise level output for your site (either up or down). Will these changes result in a requirement to update your site noise model? If so, when do you anticipate having an updated site model available?	Not applicable.
Disclose any audit/self-assessment evaluation (qualitative evaluation only, with senior site leader sign-off) completed for your site noise management plan in 2016.	Not applicable.
Provide a Noise Complaint summary for all noise complaints received in 2016 including any actions taken to address them.	Not applicable.

This information is being collected as per the NMP Standard 2010-003 Revised 31-March-2016. All information provided will be disclosed to the AER as part of the required NCIA Annual Reporting on the Regional Noise Management Plan.

Further, the Annual Report will be a public document available on our website once finalized.