
Email Memorandum

To : Sarah Ferguson
Company : Bruce Power L.P.
Email : sarah.ferguson@brucepower.com
Re : Summary of Noise Monitoring, August 9 – 23, 2019

From : Corey Kinart
Date : October 4, 2019
Total Pages : 4+4

Dear Ms. Ferguson,

As requested, HGC Engineering monitored sound levels from August 9 to 23, 2019 on the south side of the Bruce B generating station on the Bruce Power site, within the Inverhuron Provincial Park and at 129 Lake Street. We understand that the deaerator (“DA”) vents on Units 6, 7, and 8 have been equipped with silencers, and that Unit 5 was shut down the evening of August 16 (midway through the monitoring period). The purpose of the monitoring was to investigate the acoustical benefit of the installed DA vent silencers that have been installed on Units 6, 7 and 8, evidenced following shutdown of Unit 5 (which has not yet been equipped with a DA vent silencer) midway through the monitoring period, and thus representative of all four DA vents equipped with silencers. The following is a concise summary of the noise monitoring results.

Acoustical Terminology

This memorandum discusses two unique sound level quantities: the L_{EQ} and the L_{90} sound levels. The L_{EQ} sound level is the *energy-equivalent sound level*, and represents the integrated sound exposure level of both steady and time-varying sounds over the duration of the measurement. The L_{90} represents the sound level which is exceeded 90 percent of the time over the duration of the measurement, and is therefore useful in identifying the contribution of steady sources such as sound emissions from the Bruce Power facility (in cases where it may be audible) to the overall sound level, and rejecting transient sounds such as road traffic and sporadic natural sounds.

Sound Level Limits & Adjustments

The Ontario Ministry of the Environment, Conservation and Parks (“MECP”) issued an Environmental Compliance Approval to Bruce Power, which stipulates that the sound levels of the facility comply with the limits set out in MECP publication NPC-232. Those limits are 45 dBA during daytime hours (07:00 – 19:00) and 40 dBA during evening/nighttime hours (19:00 – 07:00) at any noise sensitive location in the surrounding community. Given that Bruce Power operations take place on a 24-hour basis, the more stringent limit of 40 dBA is the relevant criterion.

Some types of sound have a special quality which may tend to increase their audibility and potential for disturbance/annoyance. For tonal sound, MECP guideline NPC-104 stipulates an adjustment of +5 dBA be added to a facility-total sound level measured at a point of reception. A tonal sound is defined as one which has a “pronounced audible tonal quality such as a whine, screech, buzz or hum.” Sound emissions from the unsilenced DA vents have been observed to be tonal in character and audible in the Park, but not in the vicinity of 129 Lake Street; thus, the sound levels measured in



the Park, discussed below, consider the +5 dBA adjustment.

Summary of Sound Level Monitoring Campaigns: Summer 2016/Spring 2018

As you are aware, sound level monitoring campaigns have been completed in the community surrounding the Bruce Power site on several occasions over the past several years. To provide some context for the results of the most recent campaign, the following table is provided, summarizing the sound levels measured previously:

Table 1: Summary of Hourly Sound Levels, Summer 2016/Spring 2018 [dBA]

Location	Day		Night		Overall					
	LEQ	L90	LEQ	L90	LEQ			L90		
	Avg	Avg	Avg	Avg	Avg	Max	Min	Avg	Max	Min
Bruce B	57	52	55	51	57	81	40	51	68	40
Inverhuron Park	52	49	51	49	51	63	29	49	60	27
129 Lake Street	47	43	45	42	46	64	24	42	63	20

Notes:

1. Sound levels **underlined in bold** include +5 dBA adjustment, due to the typically audible tone from unsilenced DA vents at Bruce B.
2. At 129 Lake Street, the Bruce Power facility is rarely audible over background sound. Thus, the reported sound levels are largely representative of background sound, and not the sound levels of Bruce Power.

From the data tabulated above, it is evident that sound levels at all measurement locations varied significantly over the monitoring periods, which underscores the fact that the monitored sound levels are significantly influenced by meteorological conditions (since the sound emissions of Bruce Power are generally steady in nature). Not only do meteorological conditions affect sound propagation, but they also affect the amount of background sound (e.g. higher winds tend to increase sound from shoreline waves and trees).

Having said the above, Bruce Power was generally observed to be inaudible at 129 Lake Street, such that the actual sound levels of the facility are considerably lower than those in Table 1, and well within the applicable MECP criterion of 40 dBA. In the park, the DA vents at Bruce B were typically audible and tonal; with the inclusion of a +5 dBA tonal adjustment, the steady (L90) sound levels of Bruce B were typically about 10 dBA greater than the MECP nighttime limit.

Summer 2019 Measurement Methods & Instrumentation

HGC Engineering personnel conducted detailed acoustical measurements on the south side of Bruce B, within the Inverhuron Provincial Park and at 129 Lake Street (locations shown in Figure 1) between August 9 and 23, 2019. Attended measurements were conducted during the deployment and retrieval of the monitor at each location, and during a maintenance visit on August 16. The monitors captured sound levels on a continuous basis, compiled every one-hour period, throughout the two-week deployment; the monitors at 129 Lake Street and in the Park also captured continuous audio recordings.

The monitoring completed in the Park and at 129 Lake Street, along with all attended measurements, were conducted using *Norsonic* Nor140 sound level meters. The monitoring at Bruce B was accomplished with a *Brüel & Kjaer* model 2238 sound level meter. Correct calibration of each meter was field-verified on the deployment and retrieval dates using a *Brüel & Kjaer* model 4231 acoustic calibrator.

Summer 2019 Measurement Results & Discussion

A summary of the attended measurement results and observations are appended in Appendix A. During the attended measurements on August 9 and 16 (prior to the Unit 5 shutdown), observations of audible sound at all three locations were consistent with previous measurement campaigns:

- South of Bruce B, the Unit 5 DA vent (with a distinct tone at approximately 2.2 kHz) was generally dominant (on August 16, a standby generator under test was dominant), with natural sounds typically secondary.
- In the Park, natural sounds were typically dominant; on August 9, Bruce Power was inaudible over high background sound levels (due to high winds) but faintly audible on August 16.
- At 129 Lake Street, sounds of nature and local resident activities were dominant, with Bruce Power completely inaudible.

On August 23, after Unit 5 was shut down, the typical DA vent tone was no longer audible in the Park, or even next to Bruce B (indicative of the effectiveness of the DA vent silencers on Units 6 through 8); the Zone 2/3 Exhaust Stacks were slightly audible, but only during lulls in background sound. Bruce Power remained completely inaudible at 129 Lake Street, following the Unit 5 shutdown.

The results of the automated sound level monitoring conducted between August 9 and 23, 2019 are presented in Figure 2. Table 2, below, summarizes the results of the Summer 2019 campaign, presented pre/post Unit 5 shutdown.

Table 2: Summary of Hourly Sound Levels, Summer 2019 [dBA]

Location		Day		Night		Overall					
		LEQ Avg	L90 Avg	LEQ Avg	L90 Avg	LEQ			L90		
						Avg	Max	Min	Avg	Max	Min
Bruce B	Pre Unit 5 S/D	56	50	55	51	55	66	43	50	63	41
	Post Unit 5 S/D	54	47	53	48	54	61	43	48	58	39
	Delta	-2	-3	-1	-2	-2	-5	--	-2	-5	-2
Inverhuron Park	Pre Unit 5 S/D	50	47	52	50	51	62	35	49	60	33
	Post Unit 5 S/D	48	45	47	45	47	57	24	45	53	22
	Delta	+3	+3	--	--	+1	--	-6	+1	-2	-5
129 Lake Street	Pre Unit 5 S/D	56	46	52	49	55	72	57	48	60	23
	Post Unit 5 S/D	52	49	51	49	52	62	25	49	59	22
	Delta	-4	+3	-1	--	-3	-10	-2	+1	-1	-1

Notes:

1. Sound levels **underlined in bold** include +5 dBA adjustment, due to the typically audible tone from the unsilenced Unit 5 DA vent at Bruce B.
2. At 129 Lake Street, the Bruce Power facility is rarely audible over background sound. Thus, the reported sound levels are largely representative of background sound, and not the sound levels of Bruce Power.

Comparing the data in Tables 1 and 2, it is evident that the average sound levels measured at Bruce B and in the Park in Summer 2016/Spring 2018 were very similar (within 2 decibels) to the levels measured prior to the Unit 5 shutdown in Summer 2019. The Summer 2019 sound levels were consistently higher at 129 Lake Street; based on observations during the attended measurements and review of audio recordings from the monitoring period, this is generally attributable to higher background sound levels (e.g. resident activities and natural sounds).

From the data in Table 2, it is evident that sound levels at Bruce B decreased by 1 to 3 dBA after Unit 5 was shut down. However, in the Park (excluding the tonal adjustment applicable to sound levels prior to the Unit 5 shutdown) and at 129 Lake Street, there is no consistent reduction in sound levels following the Unit 5 shutdown. This result was expected, given the degree of interfering background sound at these locations that regularly obscures the sound of Bruce B (which decreases naturally at greater distances from the facility). In fact, Lake Huron water levels have been higher this year than in previous years, which tends to increase the amount of shoreline wave noise (a nearby resident has even installed armour stone along the shoreline to break up waves). Nevertheless, following the Unit 5 shutdown, the tone from the DA vents was no longer audible and, with no tonal applicable adjustment, the sound levels measured in the Park during periods of low background sound were well below the MECF nighttime limit.

Another measure of the improvement achieved with the installation of the DA vent silencers is the qualitative change in sound emissions from the facility (i.e. audibility). As noted above, all four of the unsilenced DA vents generated a distinct high-pitched tone which was often clearly audible in the Park, and occasionally audible on Lake Street (during periods of very low background sound). A review of audio recordings reveals that the DA vent tone was clearly audible in the Park prior to the Unit 5 shutdown, but completely inaudible after Unit 5 was shutdown, even though the Unit 6 through 8 DA vents remained active. In fact, shortly after Unit 5 was shutdown, the LEQ and L90 sound levels measured in the Park dropped as low as 24/22 dBA, respectively, equalling the lowest sound levels measured at that location during all past campaigns (despite the monitoring period following the Unit 5 shutdown being just one week in duration).

Conclusions

The results of the August 2019 acoustical monitoring indicate that sounds of nature and of resident activities generally remain dominant in the Park and at 129 Lake Street. However, the distinct tone that was clearly audible from all four DA vents prior to installation of silencers on Units 6 through 8 was completely inaudible following shutdown of Unit 5, which is a qualitative indication of the effectiveness of the installed DA vent silencers.

As discussed, the most meaningful measure of the improvement achieved with the installation of the DA vent silencers at Bruce B will be the community response; we understand that, since Unit 5 was shut down, two residents (whom, in the past, has been the most vocal with regard to noise concerns) have provided quite positive feedback. These are encouraging results; we look forward to receiving similar community feedback when the Unit 5 DA vent is equipped with a silencer, and the unit is restarted.

Trusting that this satisfies your current requirements, if you have any questions or require any additional information, please don't hesitate to give us a call.

Best regards,

Howe Gastmeier Chapnik Limited



Corey D. Kinart, MBA, PEng

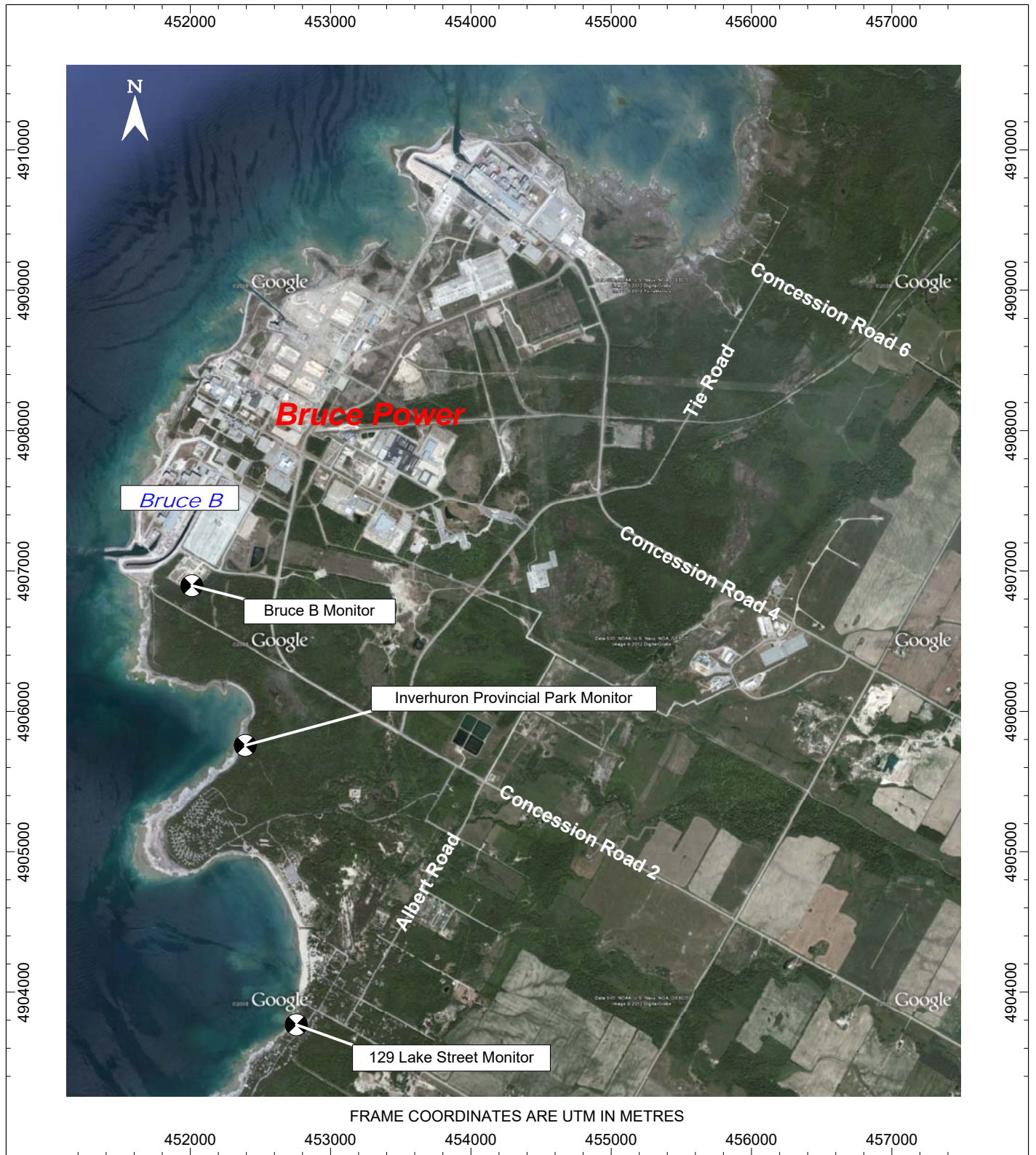
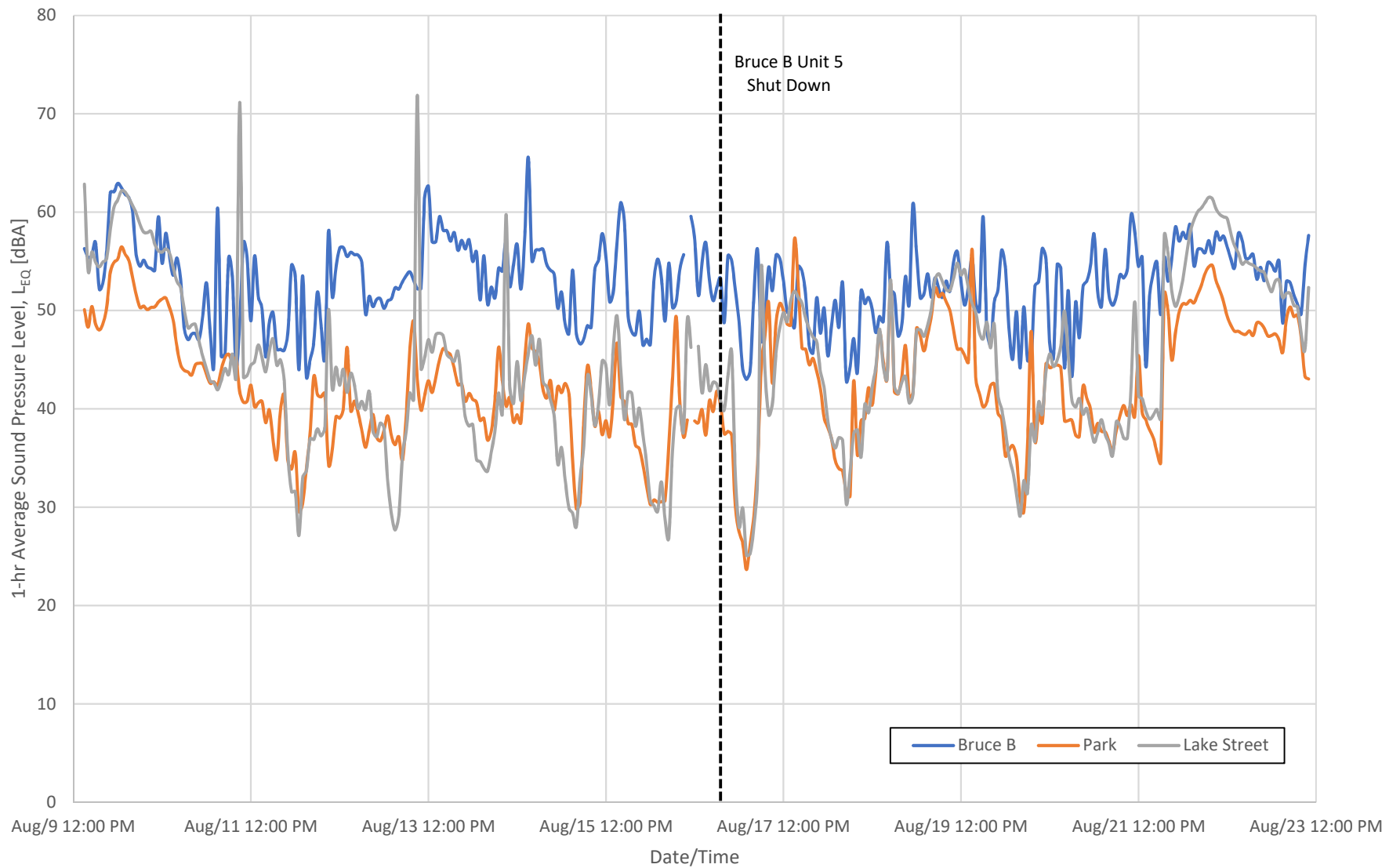


Figure 1: Satellite Image Showing Bruce Power, Surrounding Community and Locations of Sound Level Monitors

Figure 2: Automatically Monitored Sound Pressure Levels
August 9 - 23, 2019



ACOUSTICS



NOISE



VIBRATION

APPENDIX A

Summary of Attended Sound Level Measurements



ACOUSTICS



NOISE



VIBRATION

Table A1: Summary of Attended Sound Level Measurements, dBA, Summer 2019

Location	Date	Time	LEQ	L90	Notes
Bruce B	Aug. 9	12:30 PM	57	55	Bruce B (namely Unit 5 DA vent) steady and dominant; natural sounds (e.g. bird calls and wind in trees and shoreline waves) secondary.
	Aug. 16	9:20 AM	56	54	10 MW standby generator (under test) steady and dominant; Bruce B (namely Unit 5 DA vent) and natural sounds (e.g. bird calls and insects) secondary.
	Aug. 23	9:50 AM	51	49	Bruce B (namely Zone 2/3 Exhaust Stacks) steady and dominant; natural sounds (e.g. breeze in trees, insects and bird calls) secondary.
Inverhuron Provincial Park	Aug. 9	1:10 PM	77	57	Natural sounds (e.g. wind in trees and shoreline waves) dominant; Bruce Power not audible.
	Aug. 16	10:20 AM	30	27	Natural sounds (e.g. sporadic bird calls and very light shoreline waves) dominant; Bruce B barely audible (faint tone from Unit 5 DA vent audible).
	Aug. 23	10:20 AM	45	42	Natural sounds (e.g. breeze in trees and shoreline waves) dominant; Bruce B (Zone 2/3 Exhaust Stacks) barely audible during lulls in natural sounds.
129 Lake Street	Aug. 9	1:50 PM	55	54	Natural sounds (e.g. wind in trees and shoreline waves) dominant; Bruce Power not audible.
	Aug. 16	11:00 AM	47	35	Resident activities and natural sounds (e.g. shoreline waves) dominant; Bruce Power not audible.
	Aug. 23	11:00 AM	51	46	Natural sounds (e.g. wind in trees and shoreline waves) dominant; Bruce Power not audible.

