Naval Base Kitsap at Bangor
Test Pile Program

Acoustic Monitoring Report

BANGOR, WASHINGTON

17 April 2012

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

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Acronyms and Abbreviations

AB-BRG	Airborne Monitoring Microphone on Barge
BA	Biological Assessments
BRG	Barge measurement position typically 10 meters from pile
cfm	cubic feet per minute
cm	centimeter
dB	decibel(s)
dB re 1 μPa	dB referenced to a pressure of 1 microPascal
dBA	decibels A-weighted
EHW	Explosives Handling Wharf
ESA	Endangered Species Act
GPS	Global Positioning System
Hz	Hertz
ICMP	Integrated Comprehensive Monitoring Program
IHA	Incidental Harassment Authorization
Leq	Equivalent Sound Level
$L_{impulse}$	Impulse Level
L_{peak}	Peak Sound Pressure Level
L_{SEL}	Sound Exposure Level
MID	Mid-Channel Vessel outside WRA
MMPA	Marine Mammal Protection Act
NBK	Naval Base Kitsap at Bangor
NO	North Channel Vessel outside SRA
RFT	Un-Manned Raft near Toandos
RMS	Root Mean Square
SEL	Sound Exposure Level
SLM	Sound Level Meter(s)
SO	South Channel Vessel outside WRA
SPL	Sound Pressure Level
TPP	Test Pile Program
U.S.	United States
WRA	Water Restricted Area

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Executive Summary

Underwater and airborne acoustic measurements were recorded as part of the Test Pile Program (TPP) located at Naval Base Kitsap at Bangor, Washington. Acoustic data was collected during vibratory and impact pile driving activities between August 29, 2011 and October 20, 2011. Regulatory permits and consultations completed for this project identified several terms, conditions, and metrics which the Navy was required to comply with as part of this test program.

In compliance with the Endangered Species Act (ESA), the Navy completed consultations with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). The Navy received a Final Letter of Concurrence from the USFWS on May 11, 2011. A Biological Opinion was received from the NMFS Northwest Region on April 28, 2011. In compliance with the Marine Mammal Protection Act (MMPA) the Navy received an Incidental Harassment Authorization (IHA) from NMFS headquarters on June 24, 2011. The mitigation and monitoring requirements in these documents were met through three monitoring plans: the Acoustic Monitoring Plan, the Marine Mammal Monitoring Plan, and the Marbled Murrelet Monitoring Plan. This report addresses all acoustic requirements from both agencies and all permits and consultations.

This section briefly summarizes the major conditions and metrics agreed to during the ESA consultation and MMPA permit process. In addition, the IHA specifically listed reporting requirements. There are too many to include here in the Executive Summary, but a “road map” or “Where to Find Guide” is provided at the end of the section to identify where in the document this information can be found.

Table ES-1 provides the duration of project activities.

Table ES-1. Duration of General Project Activity

Activity Described	Actual Duration	Notes	Requesting Agency
Project Duration: Up to 40 days	38 days of in-water activity	The duration of the project took place over 54 days, however actual activities in the water took place over 38 days. The remaining days were not work days, either due to being a Sunday or “red day” (defined as a non- construction day due to security activities).	NMFS/USFWS
In-water work between 16 July and 31 October	29 August to 20 October	None	NMFS/USFWS
More than 1 pile may be impact proofed per day	Maximum was 4 on October 1, 2011	All strike limits and other conditions were in compliance.	USFWS
Up to 4 piles installed per day using a vibratory hammer. No extraction limit.	1 - 4 installed, average 3	Additional piles may have been removed with a vibratory hammer during those same days.	USFWS

Activity Described	Actual Duration	Notes	Requesting Agency
15 days of impact pile driving	14 days	None	NMFS/USFWS
29 hours of vibratory hammer installation	7.5 hours overall/ 4 to 26 minutes per pile	None	NMFS/USFWS
14.5 hours of vibratory extraction/no daily extraction limit	5.5 hours overall/ 3.5 to 21.5 minutes per pile	None	NMFS/USFWS
7.25 hours of impact pile driving	0.71 hours overall/ 30 seconds to 5 minutes per pile	There was never 5 minutes of straight impact pile driving. Rather there would be a set of strikes, then pauses, then more strikes for a total duration of up to 5 minutes, which included the pauses.	NMFS/USFWS
1500 strikes overall/not to exceed 100 strikes per day	844 strikes total for project (typically less than 50 strikes per day)	None	NMFS/USFWS
Up to 7 piles proofed with an impact hammer without attenuation	1 -24" pile 4 -36" piles 2 -48" piles	None	NMFS/USFWS
Unattenuated strikes not to exceed 50 strikes per day and no more than 1 minute.	Unattenuated strike max was 45 on September 1. All days were under 50 and less than one minute.	None	NMFS/USFWS

Table ES-2 describes general project restrictions from the ESA consultations and the MMPA permit.

Table ES-2. General Project Restrictions

Restriction Described	Actual	Notes	Requesting Agency
All test piles will be installed using a vibratory hammer and all piles may be proofed.	Complied as requested.	None	NMFS/USFWS
Sound attenuation device must be used for impact pile driving, except for 7 tests.	Complied as requested.	None	NMFS/USFWS

Restriction Described	Actual	Notes	Requesting Agency
No impact pile driving after 14 October for piles > 36” (i.e. 48” piles)	Complied as requested.	The last 48”pile proofed with an impact hammer was on 3 October (TP#6).	NMFS/USFWS
After 30 September, unattenuated impact pile driving will be restricted to the installation of the smallest pile (24-inch)	Complied as requested.	Last unattenuated pile was 30 September. It was TP#5 (48”).	USFWS
Sound attenuation measures will be tested on vibratory pile driving, for at least one pile of each size.	36” piles only.	The bubble curtain was deployed on two piles: TP#2 and TP#3 MP#1, both of which are 36” piles. These results were then compared to 4 other 36”piles that were vibratory driven without a bubble curtain.	NMFS/USFWS
Soft start procedures will be followed for vibratory and impact pile driving.	Complied as requested.	None	NMFS/USFWS
All piles will be removed at the end of the test program, no later than 31 October, 2011.	Complied as requested.	The last piles were removed on 20 October, 2011.	NMFS/USFWS

In the NMFS Biological Opinion, an Incidental Take Statement (ITS) was included for fish for two scenarios. For the first scenario (always attenuated), take was exempted for up to 29 days for: (1) up to 207 feet out from pile driving activity where the cumulative SEL exceeds 183 dB (re: 1 μPa2 · sec); and (2) up to112 feet out from pile driving activity where the cumulative SEL exceeds 187 dB (re: 1 μPa2 · sec).

For the second scenario (attenuation on/off), take was exempted for up to 7 days for: (1) up to 646 feet out from pile driving activity where the cumulative SEL exceeds 183 dB (re: 1 μPa2 · sec); and (2) up to 348 feet out from pile driving activity where the cumulative SEL exceeds 187 dB (re: 1 μPa2 · sec).

Table ES-3 provides the distances to the cumulative SEL for fish to compare to the distances authorized in the NMFS ITS. There are two instances (highlighted in red) where these levels were exceeded (one for the 183 cumulative SEL, and one for the 187 cumulative SEL). Both of these instances occurred with the bubble curtain on and at the deeper hydrophone, not the shallow hydrophone. There were no fish kills observed during impact pile driving (with or without a bubble curtain) over the entire project.

Table ES-3. Cumulative SEL for Fish

Down Depth Bubbles On				Mid Depth Bubbles ON				Down Depth Bubbles OFF				Mid Depth Bubbles OFF			
183		**187**		**183**		**187**		**183**		**187**		**183**		**187**	
Meters	**Feet**	**Meters**	**Feet**	**Meters**	**Feet**	**Meters**	**Feet**	**Meters**	**Feet**	**Meters**	**Feet**	**Meters**	**Feet**	**Meters**	**Feet**
1	2	0	1	1	2	0	1	3	10	2	5	3	9	1	5
51	164	28	89	20	65	11	35	145	465	78	252	58	185	31	100
30	97	16	53	22	72	12	39	172	552	93	299	69	220	37	119
4	14	2	8	2	6	1	3	14	44	7	24	5	17	3	9
15	49	8	27	7	23	4	12	26	83	14	45	35	113	19	61
6	18	3	10	6	20	3	11	79	253	43	137	50	159	27	86
34	109	18	59	4	14	2	8	64	204	34	110	74	238	40	129
30	96	16	52	33	106	18	57								
52	168	28	91	4	11	2	6								
26	82	14	45	5	15	3	8								
37	117	20	63	8	24	4	13								
43	139	23	75	13	42	7	23								
15	47	8	25	13	41	7	22								
23	74	13	40	31	101	17	55								
100	**320**	54	**173**	9	30	5	16								
46	148	25	80	40	128	22	69								
17	54	9	29	63	202	34	109								
47	151	25	82	23	72	12	39								
				23	74	12	40								
				22	70	12	38								

Bubbles on :

183 dB - 207 feet

187 dB - 112 feet

Bubbles off:

183 dB - 646 feet

187 dB - 348 feet

The “road map” or “Where to Find Guide” is provided below for reporting requirements listed in the IHA:

- Size and type of piles **(Section 2, Table 2)**
- A detailed description of the sound attenuation devices used, including design specifications for the bubble curtains (or other devices used during TPP) **(Section 2, Appendix E)**
- The impact or vibratory hammer force (energy rating) used to drive or extract the piles, and the make and model of the hammer **(Section 2)**
- Description of the sound monitoring equipment **(Section 2)**
- Distance between hydrophones and pile **(Section 3, Table 4)**
- Depth of the hydrophones and depth of water at hydrophone locations **(Section 2, Figure 6)**
- Distance from the pile to the water’s edge **(Section 2, Table 1)**
- Depth of water in which the pile was driven **(Section 2, Table 1)**
- Depth into the substrate that the pile was driven **(Section 2, Table 1)**
- Physical characteristics of the bottom substrate into which the piles were driven **(Section 2, Table 1)**
- The total number of strikes to drive each pile and for all piles driven during a 24-hour period **(Section 3, Table 4)**
- Total number of strikes to drive each pile that is monitored **(Section 3, Table 4)**
- Ranges and means for peak, RMS, and SELs for each pile **(Section 3, Tables 6-9)**
- Ambient underwater sound pressure level(s) reported in RMS **(Section 3, Tables 6 and 8)**
- The results of the airborne noise measurements including the dBA, unweighted, Lmax, Leq, and SEL. **(Section 3, Tables 10, 11, 29, 30, Appendix C)**
- Airborne acoustical data will be provided in 1/3 octave bands in the frequency range of 10 and 20 kHz **(Appendix C)**
- Results of the acoustic measurements, including the frequency spectrum, ranges and means including standard deviation/error for peak and RMS SPLs, single-strike and cumulative SEL for both projects for pile installation and pile removal **(Section 3, Appendices A and B)**

- The report will provide underwater acoustical data between 10 Hz and 20 kHz in 1/3 octave bands and by depth of hydrophone as possible **(Section 3, Appendices A and B)**

- Results of the monitoring with and without the attenuation system for impact and vibratory testing (TPP only), as well as a comparison of sound pressure levels recorded during the use of a soft start when the hammer is operating at reduced capacity versus sound pressure levels recorded when the hammer is operating at normal capacity to determine the amount of sound pressure level reduction from this mitigation measure **(Section 4, Tables 19-22)**

- An estimation of the number of strikes that exceeded the cumulative SEL threshold and an estimation of the distance at which the peak and cumulative SEL values reach the respective thresholds and the distance at which the RMS values reach the relevant marine life thresholds and background sound levels **(Section 4, Tables 12-18; Section 5)**

- Vibratory monitoring results will include the maximum and overall average RMS calculated from 30-second RMS values during the drive of the pile **(this has actually changed to 10-second values; results in Appendix A)**

- Description of any observable marine mammal, fish, or bird behavior in the immediate area and, if possible, correlation to underwater sound levels occurring at that time **(Section 5)**

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Section 1 Introduction

This report presents results of acoustic measurements collected during the Test Pile Program (TPP) at Naval Base Kitsap (NBK) on the Bangor, Washington waterfront. To help the Navy meet regulatory requirements for acoustic monitoring under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) an Acoustic Monitoring Plan was developed by the Navy and approved by the regulatory agencies (NMFS and USFWS). Monitoring was conducted based on the guidelines established in *The Acoustic Monitoring Plan* (see **Appendix D**) to support ESA and MMPA compliance documents. The TPP used vibratory and impact pile driving methods to acquire accurate geotechnical and sound propagation data to validate design concepts, construction methods, and environmental analyses for the Explosive Handling Wharf (EHW)-2 and other future projects at the NBK at Bangor waterfront. Another construction project, EHW-1, overlapped the TPP in space and time, and involved pile replacement and repairs to the existing EHW at NBK at Bangor. The EHW-1 acoustic monitoring results are presented in a separate report.

Under subcontract to HDR, Illingworth & Rodkin, Inc. was tasked to conduct underwater and airborne acoustic monitoring during the installation and removal of 29 select steel piles at the NBK at Bangor waterfront. The pile sizes ranged from 24 to 48 inches (0.61 to 1.22 meters) in diameter and 115 to 198 feet (35 to 60 meters) in length.

During the TPP, piles were installed using both vibratory and impact hammers. The project was divided into two separate phases. Phase I (August 29 - October 3) required intensive biological and acoustic monitoring, with the goal of gathering sufficient data to establish acoustic isopleths corresponding to harassment and injury zones for cetaceans and pinnipeds. Once these isopleths were generally established, the number of biological and acoustic monitors in the far-field TPP project area (i.e. outside the Waterfront Restricted Area [WRA] floating fence line) was reduced slightly for Phase II monitoring (October 4–October 20). Phase I underwater measurements were made at four locations outside the WRA, in addition to two locations within the WRA. Both vibratory pile driving and impact pile driving were conducted during that period. During Phase II (October 4–October 20), data were taken at two locations outside the WRA and at two locations within the WRA. Concurrently with impact and vibratory measurements, airborne measurements were taken at four locations: two microphones were placed along the shoreline inside the WRA between Marginal Wharf and EHW-1; and two microphones were placed on vessels within the WRA. The Navy also used two hammer sizes for both vibratory and impact pile driving, and a bubble curtain, with the goal of attenuating sound pressure levels (SPLs) due to impact pile driving. Use of the bubble curtain was limited during vibratory pile driving.

Description of Project Study Area

The TPP was conducted at NBK at Bangor waterfront, located in the Hood Canal in Kitsap County, Washington. This is located approximately 20 miles due west of Seattle, Washington (**Figure 1**). NBK at Bangor provides support to United States (U.S.) Navy submarines, as well as other fleet assets. The entire NBK at Bangor waterfront, as well as the adjacent water areas in the Hood Canal, is restricted to the general public. The TPP occurred to the north of the Marginal Wharf inside the WRA and to the southwest of the existing EHW-1. **Figure 2** shows the project area for the TPP.

Figure 1. Project Site Vicinity Map

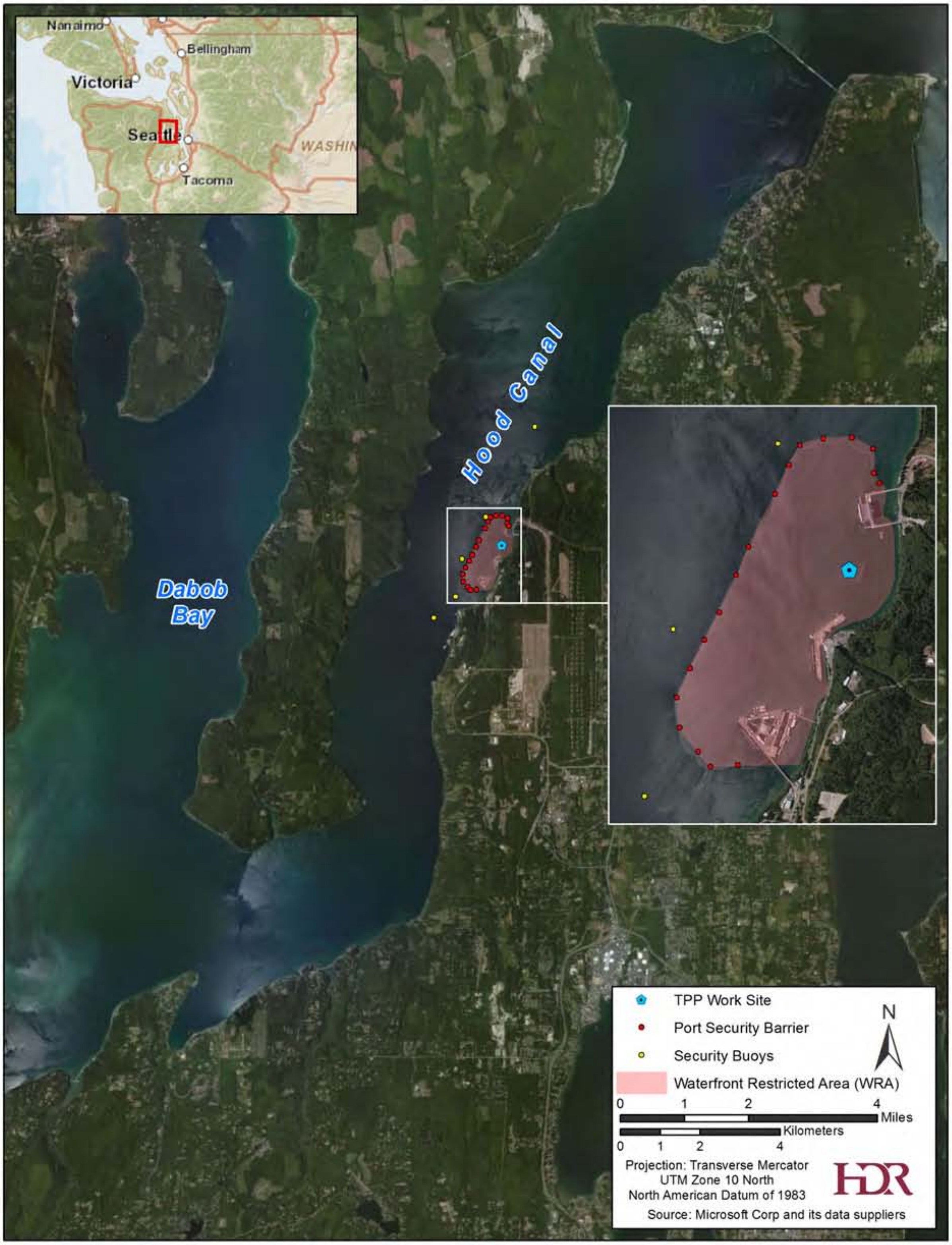

Figure 2. Test Pile Program (TPP) Project Area

Objectives

Purpose of Monitoring Program

The purpose of the TPP was to collect geotechnical and sound propagation information. Such data will be used to validate design concepts, construction methods, and environmental analyses to be used in future projects at the NBK at Bangor waterfront, as well as the EHW-2 project. In addition to acoustic monitoring during pile-driving events, biological monitoring of marine species in Hood Canal was also performed, but will not be discussed in this report.

Work Plan Objectives

The objectives for the TPP were established by the Navy in the *U.S. Navy Test Pile Program and Explosives Handling Wharf-1 Pile Replacement Project Naval Base Kitsap at Bangor Waterfront: Final Acoustic Monitoring Plan* (Plan). The Plan provided a protocol for both airborne and underwater measurements during pile-driving operations. Within this report, the main objectives are as follows:

1. **Underwater Injury Zones:** Using measurement data, compute the distance to where the following underwater sound levels occur:
    a. 180 decibels (dB) Root Mean Square (RMS) isopleths for cetaceans;
    b. 190 dB RMS isopleths for pinnipeds;
    c. 180 dB Peak for marbled murrelets;
    d. 206 dB Peak for fish;
    e. 187 dB Sound Exposure Level (SEL) for fish (greater than or equal to 2 grams); and
    f. 183 dB SEL for fish (less than 2 grams) and marbled murrelets.
2. **Airborne Injury Zones:** Using measurement data, compute the distance to where the following airborne sound levels occur:
    a. 92 dBA RMS for marbled murrelets.
3. **Underwater Behavioral Buffer Zones:** Using measurement data, compute the distance to where the following sound levels occur:
    a. 160 dB RMS for marine mammals during impact pile driving;
    b. 120 dB RMS for marine mammals during vibratory driving; and
    c. 150 dB RMS for fish and marbled murrelets.
4. **Airborne Behavioral Buffer Zones:** Using measurement data, compute the distance to where the following airborne sound levels occur:
    a. 100 dB RMS level for all pinnipeds except harbor seals and
    b. 90 dB RMS level for harbor seals.

5. **Air Bubble Curtain Effectiveness:** Measure effectiveness of the Sound Attenuation System (i.e., air bubble curtain) in reducing underwater sound levels during impact driving by measuring underwater sound levels with system on and off.
6. **Air Bubble Curtain Effectiveness:** Measure effectiveness of the Sound Attenuation System (i.e., air bubble curtain) in reducing underwater sound levels during vibratory driving by measuring underwater sound levels with system on and off.
7. **Soft-Start Technique Effectiveness:** Evaluate measured sound levels at beginning of pile-driving events to compare soft-start sound levels with levels during the initial phase of pile driving.
8. **Ambient Measurements:** Measure sound levels before and after pile-driving events to represent ambient conditions.
9. **Acoustic Spreading Losses:** Measure the rate of sound propagation based on the differences in sound level measured at the various positions during pile driving.

Terminology

This report uses specialized terminology related to underwater sound and technical aspects of the monitoring program. Unless otherwise stated, underwater sound pressure is defined as sound pressure level (SPL) in decibels (dB) referenced to one microPascal (re 1 µPa). Airborne sound pressure is defined as sound pressure level (SPL) in decibels (dB) referenced to 20 microPascals (20 µPa). Other frequently used terms are Peak, Root Mean Square (RMS) and Sound Exposure Level (SEL). Un-weighted is from the Sound Level Meter (SLM) using the Z-weighted filter that measures as close as possible to the unfiltered broad band frequency spectra and A-weighted is from the SLM using the A-weighting filters that de-emphasize the very low and very high frequency components of the measured sound.

Several noise metrics are used to describe sounds in the environment. Two common descriptors used to describe underwater sounds from pile installation projects are the peak sound pressure and the RMS sound pressure level. The peak sound pressure is the instantaneous maximum of the absolute positive or negative pressure and is presented in this report as a dB re 1 µPa). The RMS sound pressure level is also presented in dB re: 1 µPa and is averaged over a defined time period. The appropriate time period to average for the RMS computation varies by the type of sound (e.g., pulsed or continuous).

For impact pile driving (pulsed sound), the maximum RMS averaged over 35 milliseconds of an acoustical pulse-type sound can be used to describe the pile-driving sounds. This RMS value is referred to as the RMS_{imp} and is conveniently measured using the standard impulse setting on a commercially available sound level meter. Another RMS value is the RMS averaged over the duration of the pulse containing 90 percent of the energy where the first and last 5 percent of the energy is excluded. This value is referred to as the $RMS_{90\%}$. With this method, the time averaging per pulse varies. Another measure of the pressure waveform that is used to describe the sounds is the SEL, a common unit of sound energy used in airborne acoustics to describe short-duration events. The unit is dB re $1\mu Pa^2$-second.

The SEL is a measurement that is proportional to the energy associated with an acoustical event (e.g., impact pile-driving pulse) and is basically normalized to one second. The Accumulated

SEL or $SEL_{cumulative}$ is used to describe the SEL from multiple events (e.g., many pile strikes). This can be calculated directly as the logarithmic sum of the individual single-strike SELs for the pile strikes that were used to install the pile. Alternatively, it can be estimated by the following equation:

$$SEL_{cumulative} = \text{Average } SEL_{single\ strike} + 10 \text{ Log (\# of pile strikes)}$$

Figure 3 illustrates the descriptors used to describe the acoustical characteristics of an underwater pile-driving pulse. Note that the example shown in **Figure 3** is hypothetical and not based on testing results collected during this project, and is only shown for descriptive purposes here.

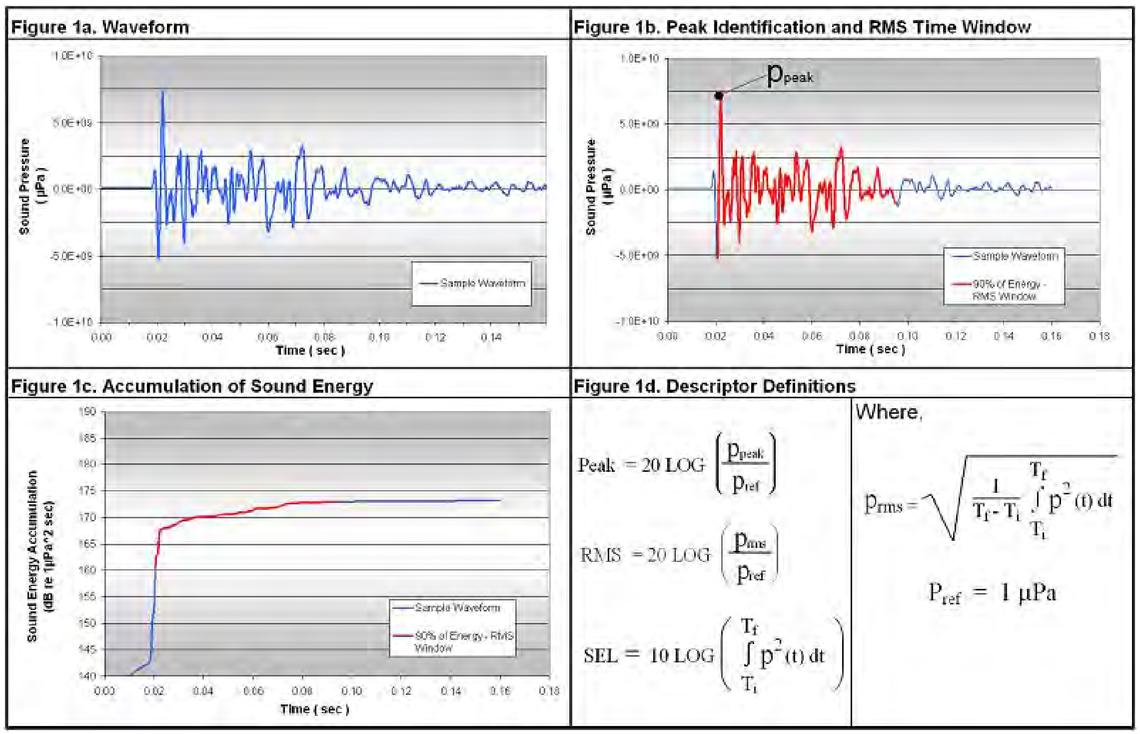

Figure 3. Illustration of Impact Pile-Driving Sounds and the Acoustic Descriptors Used in this Report

Section 2 Methods and Equipment

For the TPP, underwater and airborne sound measurements were conducted during the installation and removal of 29 steel piles. Underwater measurements were conducted during two types of pile driving (vibratory and impact) at as many as six different locations ranging from 10 meters from the test pile to more than 7,000 meters from the pile. This provided for a better understanding of how the sound propagates underwater at this location and helped to determine the regulatory limits for such construction. This section discusses the details of the test procedures and the equipment used during testing.

Overview of Acoustic Monitoring Program

Under the proposed test pile program, 29 steel piles ranging in size from 24 to 48 inches in diameter and 115 to 198 feet long were installed. Among these 29 piles, 17 were used for testing; while 12 (6 per structure) were used for tension loads. The tension-loaded piles were installed approximately 30 feet from the test piles, and therefore, the same pile coordinates were used. **Figure 4** indicates the locations of the 29 piles, and **Tables 1** and **2** shows the general information about each pile. During the TPP, the Navy tested the effectiveness of existing soft-start (or ramp-up) mitigation procedures for impact and vibratory hammers, as well as the effectiveness of an unconfined bubble curtain employed during impact pile driving. The intent was to determine the degree to which these measures reduce emitted acoustic energy levels. Descriptions of these devices are discussed in more detail below. The noise and geotechnical data collected during TPP will be integrated into the design, construction, and environmental planning of the Navy's proposed EHW-2 project.

Test Pile Operations

Pile-driving operations were conducted August 29, 2011 - October 20, 2011 for the TPP. Acoustic monitoring occurred throughout the program in two phases. Phase I included six underwater sound-monitoring positions and four airborne positions. During Phase II, there were four underwater monitoring positions and two airborne monitoring positions.

Test pile operations consisted of vibratory and impact driving of the 29 piles. The piles had 24-, 36-, and 48-inch diameters, as shown in **Table 2**. For the vibratory driving, two different hammer sizes were used: APE 400 and APE 600; for the impact driving, the hammer sizes were APE D-80 and APE D-100. The D-100 Hammer was used for most of the impact pile driving. There were restrictions on the duration of work allowed per day. Up to four piles were permitted to be installed per day using a vibratory hammer. Multiple impact-driven (proofed) piles were allowed per day, but no more than 100 total strikes were allowed in a single day with a maximum of 1,500 strikes for the entire project.

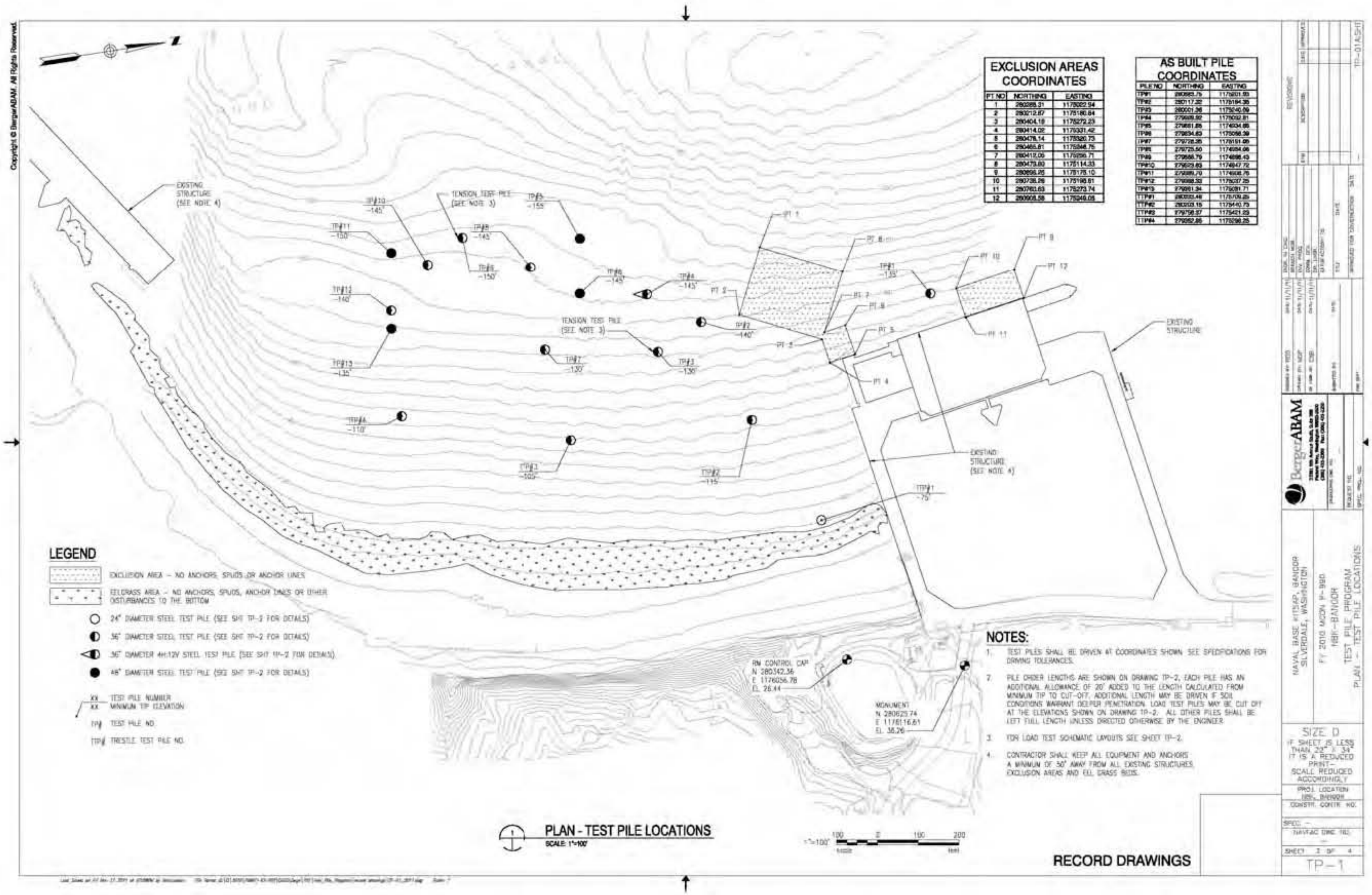

Figure 4. Test Pile Program Pile Installation Locations

Table 1. Water Depth, Soil composition and Pile Distance from Land

Test Pile No.	Distance from Shore (MLLW) (feet)	Depth of Water (MLLW) (feet)	Depth Driven (feet)	USCS Soil Classification [1]
TTP#1	120	15	60	Poorly Graded Gravel-Silty Gravel to Silty Sand/Silt
TTP#2	380	47	53	
TTP#3	420	45	40	
TTP#4	410	48	51	
TP#1	520	75	66.5	Poorly Graded Sand/Silty Sand to Silty Sand/Silt
TP#2	640	79	67	Silt to Poorly Graded Sand/Silty Sand
TP#3	590	72	58	
TP#4	740	86	68.8	
TP#5	910	92	61	
TP#6	760	86	64	
TP#7	630	72	61.5	
TP#8	820	86	71	
TP#9	840	88	64	
TP#10	770	84	63	
TP#11	710	86	64	
TP#12	620	77	63	
TP#13	590	75	60	

[1] Classification of Soils for Engineering Purposes: Annual Book of ASTM Standards, D 2487-83, 04, 08, American Society for Testing and Materials, 1985, pp. 395-408, http://www.astm.org/Standards/D2487.htm

Table 2. Test Pile Program Pile Information and Operations

Pile #	Type of Pile (Diameter, Thickness and Length)	Coordinates	Vibratory Driving				Impact Driving	
			Installation	Removal	Bubble Curtain On	Bubble Curtain Off	Bubble Curtain On	Bubble Curtain Off
TP#1	36”Ø x 3/4”T x 175’	N47°45.228” W122°43.483”	X	X		X	X	
TP#2	36”Ø x 3/4”T x 182’	N47°45.134” W122°43.485”	X	X	X[1]	X	X	
TP#3	36”Ø x 3/4”T x 172’	N47°45.118” W122°43.468”	X	X		X		X
TP#4	36”Ø x 3/4”T x 197’	N47°45.113” W122°43.507”	X	X		X	X	
TP#5	48”Ø x 1”T x 197’	N47°45.091” W122°43.545”	X	X		X	X	X
TP#6	48”Ø x 1”T x 182’	N47°45.088” W122°43.511”	X	X		X	X	

Pile #	Type of Pile (Diameter, Thickness and Length)	Coordinates	Vibratory Driving				Impact Driving	
			Installation	Removal	Bubble Curtain On	Bubble Curtain Off	Bubble Curtain On	Bubble Curtain Off
TP#7	36”Ø x 3/4”T x 172’	N47^{o}45.071” W122^{o}43.483”	X	X		X	X	X
TP#8	36”Ø x 3/4”T x 187’	N47^{o}45.069” W122^{o}43.531”	X	X		X	X	
TP#9	36”Ø x 3/4”T x 192’	N47^{o}45.043” W122^{o}43.544”	X	X		X	X	
TP#10	36”Ø x 3/4”T x 182’	N47^{o}45.032” W122^{o}43.540”	X	X		X	X	
TP#11	48”Ø x 1”T x 177’	N47^{o}45.014” W122^{o}43.551”	X	X		X	X	X
TP#12	36”Ø x 3/4”T x 182’	N47^{o}45.012” W122^{o}43.520”	X	X		X	X	
TP#13	48”Ø x 1”T x 182’	N47^{o}45.010” W122^{o}43.508”	X	X		X	X	
TTP#1	24”Ø x 5/8”T x 117’	N47^{o}45.171” W122^{o}43.359”	X	X		X	X	X
TTP#2	36”Ø x 1”T x 152’	N47^{o}45.151” W122^{o}43.425”	X	X		X	X	X
TTP#3	36”Ø x 1”T x 147’	N47^{o}45.077” W122^{o}43.428”	X	X		X	X	
TTP#4	36”Ø x 1”T x 152’	N47^{o}45.011” W122^{o}43.455”	X	X		X	X	
TP#3 RP#1	36”Ø x 5/8”T x 178’	N47^{o}45.118” W122^{o}43.468”	X	X		X	X	
TP#3 RP#2	36”Ø x 5/8”T x 178’	N47^{o}45.118” W122^{o}43.468”	X	X		X	X	
TP#3 RP#3	36”Ø x 5/8”T x 173’	N47^{o}45.118” W122^{o}43.468”	X	X		X	X	X
TP#3 MP#1	36”Ø x 3/4”T x 182’	N47^{o}45.118” W122^{o}43.468”	X		X			
TP#3 MP#2	36”Ø x 3/4”T x 172’	N47^{o}45.118” W122^{o}43.468”	X	X		X		
TP#3 MP#3	36”Ø x 1”T x 152’	N47^{o}45.118” W122^{o}43.468”	X	X		X		
TP#9 RP#1	36”Ø x 3/4”T x 187’	N47^{o}45.118” W122^{o}43.468”	X	X		X	X	
TP#9 RP#2	36”Ø x 3/4”T x 182’	N47^{o}45.118” W122^{o}43.468”	X	X		X	X	
TP#9 RP#3	36”Ø x 3/4”T x 182’	N47^{o}45.118” W122^{o}43.468”	X	X		X	X	
TP#9 MP#1	48”Ø x 1”T x 177’	N47^{o}45.118” W122^{o}43.468”	X	X		X		
TP#9 MP#2	48”Ø x 1”T x 182’	N47^{o}45.118” W122^{o}43.468”	X	X		X		
TP#9 MP#3	48”Ø x 1”T x 197’	N47^{o}45.118” W122^{o}43.468”	X	X		X		

[1] Vibratory pile removal with bubble rings on

Soft-starts were used prior to every vibratory and impact pile-driving event to test the effectiveness of this method as a mitigation measure. Additionally, a bubble curtain was used as a sound-attenuation system for this project. As shown in **Table 2**, impact driving with the bubble curtain on was done for 22 of the test piles. Seven of the test piles were also tested without the bubble curtain for comparative purposes. The bubble curtain system was designed with seven rings placed no further than 15 feet apart. The system was constructed of 3-inch diameter pipe rolled into a circle 4 feet, 10 inches in diameter at the center of the pipe, with 1/8-inch holes on the bottom spaced 2 inches apart (**Appendix E**). Each ring was designed to pass approximately 501 cubic feet per minute (cfm) of oil-free air to meet the requirements, and usually ran at approximately 550 cfm per ring.

The Biological Assessment (BA) and IHA documents assume a 10-dB reduction when the bubble curtain is used, and the sound attenuation trials were conducted as a means for assessing the assumption. There was also one pile installed and one pile removed using a vibratory hammer while the bubble curtain was on. Otherwise, the bubble-curtain system was not used during vibratory pile installation.

One to four piles were installed in a day with an average over the project of three piles per day. Additional piles may have been removed during those same days. **Table 3** summarizes the permitted versus the actual duration of pile driving.

Table 3. Permitted vs Actual Duration of Pile Driving

Activity	Proposed Duration	Permitted Duration for Project	Actual Duration[1]
Vibratory Hammer Installation	1 hour per pile *29 piles	29 hours/up to 4 piles installed per day	7.5 hours overall/4 to 26 minutes per pile/4 pile max installed per day
Vibratory Extraction	30 minutes per pile *29 piles	14.5 hours/no daily extraction limit	5.5 hours overall/ 3.5 to 21.5 minutes per pile
Impact Hammer Proofing	15 minutes per pile (not to exceed 100 pile strikes per day)	7.25 hours/1500 strikes overall	0.71 hours overall/30 seconds to 5 minutes[1] per pile. 844 strikes total for project (typically less than 50 strikes per day)

[1] includes pauses in driving

Operations

For both vibratory and impact pile driving, two hydrophones were typically used to take underwater measurements at each of the measurement locations. Each hydrophone was positioned at a different depth: typically 10 meters deep (referred to as “Mid” depth) and approximately 20–30 meters, or 2 to 3 meters above the bottom in water shallower than 30 meters (referred to as “Deep” depth). During Phase I, measurements were conducted at six positions, two of which were located inside the WRA. There was a two-channel hydrophone system positioned on the barge approximately 10 to 20 meters from the pile. The second two-channel system within the WRA was positioned on a vessel that ranged from 58 to

1,600 meters from the pile, typically between 75 and 500 meters. Measurements were also conducted outside the WRA at four other locations with distances typically beyond 700 meters from the pile. During Phase II of the project, two of the locations outside the WRA were eliminated, leaving four total measurement locations. While all reasonable efforts were made to capture data during impact and vibratory pile driving, all events were not captured at all positions. This was due to a variety of factors, including equipment failures/damage, transportation issues, timing limitations, environmental conditions, or communication failures.

Airborne Operations

Four microphones were used to collect airborne data on each construction day. One microphone was positioned approximately 15 meters from the pile driving, per standard airborne sound monitoring practices. Another microphone was located on the WRA vessel, which ranged from 58 to 1,600 meters from the pile. Both of these microphones started collecting sound pressure levels at the beginning of each testing day, and measured constantly throughout the day. The other two airborne monitors were stationary land-based systems to the north and south of the project site and the distance from the pile being driven ranged from 123 to 556 meters. These systems measured levels every day and night for several consecutive days at a time. Both systems were unattended.

Background Ambient Monitoring

Background ambient measurements were collected to determine baseline conditions for underwater testing. Ambient data were collected several times throughout each testing day to characterize background noise as environmental and testing conditions change. Ambient data were collected at each measurement location prior to and/or following most pile-driving events. Additional underwater ambient data were measured at various distances from WRA on non-testing days.

Bubble Curtain On/Off Monitoring

Bubble curtain on/off monitoring was conducted during seven impact pile-driving events, one vibratory pile-driving event and one vibratory removal, to determine the effectiveness of the sound attenuation device in reducing the energy levels emitted.

Description of Hammers Used for Pile Driving

Two hammer sizes were used during both vibratory and impact pile driving. The APE 400 hammer size was used during vibratory driving of piles TTP#1 on August 29 and October 4, 2011 and TTP#3 on August 30, 2011. For the remaining test piles and for the duration of TPP, the APE 600 hammer was used for vibratory driving. The impact hammer APE D-100 was used starting September 10, 2011 and throughout the rest of TPP. The impact hammer used on September 1, 2011 for test piles TTP#1 and TTP#2, as well as test pile TP#3 RP#3 on September 15, 2011, was an APE D-80. The 400 Vibratory Driver/Extractor is manufactured by American Pile Driving Equipment, Inc (APE). The manufacturers' specifications for the APE 400 indicate that the hammer can operate with a 13,000 inch pounds [in-lb] (149.78 kilograms [kg]) eccentric moment and a driving force of up to 361 tons (3,211.62 kilonewtons [kN]). The operational frequency and power are variable and the frequency ranges from 0 to 1400 oscillations per minute. The 600 Vibratory Driver/Extractor is manufactured by American Pile Driving Equipment, Inc (APE). The manufacturer's specifications for the APE 600 indicate that the hammer can operate with a 20,000 in-lb (230.42 kg-m) eccentric moment and a driving force of up to 556 tons (4,946.42 kN), 542 kips. The operational frequency and power are variable and the frequency ranges from 0 to 1,400 oscillations per minute. The specifications for the APE D-100 indicate that the hammer can operate with a driving force of up to 248,063 ft-lb (336,324 Nm) and a minimum driving force of 159,008 ft-lbs (215,586 Nm). There are four power settings for the hammer and it delivers between 34-53 blows per minute. The specifications for the APE D80 indicate that the hammer can operate with a driving force of up to 198,450 ft-lb (269,059 Nm) and a minimum driving force of 127,206 ft-lbs (172,466 Nm). There are four power settings for the hammer and it delivers between 34-53 blows per minute. The D-100 and the D-80 diesel impact hammers are manufactured by American Pile Driving Equipment, Inc (APE).

Deviations from the Work Plan

Adjustments in the implementation of the details of the Work Plan were necessary for a variety of reasons, including changes in the construction schedule, changes in the Navy's scheduled "red days" (days when no in-water work was permitted due to security or operational restrictions), efforts to maximize pile-driving efficiency, better understanding of the sound field produced by the pile driving, the background ambient sound levels, and biological variables. Environmental conditions (i.e., wind, waves and currents) were the primary factors affecting the ability to measure pile-driving sounds at distant positions for this study. As information was gained and team efficiency improved with experience, adjustments were made to limit monitoring activities to only those needed to establish compliance. The major deviations are discussed below. Other minor deviations will be discussed in the appropriate sections.

Initially, the vessels outside the WRA were to be positioned from 800 to 2,000 meters from the pile, but underwater sound-pressure data collected within this range during vibratory driving resulted in levels exceeding the desired 120 dB RMS level during vibratory driving. To determine the 120 dB RMS sound propagation distance, two of the vessels were positioned as far out as about 7,300 meters from the pile, and once a vessel was positioned about 10,000 meters from the pile. During impact pile driving the vessels outside the WRA repositioned to approximately 800–1500 meters to locate the desired 160 dB RMS level.

Another deviation from the originally proposed work plan was the frequency range of underwater sound measurements reported. Under the Work Plan, sound measurements were to be based on sounds over the frequency range of 10 to 20,000 Hertz (Hz). However, there was considerable low-frequency instrumentation noise that affected the measurements, especially those measurements made at positions outside the WRA. The low-frequency noise was due mostly to strumming caused by tension created on the hydrophone cables from current and waves. All attempts to minimize strumming were made. However, many of the measurement days had moderate winds, tidal currents and waves that created noise. Due to excessive noise at the lower frequency bands not consistent with the pile driving, the frequency range was modified for all locations.

The frequency spectra for data collected on three separate days were examined to identify an appropriate frequency range that would capture the acoustic energy from vibratory pile installation, but reduce the contribution of non-pile-driving noise. Where the vibratory pile-driving signal was high, the contribution of the background noise was confined to the lowest frequencies. At more distant positions, the amplitude of the pile-driving signal was relatively low as compared to the background noise, so the contribution of background noise was more critical. The frequency spectra for vibratory pile-driving signals near the pile indicated fairly broadband sound made up of considerable low-frequency sound content (i.e., below 20 Hz) that did not propagate outside the WRA to the mid-channel. On the other hand, the distant positions outside the WRA show the effect of low-frequency ambient sound around 100 to 120 dB at these very low frequencies (less than 50 Hz). To illustrate the effect of low-frequency content on the overall un-weighted sound level, the sound level was plotted by time for three different frequency ranges: 10 to 20,000 Hz; 20 to 20,000 Hz; and 50 to 20,000 Hz. The RMS levels for each frequency range were plotted to assess the effect on the overall SPL calculation from the different frequency ranges.

The Spectra plots clearly show that low-frequency ambient noise masks the sound levels resulting from pile driving at the distant positions (see **Figure 5**). For this reason, the computation of overall RMS sound pressure levels outside the WRA was based on the measured sound content between 50 and 20,000 Hz. Inside the WRA, the pile-driving signal is 20 to 40 dB higher than outside the WRA improving the signal to noise relationship. Sound pressure levels inside the WRA were found to be best characterized by sound measured from 20 to 20,000 Hz.

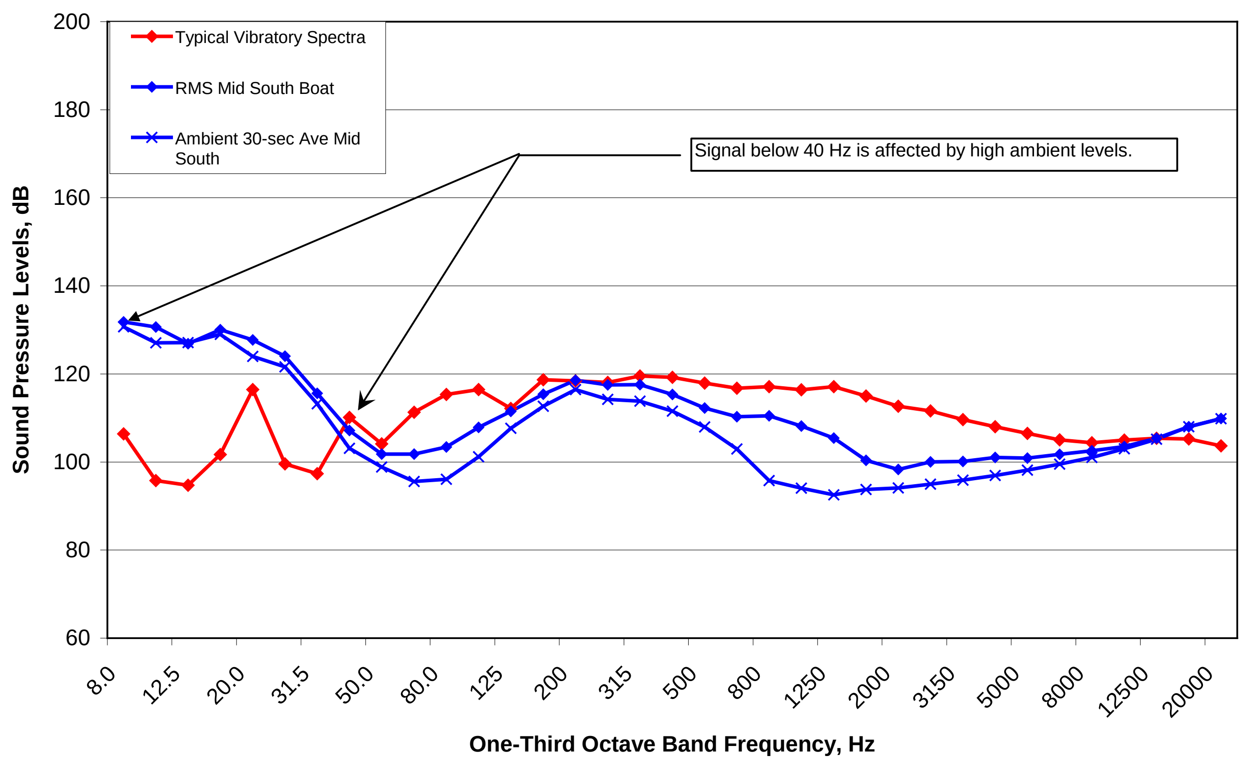

Figure 5. Sample of Low Frequency Levels

Measurement Methods and Equipment

Pile-driving operations for the TPP were conducted August 29–October 20, 2011. The following sections describe methods and materials used in monitoring underwater sounds produced by pile driving.

Monitoring Equipment

The sound pressure levels during this program ranged from about 210 dB Peak near the pile during impact pile driving to around 95–100 dB RMS in quiet ambient conditions outside of the WRA when there was no pile driving.

Reson Model TC-4013 and Reson Model TC-4033 hydrophones with PCB in-line charge amplifiers (Model 422E13) were used. For attended systems, the hydrophones were fed through in-line charge amplifier into Larson Davis Model 831 Precision Sound Level Meters (LDL 831). The LDL 831 then outputs the signal to a Marantz Model PMD660 solid-state digital data recorder (SSR). The output of the LDL 831 can be adjusted. For unmanned systems that involved signal recordings only, PCB Multi-Gain Conditioners (Model 480M122) were used with the hydrophones and in-line charge amplifier. The multi-gain signal conditioner provides the ability to increase the signal strength (i.e., add gain) so that measurements are made within the dynamic range of the instruments used to analyze the signals. Two types of hydrophones were used due to the differences in sensitivity and the availability of equipment for this program.

The TC-4013 hydrophone is about 13 dB less sensitive than the TC-4033 and better suited for measuring higher sound levels without overloading the measurement system. For this reason, these hydrophones were used inside the WRA. The TC-4033 hydrophones have a greater sensitivity and are better suited for the measurement of low-level signals, and therefore, were deployed at positions farther from the pile driving where low-amplitude signals were expected.

During vibratory driving, the 1-second interval sound pressure levels (L_{eq}) were measured either "live," using the LDL 831, or subsequently analyzed from SSR recordings. The same recording intervals were used for impact driving to capture the maximum peak sound pressures (L_{peak}), the Impulse RMS sound pressure level ($L_{impulse}$), and the 1-second SEL (L_{SEL}). The LDL 831 SLM provided measurements of the un-weighted results for each data type, including the one-third octave band spectra for the 1-second L_{eq}. Additional analyses of the acoustical impulses were performed using the LDL 831 SLMs as well. The LDL 831 captures the signal and stores the data points to be down loaded at the completion of a day of measurements.

Underwater Sound Descriptors

The acoustic monitoring program reports data in several required formats, depending on the type of pile driving and the type of acoustic measurement. Impact pile driving produces pulse-type sounds, while vibratory pile installation produces a more continuous type of sound.

For impact pile driving, data provided include the one-third octave band frequency spectrum, peak pressure, RMS, and single-strike and cumulative SELs. For vibratory driving, data reporting includes the average one-third octave band frequency spectrum over the entire pile-driving event and the average sound pressure level (L_{eq}) over the event, which would be the RMS level. Additionally, the 1-second L_{eq} data during the pile-driving events were averaged in 10-second intervals, frequency spectra were also generated from the 1-second samples, as well as the numerical average 1-second and 10-second L_{eq} and the maximum 1-second and 10-second L_{eq}.

For impact driving, the peak pressure is the highest instantaneous level of the measured waveform for every one of the 1-second time increments, which could be a negative or positive pressure (L_{peak}). The RMS level for each is computed by averaging the squared pressures over the amount of time required to achieve 90 percent of the total sound energy. However, this requires a considerable effort to analyze each pile strike individually. Alternatively, the maximum Impulse level for each second of pile driving is reported. The Impulse level is a RMS sound pressure level with a 35-millisecond time constant. The time constant is approximately the same time duration that most acoustic energy in a pile-driving acoustical pulse is contained. Use of this descriptor allows for the direct measurement of pulsed-RMS levels in the field at 12 different hydrophones. For this project, the RMS sound pressure level was directly measured by using the precision SLM setting of “maximum impulse” and is denoted in this report as $L_{impulse}$. In this report, L_{eq}, L_{peak}, and $L_{impulse}$ are expressed in decibels re 1 µPa. In addition, the un-weighted sound exposure level (SEL) for each second was measured. SEL is a common unit of sound energy used in airborne acoustics to describe short-duration events. The units are dB re 1 μPa^2-second. The total sound energy in an impulse accumulates over the duration of the impulse and the maximum level accumulated is the SEL for that event. SEL is reported by the second and for an entire impact pile-driving event. In this report, both the single-strike SEL (L_{SEL}) and the cumulated SEL (L_{cum}) are measured.

Underwater Sound Measurement Positions

Under the terms of Phase I of the TPP project, hydrophones were positioned at six measurement locations: two within the WRA and four outside the WRA. For Phase II, two of the hydrophone locations outside the WRA were discontinued. For each location, hydrophones were attached to a weighted line that was deployed from the surface. Tension on the hydrophone signal lines was minimized to reduce strumming noise. However, it was not possible to eliminate all strumming effects during conditions with strong wind, waves and strong currents. **Figure 6** shows the general location of each acoustic measurement position.

Barge inside WRA (BRG). Two hydrophones were deployed from the construction barge platform. Throughout the TPP, the BRG location was 10 meters from the pile driving (except one day where the impact driving was measured at 20 meters due to interferences with construction equipment). The shallow hydrophone was positioned at approximately 10-meter depth and the deep hydrophone was positioned at approximately 20-meter depth (depending on location and tide level). Data at BRG were not analyzed in real-time but were recorded and subsequently analyzed. Note that several hydrophones were damaged at this position.

Vessel inside WRA (WRA). Two hydrophones were deployed to depths of 10 and 30 meters from a vessel that anchored during pile driving at various locations within the WRA. The distances from the pile driving ranged from 58 to 527 meters during Phase I and from 103 to 1,600 meters during Phase II. Note that the 1,600-meter recording location during Phase II was atypical, and arose from a special circumstance: a Steller sea lion was located near Delta Pier, and a vessel was deployed in this area to conduct biological and acoustic monitoring in its vicinity. This was done to better estimate received levels for the animal, and to collect detailed behavioral information in conjunction with construction events.

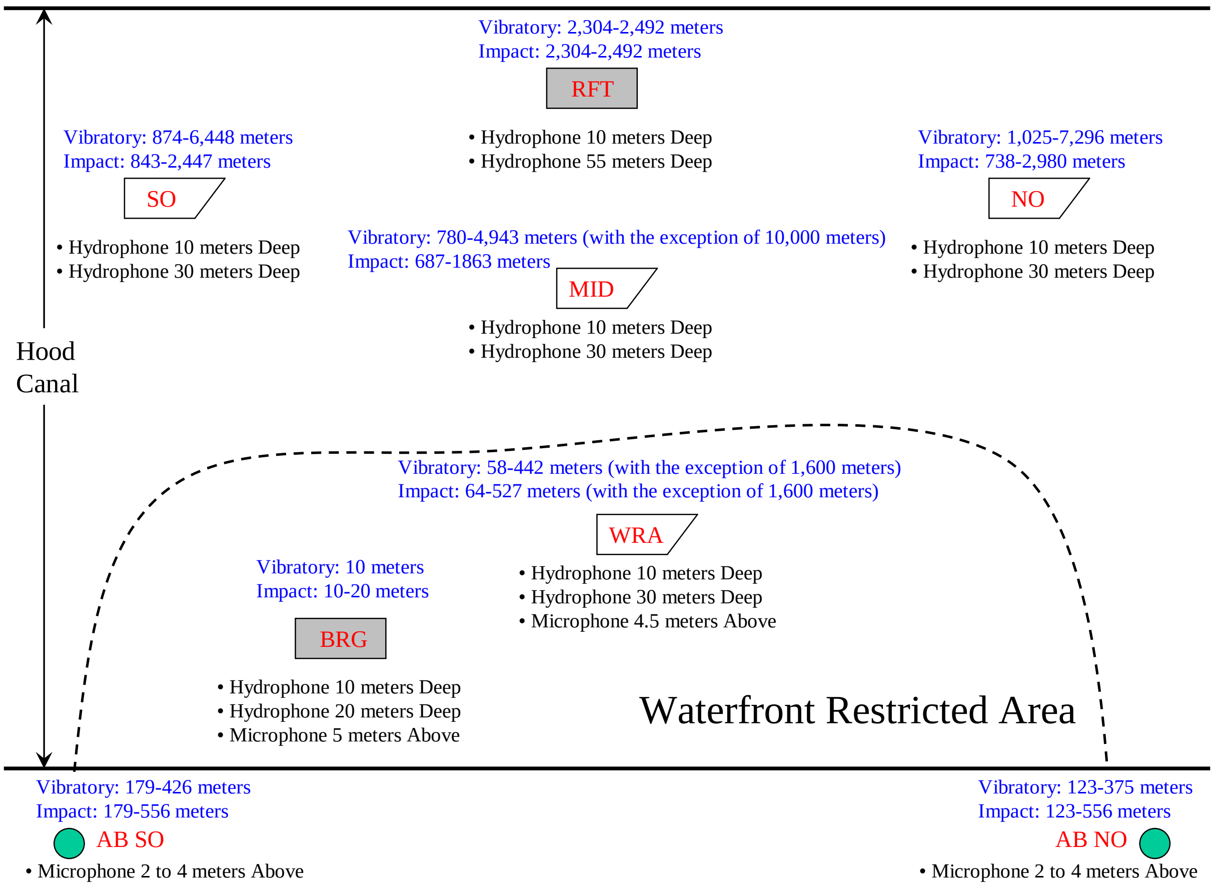

Figure 6. Measurement Positions during TPP

Mid-Channel Vessel outside WRA (MID). Two hydrophones were deployed from a vessel that drifted or was anchored in the channel of the Hood Canal just outside the WRA. Hydrophones were deployed at depths of approximately 10 and 30 meters. Water depth was typically in excess of 75 meters. For the majority of TPP, MID remained in the vicinity of the WRA fence (i.e., beyond 800 meters from the pile driving), typically around the yellow security buoys (see **Figure 2**); however, at one point MID was positioned as close as 687 meters from the pile driving, and in another instance was positioned 10,000 meters from the vibratory pile driving in an effort to measure below 120 dB RMS.

North Channel Vessel outside WRA (NO). Two hydrophones were deployed from a vessel that drifted in the channel of the Hood Canal north of the WRA. Hydrophones were deployed at depths of approximately 10 and 30 meters. Water depth was typically in excess of 75 meters. During vibratory pile installation, the NO was typically positioned 2,000 meters north or farther away from pile driving. The objective in positioning this vessel was to provide sound measurements that would best estimate the extent of the 120 dB sound pressure level from vibratory pile-driving sounds and 160 dB SPL from impact sounds. In positioning the vessel, the background noise conditions had to be taken into account. Under tidal currents or wind and waves, typical background noise was elevated above 120 dB. Distances from the pile driving ranged from 738 to 7,296 meters for NO. Typically, impact pile driving was measured from this vessel just outside the WRA on the north side (about 700 to 1,500 meters overall).

South Channel Vessel outside WRA (SO). Two hydrophones were deployed from a vessel that drifted in the channel of the Hood Canal south of the WRA. Hydrophones were deployed at depths of approximately 10 and 30 meters. Water depth was typically in excess of 75 meters. As with the NO vessel, the primary purpose of the SO vessel was to identify the extent of the 120-dB sound pressure level from vibratory pile driving and the 160-dB level from impact driving. The SO position ranged from about 843 meters during impact driving to 6,448 meters during vibratory driving.

Un-manned Raft near Toandos (RFT). The RFT position was an unattended system deployed from an anchored inflatable raft in 18–20-meter deep water. Hydrophones were deployed at 10- and 17-meter depths. Data were recorded and analyzed subsequently. Distances from the pile driving ranged from about 2,300-2,490 meters throughout TPP.

Underwater System Acoustic Calibration

The measurement systems were calibrated prior to use in the field with a G.R.A.S. Type 42AA pistonphone and hydrophone coupler. A pistonphone is an acoustical calibrator used to generate a precise sound pressure for the calibration of instrumentation microphones. The pistonphone, when used with the hydrophone coupler, produces a continuous 145.3 dB (re 1 µPa) tone for the TC-4013 hydrophones and 136.4 dB (re 1 µPa) tone for the TC-4033 hydrophones at 250 Hz. The tone measured by the SLM was recorded at the beginning of the recordings. The system calibration status was checked at the beginning of each measurement day by both measuring the calibration tone and recording the tone on the SSR. The pistonphones were certified at an independent facility.

All field notes were recorded in water-resistant field notebooks. Such notebook entries include calibration notes, measurement positions (i.e., distance from source, depth of sensor), measurement conditions (e.g., currents, sea conditions, etc.), system gain settings, and the equipment used to make each measurement. Notebook entries were copied after each measurement day and filed for safekeeping. Digital recordings were also copied and stored for subsequent analysis, if needed.

Underwater Sound Measurement Data Management

Following each day of measurements, digital data captured by the SLMs were downloaded to computer systems for WRA, MID, NO, and SO. These data were converted and stored in tabulated spreadsheets. The primary function for these data was to provide accurate live readings. These readings from the SLMs were also periodically recorded in field notebooks and the entire drive was recorded digitally on a solid-state recorder at each of the six locations. With extended memory capacity, the SLM were used as the primary data acquisition systems. The

SSR recordings for BRG and RFT were run through the LDL 831 SLMs following each day of testing. During both real-time data acquisition and post-testing recording analysis, the technicians would listen to the signals to ensure that high-quality data were measured (no noise interference) and that the dominant source was the pile driving. At times, there were relatively strong currents that caused tension on the sensor line and created noise that is referred to as "strumming." Strumming did affect some measurements made at the distant positions where the sound levels from pile driving were lower. To the extent possible strumming was filtered from the reported data.

Compliance Tests

Measurements from the monitoring events were plotted versus distance from the pile driving to assess at what distance the results fall below the various defined metrics for both vibratory and impact driving. These estimations were provided at both hydrophone depths for each pile size. For impact driving, calculations were made for bubble curtain on and off scenarios.

Airborne Testing Methods and Materials

The following sections describe methods and materials used in monitoring airborne sounds produced by pile driving. Airborne sound levels were measured at four positions. One position was on the construction barge approximately 15 meters from the pile driving. Another position was from the WRA vessel. Two fixed positions on land were located within the WRA at the shoreline.

Monitoring Equipment and Calibration

Airborne measurements were made using ½-inch G.R.A.S. Model 40AQ pre-polarized random-incidence microphones. The signals were fed into LDL 831 SLMs. The systems were calibrated with a Larson Davis Model CAL200 Acoustic Calibrator. For the airborne measurements at the two locations within the WRA, the microphones were calibrated at the beginning and end of each day, but for the microphones located on the shore to the north and south ends of the WRA, the microphones were not taken down daily. Instead, they remained in position for several consecutive days without disturbance. These systems were calibrated prior to installation and following removal. Pre-event and post-event calibration levels were within 0.1 dB.

Airborne Sound Descriptors

Un-weighted and A-weighted airborne data were collected and analyzed for TPP. During data collection, 1-minute intervals were used for measuring airborne L_{eq} data. The SELs were calculated over the duration of each pile-driving event. The maximum level of the "fast" RMS meter response over the 1-minute intervals was also identified (L_{max}). These descriptors were used for both the un-weighted and A-weighted data during vibratory and impact driving. The 1-minute spectrum was also generated for the airborne data.

Airborne Sound Measurement Positions

Microphones to measure airborne sound levels were placed in four locations:

Construction Barge (AB-BRG). An airborne acoustic monitoring system was placed on the side of the construction crane to measure pile-driving noise at a fixed position. The AB-BRG microphone was positioned on the crane used for pile driving at a distance of 15 meters from the pile and a height of 5 meters above the water surface. This was not an ideal measurement position, because the crane is powered by a large diesel engine that produces considerable noise. There was no other feasible location to place a fixed monitoring system that would not interfere with construction operations or be damaged.

WRA Vessel (AB-WRA). A system for monitoring airborne noise levels was fixed to the WRA vessel that was used to make underwater sound measurements and marine mammal observations. The AB-WRA was attached to the WRA vessel at a height of 4.5 meters above the water. This system was also not ideal since the boat makes noise and marine mammal observers frequently made noise near the microphone, particularly radio communications, contaminating results.

Land-Based Monitoring Positions (AB-NO and AB-SO). The two land-based microphones were placed at the northern and southern shorelines of the WRA in the construction zone. AB-NO and AB-SO were positioned approximately 2 to 4 meters above the ground and ranged from 123 to 556 meters from the pile driving. These systems included weather-protected microphones.

Airborne Sound Measurement Data Management

Acoustic data recorded from the airborne-sound monitoring systems were acquired infrequently due to access issues. The BRG and WRA microphones acquired data throughout the duration of each testing day. The AB-NO and AB-SO microphones recorded airborne data for several consecutive days at a time and were accessed about once per week.

Airborne Compliance Tests

Measurements from each monitoring event were plotted versus distance from the pile driving to determine at what distance the levels fall below the defined metrics for both vibratory and impact driving.

Section 3 Description of Measurement Results

Underwater sound measurements were conducted for 66 vibratory pile-driving events, 43 in Phase 1 and 23 in Phase II. These events included both the installation and removal of piles and one bubble curtain on and off test. There were 22 impact pile-driving events measured, with seven involving air bubble curtain on and off tests. Airborne sound measurements were made for each of these events. This section presents examples of acoustical data collected during the TPP. **Appendix A** contains the results for all the vibratory pile driving. **Appendix B** contains results for impact pile driving, including measurements made during bubble curtain on and off tests. The airborne data are provided in **Appendix C**. The results are summarized in **Section 4**.

Pile-driving activities and acoustic monitoring events are summarized in **Table 4**. During vibratory and impact pile driving, distances between the piles and the measurement locations were calculated by recording vessel position coordinates and relating these to the coordinates of each pile (summarized in **Table 4**). The distances from the pile to the monitoring positions on the barge were measured directly. Distances from the piles to the land-based microphones and RAFT hydrophone were determined by comparing the coordinates of the land-based positions to the coordinates of each pile.

Example of Underwater Sound Data During Vibratory Pile Installation/Removal

Vibratory Pile Installation

Vibratory pile-driving acoustical data are provided in graphical and tabular format in **Appendix A**. A time history plot of the 1-second sound pressure levels is provided for each position (shown on one chart for comparative purposes). **Figure 7** shows an example of the time history plot contained in **Appendix A** for a vibratory pile installation that occurred on September 8, 2011. In this example, pile TP#3 RP#2 was installed using the APE600 vibratory hammer. Two separate events were analyzed for this pile. The first event started at 16:16 and stopped at 16:32, while the second event ran from 16:46 to 16:57. **Figure 7** shows the sound pressure levels for the mid-depth hydrophones from 16:16 to 16:32 at each of the six measurement locations. This pile-driving event was characterized with three soft-starts followed by two high-energy driving sequences, all of which are labeled in **Figure 7**. The average RMS was calculated by taking the average of the ten second RMS levels for the entire event, which included two high-energy sequences. The 3-minute break was not part of the calculation. The average RMS was calculated for the one-third octave band frequencies of 20 to 20,000 Hz for the two measurement locations within the WRA and for frequencies of 50 to 20,000 Hz for those beyond the WRA. These values are shown in **Figure 7** by the large squares. Also shown in **Figure 7** are the measured distances of each measurement from TP#3 RP#2 at the time of the event. These numbers correlate to those summarized in **Table 4**.

Table 4. Summary of Pile Driving Activities and Monitoring Events

Date	Pile	Pile Size	Coordinates	Hammer Size	Bubble Curtain (ON/OFF)	# of Strikes	Time	IMP/VIB VIB IN/OUT	Distance from Pile							
									BRG	WRA	MID	NO	SO	Raft	AB NO	AB SO
8/29/2011	TTP#1	24"	N47°45.171" W122°43.359"	APE 400	OFF	N/A	12:10:13-12:21:42	VIB IN	10	145	780	2000	2076	2492	123	426
	TTP#2	36"	N47°45.151" W122°43.425"	APE 600	OFF	N/A	15:06:33-15:20:21	VIB IN	10	58	887	2102	1989	2421	172	400
8/30/2011	TTP#3	36"	N47°45.077" W122°43.428"	APE 400	OFF	N/A	9:53:27-10:13:28	VIB IN	10	361	869	2631	1249	2451	186	268
	TTP#3, larger hammer	36"	N47°45.077" W122°43.428"	APE 600	OFF	N/A	10:42:36-10:48:25	VIB IN	10	361	995	2191	2257	2451	186	268
	TP#3	36"	N47°45.116" W122°43.473"	APE 600	OFF	N/A	13:11:17-13:20:10	VIB IN	10	442	No Monitoring Due to Rapid Gate Badging			2384	223	356
	TP#7	36"	N47°45.071" W122°43.483"	APE 600	OFF	N/A	14:39:48-14:55:48	VIB IN	10	295	1056	1784	2281	2392	250	290
8/31/2011	TTP#4	36"	N47°45.011" W122°43.455"	APE 600	OFF	N/A	9:19:02-9:25:35	VIB IN	10	86	1036	2131	1883	2454	286	179
	TTP#4, heavy hammer	36"	N47°45.011" W122°43.455"	APE 600	OFF	N/A	9:40:35-9:57:01	VIB IN	10	86	1036	2131	1883	2454	286	179
	TP#13	48"	N47°45.010" W122°43.508"	APE 600	OFF	N/A	11:59:01-12:10:27	VIB IN	10	272	1299	2134	1833	2393	337	231
	TP#12	36"	N47°45.012" W122°43.520"	APE 600	OFF	N/A	14:23:00-14:31:00	VIB IN	10	82	910	1900	2080	2375	350	244
9/1/2011	TTP#1	24"	N47°45.171" W122°43.359"	D-80	ON	3	11:29:45 11:32:37	IMP	10	527	977	965	1489	2492	123	426
	TTP#1	24"	N47°45.171" W122°43.359"	D-80	OFF	7	11:34:16 11:37:16	IMP	10	527	1013	1100	1489	2492	123	426
	TTP#2	36"	N47°45.151" W122°43.425"	D-80	ON	40	15:40:25 15:45:48	IMP	11	415	950	922	1169	2421	172	400
	TTP#2	36"	N47°45.151" W122°43.425"	D-80	OFF	38	15:51:12 15:52:06	IMP	11	415	983	738	1101	2421	172	400
9/8/2011	TP#3 RP#3	36"	N47°45.118" W122°43.468"	APE 600	OFF	N/A	14:34:08-15:06:46	VIB IN	10	92	954	3766	3664	2384	223	356
	TP#3 RP#2	36"	N47°45.118" W122°43.468"	APE 600	OFF	N/A	16:16:34-16:32:06	VIB IN	10	167	899	5523	4220	2384	223	356
	TP#3 RP#2	36"	N47°45.118" W122°43.468"	APE 600	OFF	N/A	16:46:08-16:57:34	VIB IN	10	87	899	5100	4435	2384	223	356

Date	Pile	Pile Size	Coordinates	Hammer Size	Bubble Curtain (ON/OFF)	# of Strikes	Time	IMP/VIB VIB IN/OUT	Distance from Pile							
									BRG	WRA	MID	NO	SO	Raft	AB NO	AB SO
9/10/2011	TP#3 RP#1	36"	N47°45.118" W122°43.468"	APE 600	OFF	N/A	10:45:51-11:00:20	VIB IN	10	107	1686	7288	6236	2384	223	356
	TP#2	36"	N47°45.134" W122°43.485"	APE 600	OFF	N/A	12:54:52-13:05:03	VIB IN	10	66	4943	7296	6202	2355	241	392
	TP#7	36"	N47°45.071" W122°43.483"	D-100	ON	47	16:36:38-16:49:12	IMP	20	64	1863	2980	2447	2392	250	290
	TP#7	36"	N47°45.071" W122°43.483"	D-100	OFF	40	16:56:57 16:57:50	IMP	20	66	1737	2980	2445	2392	250	290
9/15/2011	TP#3 RP#3	36"	N47°45.118" W122°43.468"	D-80	ON	9	14:18:04 14:25:55	IMP	10	92	989	1121	912	2384	223	356
	TP#3 RP#3	36"	N47°45.118" W122°43.468"	D-80	OFF	10	14:27:15 14:34:05	IMP	10	92	1020	1127	876	2384	223	356
9/16/2011	TP#3 RP#2	36"	N47°45.118" W122°43.468"	D-100	ON	26	10:44:24 10:53:40	IMP	10	90	1167	1382	1093	2384	223	356
	TP#3 RP#1	36"	N47°45.118" W122°43.468"	D-100	ON	30	15:02:45 15:10:58	IMP	10	95	687	782	931	2384	223	356
	TP#3	36"	N47°45.116" W122°43.473"	D-100	OFF	29	16:10:39 16:16:37	IMP	10	90	1039	1685	1034	2384	223	356
9/17/2011	TP#2	36"	N47°45.134" W122°43.485"	D-100	ON	15	10:26:20 10:31:14	IMP	10	125	1025	1470	843	2355	241	392
	TP#2	36"	N47°45.134" W122°43.435"	APE 600	ON	N/A	11:21:07-11:38:04	VIB OUT	10	103	1025	2000	1827	2355	241	392
	TP#3 MP#1	36"	N47°45.120" W122°43.466"	APE 600	ON	N/A	12:24:06-12:35:27	VIB IN	10	92	1878	2200	1659	2384	223	356
	TTP#2	36"	N47°45.151" W122°43.425"	APE 600	OFF	N/A	14:04:48-14:24:05	VIB OUT	10	133	1833	1950	1568	2421	172	400
	TP#3 MP#3	36"	N47°45.119" W122°43.480"	APE 600	OFF	N/A	14:51:28-15:03:41	VIB IN	10	93	1035	1400	874	2384	223	356
	TP#7	36"	N47°45.071" W122°43.483"	APE 600	OFF	N/A	15:25:21-15:40:16	VIB OUT	10	75	995	1095	877	2392	250	290
	TP#3 MP#2	36"	N47°45.113" W122°43.469"	APE 600	OFF	N/A	19:09:26-16:17:20	VIB IN	10	85	941	1100	876	2384	223	356
9/21/2011	TTP#3	36"	N47°45.077" W122°43.428"	D-100	ON	33	10:10:18 10:20:41	IMP	10	123	817	991	953	2451	186	268
	TP#10	36"	N47°45.032" W122°43.540"	APE 600	OFF	N/A	13:38:53-13:48:06	VIB IN	10	117	2291	2450	1667	2341	348	288
	TP#10	36"	N47°45.032" W122°43.540"	APE 600	OFF	N/A	15:01:19-15:14:35	VIB IN	10	117	2291	3800	3278	2341	348	288
	TP#9	36"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	16:47:16-17:00:12	VIB IN	10	145	2149	3850	5180	2329	344	304

Date	Pile	Pile Size	Coordinates	Hammer Size	Bubble Curtain (ON/OFF)	# of Strikes	Time	IMP/VIB VIB IN/OUT	Distance from Pile							
									BRG	WRA	MID	NO	SO	Raft	AB NO	AB SO
9/22/2011	TP#8	36"	N47°45.069" W122°43.531"	APE 600	OFF	N/A	9:08:23-9:29:36	VIB IN	10	71	944	3300	3730	2333	309	323
	TP#11	48"	N47°45.014" W122°43.551"	APE 600	OFF	N/A	15:18:20-15:31:25	VIB IN	10	112	944	1288	1614	2339	375	279
9/23/2011	TP#6	48"	N47°45.088" W122°43.511"	APE 600	OFF	N/A	8:54:48-9:08:56	VIB IN	10	109	1609	1170	1794	2343	278	334
	TP#5	48"	N47°45.091" W122°43.545"	APE 600	OFF	N/A	11:21:56-11:39:51	VIB IN	10	110	876	1025	1788	2304	316	365
	TP#4 Batter	36"	N47°45.113" W122°43.507"	APE 600	OFF	N/A	15:36:58-16:15:20	VIB IN	10	80	931	2386	919	2337	266	371
9/24/2011	TP#10	36"	N47°45.032" W122°43.540"	D-100	ON	13	14:09:31-14:18:50	IMP	10	118	980	1100	998	2341	348	288
	TP#10	36"	N47°45.032" W122°43.540"	APE 600	OFF	N/A	14:46:28-15:01:00	VIB OUT	10	118	2236	1800	2148	2341	348	288
	TP#9 RP#3	36"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	15:59:38-16:14:19	VIB IN	10	150	1150	2100	1786	2329	344	304
9/26/2011	TP#8	36"	N47°45.069" W122°43.531"	D-100	ON	22	9:31:38 9:41:32	IMP	10	235	981	1463	1000	2333	309	323
	TP#8	36"	N47°45.069" W122°43.531"	APE 600	OFF	N/A	10:25:57-10:47:39	VIB OUT	10	147	917	1800	1000	2333	309	323
	TP#9 RP#1	36"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	11:16:20-11:30:41	VIB IN	10	140	917	3600	1000	2329	344	304
9/29/2011	TP#12	36"	N47°45.012" W122°43.520"	D-100	ON	20	10:18:18 10:23:13	IMP	10	81	937	1268	884	2375	350	244
	TP#12	36"	N47°45.012" W122°43.520"	APE 600	OFF	N/A	11:14:00 11:29:35	VIB OUT	10	81	953	5530	5839	2375	350	244
	TP#9 RP#2	36"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	12:09:31 12:18:50	VIB IN	10	140	840	5580	6448	2329	344	304
	TP#11	48"	N47°45.014" W122°43.551"	D-100	ON	38	15:03:22 15:11:22	IMP	10	120	897	1216	1077	2339	375	279
	TP#11	48"	N47°45.014" W122°43.551"	D-100	OFF	33	15:17:36 15:18:18	IMP	10	120	886	1100	1055	2339	375	279
	TP#11	48"	N47°45.014" W122°43.551"	APE 600	OFF	N/A	16:27:16-16:43:42	VIB OUT	10	120	945	6100	5824	2339	375	279
	TP#9 MP#1	48"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	17:02:44-17:09:26	VIB IN	10	140	849	5500	5824	2329	344	304

Date	Pile	Pile Size	Coordinates	Hammer Size	Bubble Curtain (ON/OFF)	# of Strikes	Time	IMP/VIB VIB IN/OUT	Distance from Pile							
									BRG	WRA	MID	NO	SO	Raft	AB NO	AB SO
9/30/2011	TP#13	48"	N47°45.010" W122°43.508"	D-100	ON	12	9:52:01 9:56:59	IMP	10	163	931	1500	1190	2393	337	231
	TP#13	48"	N47°45.010" W122°43.508"	APE 600	OFF	N/A	10:39:49- 10:55:35	VIB OUT	10	270	857	6200	5917	2393	337	231
	TP#9 MP#2	48"	N47°45.041" W122°43.563"	APE 600	OFF	N/A	11:29:35- 11:39:19	VIB IN	10	145	796	5800	5910	2329	344	304
	TP#5	48"	N47°45.091" W122°43.545"	D-100	ON	35	13:36:18 13:40:32	IMP	10	194	754	1080	1000	2304	316	365
	TP#5	48"	N47°45.091" W122°43.545"	D-100	OFF	32	13:43:59 13:44:38	IMP	10	194	754	1400	1060	2304	316	365
	TP#5	48"	N47°45.091" W122°43.545"	APE 600	OFF	N/A	14:23:19- 14:47:04	VIB OUT	10	190	811	3200	3106	2304	316	365
	TP#9 MP#3	48"	N47°45.053" W122°43.557"	APE 600	OFF	N/A	15:11:05- 15:16:14	VIB IN	10	145	806	6030	6172	2329	344	304
10/1/2011	TP#9 RP#3	36"	N47°45.043" W122°43.544"	D-100	ON	13	9:19:11 9:24:05	IMP	10	142	921	1450	1213	2329	344	304
	TP#9 RP#2	36"	N47°45.043" W122°43.544"	D-100	ON	12	11:27:25 11:31:11	IMP	10	140	860	1100	1110	2329	344	304
	TP#9 RP#1	36"	N47°45.043" W122°43.544"	D-100	ON	11	14:07:50 14:12:00	IMP	10	140	880	1100	964	2329	344	304
	TP#9	36"	N47°45.043" W122°43.544"	D-100	ON	64	16:29:13 16:34:06	IMP	10	140	815	1300	924	2329	344	304
10/3/2011	TP#6	48"	N47°45.088" W122°43.511"	D-100	ON	21	12:04:52 12:11:04	IMP	10	155	1000	927	886	2343	278	334
	TP#6	48"	N47°45.088" W122°43.511"	APE 600	OFF	N/A	13:58:49- 14:17:22	VIB OUT	10	155	1000	3700	5760	2343	278	334
	TP#4	36"	N47°45.113" W122°43.508"	D-100	ON	15	16:44:45 16:50:15	IMP	10	200	1000	879	983	2337	266	371
	TP#4	36"	N47°45.113" W122°43.508"	APE 600	OFF	N/A	17:50:23- 18:04:08	VIB OUT	10	200	1000	2350	2525	2337	266	371

Date	Pile	Pile Size	Coordinates	Hammer Size	Bubble Curtain (ON/OFF)	# of Strikes	Time	IMP/VIB VIB IN/OUT	Distance from Pile					
									BRG	WRA	MID	Raft	AB NO	AB SO
10/4/2011	TP#4	36"	N47°45.113" W122°43.508"	APE 600	OFF	N/A	10:43:06- 11:09:20	VIB OUT	10	215	890	2337	266	371
	TTP#4	36"	N47°45.011" W122°43.455"	D-100	ON	38	14:52:00 14:59:52	IMP	10	170	965	2454	286	179
	TTP#1	24"	N47°45.171" W122°43.359"	APE 400	OFF	N/A	15:48:31- 16:08:10	VIB IN/ OUT	10	300	1080	2492	123	426
10/5/2011	TP#1	36"	N47°45.228" W122°43.483"	APE 600	OFF	N/A	16:25:04- 16:52:25	VIB IN	10	205	10000	2322	310	556

Date	Pile	Pile Size	Coordinates	Hammer Size	Bubble Curtain (ON/OFF)	# of Strikes	Time	IMP/VIB VIB IN/OUT	Distance from Pile					
									BRG	WRA	MID	Raft	AB NO	AB SO
10/8/2011	TP#1	36"	N47°45.228" W122°43.483"	D-100	ON	98	15:04:29 15:17:14	IMP	10	1600	982	2322	310	556
	TP#1	36"	N47°45.228" W122°43.483"	APE 600	OFF	N/A	16:06:48-16:20:27	VIB OUT	10	1600	1000	2322	310	556
10/17/2011	TP#3 MP#3	36"	N47°45.119" W122°43.480"	APE 600	OFF	N/A	12:57:55-13:07:01	VIB OUT	10	105	2416	2384	223	356
	TP#3 MP#2	36"	N47°45.113" W122°43.469"	APE 600	OFF	N/A	15:16:43-15:25:32	VIB OUT	10	105	2416	2384	223	356
	TP#3	36"	N47°45.116" W122°43.473"	APE 600	OFF	N/A	16:12:49-16:20:32	VIB OUT	10	105	2386	2384	223	356
10/18/2011	TP#3 RP#3	36"	N47°45.118" W122°43.468"	APE 600	OFF	N/A	11:21:27-11:39:04	VIB OUT	10	118	948	2384	223	356
	TP#3 RP#1	36"	N47°45.118" W122°43.468"	APE 600	OFF	N/A	13:13:42-13:31:02	VIB OUT	10	118	948	2384	223	356
	TP#3 RP#2	36"	N47°45.118" W122°43.468"	APE 600	OFF	N/A	14:13:46-14:30:03	VIB OUT	10	103	948	2384	223	356
	TP#3 MP#1	36"	N47°45.120" W122°43.466"	APE 600	OFF	N/A	15:10:36-15:21:07	VIB OUT	10	108	948	2384	223	356
10/19/2011	TP#9 MP#2	48"	N47°45.041" W122°43.563"	APE 600	OFF	N/A	8:31:48-8:37:15	VIB OUT	10	137	1019	2329	344	304
	TP#9 MP#2	48"	N47°45.041" W122°43.563"	APE 600	OFF	N/A	10:18:36-10:56:03	VIB OUT	10	137	1019	2329	344	304
	TP#9 MP#3	48"	N47°45.053" W122°43.557"	APE 600	OFF	N/A	13:28:04-13:40:01	VIB OUT	10	169	1019	2329	344	304
	TP#9 MP#1	48"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	14:30:42-14:40:00	VIB OUT	10	169	1019	2329	344	304
	TP#9	36"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	15:51:37-16:12:33	VIB OUT	10	169	910	2329	344	304
10/20/2011	TP#9 RP#3	36"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	8:41:08-8:55:53	VIB OUT	10	146	915	2329	344	304
	TP#9 RP#1	36"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	10:46:25-11:02:20	VIB OUT	10	146	915	2329	344	304
	TP#9 RP#2	36"	N47°45.043" W122°43.544"	APE 600	OFF	N/A	11:42:12-11:55:24	VIB OUT	10	146	915	2329	344	304
	TTP#4	36"	N47°45.011" W122°43.455"	APE 600	OFF	N/A	13:29:21-13:39:45	VIB OUT	10	128	1069	2454	286	179
	TTP#4	36"	N47°45.011" W122°43.455"	APE 600	OFF	N/A	14:03:24-14:13:43	VIB OUT	10	128	1069	2454	286	179
	TTP#3	36"	N47°45.077" W122°43.428"	APE 600	OFF	N/A	15:22:42-15:36:16	VIB OUT	10	150	1071	2451	186	268

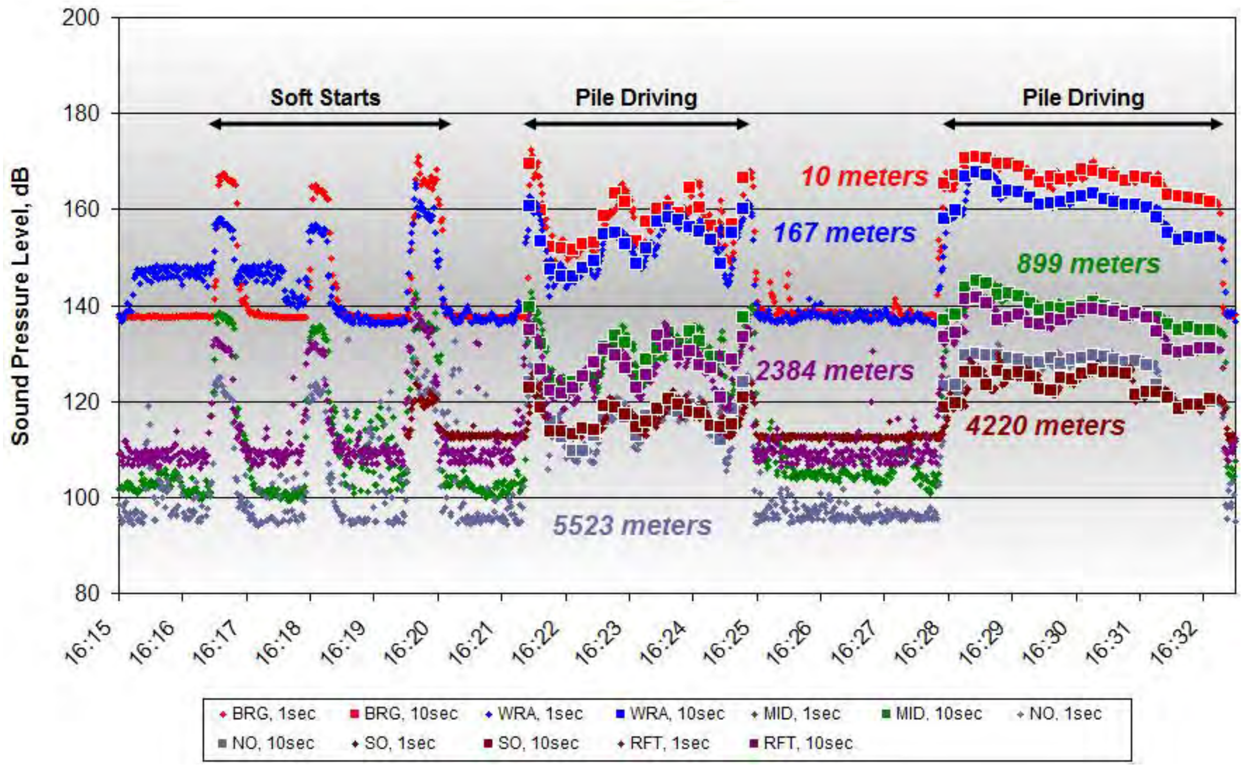

Figure 7. 1-second and 10-second Average Data for TP#3 RP#2, 16:21-16:32, at the Mid-Depth Position on September 8, 2011

Figures 8 through **13** show the frequency spectrum (based on the 1-second RMS) over the entire pile-driving event, the maximum 10-second average spectrum, and a 30-second average spectrum of the ambient noise just before the pile driving started for all six measurement locations. Also shown on each of the plots are tables summarizing the RMS and 10-second average results for each location. Plots of the RMS levels and the corresponding spectra for the remaining pile-driving events are provided in **Appendix A**, as is a more comprehensive summary table of all the measured results for both deep and mid-depths. The RMS values calculated over the entire pile-driving event, together with the measured distances of each location from the pile, were used to determine the propagation effects during pile driving and the distance at which the 120 dB limit occurred.

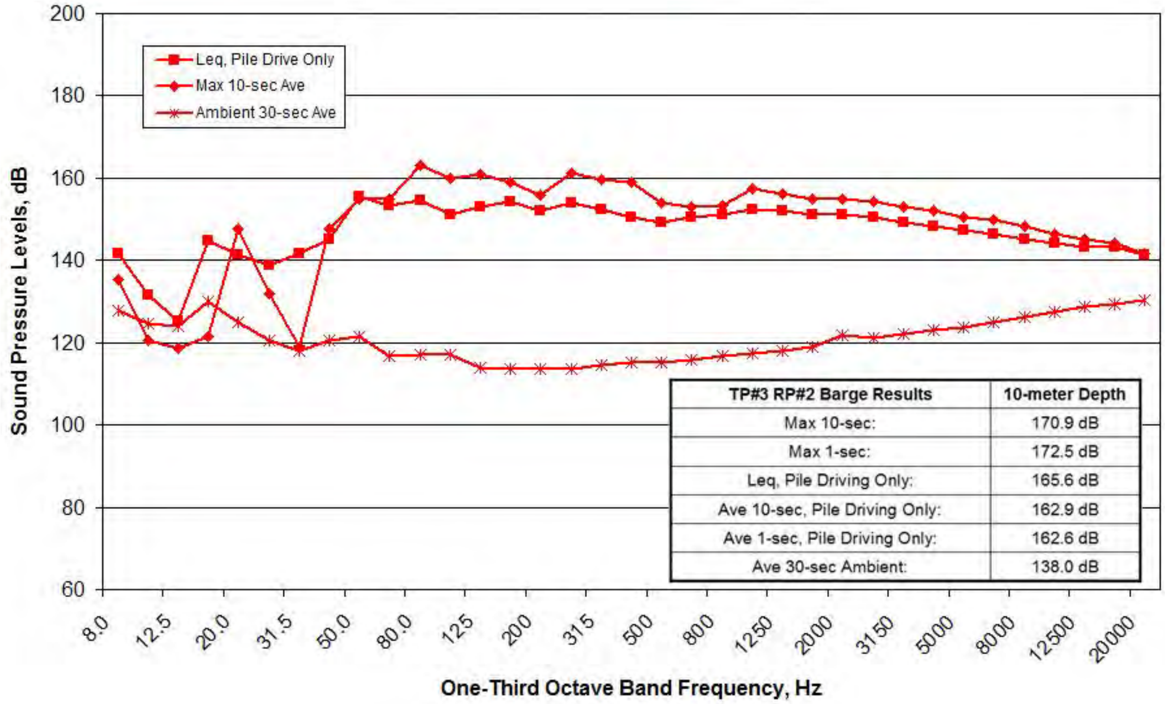

Figure 8. Spectral Data Measured at the BRG Location during TP#3 RP#2, 16:21-16:32, at the Mid-Depth Position on September 8, 2011

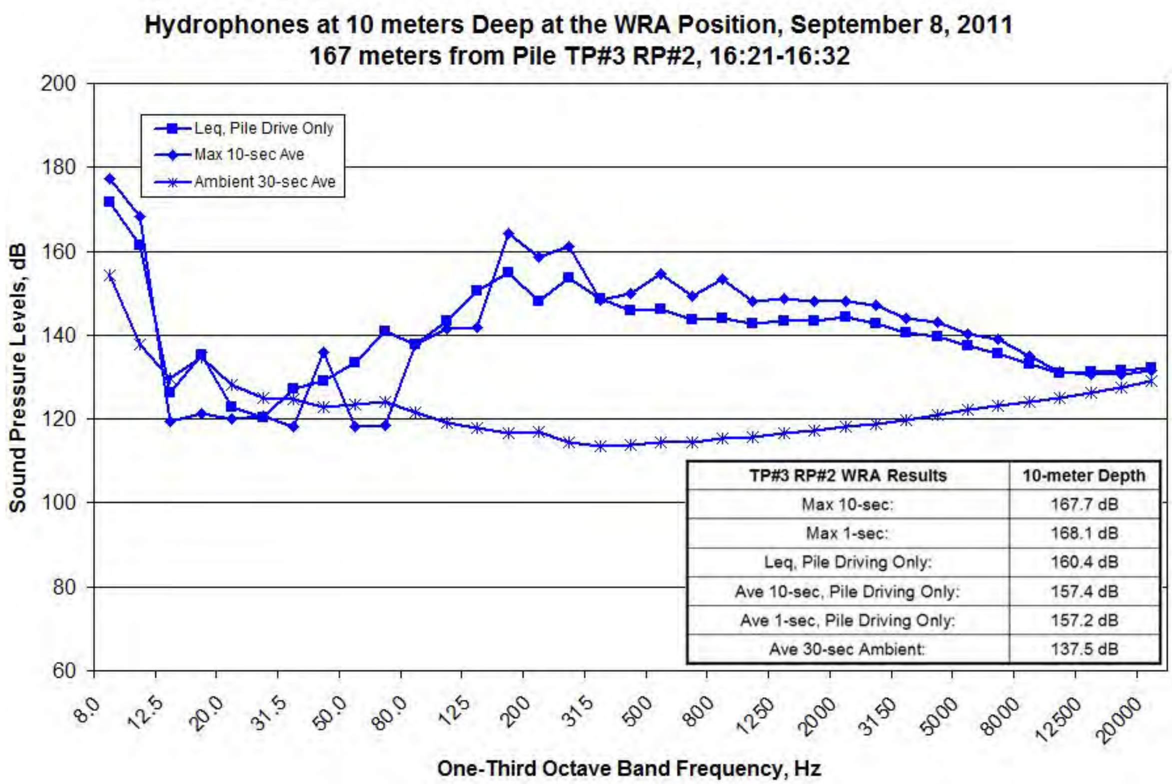

Figure 9. Spectral Data Measured at the WRA Location during TP#3 RP#2, 16:21-16:32, at the Mid-Depth Position on September 8, 2011

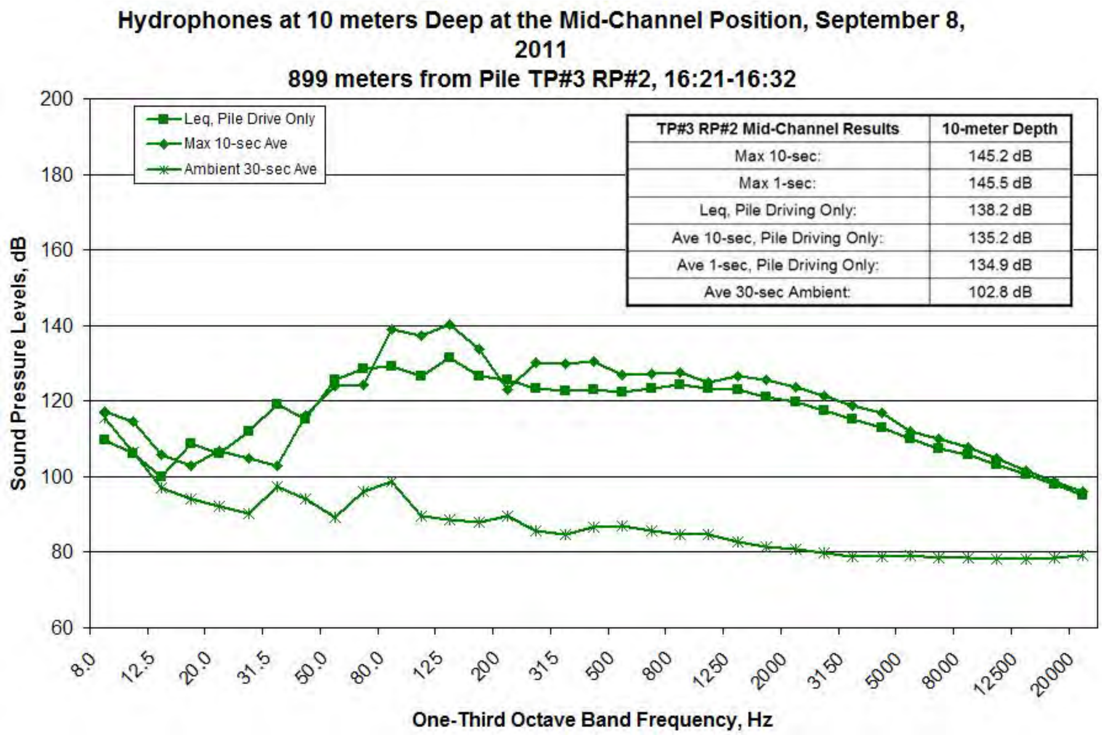

Figure 10. Spectral Data Measured at the MID Location during TP#3 RP#2, 16:21-16:32, at the Mid-Depth Position on September 8, 2011

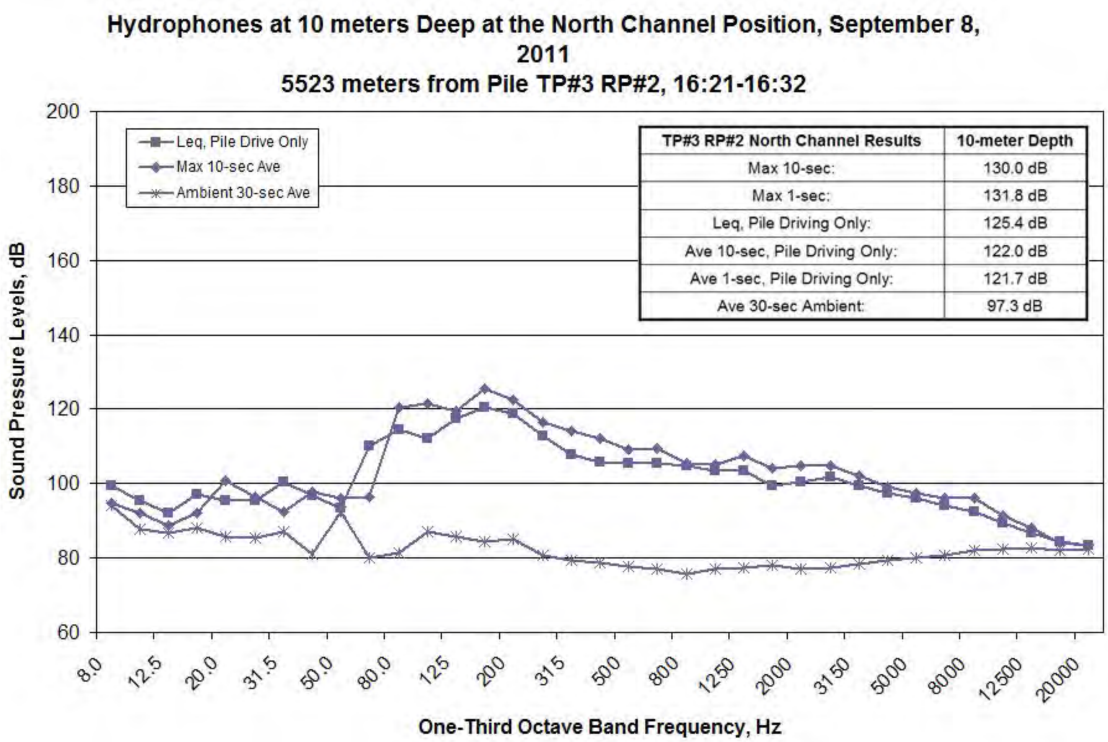

Figure 11. Spectral Data Measured at the NO Location during TP#3 RP#2, 16:21-16:32, at the Mid-Depth Position on September 8, 2011

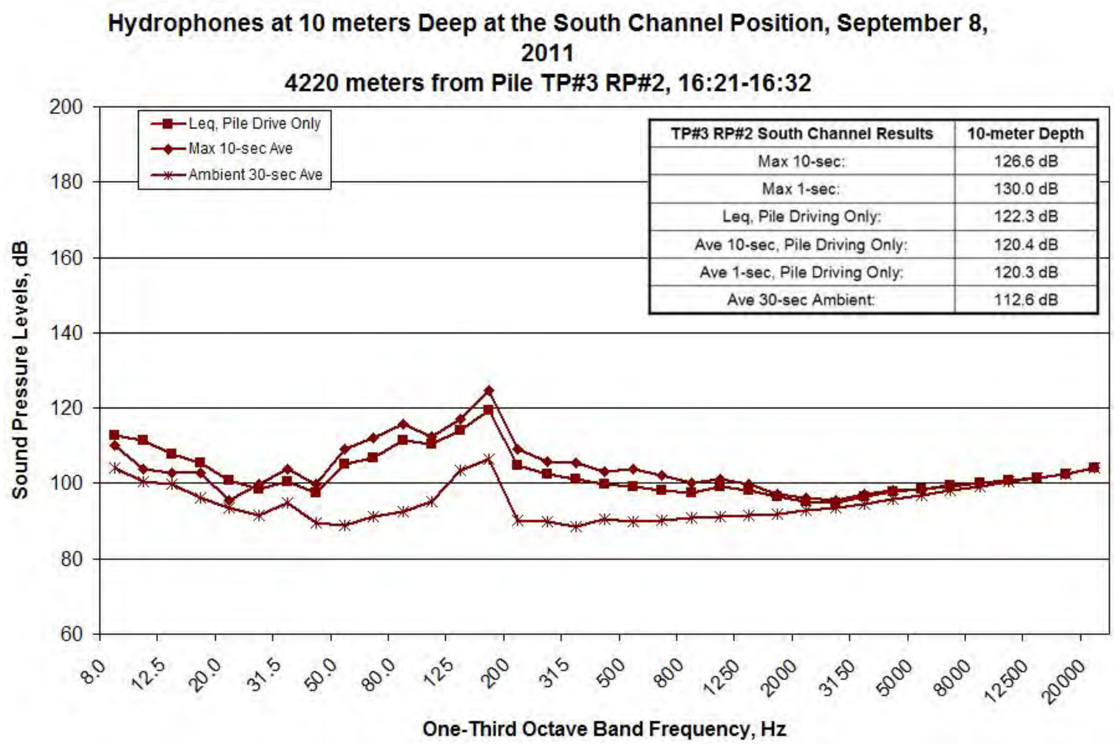

Figure 12. Spectral Data Measured at the SO Location during TP#3 RP#2, 16:21-16:32, at the Mid-Depth Position on September 8, 2011

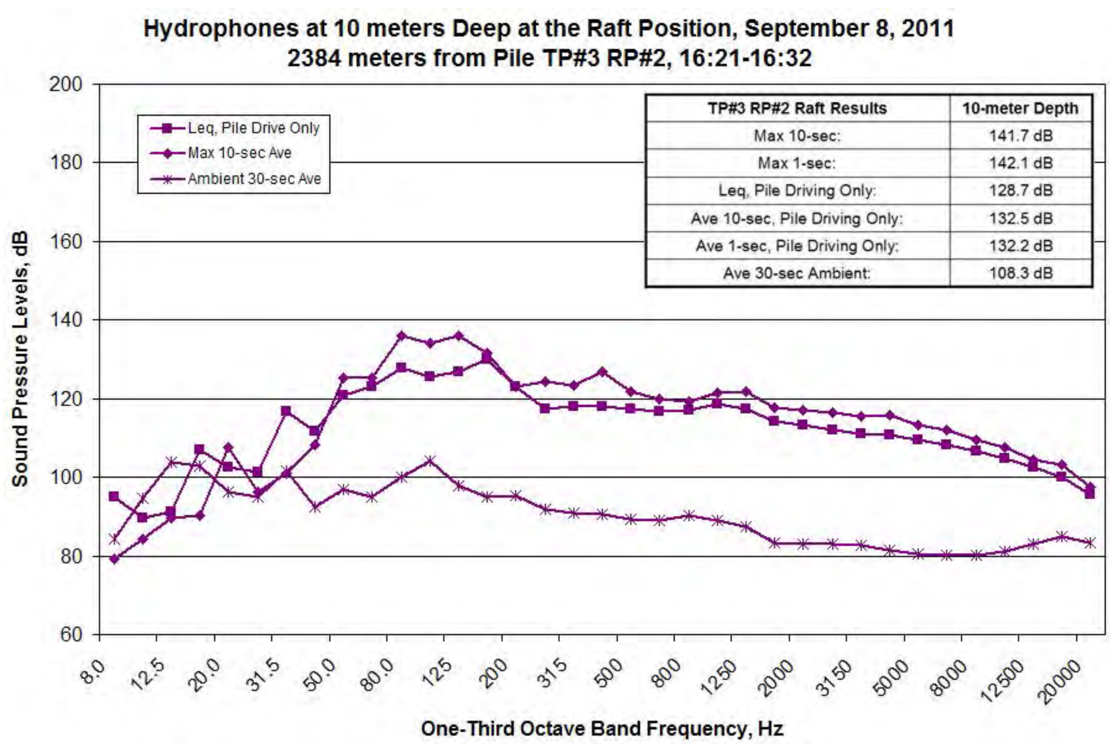

Figure 13. Spectral Data Measured at the RFT Location during TP#3 RP#2, 16:21-16:32, at the Mid-Depth Position on September 8, 2011

Vibratory Pile Removal

Similar to the vibratory installation events, vibratory removal events were also analyzed by calculating L_{eq} for the high-energy driving sequence(s). Such a removal event took place on September 17, 2011 starting at 15:28 and ending at 15:40 when pile TP#7 was removed with the APE600 vibratory hammer. There were no soft-starts, which was also the case for some other vibratory removals if the interval between events was less than 30 minutes. During this event, continuous operation took place throughout the time period, but as was usual with removal events, the initial and final energy levels were significantly greater than the mid-section of the drive. At some of the distant recording locations, the levels during the removal were as low as ambient levels measured before and after the removal. The 1-second L_{eq} time history for TP#7 and the 10-second averages during the pile-removal event are shown in **Figure 16** for each of the measurement locations at the mid-depth hydrophone position. The L_{eq} for locations within the WRA were calculated for the frequency bands of 20-20,000 Hz. For the locations outside the WRA, the L_{eqs} were calculated for the 50-20,000 Hz bands. The distances of each measurement location from TP#7 are also shown in **Figure 16**.

Figures 14 through **20** show the frequency spectra that characterize the results measured at each location, as well as the summary table of results. All figures and a comprehensive results summary table are provided in the appendices. The distances from each pile to the 120 dB limit for each of the vibratory removal events that are listed in **Table 5** were calculated from the results described here.

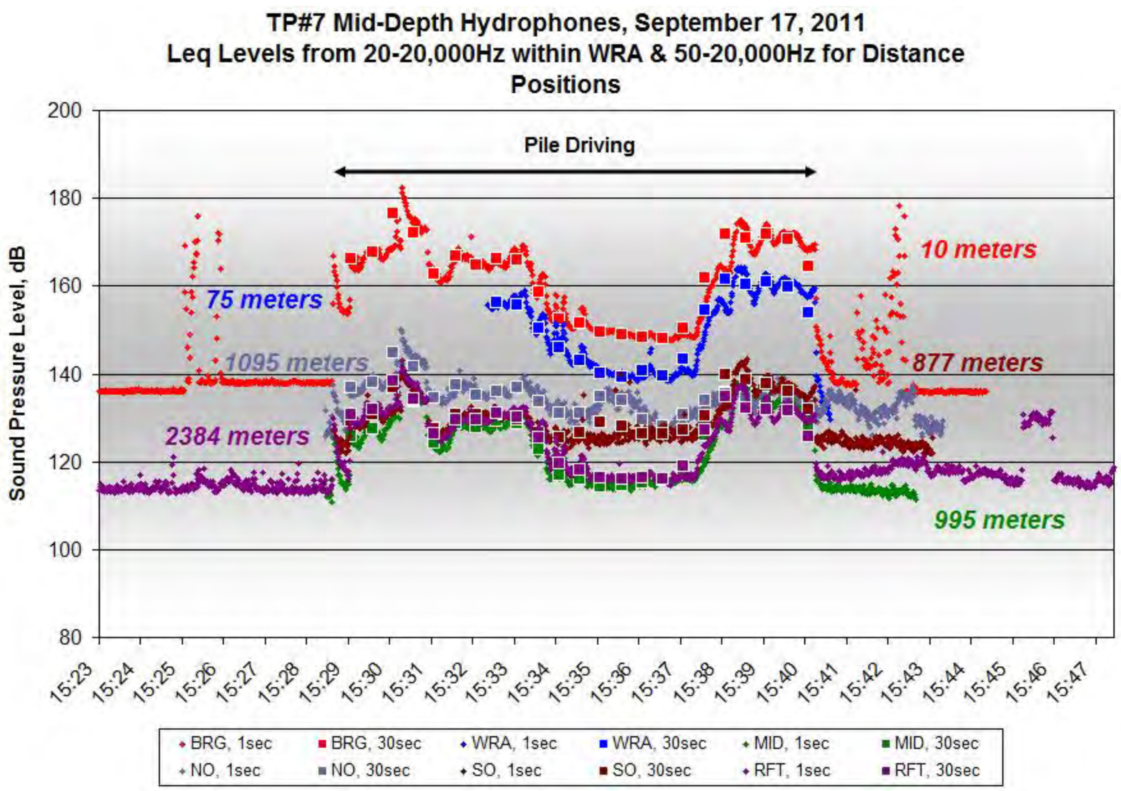

Figure 14. 1-second and 10-second Average Data for Removal of TP#7, 15:28-15:40, at the Mid-Depth Position on September 17, 2011

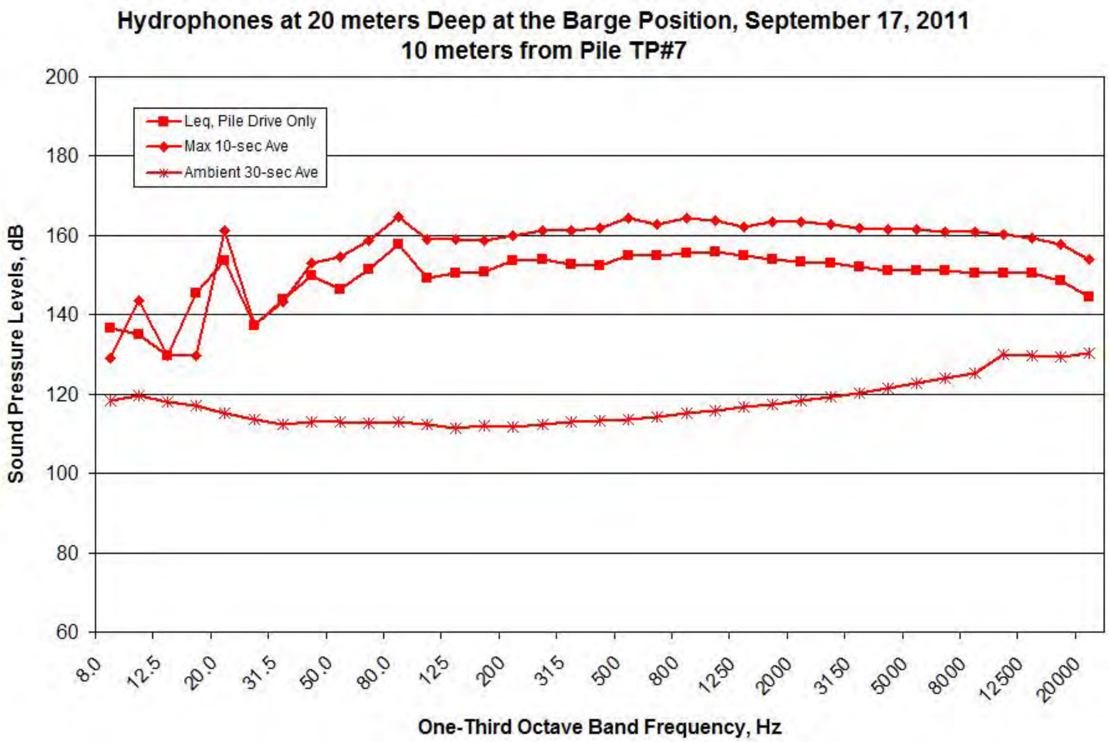

Figure 15. Spectral Data Measured at the BRG Location during TP#7, 15:28-15:40, at the Mid-Depth Position on September 17, 2011

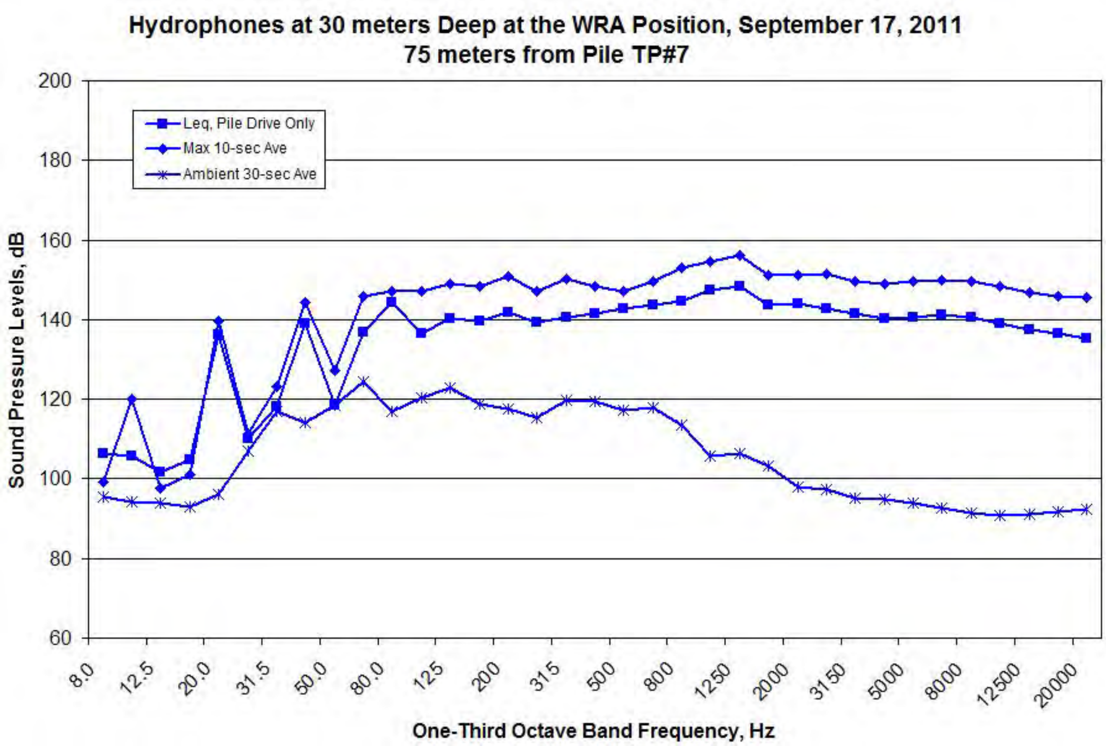

Figure 16. Spectral Data Measured at the WRA Location during TP#7, 15:28-15:40, at the Mid-Depth Position on September 17, 2011

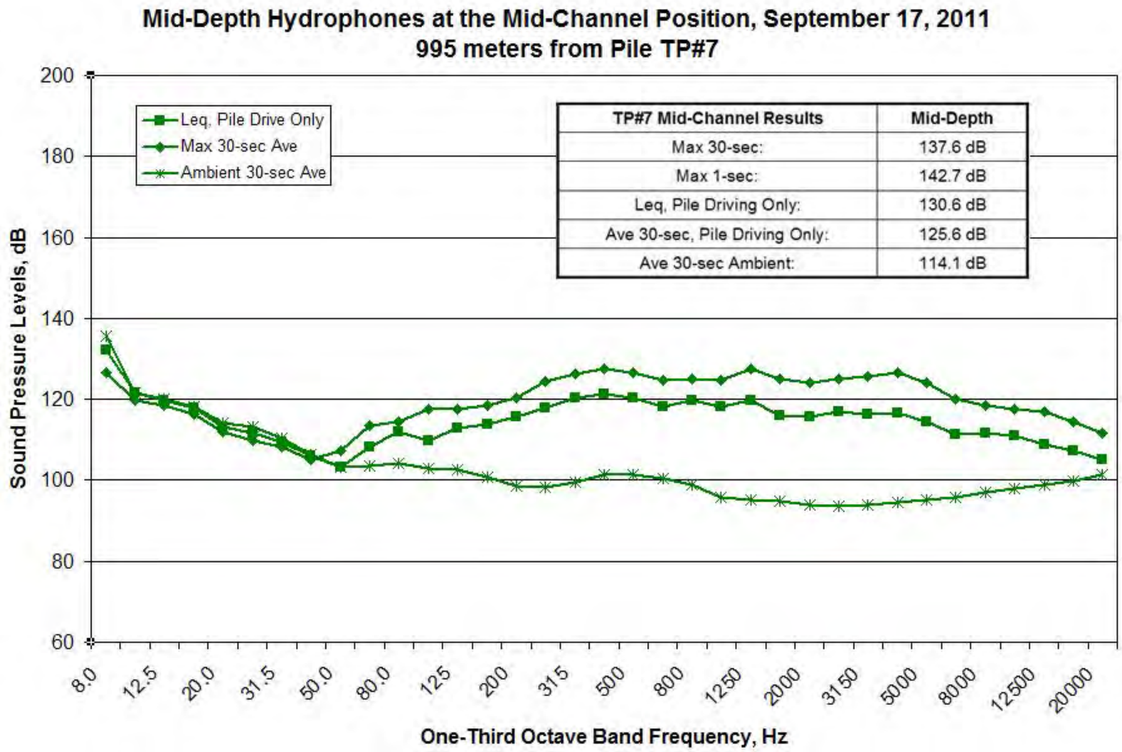

Figure 17. Spectral Data Measured at the MID Location during TP#7, 15:28-15:40, at the Mid-Depth Position on September 17, 2011

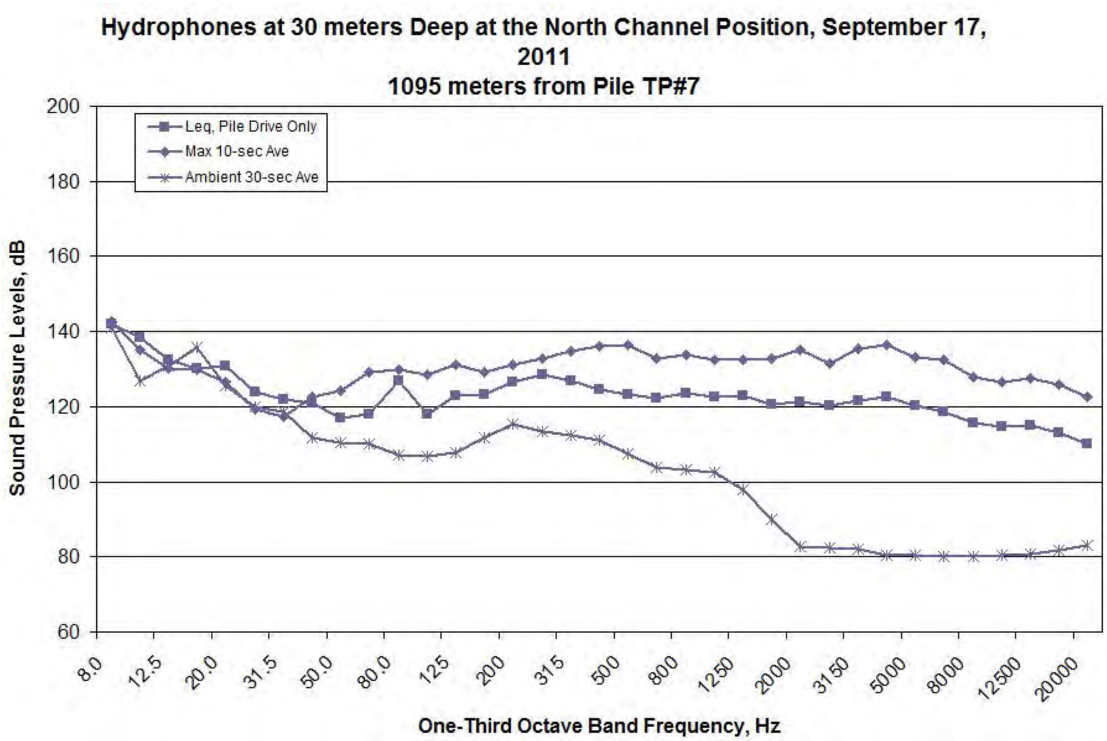

Figure 18. Spectral Data Measured at the NO Location during TP#7, 15:28-15:40, at the Mid-Depth Position on September 17, 2011

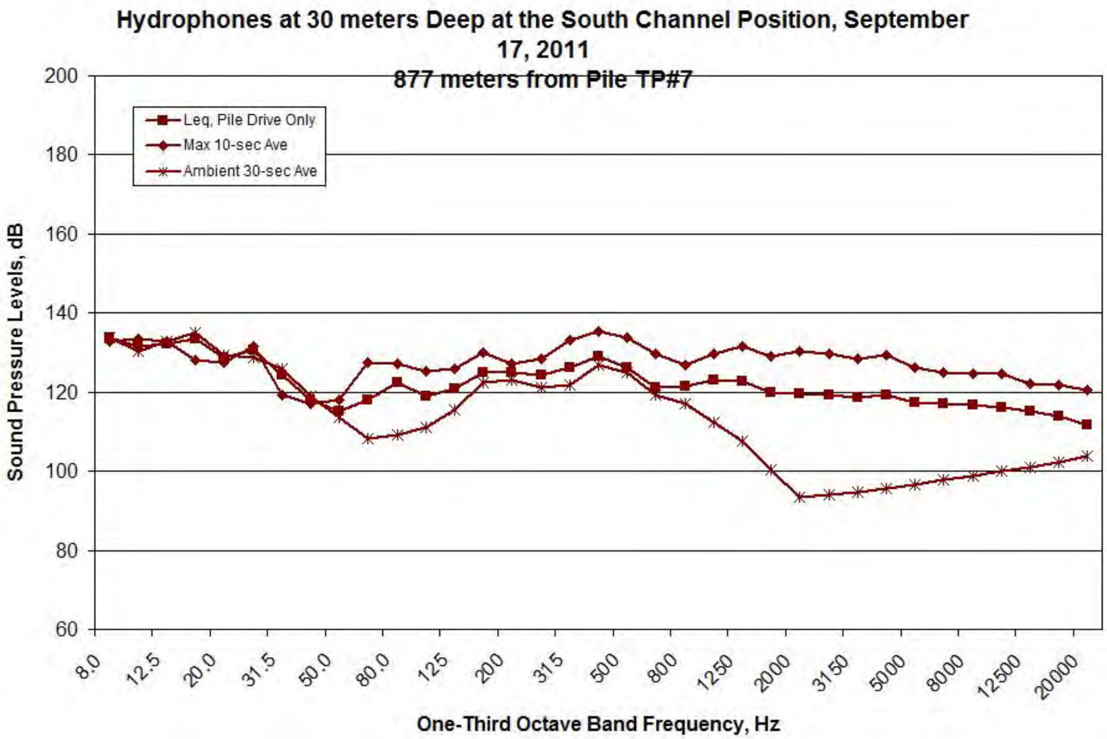

Figure 19. Spectral Data Measured at the SO Location during TP#7, 15:28-15:40, at the Mid-Depth Position on September 17, 2011

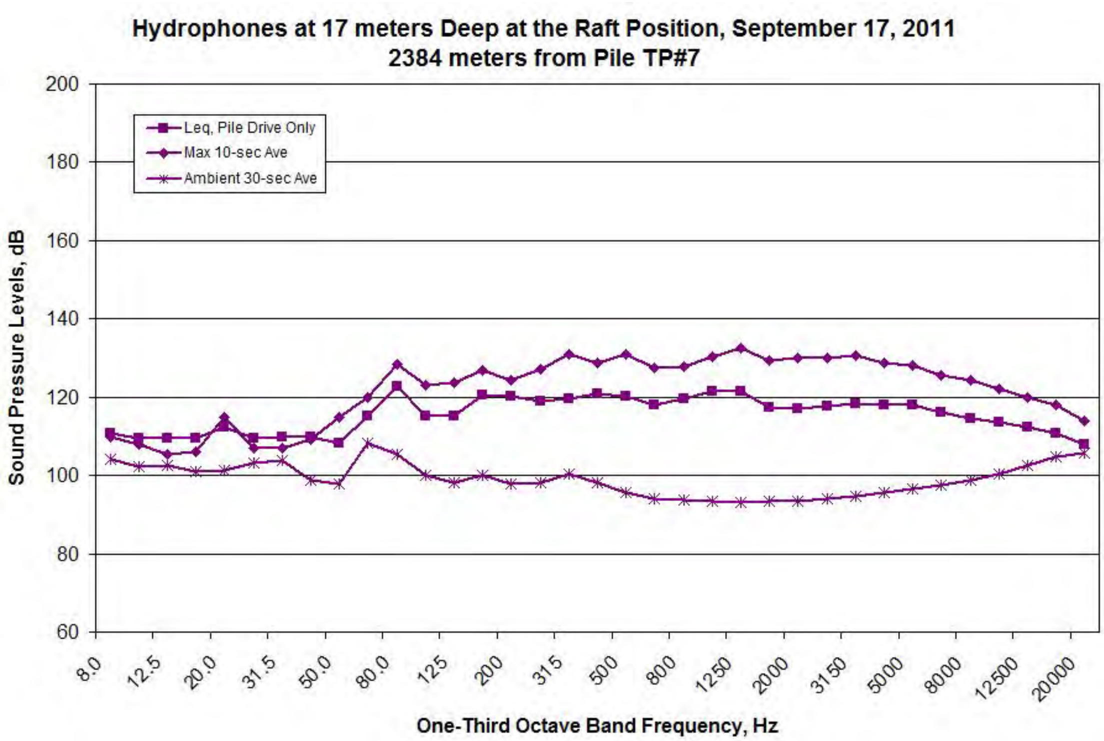

Figure 20. Spectral Data Measured at the RFT Location during TP#7, 15:28-15:40, at the Mid-Depth Position on September 17, 2011

Example of Underwater Sound Data During Impact Pile Driving

Impact pile driving took place primarily in Phase I of TPP. Impact driving for Phase I started on September 1, 2011 and concluded on October 3, 2011. Six piles in Phase I were driven using an impact hammer with and without the bubble curtain; 14 piles were driven with the bubble curtain only, and one pile was driven without the bubble curtain. There were two impact driving events occurring in Phase II on October 4 and October 8, 2011, which both utilized the bubble curtain. Sound levels generated by impact driving varied considerably from pile to pile, as did the effectiveness of the bubble curtain. This section presents and describes the data analysis used for impact pile-driving events and provides a representative event for the bubble on/off conditions.

Each impact event started with a "soft-start" procedure. This was implemented to minimize the effects of the pile driving. During soft-start, the impact hammer started at reduced energy before engaging in high-energy impact. In calculating the RMS and single strike SEL average, the soft-starts were not included in the calculations. However, the soft-starts were included in calculating the cumulative SEL value for each pile. For some piles, there was a limited number of impact strikes, and in counting the number of strikes per pile, the soft-starts were included.

Impact pile-driving acoustical data are provided in graphical and tabular format in **Appendix B**. A time history plot of the 1-second L_{eq} (SEL) sound levels is provided for each position (shown on one chart for comparative purposes). An example of these data is presented in **Figures 21** through **27**. This is when impact pile driving was conducted under bubble curtain on and off conditions on September 1, 2011 with TTP#2. TTP#2 was a 36-inch diameter pile impacted using the D-80 hammer from 15:43 to 15:50. **Figures 21** through **23** are time history plots that show the peak levels, RMS levels, and single strike SEL levels for the mid-depth hydrophone at each of the six measurement locations. Three soft-start impacts were conducted prior to full-drive with the bubble curtain on. Since the bubble curtain was turned off and immediately tested in the bubble curtain off condition, no soft-starts were done prior to the bubble off condition. This was common procedure for all bubble curtain on/off testing. In addition to the peak, RMS, and SEL 1-second results, **Figures 21** through **24** also show the measured distances of each location from TTP#2 at the time of the event. The soft-starts were not discernible at NO due to repositioning and at RFT due to excessive noise. From 15:37 to 15:42, RFT noise reached levels above the BRG and WRA ambient results. Since this was an unmanned position, it was difficult to identify cause, but there was considerable outside interference, which may have included other boats, jet skis, etc., that may have been picked up by the hydrophones. It is possible that there was interference from debris or the raft anchor lines in certain current or wind conditions.

Figures 24 through **29** show the average single strike SEL spectrum over the entire pile-driving event under both bubble curtain on and off conditions and a 10-second average spectrum of the ambient noise just before the pile driving started for all six measurement locations. Also shown on each plot are tables summarizing the average and maximum reported RMS, the average single-strike and cumulative SEL, and a 30-second average ambient RMS plotted in the figure. Similar figures for the remaining impact pile-driving events are provided in **Appendix B**, as is a more comprehensive summary table of all the measured results for both deep and mid-depths. Studying the propagation of the RMS and SEL levels as the distance from the pile increases helped to determine the distance at which the acoustic metric limitations can be found per event.

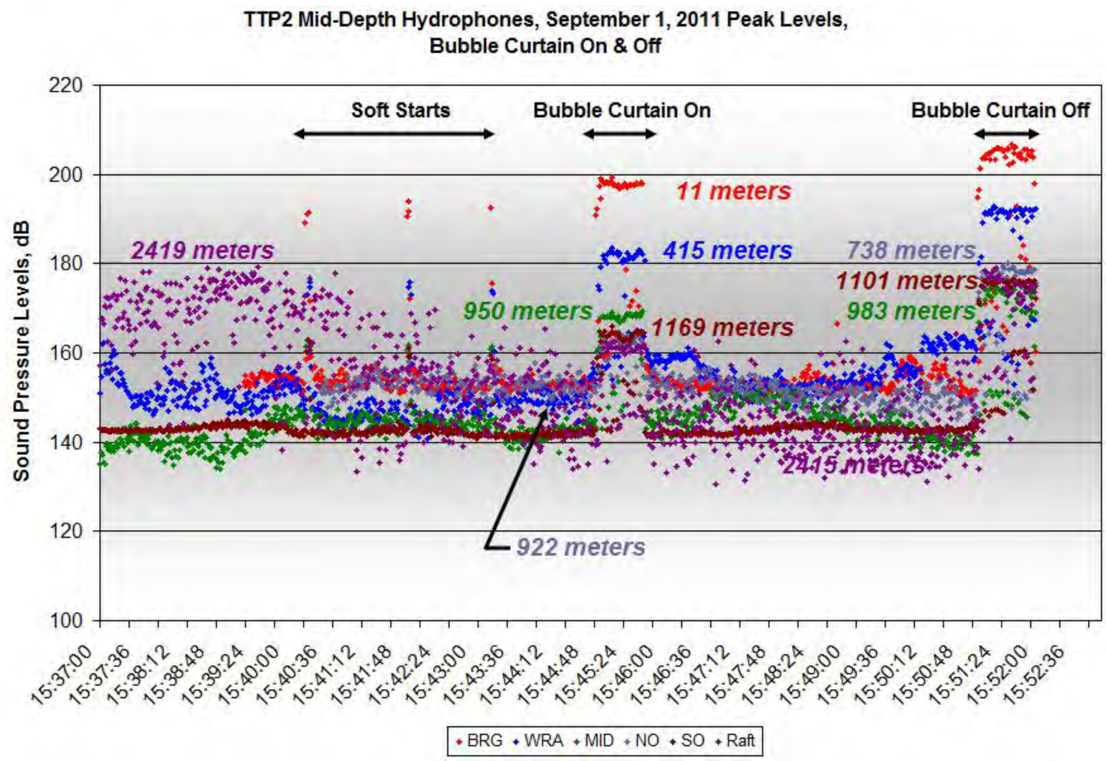

Figure 21. 1-second Peak Level Data for TTP#2 during Bubble On and Off Conditions, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

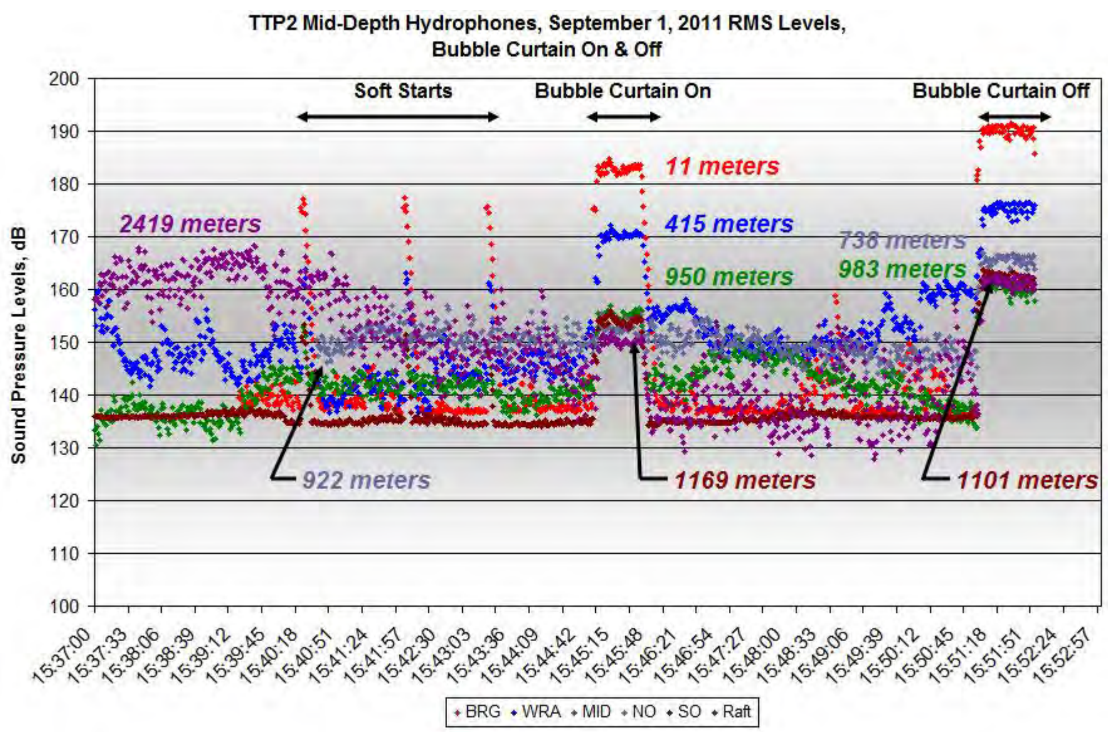

Figure 22. Impulse RMS Data for TTP#2 during Bubble On and Off Conditions, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

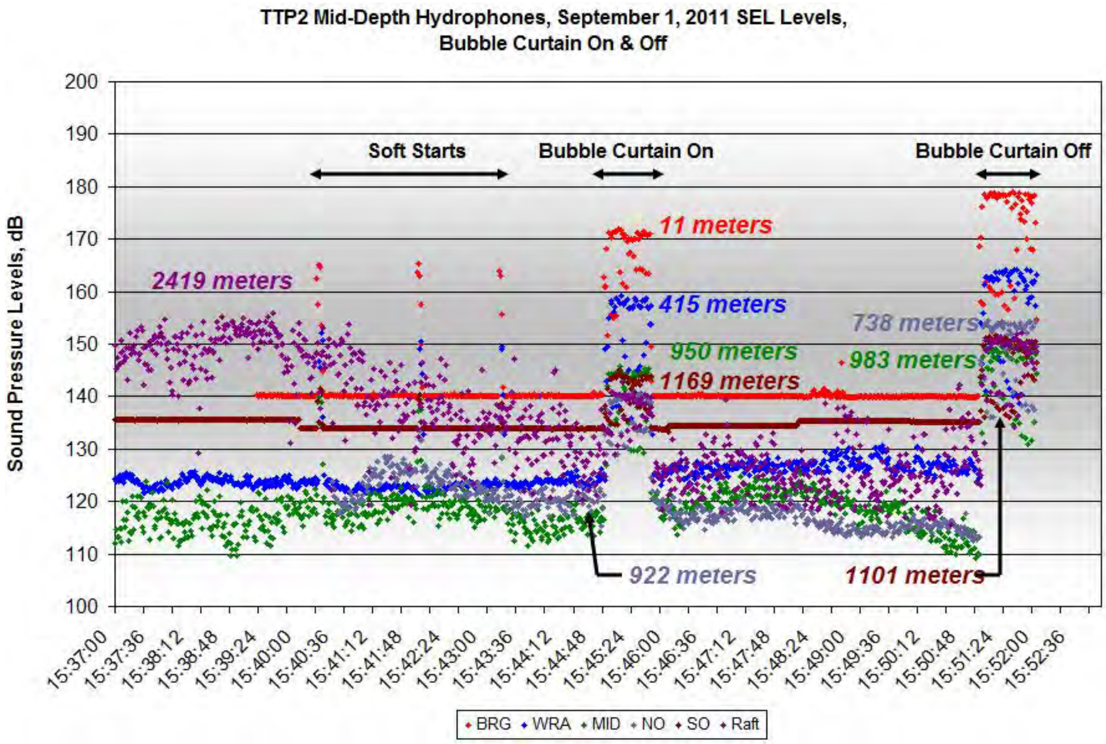

Figure 23. 1-second SEL Data for TTP#2 during Bubble On and Off Conditions, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

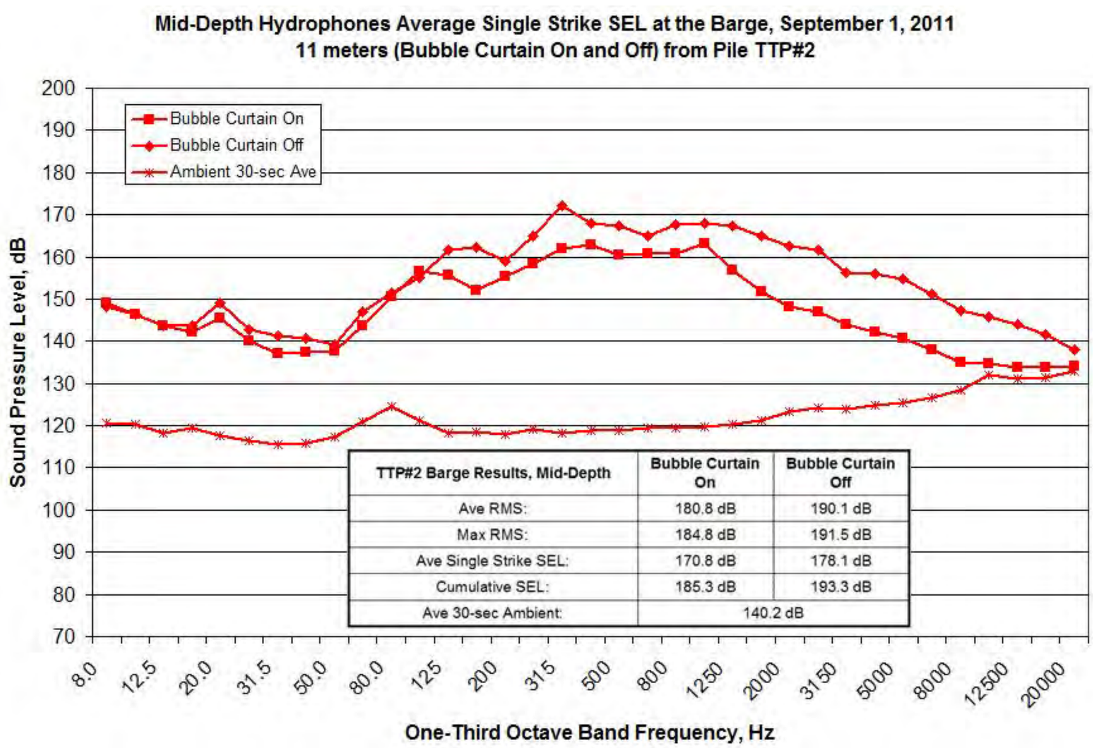

Figure 24. Average 1-second SEL Spectral Data Measured at the BRG Location during TTP#2, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

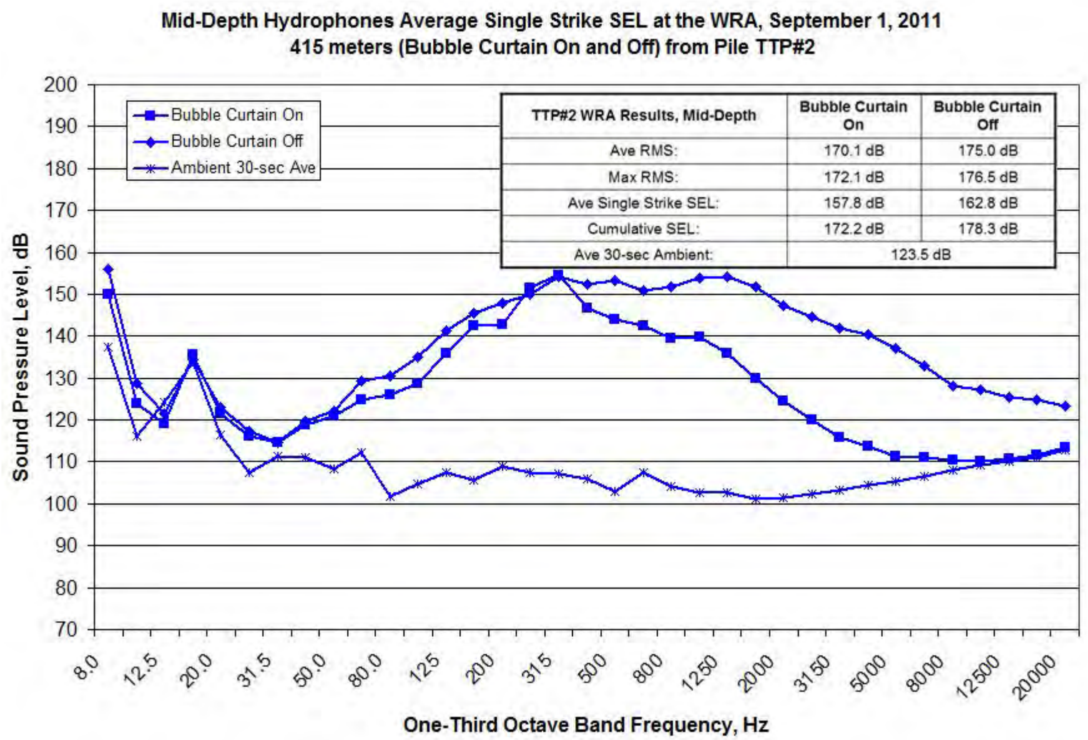

Figure 25. Average 1-second SEL Spectral Data Measured at the WRA Location during TTP#2, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

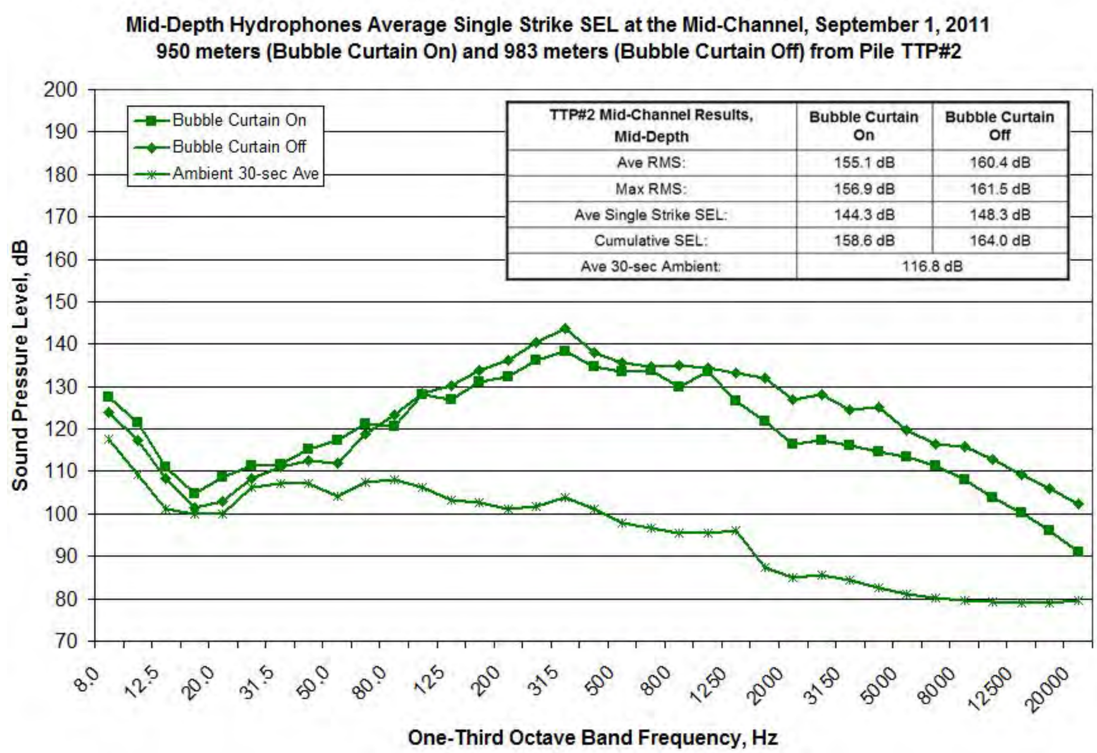

Figure 26. Average 1-second SEL Spectral Data Measured at the MID Location during TTP#2, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

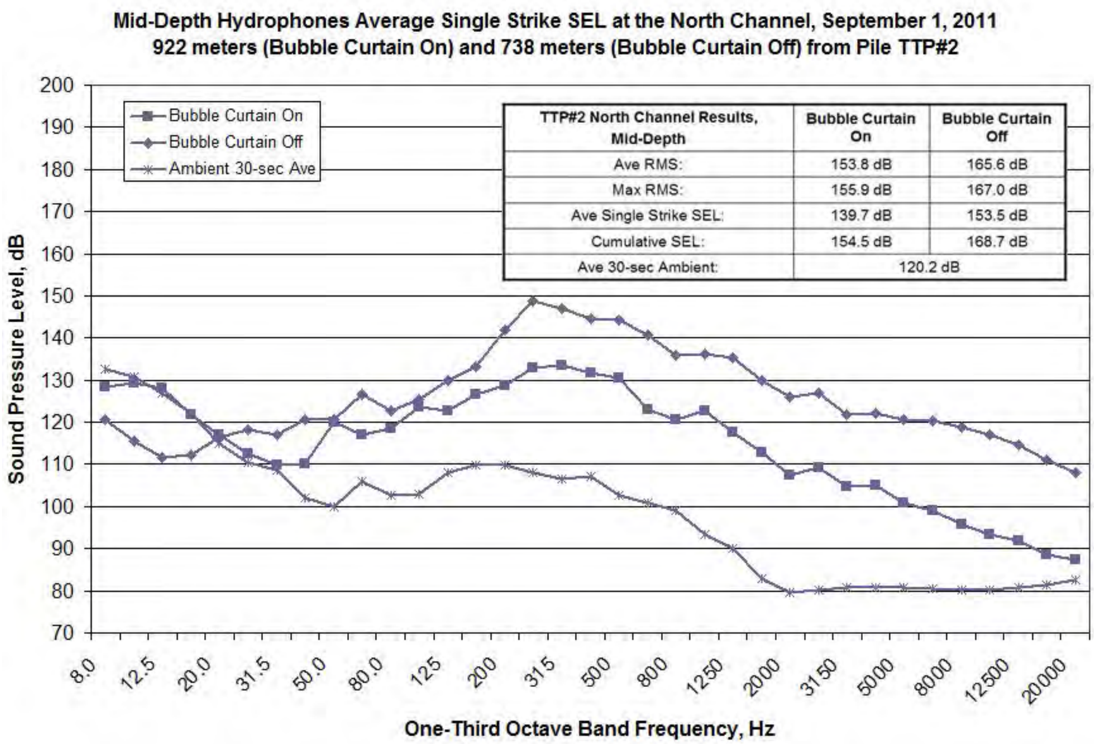

Figure 27. Average 1-second SEL Spectral Data Measured at the NO Location during TTP#2, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

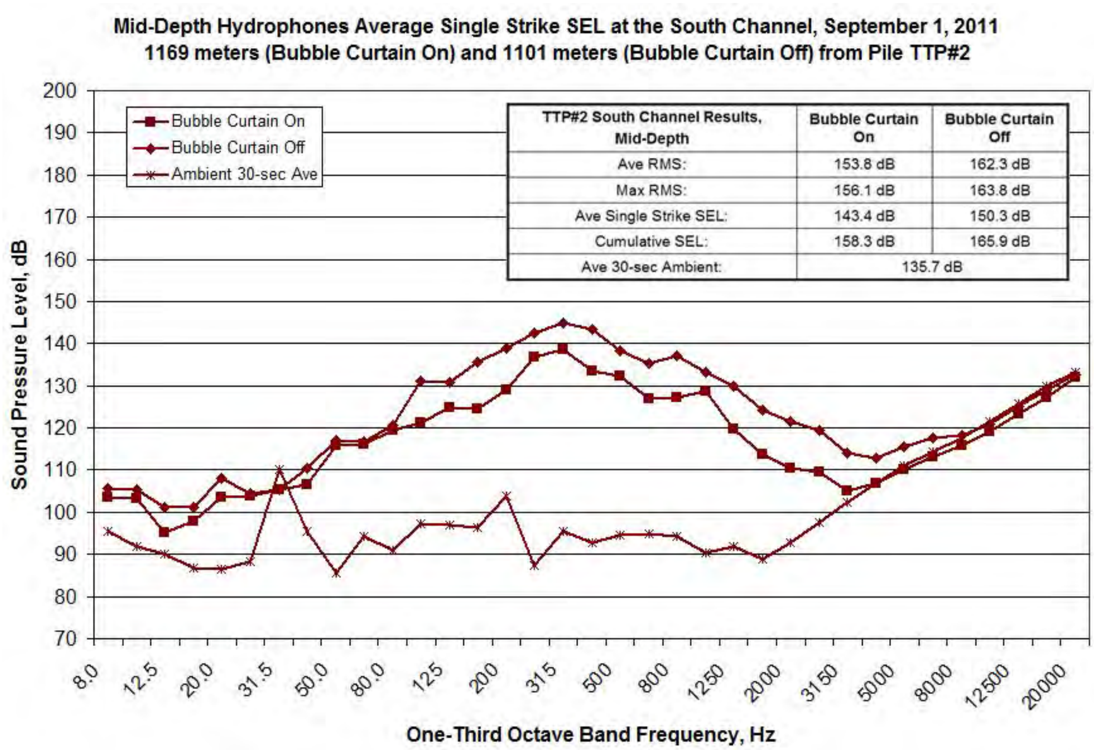

Figure 28. Average 1-second SEL Spectral Data Measured at the SO Location during TTP#2, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

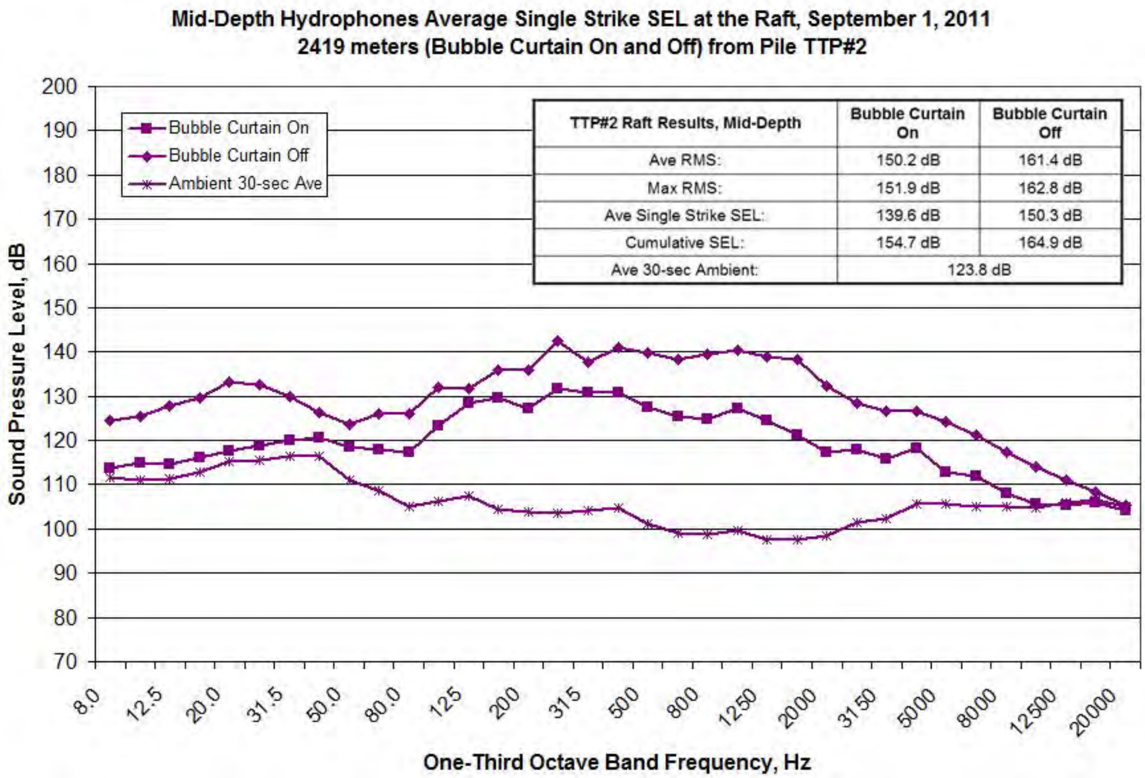

Figure 29. Average 1-second SEL Spectral Data Measured at the RFT Location during TTP#2, 15:43-15:50, at the Mid-Depth Position on September 1, 2011

Example of Airborne Sound Data

Airborne sound data are provided in graphical and tabular format in **Appendix C**. The reference pressure for airborne sound levels (dB) is 20 microPascals. Time history plots of the 1-minute L_{eq} and L_{max} sound levels are provided for each position (shown on one chart for comparative purposes). **Figures 30** through **33** present examples of the time history plots contained in **Appendix C** for the airborne un-weighted L_{eq} and L_{max} and A-weighted L_{eq} and L_{max} data that occurred on September 17, 2011. In this example, pile TP#3 MP#2 was installed using the APE600 vibratory hammer. The airborne data were collected in 1-minute increments and therefore were analyzed continuously from the start of the pile-driving event (16:09) through its conclusion (16:17). This pile-driving event contained a 3-minute hiatus during pile driving that was not included in the calculations of the L_{eq}; however, no such break was apparent for the 1-minute airborne measurements. The un-weighted and A-weighted L_{eq} was calculated by taking the energy average of the spectral information between the frequency bands of 25 to 20,000 Hz for the period of time specific to the pile-driving event. The un-weighted and A-weighted L_{max} represent the maximum level recorded per minute. **Figures 30** through **33** also show the measured distances of each microphone from TP#3 MP#2 at the time of the event.

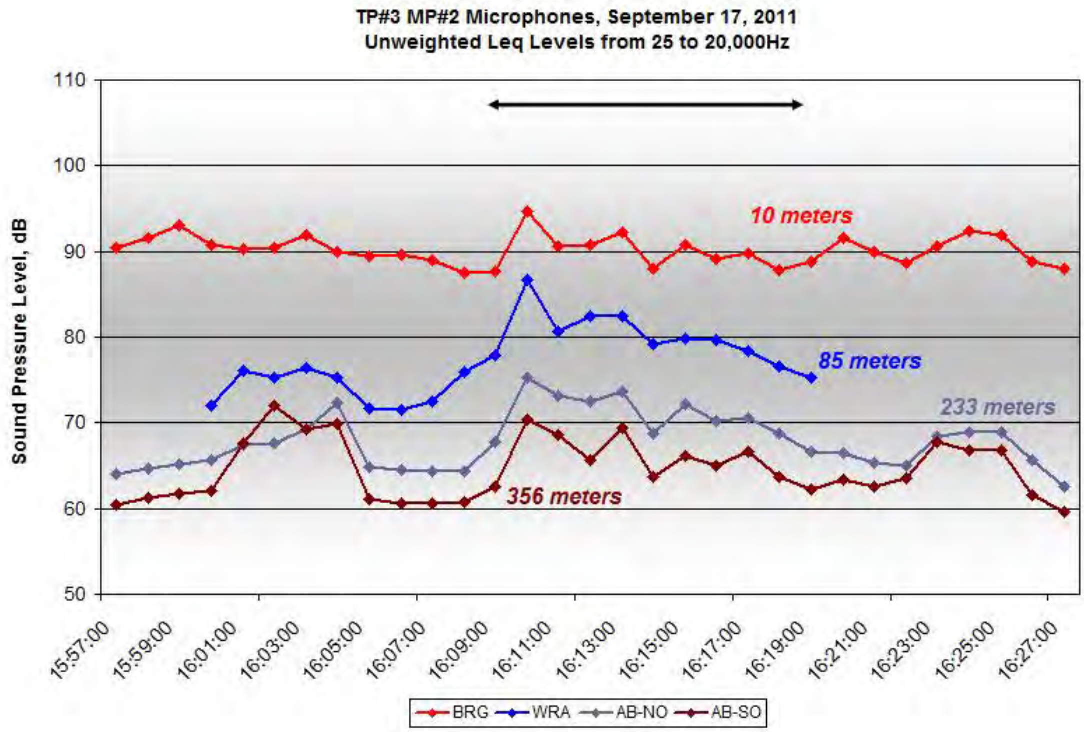

Figure 30. 1-minute Un-weighted Leq Data for TP#3 MP#2, 16:09-16:17, at the Airborne Microphones on September 17, 2011

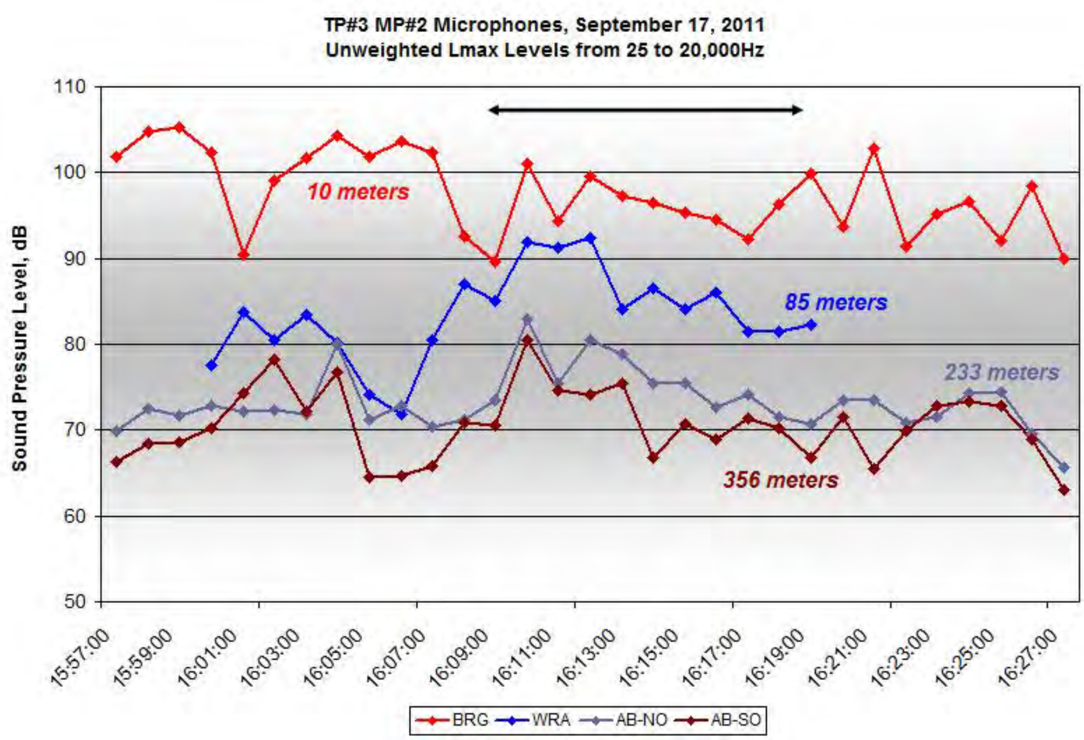

Figure 31. 1-minute Un-weighted Lmax Data for TP#3 MP#2, 16:09-16:17, at the Airborne Microphones on September 17, 2011

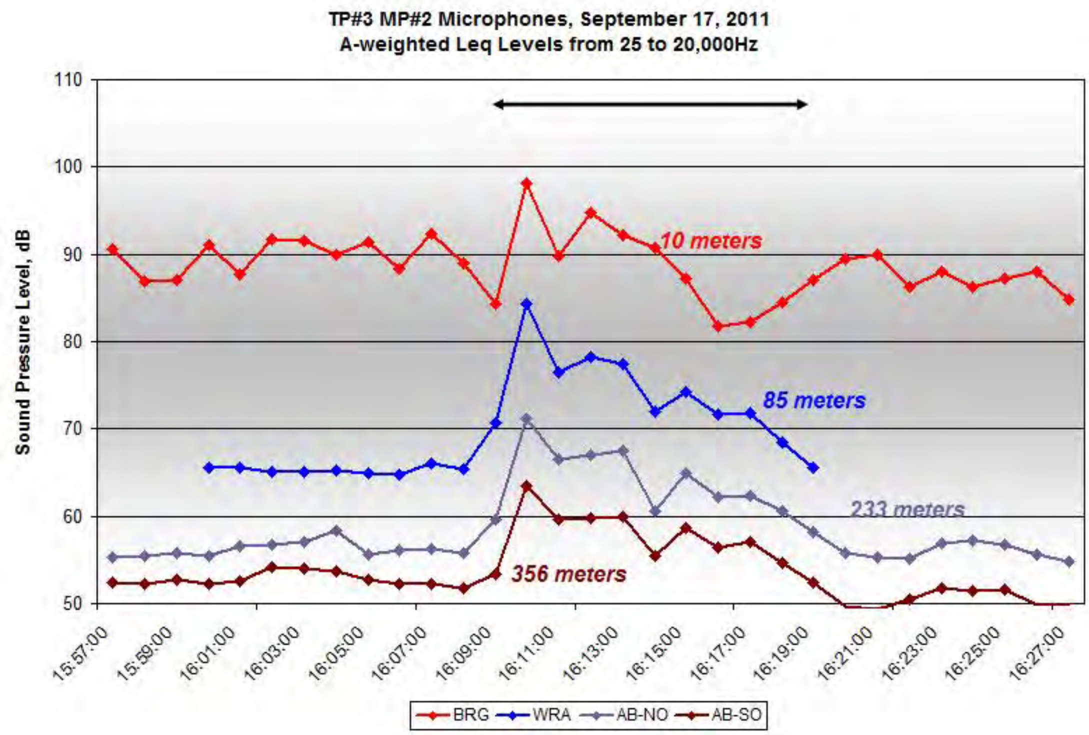

Figure 32. 1-minute A-weighted Leq Data for TP#3 MP#2, 16:09-16:17, at the Airborne Microphones on September 17, 2011

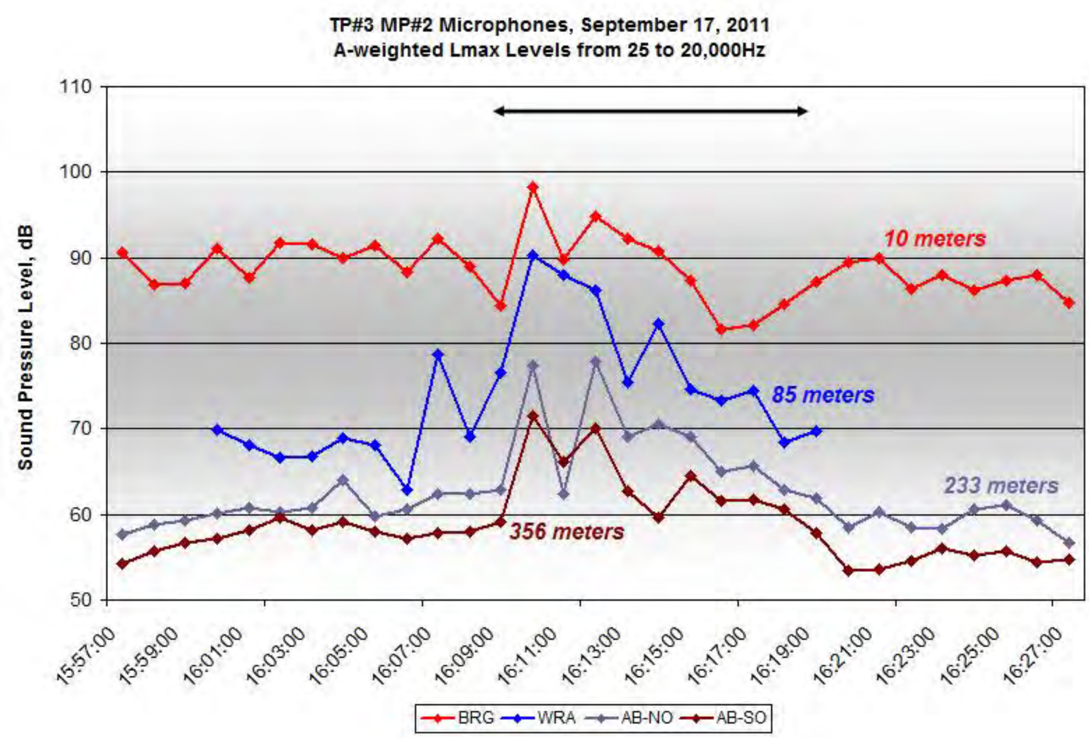

Figure 33. 1-minute A-weighted Lmax Data for TP#3 MP#2, 16:09-16:17, at the Airborne Microphones on September 17, 2011

Figures 34 through **37** show the frequency spectra (based on the 1-minute L_{eq} and L_{max}) over the entire pile-driving event for both un-weighted and A-weighted data. Three-minute average spectra of the ambient noise taken just before the pile-driving event are also shown. All four measurement locations are provided. Summary tables on the plots illustrate the overall values used to determine the distances to the 92 dBA, 100 dB and 90 dB limits. Similar plots of the L_{eq} and L_{max} levels, as well as the corresponding spectra for the remaining pile-driving events and a comprehensive summary table are provided in **Appendix C**.

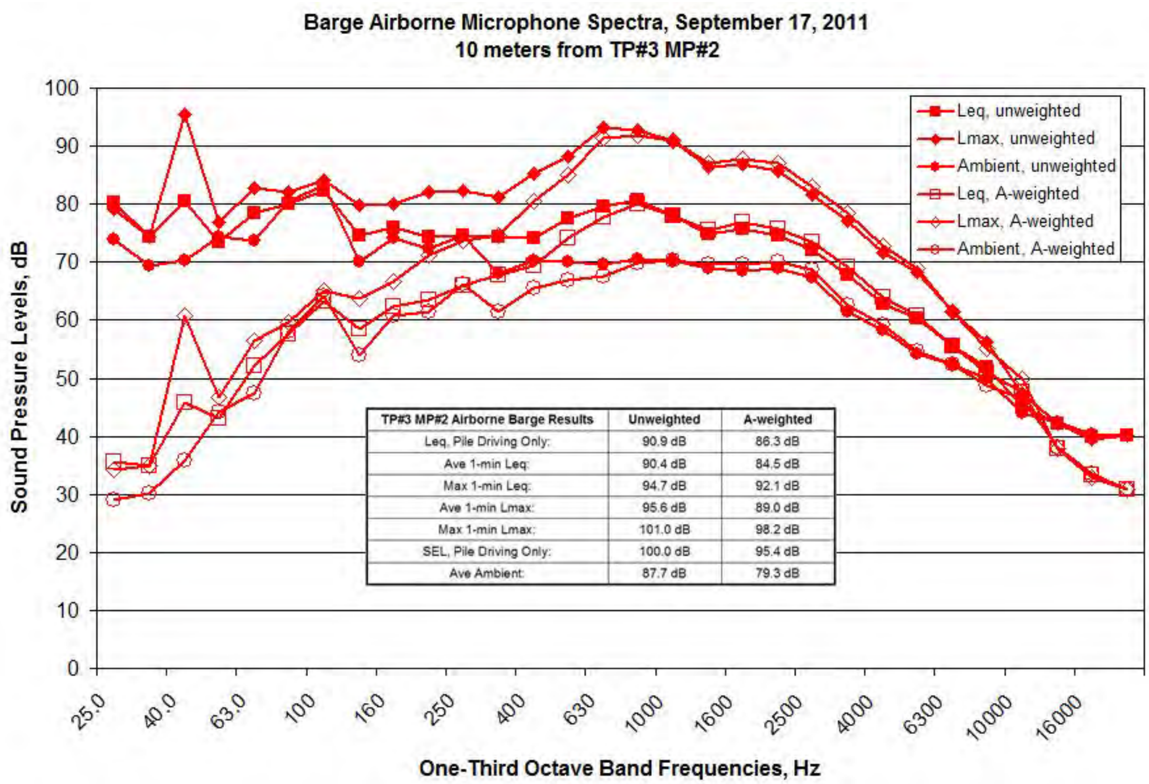

Figure 34. Average 1-minute Leq and Maximum 1-Minute Lmax Spectra at the BRG Microphone during TP#3 MP#2, 16:09-16:17 on September 17, 2011

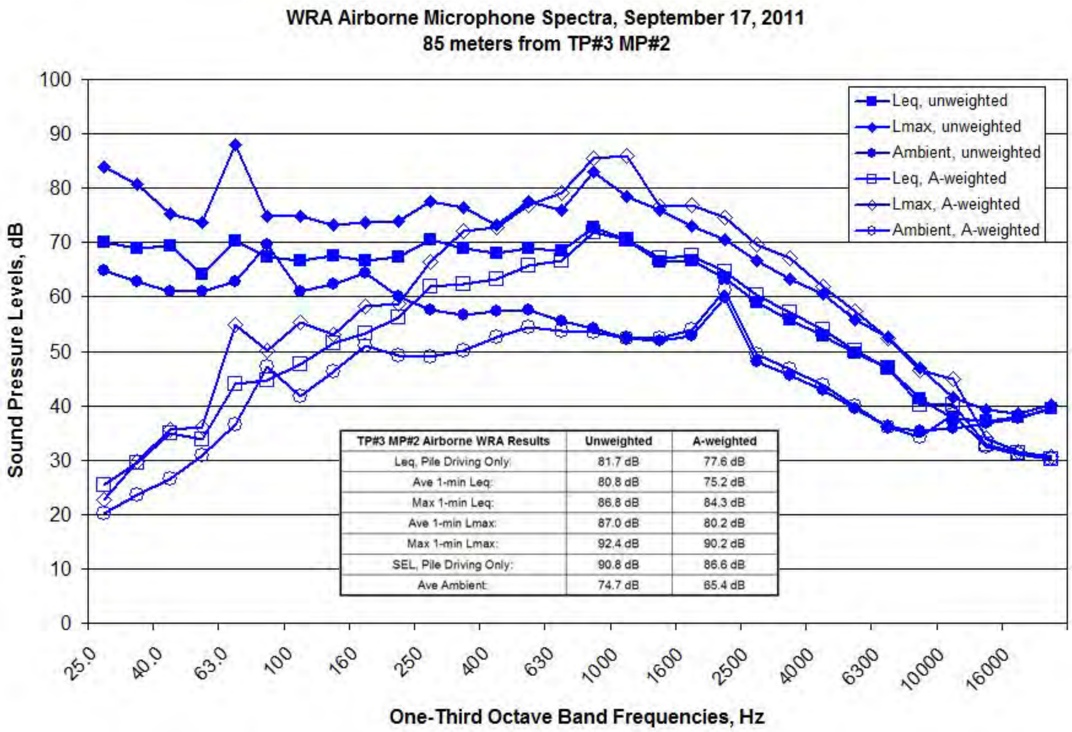

Figure 35. Average 1-minute Leq and Maximum 1-Minute Lmax Spectra at the WRA Microphone during TP#3 MP#2, 16:09-16:17 on September 17, 2011

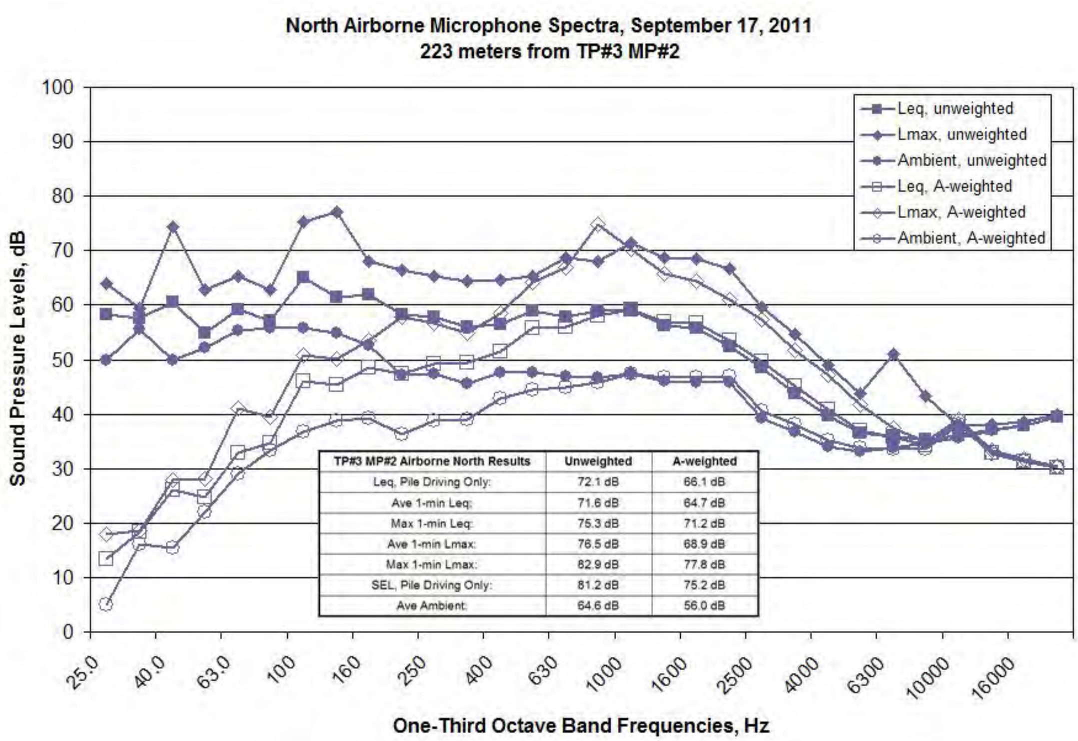

Figure 36. Average 1-minute Leq and Maximum 1-Minute Lmax Spectra at the AB-NO Microphone during TP#3 MP#2, 16:09-16:17 on September 17, 2011

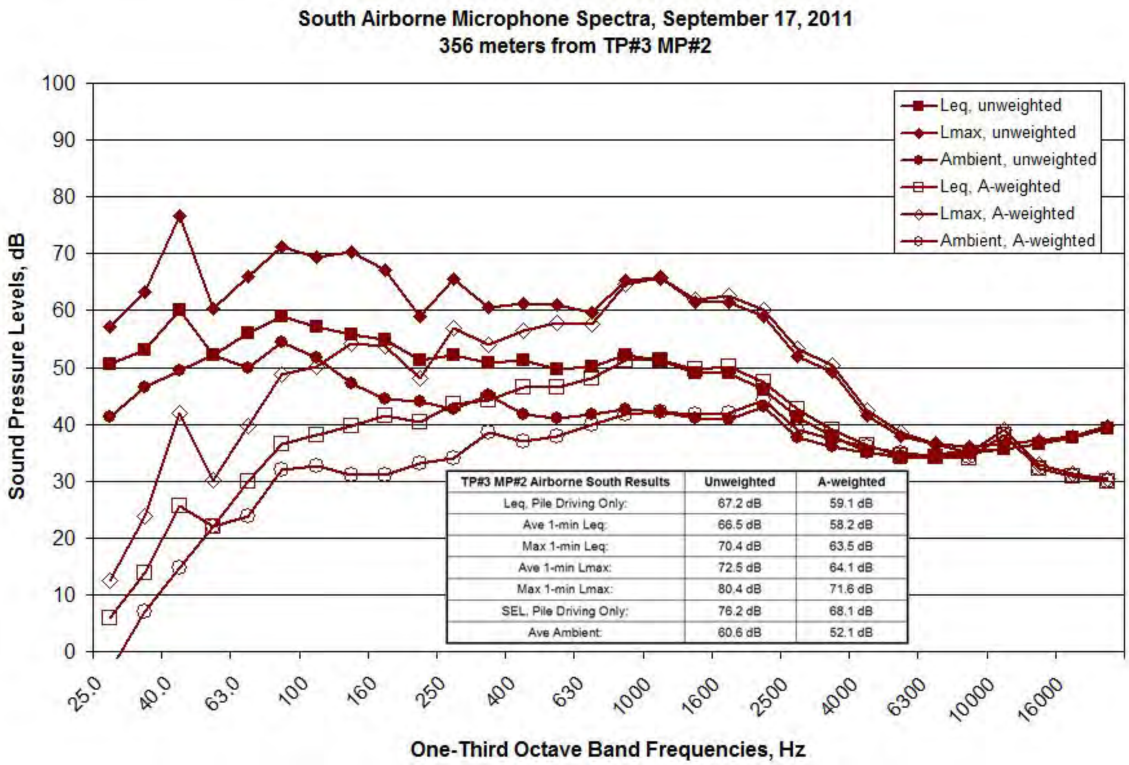

Figure 37. Average 1-minute Leq and Maximum 1-Minute Lmax Spectra at the AB-SO Microphone during TP#3 MP#2, 16:09-16:17 on September 17, 2011

Example of Ambient Underwater Sound Data

Ambient levels were measured prior to and following pile-driving events at each of the distant measurement locations. Although ambient measurements were also made before and after pile driving at positions inside the WRA (BRG and WRA), those systems were set up to measure higher pile-driving sounds than the systems outside the WRA. As a result, levels before and after pile-driving conditions likely reflect instrument background levels rather than ambient conditions. Typically, measurements began several minutes before pile driving and continued several minutes after pile driving (see Time History Plots in **Appendices A** and **B**). There were exceptions when monitoring boats were forced to maneuver just prior and/or after pile driving.

If sound levels measured during pile-driving levels were abnormally high due to inadequate testing conditions, such as strong water currents, the same high levels would appear in the ambient data as well, and prove not to be caused by pile driving. Furthermore, by taking ambient measurements before and after pile-driving events, effects of the changing environmental conditions on the results were observed. These ambient data are discussed in the pile-driving results sections. Ambient data were also acquired outside the WRA during “red days” when no piles were driven. The ambient data were analyzed as RMS levels over a given time period. **Figure 38** represents typical ambient data from the 1-second L_{eq} measurements taken at the mid-level and deep depths when the vessel was located approximately 2,300-2,500 meters from the job site, which corresponds to the distances of the NO and SO locations. The 1-second data shown in the figure were calculated by summing the energy in the frequency bands from 50 to

20,000 Hz, which is the same frequency range used to calculate the L_{eq} values during pile driving at these distances. Also included in **Figure 6** are the 10-second energy averages of the ambient data over the testing period. **Figure 39** shows the full spectra of the ambient measurements from 8 to 20,000 Hz. The table included on the spectra plots summarizes the overall 1-second L_{eqs} calculated for different frequency band ranges, as well as the maximum 10-second average measured during the testing period.

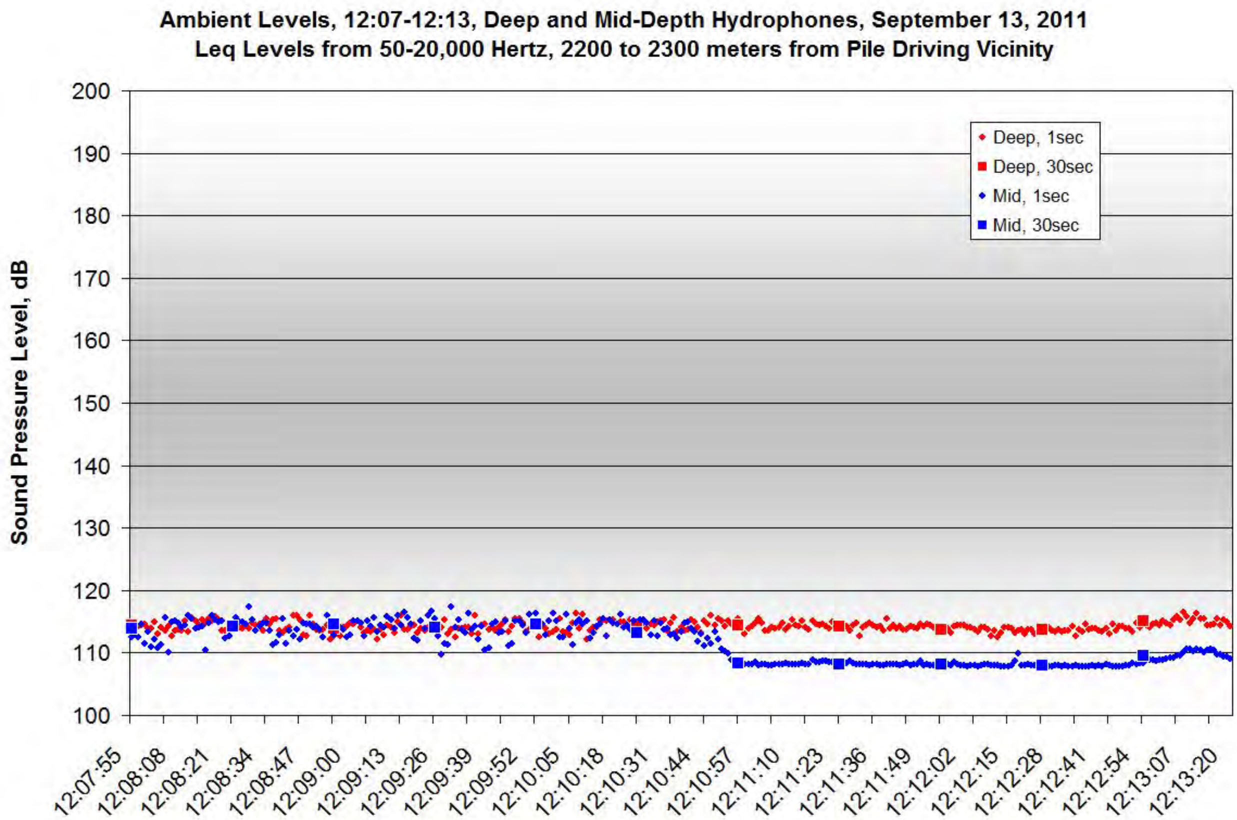

Figure 38. Typical Ambient Levels Measured from 50 to 20,000 Hz on September 13, 2011, 1,000 meters from the Job Site

The data in the figures were collected on September 13, 2011, from 12:07 to 12:13. Conditions during ambient testing were overcast with southwest winds ranging from 3.5 to 5.8 mph and little water disturbance. Overall RMS levels calculated over the entire six-minute measurement duration were approximately 114.3 dB at the deep depth and 112.4 dB at the mid-depth. The frequency spectra shown in **Figure 39** indicate that ambient levels are dominated by sounds (or levels) below 200 Hz. Ambient results varied with the testing conditions throughout the course of the TPP. These variations during any given pile-driving event are discussed in the subsequent sections. The results showed here reflected calm conditions with relatively light currents.

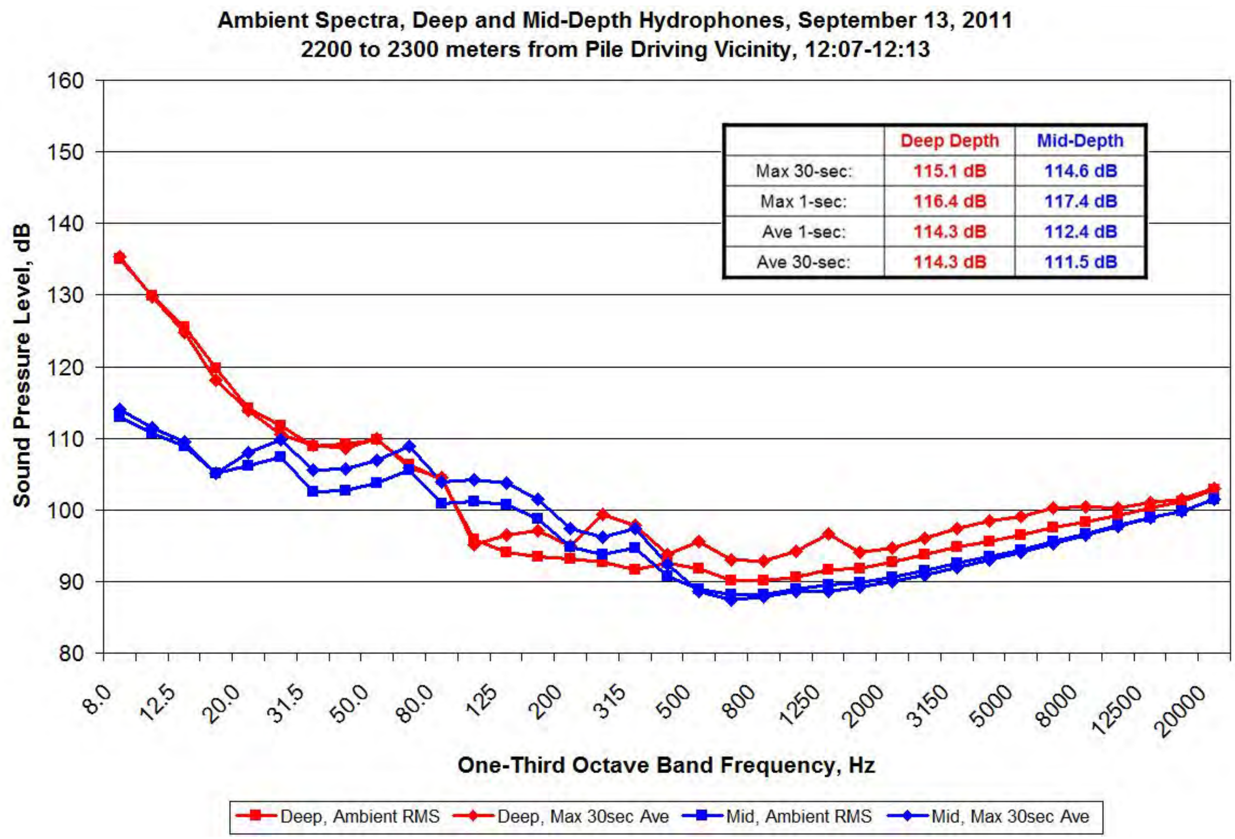

Figure 39. Ambient Spectra Measured on September 13, 2011, 2200 to 2300 meters from the Job Site

Example of Ambient Airborne Sound Data

Ambient levels were measured prior to and following pile-driving events at each of the land based airborne measurement locations. Although ambient measurements were also made before and after pile driving at the Barge and WRA positions, those systems were close to the work being preformed and had operational noise rather than ambient conditions. The measurements were recorded 24-hours however only the time prior to and after the pile driving events is shown (see Time History Plots in Appendix C).

The ambient data were analyzed as L_{eq} levels over a given time period. **Figure 40** represents typical ambient data from the 1-minute L_{eq} measurements taken at the North and South land based locations located approximately 225 and 290 meters from the Pile driving respectively. The one-minute data shown in the figure were calculated by summing the energy in the frequency bands from 25 to 20,000 Hz. Below 25 Hz even a very light wind can affect the measured levels. The difference between using the 10-20,000 Hz and 25-20,000 Hz was compared on days where there was no wind or rain and calculated to a less than a 0.3 dB difference between the two frequency ranges. So to reduce the effects of the environmental conditions the 25-20,000 Hz range was used. There was no difference in the A-weighted levels in the calculations for either range. **Figure 41** shows the full spectra of the ambient measurements from 10 to 20,000 Hz and the levels calculated using both frequency ranges.

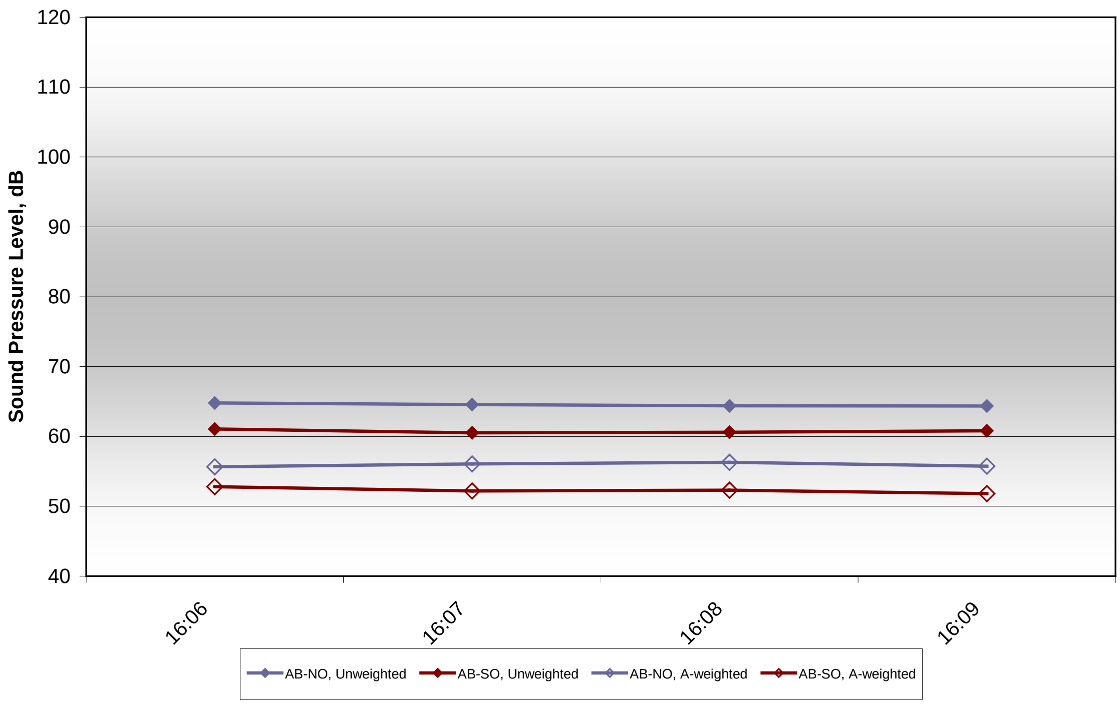

Figure 40. Typical Ambient Levels Measured from 25 to 20,000 Hz on September 17, 2011 at the North and South Land Based Locations

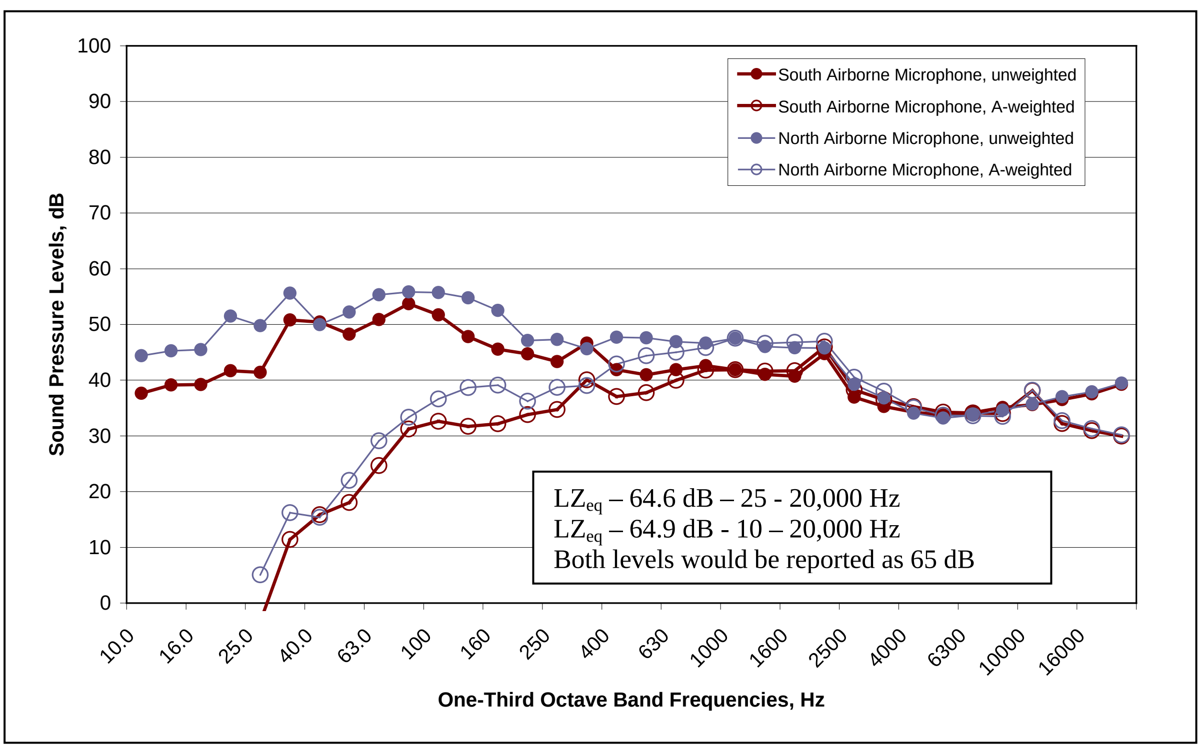

Figure 41. Ambient Spectra Measured on September 17, 2011 at the North and South Land Based Locations

Example of Bubble Curtain Effect

One of the objectives for impact pile-driving monitoring effort was to gauge the effectiveness of the bubble curtain as a sound attenuation measure. As depicted in **Figures 21** through **23**, from September 1, 2011, TTP#2 was driven with and without the bubble curtain. The average RMS levels were reduced by 4.9 to 11.8 dB, while the average single-strike SELs were reduced by 4.0 to 13.8 dB. The bubble curtain also reduced the maximum RMS and cumulative SEL by 4.4 to 11.1 dB and 5.4 to 14.2 dB, respectively. All measured results and calculated level reductions for TTP#2 are shown in **Table 5**. The large variation in level reductions was common for bubble curtain on/off studies in TPP. A discussion of bubble curtain effectiveness is provided in **Section 4**.

Table 5. Level Difference on September 1, 2011, between TTP#2 with the Bubble Curtain On and TTP#2 without the Bubble Curtain

Location	Pile	Ave RMS	Max RMS	Ave SEL	Cumulative SEL
BRG	Bubble On	180.8 dB	184.8 dB	170.8 dB	185.3 dB
	Bubble Off	190.1 dB	191.5 dB	178.1 dB	193.3 dB
	Difference	***9.3 dB***	***6.7 dB***	***7.3 dB***	***8.0 dB***
WRA	Bubble On	170.1 dB	172.1 dB	157.8 dB	172.2 dB
	Bubble Off	175.0 dB	176.5 dB	162.8 dB	178.3 dB
	Difference	***4.9 dB***	***4.4 dB***	***5.0 dB***	***6.1 dB***
MID	Bubble On	155.1 dB	156.9 dB	144.3 dB	158.6 dB
	Bubble Off	160.4 dB	161.5 dB	148.3 dB	164.0 dB
	Difference	***5.3 dB***	***4.6 dB***	***4.0 dB***	***5.4 dB***
NO	Bubble On	153.8 dB	155.9 dB	139.7 dB	154.5 dB
	Bubble Off	165.6 dB	167.0 dB	153.5 dB	168.7 dB
	Difference	***11.8 dB***	***11.1 dB***	***13.8 dB***	***14.2 dB***
SO	Bubble On	154.0 dB	156.1 dB	143.4 dB	158.3 dB
	Bubble Off	162.4 dB	163.8 dB	150.3 dB	165.9 dB
	Difference	***8.4 dB***	***7.7 dB***	***6.9 dB***	***7.6 dB***
RFT	Bubble On	150.3 dB	151.9 dB	139.6 dB	154.7 dB
	Bubble Off	161.5 dB	162.8 dB	150.3 dB	164.9 dB
	Difference	***11.2 dB***	***10.9 dB***	***10.7 dB***	***10.2 dB***

Section 4 Discussion of Results

This section presents the discussion of the results of the acoustic monitoring for the TPP. Monitoring data are analyzed and summarized. The results are then evaluated with respect to the Work Plan objectives.

Summary of Underwater Sound Monitoring Data

Vibratory Pile Driving

Vibratory pile driving took place in Phase I and Phase II of TPP. Phase I, consisted of 33 vibratory installation events and 11 vibratory removal events. Phase II consisted of 2 vibratory installations and 21 vibratory removals. Sound levels generated by both vibratory installations and removals varied considerably during the driving or removal of an individual pile, and from pile to pile. This section discusses the results of the data analysis performed for vibratory pile driving events.

Each vibratory event initiated with a “soft-start” procedure. This was implemented to minimize the effects of the pile driving. During soft-start, the vibratory hammer started at reduced energy before engaging in high-energy vibration. For the RMS calculation, only the time period of maximum energy was used; the soft-starts were not analyzed. Neither was any pile-driving break lasting longer than a minute. If a pile was driven in two or more high-energy sequences containing a break lasting longer than 10 minutes, multiple events were assumed. This was due to changing testing conditions and vessel positioning.

During vibratory driving, vessel positions were recorded and compared to the coordinates of each pile (summarized in **Table 4**) to obtain the distances from the piles to the hydrophone measurement locations. **Table 6** summarizes the distances for each vibratory driving event.

Table 6 also summarizes the daily results of RMS sound pressure levels measured during vibratory pile driving throughout TPP. Data are summarized for each measurement location and shown separately for the mid-depth and the down-depth. The distances to the 190-dB RMS level and 180-dB RMS level, the injury thresholds for marine mammals, were always 10 meters or less. Distances to those threshold levels have not been included in the table. The estimated distances to the 120-dB RMS to the north and to the south are shown in the table for each day of driving. The average sound levels over the duration of the pile-driving event, and the maximum level during the pile-driving event, are shown at each depth and each location for which data was obtained. The RMS sound pressure levels were averaged in consecutive 10-second periods throughout the pile-driving event.

Table 6. Summary of Sound Levels During Vibratory Pile Installation and Removal

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS[A] Barge Avg	Barge Max	WRA Boat Avg	WRA Boat Max	Mid Channel Avg	Mid Channel Max	North Channel Avg	North Channel Max	South Channel Avg	South Channel Max	Raft Avg	Raft Max	Calculated distance (m) to 120 dB RMS to the North[B]	Calculated distance (m) to 120 dB RMS to the South[B]
Date:	**8/29/2011**																	
TTP#1 = 24", Bubble Curtain Off	Lat.	47° 45.171'	12:10:13-12:21:42	Mid			152	164	128	142			111	116	<108	<109	1,200	1,200
	Long.	122° 43.359'		Down	159	168	147	157	<134	<138			119	128	<121	<127		
	Distance from Pile in meters				10		145		780		2000		2076		2492			
TTP#2 = 36", Bubble Curtain Off	Lat.	47° 45.151'	15:06:33-15:20:21	Mid			160	168	134	140	<111	<114	121	130	<108	<112	450	3,500
	Long.	122° 43.425'		Down	169	174	155	161	140	146	109	119	126	132	<107	<103		
	Distance from Pile in meters				10		58		887		2102		1989		2421			
Date:	**8/30/2011**																	
TTP#3 = 36", Bubble Curtain Off	Lat.	47° 45.077'	9:53:27-10:13:28	Mid	168	173	144	149	133	145	109	115	136	139	132	138	500	±7,000 (land)
	Long.	122° 43.428'		Down	168	174	150	153	143	150	110	114	<135	<136	134	138		
	Distance from Pile in meters				10		361		869		2631		1760		2448			
TTP#3 = 36", Bubble Curtain Off	Lat.	47° 45.077'	10:42:36-10:48:25	Mid	165	168	141	142	132	135	112	115			130	139	600	
	Long.	122° 43.428'		Down	166	168	144	144	140	143	112	116			130	132		
	Distance from Pile in meters				10		361		995		2191		2330		2448			
TP#3 = 36", Bubble Curtain Off	Lat.	47° 45.116'	13:11:17 13:20:10	Mid	166	179	156	166							135	147		
	Long.	122° 43.473'		Down	167	180	157	168							136	143		
	Distance from Pile in meters				10		442								2375			
TP#7 = 36", Bubble Curtain Off	Lat.	47° 45.071'	14:39:48-14:55:48	Mid	162	174	143	152	130	141	127	137			127	136	5,500	
	Long.	122° 43.483'		Down			<149	<155	135	145	128	139			129	137		
	Distance from Pile in meters				10		295		1056		1784		2281		2384			
Date:	**8/31/2011**																	
TTP#4 = 36", Bubble Curtain Off	Lat.	47° 45.011'	9:19:02-9:25:35	Mid	167	172	159	163	129	137	<131	<138	<129	<138	130	135	<11,400	±7,000 (land)
	Long.	122° 43.455'		Down	166	172	153	159	135	143			136	138	131	136		
	Distance from Pile in meters				10		86		1036		2131		1883		2452			
TTP#4 = 36", Bubble Curtain Off	Lat.	47° 45.011'	9:40:35-9:57:01	Mid	168	174	157	161	130	136	126	138	124	131	133	141	5,500	±7,000 (land)
	Long.	122° 43.455'		Down	169	174	156	163	140	144	127	140	136	138	132	141		
	Distance from Pile in meters				10		86		1036		2131		1883		2452			
TP#13 = 48", Bubble Curtain Off	Lat.	47° 45.010'	11:59:01-12:10:27	Mid	171	178	154	160	141	146	134	143	128	134	137	146	19,800	±7,000 (land)
	Long.	122° 43.508'		Down	172	179	157	162	151	156	135	144	136	141	136	147		
	Distance from Pile in meters				10		272		1299		2134		1833		2389			

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS[A]												Calculated distance (m) to 120 dB RMS to the North[B]	Calculated distance (m) to 120 dB RMS to the South[B]
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft			
					Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max		
TP#12 = 36", Bubble Curtain Off	Lat.	47° 45.012'	14:23:00-14:31:00	Mid	163	170	150	157	132	139	135	143	130	138	132	140	±13,500 (land)	±7,000 (land)
	Long.	122° 43.520'		Down	168	176	150	157	141	149	136	144	132	137	132	141		
	Distance from Pile in meters				10		82		910		1900		2080		2375			
Date:	**9/8/2011**																	
TP#3 RP#3 = 36", Bubble Curtain Off	Lat.	47° 45.118'	14:34:08-15:06:46	Mid	158	173	149	165	125	142	116	130	115	121	125	139	2,500	3,000
	Long.	122° 43.468'		Down			151	167	135	149	118	135	121	143	124	140		
	Distance from Pile in meters				10		92		954		3766		3664		2384			
TP#3 RP#2 = 36", Bubble Curtain Off	Lat.	47° 45.118'	16:16:34-16:32:06	Mid	163	171	157	168	135	145	122	130	120	127	133	142	8,800	5,900
	Long.	122° 43.468'		Down			158	166	138	148	124	133	124	133	132	142		
	Distance from Pile in meters				10		167		899		5523		4220		2348			
TP#3 RP#2 = 36", Bubble Curtain Off	Lat.	47° 45.118'	16:46:08-16:57:34	Mid	158	173	150	164	126	141	116	133	117	132	129	145	2,800	4,000
	Long.	122° 43.468'		Down			151	168	135	151	116	131	121	133	127	145		
	Distance from Pile in meters				10		87		899		5100		4435		2384			
Date:	**9/10/2011**																	
TP#3 RP#1 = 36", Bubble Curtain Off	Lat.	47° 45.118'	10:45:51-11:00:20	Mid	161	170	150	159	122	132	<125	<129	<122	<135	130	140	<12,100	±7,000 (land)
	Long.	122° 43.468'		Down	163	173	153	164	135	146	<121	<126	<126	<135	127	130		
	Distance from Pile in meters				10		107		1686		7288		6236		2384			
TP#2 = 36", Bubble Curtain Off	Lat.	47° 45.134'	12:54:52-13:05:03	Mid	162	169	154	158	<120	<126	<110	<114	<114	<119	128	132	<2,500	<3,000
	Long.	122° 43.485'		Down	164	171	155	160	122	127	<115	<119	<116	<121	<120	<125		
	Distance from Pile in meters				10		66		4943		7296		6202		2355			
Date:	**9/17/2011**																	
TP#2 = 36", Bubble Curtain On	Lat.	47° 45.134'	11:21:07-11:38:04	Mid	153	168	142	158	121	135	<132	<135	<125	<130	125	137	3,400	3,400
	Long.	122° 43.485'		Down	157	168	144	158	132	141	<121	<126	<133	<137	128	138		
	Distance from Pile in meters				10		103		1025		2000		1827		2355			
TP#3 MP#1 = 36", Bubble Curtain On	Lat.	47° 45.120'	12:24:06-12:35:27	Mid	153	160	144	150	<117	<121			<123	<131	<122	<131	4,200	4,200
	Long.	122° 43.466'		Down			146	151			<131	<132	<135	<136	127	134		
	Distance from Pile in meters				10		92		1878		2200		1659		2384			
TTP#2 = 36", Bubble Curtain Off	Lat.	47° 45.151'	14:04:48-14:24:05	Mid	162	173	150	159	120	127	<134	<135	<129	134	130	138	±13,500 (land)	±7,000 (land)
	Long.	122° 43.425'		Down	163	172	151	159			<135	<140	<137	<140	132	142		
	Distance from Pile in meters				10		133		1833		1950		1568		2421			
TP#3 MP#3 = 36", Bubble Curtain Off	Lat.	47° 45.119'	14:51:28-15:03:41	Mid	157	169	150	161	121	129	<135	<137	<128	<135	125	136	7,000	7,000
	Long.	122° 43.480'		Down	159	170	152	163			<127	<132	<133	<138	129	141		
	Distance from Pile in meters				10		93		1035		1400		874		2384			

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS[A]												Calculated distance (m) to 120 dB RMS to the North[B]	Calculated distance (m) to 120 dB RMS to the South[B]
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft			
					Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max		
TP#7 = 36", Bubble Curtain Off	Lat.	47° 45.071'	15:25:21-15:40:16	Mid	162	179	150	164	125	140	135	147	131	142	126	140	10,800	6,600
	Long.	122° 43.483'		Down	162	176	150	164			135	147	135	143	128	142		
	Distance from Pile in meters				10		75		995		1095		877		2384			
TP#3 MP#2 = 36", Bubble Curtain Off	Lat.	47° 45.113'	16:09:26-16:17:20	Mid	159	169	153	160	124	134	136	143	130	135	130	137	±13,500 (land)	4,100
	Long.	122° 43.469'		Down	159	168	153	162			138	142	<137	<140	131	140		
	Distance from Pile in meters				10		85		941		1100		876		2384			
Date:	**9/21/2011**																	
TP#10 = 36", Bubble Curtain Off	Lat.	47° 45.032'	13:38:53-13:48:06	Mid	156	172	150	165	128	142	129	140	123	136	127	140	9,000	3,500
	Long.	122° 43.540'		Down	154	171	151	166	127	142	128	142	127	141	130	143		
	Distance from Pile in meters				10		117		2291		2450		1667		2341			
TP#10 = 36", Bubble Curtain Off	Lat.	47° 45.032'	15:01:19-15:14:35	Mid	159	168	152	162	130	141	126	<126	<130	140	131	142	6,100	±7,000 (land)
	Long.	122° 43.540'		Down	156	167	153	163	130	141	119	129	129	137	130	139		
	Distance from Pile in meters				10		117		2291		3800		3278		2341			
TP#9 = 36", Bubble Curtain Off	Lat.	47° 45.043'	16:47:16-17:00:12	Mid	162	166	153	158	130	135	<120	<126	<120	<123	129	135	9,200	±7,000 (land)
	Long.	122° 43.544'		Down	159	165	154	158	130	136	<116	<118	<125	<128	129	136		
	Distance from Pile in meters				10		145		2149		3850		5180		2329			
Date:	**9/22/2011**																	
TP#8 = 36", Bubble Curtain Off	Lat.	47° 45.069'	9:08:23-9:29:36	Mid	156	166	148	160	<120	<124	<130	<132	<124	<129			5,800	5,800
	Long.	122° 43.531'		Down	159	169	149	158	<134	<137	<124	<130	<135	<140				
	Distance from Pile in meters				10		71		944		3300		2330					
TP#11 = 48", Bubble Curtain Off	Lat.	47° 45.014'	15:18:20-15:31:25	Mid	161	170	151	160	126	135	135	141	<125	<131			11,200	±7,000 (land)
	Long.	122° 43.551'		Down	164	173	153	161	133	139	133	142	<134	<137				
	Distance from Pile in meters				10		112		944		1288		1614					
Date:	**9/23/2011**																	
TP#6 = 48", Bubble Curtain Off	Lat.	47° 45.088'	8:54:48-9:08:56	Mid	161	176	149	165	122	131	135	145	<127	<132			11,700	6,300
	Long.	122° 43.511'		Down	163	176	151	167	129	138	135	147	129	136				
	Distance from Pile in meters				10		109		1609		1170		1794					
TP#5 = 48", Bubble Curtain Off	Lat.	47° 45.091'	11:21:56-11:39:51	Mid	161	175	151	161	128	140	134	154	128	137			8,400	±7,000 (land)
	Long.	122° 43.545'		Down	165	174	153	163	129	139	134	142	132	136				
	Distance from Pile in meters				10		110		876		1025		1788					
TP#4, Batter = 36", Bubble Curtain Off	Lat.	47° 45.113'	15:36:58-16:15:20	Mid	163	175	152	164	128	139	<129	<133	131	143			6,000	6,000
	Long.	122° 43.507'		Down	162	175	152	164	128	140	<120	129	133	142				
	Distance from Pile in meters				10		80		931		2386		919					

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS[A]												Calculated distance (m) to 120 dB RMS to the North[B]	Calculated distance (m) to 120 dB RMS to the South[B]
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft			
					Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max		
Date:	**9/24/2011**																	
TP#10 = 36", Bubble Curtain Off	Lat.	47° 45.032'	14:46:28-15:01:00	Mid	149	165	145	158	118	132	120	137	120	130			1,700	2,400
	Long.	122° 43.540'		Down	152	165	147	159	123	131	119	131	122	131				
	Distance from Pile in meters				10		118		2236		1800		2148					
TP#9 RP#3 = 36", Bubble Curtain Off	Lat.	47° 45.043'	15:59:38-16:14:19	Mid	154	166	146	155	117	126	<122	129	123	129			2,200	2,800
	Long.	122° 43.544'		Down	155	166	147	157	125	132	120	129	123	129				
	Distance from Pile in meters				10		150		2130		2100		1786					
Date:	**9/26/2011**																	
TP#8 = 36", Bubble Curtain Off	Lat.	47° 45.069'	10:25:57-10:47:39	Mid	161	174	148	162	126	143	129	137			116		6,800	±7,000 (land)
	Long.	122° 43.531'		Down	162	174	150	162	128	143	128	139	133	141				
	Distance from Pile in meters				10		147		917		1800		1000		2333			
TP#9 RP#1 = 36", Bubble Curtain Off	Lat.	47° 45.043'	11:16:20-11:30:41	Mid	161	170	153	162	131	139	<128	<132	<129	<133	114	126	8,000	±7,000 (land)
	Long.	122° 43.544'		Down	162	171	155	164	139	150	<133	<136	<133	<136				
	Distance from Pile in meters				10		140		917		3600		1000		2329			
Date:	**9/29/2011**																	
TP#12 = 36", Bubble Curtain Off	Lat.	47° 45.012'	11:17-11:29	Mid														
	Long.	122° 43.520'		Down														
	Distance from Pile in meters																	
TP#9 RP#2 = 36", Bubble Curtain Off	Lat.	47° 45.043'	12:09:31-12:18:50	Mid	156	166	147	155	129	137	117	124	<115	<120	111	117	3,800	3,700
	Long.	122° 43.544'		Down	157	165	149	157	130	139	118	125	<114	<120				
	Distance from Pile in meters				10		140		840		5580		6448		2329			
TP#11 = 48", Bubble Curtain Off	Lat.	47° 45.014'	16:27:16-16:43:42	Mid	149	166	143	156	120	149	<107	122	<113	<117	119	136	1,000	1,000
	Long.	122° 43.551'		Down			145	157	120	138	102	123	<111	<113				
	Distance from Pile in meters				10		120		945		6100		5824		2339			
TP#9 MP#1 = 36", Bubble Curtain Off	Lat.	47° 45.043'	17:02:44-17:09:26	Mid	154	162	147	152	124	132	114	124			110	116	2,100	2,100
	Long.	122° 43.544'		Down	155	162	150	153	126	135	113	124						
	Distance from Pile in meters				10		140		849		5500				2329			
Date:	**9/30/2011**																	
TP#13 = 48", Bubble Curtain Off	Lat.	47° 45.010'	10:39:49-10:55:35	Mid	160	178	143	161	126	146	<100	<114	116	122	107	125	2,700	3,300
	Long.	122° 43.508'		Down	161	176	142	159	129	148	101	115						
	Distance from Pile in meters				10		270		857		6200		5917		2393			
TP#9 MP#2 = 36", Bubble Curtain Off	Lat.	47° 45.041'	11:29:35-11:39:19	Mid	161	174	147	157	128	141	115	125	116	125	108	119	2,500	3,200
	Long.	122° 43.563'		Down	162	173	148	159	130	143	115	123						
	Distance from Pile in meters				10		145		796		5800		5910		2329			

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS[A]												Calculated distance (m) to 120 dB RMS to the North[B]	Calculated distance (m) to 120 dB RMS to the South[B]
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft			
					Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max		
TP#5 = 48", Bubble Curtain Off	Lat.	47° 45.091'	14:23:19-14:47:04	Mid	161	176	147	162	127	143	126	139	125	136	110	123	6,300	±7,000 (land)
	Long.	122° 43.545'		Down	162	174	149	162	130	146	123	137	129	141				
	Distance from Pile in meters				10		190		811		3200		3106		2304			
TP#9 MP#3 = 36", Bubble Curtain Off	Lat.	47° 45.053'	15:11:05-15:16:14	Mid	166	177	156	165	132	141	119	128	<119	<124	113	121	4,600	4,600
	Long.	122° 43.557'		Down	167	175	158	165	137	146	118	126	<127.2	<134				
	Distance from Pile in meters				10		145		806		6030		6172		2329			
Date:	**10/3/2011**																	
TP#6 = 48", Bubble Curtain Off	Lat.	47° 45.088'	13:58:49-14:17:22	Mid	152	165	141	156	124	137	<134	<138	<130	<133			2,000	2,000
	Long.	122° 43.511'		Down	154	169	142	158	124	141	<131	<133	<131	<135				
	Distance from Pile in meters				10		155		1000		3700		5760					
TP#4 = 36", Bubble Curtain Off	Lat.	47° 45.113'	17:50:23-18:04:08	Mid	158	172	145	158	127	142	<134	<137	<132	<134	118	129	3,700	3,700
	Long.	122° 43.508'		Down	159	171	147	159	130	144	<130	<134	<128	135				
	Distance from Pile in meters				10		200		1000		2350		2525		2337			

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS[A]												Calculated distance (m) to 120 dB RMS
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft		
					Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	
Date:	**10/4/2011**																
TP#4 = 36", Bubble Curtain Off	Lat.	47° 45.113'	10:43:06-11:09:20	Mid	157	172	142	158	126	144					125	140	4,900
	Long.	122° 43.508'		Down	159	175	142	157	127	145							
	Distance from Pile in meters				10		215		890						2337		
TTP#1 = 24", Bubble Curtain Off	Lat.	47° 45.171'	15:48:31-16:08:10	Mid	157	166	136	143	128	134					125	131	5,500
	Long.	122° 43.359'		Down	160	167	138	144	130	136							
	Distance from Pile in meters				10		300		1080						2492		
Date:	**10/5/2011**																
TP#1 = 36", Bubble Curtain Off	Lat.	47° 45.228'	16:25:04-16:52:25	Mid			150	158	<114	<117							3,500
	Long.	122° 43.483'		Down			151	159	<112	<117							
	Distance from Pile in meters						205		10000								
Date:	**10/8/2011**																
TP#1 = 36", Bubble Curtain Off	Lat.	47° 45.228'	16:06:48-16:20:27	Mid	160	178	150	153	130	146					129	147	±7,000 (land)
	Long.	122° 43.483'		Down	161	176	147	149	129	149							
	Distance from Pile in meters				10		1600		1000						2320		

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS[A]												Calculated distance (m) to 120 dB RMS
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft		
					Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	
Date:	**10/17/2011**																
TP#3 MP#3 = 36", Bubble Curtain Off	Lat.	47° 45.119'	12:57:55-13:07:01	Mid	151	164	141	153	124	133							4,200
	Long.	122° 43.480'		Down	152	164	143	154	124	134							
	Distance from Pile in meters				10		105		2416								
TP#3 MP#2 = 36", Bubble Curtain Off	Lat.	47° 45.113'	15:16:43-15:25:32	Mid	155	167	146	161	125	137					125	135	4,800
	Long.	122° 43.469'		Down	153	167	147	161	125	136							
	Distance from Pile in meters				10		105		2416						2375		
TP#3 = 36", Bubble Curtain Off	Lat.	47° 45.116'	16:12:49-16:20:32	Mid	155	167	146	162	128	140					129	139	±7,000 (land)
	Long.	122° 43.473'		Down	156	167	148	162	128	139							
	Distance from Pile in meters				10		105		2386						2375		
Date:	**10/18/2011**																
TP#3 RP#3 = 36", Bubble Curtain Off	Lat.	47° 45.118'	11:21:27-11:39:04	Mid	159	167	146	156	126	135					126	134	6,000
	Long.	122° 43.468'		Down	161	169	146	156	128	136					126	134	
	Distance from Pile in meters				10		118		948						2384		
TP#3 RP#1 = 36", Bubble Curtain Off	Lat.	47° 45.118'	14:13:46-14:30:03	Mid	158	170	150	161	127	141					126	136	6,200
	Long.	122° 43.468'		Down			150	160	130	141					126	136	
	Distance from Pile in meters				10		118		948						2384		
TP#3 RP#2 = 36", Bubble Curtain Off	Lat.	47° 45.118'	13:13:42-13:31:02	Mid	160	172	148	160	128	139					127	138	±7,000 (land)
	Long.	122° 43.468'		Down			147	159	129	140					127	138	
	Distance from Pile in meters				10		103		948						2384		
TP#3 MP#1 = 36", Bubble Curtain Off	Lat.	47° 45.120'	15:10:36-15:21:07	Mid	158	173	146	161	125	138					125	137	5,200
	Long.	122° 43.466'		Down			147	161	126	141					125	139	
	Distance from Pile in meters				10		108		948						2384		
Date:	**10/19/2011**																
TP#9 MP#2 = 36", Bubble Curtain Off	Lat.	47° 45.041'	8:31:48-8:37:15	Mid	154	156	140	142	116	118					117	120	1,400
	Long.	122° 43.563'		Down	154	156	143	145	120	125					117	120	
	Distance from Pile in meters				10		137		1019						2329		
TP#9 MP#2 = 36", Bubble Curtain Off	Lat.	47° 45.041'	10:18:36-10:56:03	Mid	152	171	143	162	119	140					118	140	1,900
	Long.	122° 43.563'		Down	154	175	143	161	121	142					119	140	
	Distance from Pile in meters				10		137		1019						2329		
TP#9 MP#3 = 36", Bubble Curtain Off	Lat.	47° 45.053'	13:28:04-13:40:01	Mid	151	169	141	156	121	137					117	135	1,700
	Long.	122° 43.557'		Down	154	169	142	156	123	138					119	138	
	Distance from Pile in meters				10		137		1019						2329		

Event Description	**Pile Coordinates**		**Time**	**Sensor**	**Measured Sound Pressure Level - RMS[A]**												**Calculated distance (m) to 120 dB RMS**
					Barge		**WRA Boat**		**Mid Channel**		**North Channel**		**South Channel**		**Raft**		
					Avg	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	
TP#9 MP#1 = 36", Bubble Curtain Off	Lat.	47° 45.043'	14:30:42-14:40:00	Mid	149	162	141	154	118	135					117	133	1,700
	Long.	122° 43.544'		Down	150	163	140	153	120	136					119	133	
	Distance from Pile in meters				10		169		1019						2326		
TP#9 = 36", Bubble Curtain Off	Lat.	47° 45.043'	15:51:37-16:12:33	Mid	158	176	147	164	127	145					126	142	6,000
	Long.	122° 43.544'		Down	159	175	147	164	128	146					127	144	
	Distance from Pile in meters				10		169		910						2329		
Date:	**10/20/2011**																
TP#9 RP#3 = 36", Bubble Curtain Off	Lat.	47° 45.043'	8:41:08-8:55:53	Mid	149	161	142	156	124	136							2,500
	Long.	122° 43.544'		Down	148	161	143	156	127	137							
	Distance from Pile in meters				10		146		915								
TP#9 RP#1 = 36", Bubble Curtain Off	Lat.	47° 45.043'	10:46:25-11:02:20	Mid	153	162	146	155	124	136					125	134	5,100
	Long.	122° 43.544'		Down	154	166	145	155	128	137					125	134	
	Distance from Pile in meters				10		146		915						2326		
TP#9 RP#2 = 36", Bubble Curtain Off	Lat.	47° 45.043'	11:42:12-11:55:24	Mid	151	163	142	153	120	133					137	140	1,100
	Long.	122° 43.544'		Down	152	166	142	153	123	133					123	130	
	Distance from Pile in meters				10		146		915						2326		
TTP#4 = 36", Bubble Curtain Off	Lat.	47° 45.011'	13:29:21-13:39:45	Mid			154	159	132	139					133	138	±7,000 (land)
	Long.	122° 43.455'		Down	164	171	154	159	134	139					133	138	
	Distance from Pile in meters				10		128		1069						2452		
TTP#4 = 36", Bubble Curtain Off	Lat.	47° 45.011'	14:03:24-14:13:43	Mid			156	163	135	142					134	140	±7,000 (land)
	Long.	122° 43.455'		Down	167	173	157	163	136	143					134	141	
	Distance from Pile in meters				10		128		1069						2452		
TTP#3 = 36", Bubble Curtain Off	Lat.	47° 45.077'	15:22:42-15:36:16	Mid			150	160	130	139					133	140	5,400
	Long.	122° 43.428'		Down	161	171	151	161	131	140					131	139	
	Distance from Pile in meters				10		150		1071						2448		

[A] RMS Sound levels during vibratory driving analyzed in 10 sec periods "Max" is the maximum level for any 10 sec. period "Avg" is the average of the 10 sec. periods over the duration of the pile driving events.

[B] Based on best available data for each pile driving event

The detailed results of every measurement are presented in **Appendix A**. These data were carefully reviewed to evaluate the data gathered during each measurement. In many cases, measured sound levels outside the WRA were similar to ambient or background levels[1]. As a result, levels from pile driving were not discernible from background during many distant measurements. Where instrumentation-related effects or background noise were believed to influence measured sound levels, the levels are reported as being less than the measured level. This accounts for the potential influence of ambient noise. Similarly, where estimated distances to the 120-dB RMS are believed to include the potential influence of ambient noise in the measurements, these distances have been indicated with a 'less than' symbol. The large variation in distances to the 120-dB threshold level exemplifies the sensitivity of this prediction to small changes in the sound level. Ideally, ambient noise levels should be at least 10 dB below the signal level in order to not influence the measurement of the pile-driving noise. This was rarely the case when measuring sound levels of less than about 125 dB. Also, the problems with hydrophone line strumming were most prevalent during the first 2 weeks of monitoring. Once efforts to minimize strumming were implemented, the spread in the data was significantly reduced.

Impact Pile Driving

Impact pile driving took place primarily in Phase I of TPP. Impact driving for Phase I started on September 1, 2011 and concluded on October 3, 2011. Six piles in Phase I were driven using an impact hammer with and without the bubble curtain; 14 piles were driven with the bubble curtain only, and one pile was driven without the bubble curtain. There were two impact-driving events in Phase II between October 4, 2011 and October 8, 2011, both of which utilized the bubble curtain. Sound levels generated by impact driving varied considerably from pile to pile. This section summarizes the results of the data analysis for impact pile-driving events.

Each impact event started with a "soft-start" procedure. This was implemented to minimize the effects of the pile driving. During soft-start, the impact hammer started at reduced energy before engaging in high-energy impact. In calculating the RMS and single strike SEL average, the soft-starts were not included in the calculations, but the soft-starts were included in calculating the cumulative SEL value for each pile.

The Acoustic Monitoring Plan anticipated that each impact pile-driving event would last between 5 and 15 minutes. Impact hammers normally have a repetition rate of about 1-1.5 seconds per strike, resulting in the number of pile strikes per pile-driving event expected to range from several hundred to approximately 1,000 pile strikes. This assumption led to a reasonable expectation regarding the number of pile strikes that would be available for analysis, and also an analysis for impact pile-driving levels from each pile-driving event. There would also be sufficient pile strikes to conduct a bubble curtain on and off test for a particular pile. During the TPP, however, the number of daily impact pile strikes was limited to 100 strikes, resulting in a substantially smaller data set for impact pile driving than was envisioned in the Acoustic Monitoring Plan.

[1] Background could be noise from current, wind and wave effects, or ambient levels, or a combination of both.

Impact pile driving occurred on 22 piles over the course of 14 days. A total of 844 of the permitted 1,500 strikes were utilized. The number of pile strikes per event ranged from 3 to 98. The durations of impact pile-driving events were short. With the exception of one 2-minute event, these events lasted less than 1 minute. Ten of the events, including two of the air bubble curtain off tests, utilized 20 pile strikes or fewer. During the tests of the effectiveness of the bubble curtain, the number of unattenuated impact strikes per event ranged from 7 to 40.

Vessel positions were recorded and related to the coordinates of each pile (summarized in **Table 4**) to obtain the distances from the piles to the hydrophone measurement locations. **Table 5** summarizes the distances for each impact-driving event and whether the bubble curtain was on or off. For bubble curtain on/off tests, the conditions with the air bubble curtain on were measured first. Then the vessels returned to the same monitoring position to record the sound levels with the air bubble curtain off.

Table 7 summarizes the daily results of peak sound pressure levels measured during impact pile driving throughout the TPP. Data are summarized for each measurement location, and shown separately for the mid-depth and the down-depth. The distances have been estimated to the 206-dB peak injury threshold established for fish and the 180-dB peak injury threshold established for marbled murrelets. **Table 8** reports the daily results of RMS impulse sound pressure levels during impact driving. Estimated distances to the 190-dB RMS, 180-dB RMS, 160-dB RMS, and 150-dB RMS threshold levels for marine mammals and fish are shown for each individual pile-driving event as well as the range of attenuation provided from the bubble curtain on/off tests. **Table 9** summarizes the SEL levels measured during each pile-driving event. The single-strike and cumulative SEL at each measurement location for each depth are shown, with the cumulative SEL values calculated by summing the SEL values for each of the pile strikes. The estimated distances to the 187-dB SEL and 183-dB SEL cumulative values are shown for each pile-driving event.

Data for 24-inch piles driven with an impact hammer were limited to one pile (TTP#1) on the first day of using the impact hammer. The pile was tapped with the impact hammer ten times, three with the bubble curtain on and seven with the bubble curtain off. Subsequent to this first pile-driving event the contractor agreed to attempt to achieve approximately 30 pile strikes for each pile-driving event. The estimated distances to the threshold levels for each day of driving are based on the maximum level (either mid-depth or down-depth) measured at each measurement location so as to provide a conservative estimate of the daily distances for use by the marine mammal monitors. In the Evaluation of Work Plan Objectives, the data for each pile size are aggregated and differentiated by depth to establish rates of acoustic spreading loss for each pile size and each acoustical metric—Peak, RMS, and SEL.

Summary of Airborne Sound Monitoring Data

Airborne sound levels were measured and analyzed as un-weighted and A-weighted levels and both are reported. Airborne sound levels were measured in 1-minute intervals throughout each workday on the barge and the WRA boat, and continuously at the two land-based monitoring sites. The maximum sound level measured during each event was used to estimate the distances to the injury and behavioral threshold levels. The average sound level (L_{eq}) and the sound exposure level (SEL) for each measurement event were also calculated from the measurement data in response to a request from USFWS.

Table 7. Summary of Peak Sound Levels During Impact Pile Driving

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - Absolute Peak: Barge	WRA Boat	Mid Channel	North Channel	South Channel	Raft	Number of Pile Strikes	Calculated distance to 206 dB Peak	Calculated distance to 180 dB Peak	Approximate dB Peak/Strike Reduction (at Barge)
Date:	**9/1/2011**													
TTP#1 = 24", Bubble Curtain On	Lat.	47° 45.171'	11:29:45 11:32:37	Mid	185	<163	<158	<153	156	153	3	<10	50	8
	Long.	122° 43.359'		Down	186	162	<176	<150	<155	150				7
	Distance from Pile in meters				10	145	145	0	780	0				
TTP#1 = 24", Bubble Curtain Off	Lat.	47° 45.171'	11:34:16 11:37:16	Mid	193	166	<158	<153	161	160	7	<10	100	
	Long.	122° 43.359'		Down	193	167	<176	<150	164	157				
	Distance from Pile in meters				10	527	1013	1100	1489	2492				
TTP#2 = 36", Bubble Curtain On	Lat.	47° 45.151'	15:40:25 15:45:48	Mid	199	183	169	165	166	163	40	10	1000	5
	Long.	122° 43.425'		Down	206	183	181	166	170	165				7
	Distance from Pile in meters				11	415	950	922	1169	2421				
TTP#2 = 36", Bubble Curtain Off	Lat.	47° 45.151'	15:51:12 15:52:06	Mid	207	193	175	180	177	179	38	<20	800	
	Long.	122° 43.425'		Down	211*	194	191	178	176	175				
	Distance from Pile in meters				11	415	983	738	1101	2421				
Date:	**9/10/2011**													
TP#7 = 36", Bubble Curtain On	Lat.	47° 45.071'	16:36:38- 16:49:12	Mid	194	193	<157	<146	<158	161	47	<10	500	15
	Long.	122° 43.483'		Down	195	188	<170	N/A	<164	160				11
	Distance from Pile in meters				20	64	1863	2980	2447	2392				
TP#7 = 36", Bubble Curtain Off	Lat.	47° 45.071'	16:56:57 16:57:50	Mid	205	195	166	<147	167	171	40	50	1000	
	Long.	122° 43.483'		Down	210	204	<174	N/A	172	173				
	Distance from Pile in meters				20	66	1737	2980	2445	2392				
Date:	**9/15/2011**													
TP#3 RP#3 = 36", Bubble Curtain On	Lat.	47° 45.118'	14:18:04 14:25:55	Mid	188	174	164	158	161	<160	9	<10	100	4
	Long.	122° 43.468'		Down	194	178	164	159	163	134				7
	Distance from Pile in meters				10	92	989	1121	912	2384				
TP#3 RP#3 = 36", Bubble Curtain Off	Lat.	47° 45.118'	14:27:15 14:34:05	Mid	192	184	171	162	171	<161	10	<10	300	
	Long.	122° 43.468'		Down	201	187	170	161	170	140				
	Distance from Pile in meters				10	92	1020	1127	876	2384				
Date:	**9/16/2011**													
TP#3 RP#2 = 36", Bubble Curtain On	Lat.	47° 45.118'	10:44:24 10:53:40	Mid	193	183	152	153	153	152	30	<10	200	
	Long.	122° 43.468'		Down	N/A	185	163	154	158	150				
	Distance from Pile in meters				10	90	1167	1382	1093	2384				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - Absolute Peak						Number of Pile Strikes	Calculated distance to 206 dB Peak	Calculated distance to 180 dB Peak	Approximate dB Peak/Strike Reduction (at Barge)
					Barge	WRA Boat	Mid Channel	North Channel	South Channel	Raft				
TP#3 RP#1 = 36", Bubble Curtain On	Lat.	47° 45.118'	15:02:45 15:10:58	Mid	192	186	164	165	165	N/A	30	<10	300	
	Long.	122° 43.468'		Down	N/A	188	172	167	160	N/A				
	Distance from Pile in meters				10	95	687	782	931	2384				
TP#3 = 36", Bubble Curtain Off	Lat.	47° 45.116'	16:10:39 16:16:37	Mid	206	196	171	173	170	N/A	33	10	800	
	Long.	122° 43.473'		Down	202	196	186	173	179	N/A				
	Distance from Pile in meters				10	90	1039	1685	1034	2384				
Date:	**9/17/2011**													
TP#2 = 36", Bubble Curtain On	Lat.	47° 45.134'	10:26:20 10:31:14	Mid	192	N/A	166	<158	172	167	15	<10	400	
	Long.	122° 43.485'		Down	203	N/A	171	<158	168	167				
	Distance from Pile in meters				10	125	1025	1470	843	2355				
Date:	**9/21/2011**													
TTP#3 = 36", Bubble Curtain On	Lat.	47° 45.077'	10:10:18 10:20:41	Mid	208	195	167	163	168	165	30	<20	500	
	Long.	122° 43.428'		Down	N/A	196	169	168	169	167				
	Distance from Pile in meters				10	123	817	991	953	2451				
Date:	**9/24/2011**													
TP#10 = 36", Bubble Curtain ??	Lat.	47° 45.032'	14:05:00 14:12:24	Mid	187	N/A	166	170	165	N/A	17	<10	300	
	Long.	122° 43.540'		Down	194	185	171	171	169	N/A				
	Distance from Pile in meters				10	118	980	1100	998	2341				
Date:	**9/26/2011**													
TP#8 = 36", Bubble Curtain On	Lat.	47° 45.069'	9:31:38 9:41:32	Mid	192	185	166	169	N/A	N/A	25	10	500	
	Long.	122° 43.531'		Down	205	191	170	168	N/A	N/A				
	Distance from Pile in meters				10	235	981	1463	1000	2333				
Date:	**9/29/2011**													
TP#12 = 36", Bubble Curtain On	Lat.	47° 45.012'	10:18:18 10:23:13	Mid	194	185	167	167	168	163	26	10	150	
	Long.	122° 43.520'		Down	206	184	167	169	169	N/A				
	Distance from Pile in meters				10	81	937	1268	884	2336				
TP#11 = 48", Bubble Curtain On	Lat.	47° 45.014'	15:03:22 15:11:22	Mid	194	192	177	180	183	<170	38	10	600	11
	Long.	122° 43.551'		Down	206	195	177	182	184	N/A				3
	Distance from Pile in meters				10	120	897	1216	1077	2339				
TP#11 = 48", Bubble Curtain Off	Lat.	47° 45.014'	15:17:36 15:18:18	Mid	205	201	178	182	179	170	33	60	1500	
	Long.	122° 43.551'		Down	209	202	182	182	182	N/A				
	Distance from Pile in meters				10	120	886	1100	1055	2339				
Date:	**9/30/2011**													
TP#13 = 48", Bubble Curtain On	Lat.	47° 45.010'	9:52:01 9:56:59	Mid	194	187	168	160	<185	164	13	20	600	
	Long.	122° 43.508'		Down	209	190	172	162	<174	N/A				
	Distance from Pile in meters				10	163	931	1500	1190	2393				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - Absolute Peak: Barge	WRA Boat	Mid Channel	North Channel	South Channel	Raft	Number of Pile Strikes	Calculated distance to 206 dB Peak	Calculated distance to 180 dB Peak	Approximate dB Peak/Strike Reduction (at Barge)
TP#5 = 48", Bubble Curtain On	Lat.	47° 45.091'	13:36:18	Mid	196	189	179	180	177	177	35	10	1000	11
	Long.	122° 43.545'	13:40:32	Down	205	191	180	179	180	N/A				3
	Distance from Pile in meters				10	194	754	1080	1000	2304				
TP#5 = 48", Bubble Curtain Off	Lat.	47° 45.091'	13:43:59	Mid	207	197	181	183	178	179	32	20	2000	
	Long.	122° 43.545'	13:44:38	Down	208	N/A	184	183	182	N/A				
	Distance from Pile in meters				10	194	754	1400	1060	2304				
Date:	**10/1/2011**													
TP#9 RP#3 = 36", Bubble Curtain On	Lat.	47° 45.043'	9:19:11	Mid	189	179	164	163	160	165	18	<10	150	
	Long.	122° 43.544'	9:24:05	Down	196	180	169	168	165	N/A				
	Distance from Pile in meters				10	142	921	1450	1213	2329				
TP#9 RP#2 = 36", Bubble Curtain On	Lat.	47° 45.043'	11:27:25	Mid	195	186	165	163	165	162	14	<10	500	
	Long.	122° 43.544'	11:31:11	Down	193	187	170	166	168	N/A				
	Distance from Pile in meters				10	140	860	1100	1110	2329				
TP#9 RP#1 = 36", Bubble Curtain On	Lat.	47° 45.043'	14:07:50	Mid	191	184	168	163	167	165	14	<10	300	
	Long.	122° 43.544'	14:12:00	Down	195	185	170	165	169	N/A				
	Distance from Pile in meters				10	140	880	1100	964	2329				
Date:	**10/2/2011**													
TP#9 = 36", Bubble Curtain On	Lat.	47° 45.043'	16:29:13	Mid	191	190	176	170	174	170	63	<10	500	
	Long.	122° 43.544'	16:34:06	Down	199	189	175	174	173	N/A				
	Distance from Pile in meters				10	140	815	1300	924	2329				
Date:	**10/3/2011**													
TP#6 = 48", Bubble Curtain On	Lat.	47° 45.088'	12:04:52	Mid	202	192	172	174	172	<163	25	10	1000	
	Long.	122° 43.511'	12:11:04	Down	205	192	179	172	176	N/A				
	Distance from Pile in meters				10	155	1000	927	886	2343				
TP#4 = 36", Bubble Curtain On	Lat.	47° 45.113'	16:44:45	Mid	185	188	168	163	169	163	17	<10	500	
	Long.	122° 43.508'	16:50:15	Down	N/A	189	174	162	171	N/A				
	Distance from Pile in meters				10	200	1000	879	983	2337				
Date:	**10/4/2011**													
TTP#4 = 36", Bubble Curtain On	Lat.	47° 45.011'	14:52:00	Mid	N/A	190	164	N/A	N/A	161	44		350	
	Long.	122° 43.455'	14:59:52	Down	N/A	185	164	N/A	N/A	N/A				
	Distance from Pile in meters				10	170	965	N/A	N/A	2454				
Date:	**10/8/2011**													
TP#1 = 36", Bubble Curtain On	Lat.	47° 45.228'	15:04:29	Mid	N/A	<176	170	N/A	N/A	155	98		500	
	Long.	122° 43.483'	15:17:14	Down	N/A	<170	174	N/A	N/A	N/A				
	Distance from Pile in meters				10	1600	982	N/A	N/A	2322				

Table 8. Summary RMS Sound Levels During Impact Pile Driving

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS												Number of Pile Strikes	Calculated distance (m) 190 dB RMS	Calculated distance (m) 180 dB RMS	Calculated distance (m) 160 dB RMS	Calculated distance (m) 150 dB RMS	Approximate dB RMS/Strike Reduction
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft							
					Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max						
Date:	**9/1/2011**																					
TTP#1 = 24", Bubble Curtain On	Lat.	47° 45.171'	11:29:45 11:32:37	Mid	173	173	<160	<160	<153	<153	<150	<150	143	145	141	142	3	<10	<10	<500	<1,000 North <1,000 South	6 to 7
	Long.	122° 43.359'		Down	174	174	<151	<151	<173	<173	<146	<146	<153	<153	140	140						
	Distance from Pile in meters				10		527		977		965		1489		2492							
TTP#1 = 24", Bubble Curtain Off	Lat.	47° 45.171'	11:34:16 11:37:16	Mid	180	180	<160	<160	<153	<153	<150	<150	150	152	149	150	7	<10	10	500	1,000 North 2,000 South	-
	Long.	122° 43.359'		Down	180	180	155	156	<173	<173	<146	<146	<153	<153	147	148						
	Distance from Pile in meters				10		527		1013		1100		1489		2492							
TTP#2 = 36", Bubble Curtain On	Lat.	47° 45.151'	15:40:25 15:45:48	Mid	183	185	170	172	155	157	154	155	154	156	150	152	40	10	50	600 MID & North 1,000 South	2,000 North 4,000 South	7
	Long.	122° 43.425'		Down	189	191	167	169	<172	<172	153	155	158	159	153	155						
	Distance from Pile in meters				11		415		950		922		1169		2421							
TTP#2 = 36", Bubble Curtain Off	Lat.	47° 45.151'	15:51:12 15:52:06	Mid	190	191	175	177	161	162	166	167	162	164	161	163	38	50	250	2,500 North 2,500 South	7,500 North 9,000 South	-
	Long.	122° 43.425'		Down	196	197	176	177	<174	<174	163	164	164	164	161	163						
	Distance from Pile in meters				11		415		983		738		1101		2421							
Date:	**9/10/2011**																					
TP#7 = 36", Bubble Curtain On	Lat.	47° 45.071'	16:36:38- 16:49:12	Mid	180	182	177	180	<148	<148	<131	<131	<144	<144	148	149	47	<10	20	700	2,000 North 2,000 South	8 to 12
	Long.	122° 43.483'		Down	181	183	175	177	<164	<164	N/A	N/A	<159	<159	148	149						
	Distance from Pile in meters				20		64		1863		2980		2447		2392							
TP#7 = 36", Bubble Curtain Off	Lat.	47° 45.071'	16:56:57 16:57:50	Mid	188	189	182	183	153	154	133	134	155	159	160	161	40	60	250	2,500 North 2,500 South	3,000 North 9,000 South	-
	Long.	122° 43.483'		Down	193	194	188	189	<164	<164	N/A	N/A	<163	<163	160	161						
	Distance from Pile in meters				20		66		1737		2980		2445		2392							
Date:	**9/15/2011**																					
TP#3 RP#3 = 36", Bubble Curtain On	Lat.	47° 45.118'	14:18:04 14:25:55	Mid	174	176	165	171	147	149	146	147	150	154	<147	<147	9	<10	20	<500	1,000 North 1,500 South	6 to 7
	Long.	122° 43.468'		Down	180	182	166	166	150	152	146	147	149	150	122	124						
	Distance from Pile in meters				10		92		989		1121		912		2384							
TP#3 RP#3 = 36", Bubble Curtain Off	Lat.	47° 45.118'	14:27:15 14:34:05	Mid	180	181	173	179	155	156	151	152	161	163	<147	<147	10	<10	50	1,000	4,000 North 1,500 South	-
	Long.	122° 43.468'		Down	187	188	173	175	158	159	150	151	155	157	129	130						
	Distance from Pile in meters				10		92		1020		1127		876		2384							
Date:	**9/16/2011**																					
TP#3 RP#2 = 36", Bubble Curtain On	Lat.	47° 45.118'	10:44:24 10:53:40	Mid	177	179	170	171	136	139	139	142	141	141	140	141	30	<10	10	<500	<1,000 North <1,000 South	12 to 15
	Long.	122° 43.468'		Down	N/A	N/A	169	171	148	152	141	144	143	147	139	141						
	Distance from Pile in meters				10		90		1167		1382		1093		2384							
TP#3 RP#1 = 36", Bubble Curtain On	Lat.	47° 45.118'	15:02:45 15:10:58	Mid	175	178	171	175	152	153	152	153	152	153	N/A	N/A	30	<10	<10	800	1,500 North 1,500 South	14
	Long.	122° 43.468'		Down	N/A	N/A	173	176	162	164	154	155	149	150	N/A	N/A						
	Distance from Pile in meters				10		95		687		782		931		2384							
TP#3 = 36", Bubble Curtain Off	Lat.	47° 45.116'	16:10:39 16:16:37	Mid	189	190	182	183	158	159	158	159	157	159	N/A	N/A	33	10	150	1,600 North 1,800 South	6,000 North 6,500 South	-
	Long.	122° 43.473'		Down	187	188	182	183	170	171	158	159	162	163	N/A	N/A						
	Distance from Pile in meters				10		90		1039		1685		1034		2384							
Date:	**9/17/2011**																					
TP#2 = 36", Bubble Curtain On	Lat.	47° 45.134'	10:26:20 10:31:14	Mid	177	178	N/A	N/A	151	152	<148	<157	158	159	152	155	15	10	30	500	2,500 North 2,500 South	-
	Long.	122° 43.485'		Down	186	188	N/A	N/A	<164	<164	<153	<153	<157	<156	<154	<154						
	Distance from Pile in meters				10		125		1025		1470		843		2355							

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS												Number of Pile Strikes	Calculated distance (m) 190 dB RMS	Calculated distance (m) 180 dB RMS	Calculated distance (m) 160 dB RMS	Calculated distance (m) 150 dB RMS	Approximate dB RMS/Strike Reduction
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft							
					Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max						
Date:	**9/21/2011**																					
TTP#3 = 36", Bubble Curtain On	Lat.	47° 45.077'	10:10:18	Mid	190	192	181	183	155	157	151	152	158	160	152	153	30	20	200	600 MID & North 950 South	2,000 North 4,000 South	-
	Long.	122° 43.428'	10:20:41	Down	N/A	N/A	180	182	156	157	155	156	156	157	153	154						
	Distance from Pile in meters				10		123		817		991		953		2451							
Date:	**9/24/2011**																					
TP#10 = 36", Bubble Curtain On	Lat.	47° 45.032'	14:05:00	Mid	174	176	N/A	N/A	153	155	159	161	155	156	N/A	N/A	17	<10	20	<500	2,000 North 2,000 South	-
	Long.	122° 43.540'	14:12:24	Down	181	182	172	173	166	169	156	157	<160	<160	N/A	N/A						
	Distance from Pile in meters				10		118		980		1100		998		2341							
Date:	**9/26/2011**																					
TP#8 = 36", Bubble Curtain On	Lat.	47° 45.069'	9:31:38	Mid	177	180	170	172	152	153	155	158	N/A	N/A	N/A	N/A	25	10	50	1,000 North 500 Mid	5,000 North 4,000 South	-
	Long.	122° 43.531'	9:41:32	Down	189	191	173	175	<156	<156	<159	<159	N/A	N/A	N/A	N/A						
	Distance from Pile in meters				10		235		981		1463		1000		2333							
Date:	**9/29/2011**																					
TP#12 = 36", Bubble Curtain On	Lat.	47° 45.012'	10:18:18	Mid	179	183	170	173	154	155	156	158	153	154	150	152	26	10	50	600 MID & North 500 South	4,000 North 2,000 South	-
	Long.	122° 43.520'	10:23:13	Down	188	191	172	174	154	156	155	157	<157	<157	N/A	N/A						
	Distance from Pile in meters				10		81		937		1268		884		2421							
TP#11 = 48", Bubble Curtain On	Lat.	47° 45.014'	15:03:22	Mid	181	182	164	166	163	164	168	169	165	166	<158	N/A	38	20	100	3,500 North 3,000 Mid & South	>10,000 North >10,000 South	3 to 9
	Long.	122° 43.551'	15:11:22	Down	191	192	177	178	162	164	168	169	166	168	N/A	N/A						
	Distance from Pile in meters				10		120		897		1216		1077		2339							
TP#11 = 48", Bubble Curtain Off	Lat.	47° 45.014'	15:17:36	Mid	190	191	169	171	164	164	169	170	163	164	158	159	33	30	150	4,000 North 3,500 Mid & South	>10,000 North >10,000 South	-
	Long.	122° 43.551'	15:18:18	Down	194	195	182	183	166	167	168	169	168	169	N/A	N/A						
	Distance from Pile in meters				10		120		886		1100		1055		2339							
Date:	**9/30/2011**																					
TP#13 = 48", Bubble Curtain On	Lat.	47° 45.010'	9:52:01	Mid	182	183	174	175	154	156	146	147	<184	N/A	153	155	10	10	100	<500 North 900 Mid	1,500 North 3,000 South	-
	Long.	122° 43.508'	9:56:59	Down	191	192	176	177	157	159	148	150	<170	N/A	N/A	N/A						
	Distance from Pile in meters				10		163		931		1500		1190		2393							
TP#5 = 48", Bubble Curtain On	Lat.	47° 45.091'	13:36:18	Mid	182	183	175	177	160	162	162	164	159	161	161	164	35	10	120	2,000 North 1,800 South	10,000 North 5,000 South	4 to 9
	Long.	122° 43.545'	13:40:32	Down	189	190	175	177	165	167	165	167	162	163	N/A	N/A						
	Distance from Pile in meters				10		194		754		1080		1000		2304							
TP#5 = 48", Bubble Curtain Off	Lat.	47° 45.091'	13:43:59	Mid	191	193	182	183	165	166	168	169	160	161	166	168	32	30	300	5,000 North 3,000 South	>10,000 North >10,000 South	-
	Long.	122° 43.545'	13:44:38	Down	193	194	N/A	N/A	169	171	170	171	167	168	N/A	N/A						
	Distance from Pile in meters				10		194		754		1400		1060		2304							
Date:	**10/1/2011**																					
TP9 RP#3 = 36", Bubble Curtain On	Lat.	47° 45.043'	9:19:11	Mid	N/A	N/A	167	169	153	153	150	151	146	147	151	152	18	<10	<50	500	2,000 North 2,000 South	-
	Long.	122° 43.544'	9:24:05	Down	N/A	N/A	167	168	156	157	152	153	151	152	N/A	N/A						
	Distance from Pile in meters				10		142		921		1450		1213		2329							
TP9 RP#2 = 36", Bubble Curtain On	Lat.	47° 45.043'	11:27:25	Mid	N/A	N/A	173	174	151	153	151	152	151	151	151	152	14	<20	70	500	2,500 North 2,500 South	-
	Long.	122° 43.544'	11:31:11	Down	N/A	N/A	172	174	156	156	153	153	148	149	N/A	N/A						
	Distance from Pile in meters				10		140		860		1100		1110		2329							
TP9 RP#1 = 36", Bubble Curtain On	Lat.	47° 45.043'	14:07:50	Mid	N/A	N/A	174	174	151	153	152	153	152	153	151	152	14	<20	70	500	2,500 North 2,500 South	-
	Long.	122° 43.544'	14:12:00	Down	N/A	N/A	172	173	154	155	154	154	<158	<158	N/A	N/A						
	Distance from Pile in meters				10		140		880		1100		964		2329							

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS												Number of Pile Strikes	Calculated distance (m) 190 dB RMS	Calculated distance (m) 180 dB RMS	Calculated distance (m) 160 dB RMS	Calculated distance (m) 150 dB RMS	Approximate dB RMS/Strike Reduction
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft							
					Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max						
Date:	**10/2/2011**																					
TP#9 = 36", Bubble Curtain On	Lat.	47° 45.043'	16:29:13 16:34:06	Mid	N/A	N/A	176	177	158	160	158	159	156	158	N/A	N/A	63	20	100	1,500	6,000 North 3,000 South	-
	Long.	122° 43.544'		Down	N/A	N/A	174	176	159	161	160	161	157	159	N/A	N/A						
	Distance from Pile in meters				10		140		815		1300		924		2329							
Date:	**10/3/2011**																					
TP#6 = 48", Bubble Curtain On	Lat.	47° 45.088'	12:04:52 12:11:04	Mid	187	189	176	177	158	160	162	164	<160	<160	N/A	N/A	25	10	120	1,600 North 1,500 South	6,000 North 6,000 South	-
	Long.	122° 43.511'		Down	191	191	177	178	162	163	156	158	<165	<165	N/A	N/A						
	Distance from Pile in meters				10		155		1000		927		886		2343							
TP#4 = 36", Bubble Curtain On	Lat.	47° 45.113'	16:44:45 16:50:15	Mid	N/A	N/A	174	174	155	157	152	154	156	157	149	153	17	<20	<100	500 North 900 Mid & South	1,500 North 4,500 South	-
	Long.	122° 43.508'		Down	N/A	N/A	174	175	158	159	149	150	160	161	N/A	N/A						
	Distance from Pile in meters				10		200		1000		879		983		2337							
Date:	**10/4/2011**																					
TTP#4 = 36", Bubble Curtain On	Lat.	47° 45.011'	14:52:00 14:59:52	Mid	N/A	N/A	175	176	153	154	N/A	N/A	N/A	N/A	151	152	44	<20	<100	500	2,500 North 2,500 South	-
	Long.	122° 43.455'		Down	N/A	N/A	172	174	152	153	N/A	N/A	N/A	N/A	N/A	N/A						
	Distance from Pile in meters				10		170		965		N/A		N/A		2454							
Date:	**10/8/2011**																					
TP#1 = 36", Bubble Curtain On	Lat.	47° 45.228'	15:04:29 15:17:14	Mid	N/A	N/A	<172	<172	155	157	N/A	N/A	N/A	N/A	N/A	N/A	98	<10	<100	900	3,500 North 3,500 South	-
	Long.	122° 43.483'		Down	N/A	N/A	<164	<164	158	159	N/A	N/A	N/A	N/A	N/A	N/A						
	Distance from Pile in meters				10		1600		982		N/A		N/A		2322							

Note: Calculated distances are based on the maximum RMS levels measured on that day

Table 9. Summary of SEL Sound Levels During Impact Driving

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL												Number of Pile Strikes	Calculated distance (m) 187 dB SEL	Calculated distance (m) 183 dB SEL	Approximate dB SEL/Strike Reduction
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft					
					Strike	Cum.	Strike	Cum.	Strike	Cum.	Strike	Cum.	Strike	Cum.	Strike	Cum.				
Date:	**9/1/2011**																			
TTP#1 = 24", Bubble Curtain On	Lat.	47° 45.171'	11:29:45	Mid	160	165	136	141	<139	N/A	<127	N/A	<138	N/A	129	134	3	<10	<10	6 to 7
	Long.	122° 43.359'	11:32:37	Down	161	166	135	140	<151	N/A	<127	N/A	133	138	128	132				
	Distance from Pile in meters				10		527		977		965		1489		2492					
TTP#1 = 24", Bubble Curtain Off	Lat.	47° 45.171'	11:34:16	Mid	166	174	143	148	<139	N/A	<127	N/A	140	145	137	142	7	<10	<10	-
	Long.	122° 43.359'	11:37:16	Down	167	175	143	148	<151	N/A	<127	N/A	141	146	135	140				
	Distance from Pile in meters				10		527		1013		1100		1489		2492					
TTP#2 = 36", Bubble Curtain On	Lat.	47° 45.151'	15:40:25	Mid	171	187	158	172	144	159	140	154	143	158	140	154	40	28	51	7 to 8
	Long.	122° 43.425'	15:45:48	Down	177	193	155	169	151	166	141	156	146	160	142	157				
	Distance from Pile in meters				11		415		950		922		1169		2421					
TTP#2 = 36", Bubble Curtain Off	Lat.	47° 45.151'	15:51:12	Mid	178	194	163	178	149	164	154	169	150	166	150	165	38	78	145	-
	Long.	122° 43.425'	15:52:06	Down	184	200	163	179	159	176	151	157	150	162	150	165				
	Distance from Pile in meters				11		415		983		738		1101		2421					
Date:	**9/10/2011**																			
TP#7 = 36", Bubble Curtain On	Lat.	47° 45.071'	16:36:38-	Mid	167	184	165	180	132	147	<129	N/A	<134	N/A	137	154	47	16	30	8 to 13
	Long.	122° 43.483'	16:49:12	Down	169	186	163	177	137	150	N/A	N/A	<137	N/A	137	151				
	Distance from Pile in meters				20		64		1863		2980		2447		2392					
TP#7 = 36", Bubble Curtain Off	Lat.	47° 45.071'	16:56:57	Mid	175	191	170	186	142	158	<129	N/A	145	160	149	163	40	93	172	-
	Long.	122° 43.483'	16:57:50	Down	181	197	176	191	149	164	N/A	N/A	145	161	149	164				
	Distance from Pile in meters				20		66		1737		2980		2445		2392					
Date:	**9/15/2011**																			
TP#3 RP#3 = 36", Bubble Curtain On	Lat.	47° 45.118'	14:18:04	Mid	162	172	154	164	138	145	135	141	141	148	<135	N/A	9	<10	<10	5 to 7
	Long.	122° 43.468'	14:25:55	Down	168	178	153	161	139	146	135	142	139	146	113	120				
	Distance from Pile in meters				10		92		989		1121		912		2384					
TP#3 RP#3 = 36", Bubble Curtain Off	Lat.	47° 45.118'	14:27:15	Mid	169	179	161	168	144	151	140	149	150	157	<135	N/A	10	<10	14	-
	Long.	122° 43.468'	14:34:05	Down	175	185	161	169	147	154	139	147	144	152	119	126				
	Distance from Pile in meters				10		92		1020		1127		876		2384					
Date:	**9/16/2011**																			
TP#3 RP#2 = 36", Bubble Curtain On	Lat.	47° 45.118'	10:44:24	Mid	166	181	157	170	<135	N/A	128	143	<134	N/A	129	143	30	<10	<10	9 to 13
	Long.	122° 43.468'	10:53:40	Down	N/A	N/A	157	171	137	152	130	144	<137	N/A	129	144				
	Distance from Pile in meters				10		90		1167		1382		1093		2384					
TP#3 RP#1 = 36", Bubble Curtain On	Lat.	47° 45.118'	15:02:45	Mid	165	180	160	171	141	156	141	154	142	154	N/A	N/A	30	<10	<10	7 to 13
	Long.	122° 43.468'	15:10:58	Down	N/A	N/A	161	173	151	165	143	156	139	153	N/A	N/A				
	Distance from Pile in meters				10		95		687		782		931		2384					
TP#3 = 36", Bubble Curtain Off	Lat.	47° 45.116'	16:10:39	Mid	176	191	165	180	146	161	147	161	148	164	N/A	N/A	33	19	35	-
	Long.	122° 43.473'	16:16:37	Down	174	189	169	184	157	163	147	162	150	165	N/A	N/A				
	Distance from Pile in meters				10		90		1039		1685		1034		2384					
Date:	**9/17/2011**																			
TP#2 = 36", Bubble Curtain On	Lat.	47° 45.134'	10:26:20	Mid	166	178	N/A	N/A	140	151	<137	N/A	147	157	141	152	15	<10	15	-
	Long.	122° 43.485'	10:31:14	Down	174	186	N/A	N/A	147	159	<141	N/A	145	157	142	156				
	Distance from Pile in meters				10		125		1025		1470		843		2355					
Date:	**9/21/2011**																			
TTP#3 = 36", Bubble Curtain On	Lat.	47° 45.077'	10:10:18	Mid	176	191	169	182	145	159	140	155	148	162	141	154	30	18	33	-
	Long.	122° 43.428'	10:20:41	Down	N/A	N/A	166	182	144	158	143	158	145	159	142	156				
	Distance from Pile in meters				10		123		817		991		953		2451					
Date:	**9/24/2011**																			
TP#10 = 36", Bubble Curtain On	Lat.	47° 45.032'	14:05:00	Mid	164	176	N/A	N/A	142	151	148	157	145	155	N/A	N/A	17	<10	<10	-
	Long.	122° 43.540'	14:12:24	Down	167	179	161	169	143	154	144	155	142	152	N/A	N/A				
	Distance from Pile in meters				10		118		980		1100		998		2341					

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL												Number of Pile Strikes	Calculated distance (m) 187 dB SEL	Calculated distance (m) 183 dB SEL	Approximate dB SEL/Strike Reduction
					Barge		WRA Boat		Mid Channel		North Channel		South Channel		Raft					
					Strike	Cum.	Strike	Cum.	Strike	Cum.	Strike	Cum.	Strike	Cum.	Strike	Cum.				
Date:	**9/26/2011**																			
TP#8 = 36", Bubble Curtain On	Lat.	47° 45.069'	9:31:38	Mid	164	178	159	164	142	154	144	157	N/A	N/A	N/A	N/A	25	18	34	-
	Long.	122° 43.531'	9:41:32	Down	177	191	157	168	143	156	143	157	N/A	N/A	N/A	N/A				
	Distance from Pile in meters				10		235		981		1463		1000		2333					
Date:	**9/29/2011**																			
TP#12 = 36", Bubble Curtain On	Lat.	47° 45.012'	10:18:18	Mid	167	181	159	171	142	153	146	155	142	153	139	150	26	16	30	-
	Long.	122° 43.520'	10:23:13	Down	176	190	160	172	141	154	143	155	143	154	N/A	N/A				
	Distance from Pile in meters				10		81		937		1268		884		2336					
TP#11 = 48", Bubble Curtain On	Lat.	47° 45.014'	15:03:22	Mid	169	185	168	182	151	165	157	171	152	167	<148	N/A	38	28	52	3 to 10
	Long.	122° 43.551'	15:11:22	Down	178	194	168	183	150	165	156	171	153	169	N/A	N/A				
	Distance from Pile in meters				10		120		897		1216		1077		2339					
TP#11 = 48", Bubble Curtain Off	Lat.	47° 45.014'	15:17:36	Mid	178	193	173	188	152	167	159	174	152	167	148	162	33	43	79	-
	Long.	122° 43.551'	15:18:18	Down	181	196	174	189	154	169	158	173	156	171	N/A	N/A				
	Distance from Pile in meters				10		120		886		1100		1055		2339					
Date:	**9/30/2011**																			
TP#13 = 48", Bubble Curtain On	Lat.	47° 45.010'	9:52:01	Mid	<174	N/A	162	172	143	153	135	146	<179	N/A	142	154	13	14	26	-
	Long.	122° 43.508'	9:56:59	Down	178	189	163	171	146	154	137	148	<168	N/A	N/A	N/A				
	Distance from Pile in meters				10		163		931		1500		1190		2393					
TP#5 = 48", Bubble Curtain On	Lat.	47° 45.091'	13:36:18	Mid	<174	N/A	163	178	148	163	151	166	147	161	149	165	35	20	37	4 to 7
	Long.	122° 43.545'	13:40:32	Down	176	191	162	173	152	168	153	168	149	165	N/A	N/A				
	Distance from Pile in meters				10		194		754		1080		1000		2304					
TP#5 = 48", Bubble Curtain Off	Lat.	47° 45.091'	13:43:59	Mid	181	196	171	183	153	168	155	170	148	166	153	169	32	40	74	-
	Long.	122° 43.545'	13:44:38	Down	180	195	N/A	N/A	157	171	157	172	154	169	N/A	N/A				
	Distance from Pile in meters				10		194		754		1400		1060		2304					
Date:	**10/1/2011**																			
TP#9 RP#3 = 36", Bubble Curtain On	Lat.	47° 45.043'	9:19:11	Mid	172	185	156	166	141	151	140	150	135	145	140	149	18	23	43	-
	Long.	122° 43.544'	9:24:05	Down	180	193	156	166	143	153	140	152	139	148	N/A	N/A				
	Distance from Pile in meters				10		142		921		1450		1213		2329					
TP#9 RP#2 = 36", Bubble Curtain On	Lat.	47° 45.043'	11:27:25	Mid	179	190	161	169	140	149	142	150	139	147	139	148	14	17	31	-
	Long.	122° 43.544'	11:31:11	Down	174	185	162	168	144	152	143	151	141	149	N/A	N/A				
	Distance from Pile in meters				10		140		860		1100		1110		2329					
TP#9 RP#1 = 36", Bubble Curtain On	Lat.	47° 45.043'	14:07:50	Mid	171	182	161	169	140	150	140	150	140	150	140	147	14	13	23	-
	Long.	122° 43.544'	14:12:00	Down	177	188	161	169	142	152	143	152	142	151	N/A	N/A				
	Distance from Pile in meters				10		140		880		1100		963.75		2329					
Date:	**10/2/2011**																			
TP#9 = 36", Bubble Curtain On	Lat.	47° 45.043'	16:29:13	Mid	174	192	163	181	147	164	147	165	144	162	152	170	63	54	100	-
	Long.	122° 43.544'	16:34:06	Down	180	198	162	174	148	165	150	167	146	163	N/A	N/A				
	Distance from Pile in meters				10		140		815		1300		924.25		2329					
Date:	**10/3/2011**																			
TP#6 = 48", Bubble Curtain On	Lat.	47° 45.088'	12:04:52	Mid	181	195	165	176	147	159	150	162	147	160	<156	N/A	25	34	63	-
	Long.	122° 43.511'	12:11:04	Down	179	193	165	177	150	163	145	157	<152	N/A	N/A	N/A				
	Distance from Pile in meters				10		155		1000		927		886		2343					
TP#4 = 36", Bubble Curtain On	Lat.	47° 45.113'	16:44:45	Mid	176	188	161	171	144	154	141	151	144	153	137	145	17	12	23	-
	Long.	122° 43.508'	16:50:15	Down	N/A	N?A	161	170	146	156	138	147	149	158	N/A	N/A				
	Distance from Pile in meters				10		200		1000		879		983		2337					
Date:	**10/4/2011**																			
TTP#4 = 36", Bubble Curtain On	Lat.	47° 45.011'	14:52:00	Mid	172	188	163	177	142	157	N/A	N/A	N/A	N/A	140	154	44	12	23	-
	Long.	122° 43.455'	14:59:52	Down	170	186	161	175	142	157	N/A	N/A	N/A	N/A	N/A	N/A				
	Distance from Pile in meters				10		170		965		N/A		N/A		2454					
Date:	**10/8/2011**																			
TP#1 = 36", Bubble Curtain On	Lat.	47° 45.228'	15:04:29	Mid	168	188	<160	N/A	144	163	N/A	N/A	N/A	N/A	146	165	98	25	47	-
	Long.	122° 43.483'	15:17:14	Down	173	193	<148	N/A	146	166	N/A	N/A	N/A	N/A	N/A	N/A				
	Distance from Pile in meters				10		1600		982		N/A		N/A		2322					

The airborne measuring microphones were affected by pile-driving noise, other construction activities, and other noise sources including patrol boats, monitoring boats, and intermittent sources such as voices and radio communications. The level of these noises and their frequencies of occurrence depended upon the noises that were being generated in proximity to each of the measuring microphones. It was, therefore, not possible to correlate data between the different locations. Noise levels from competing sources with the pile driving were frequently at levels equal to or above the noise level generated by the pile-driving activities. This does not mean those sources are louder, just that they were closer to the microphones and appeared to be a higher amplitude. The measurements made at the barge, approximately 15 meters from the pile-driving activity, provided the best data for pile-driving noise because it was the closest location to the pile driving where noise levels from this activity are the highest. However, the crane and compressors on the barge also produce considerable noise. While vibratory driving may be clearly audible from the construction barge to humans, the low-frequency contribution from engines and other construction equipment may contribute significantly to the un-weighted sound levels that are measured prior, during and after pile driving. This compromises the use of these data for predicting attenuation of the vibratory sound levels, since the competing sources are at different distances than the vibratory pile-driving sounds.

Vibratory Pile Driving

The results of daily monitoring of airborne sound levels during vibratory pile driving are summarized in **Table 10**. The table shows the average and maximum sound levels during each pile-driving event measured at the barge, the WRA boat, and the two on-shore positions. The distance from the pile being driven to the microphone on the barge was measured and fixed. The distances between the pile and the other microphone positions were estimated from Global Positioning System (GPS) coordinates as previously described. At the three distant monitoring positions, maximum sound levels during vibratory driving typically resulted from non-vibratory pile-driving sources. On the WRA boat, the primary source was radio communications carried on by the marine mammal monitor who frequently stood near the airborne microphone. The north shore and south shore positions were less affected by non-construction related sources.

Maximum un-weighted sound levels ranged from 96 dB to 108 dB measured at a distance of 15 meters from the pile. Maximum A-weighted sound levels ranged from 92 dBA to 104 dBA at that same distance of 15 meters from the pile. Sound levels averaged over the duration of the vibratory pile-driving events were typically 10 dB +/- below maximum levels. Just as with underwater sound levels, maximum levels occurred for short periods near the beginning or the end of a vibratory event. This sometimes occurred at both the beginning and the end of a vibratory pile-driving event.

Impact Pile Driving

Table 11 summarizes the daily results of average and maximum RMS sound pressure levels measured during impact pile driving. Maximum un-weighted sound levels ranged from 106 to 112 dB RMS at a distance of 15 meters, while the corresponding maximum A-weighted sound levels ranged from 105 to 110 dBA.

Table 10. Summary of Airborne Sound Levels During Vibratory Driving

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS: Barge Avg	Barge Max	WRA Boat Avg	WRA Boat Max	North Shore Avg	North Shore Max	South Shore Avg	South Shore Max	Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
Date:	**8/29/2011**														
TTP#1 - 24"	Lat.	47° 45.171'	12:10:13-12:21:42	Un-weighted	92	102			78	87			19	60	
	Long.	122° 43.359'		A-weighted	85	96			72	82					30
	Distance from Pile in meters				15		145		123		426				
TTP#2 - 36"	Lat.	47° 45.151'	15:06:33-15:20:21	Un-weighted	96	103			79	87	74	90	21	67	
	Long.	122° 43.425'		A-weighted	89	98			75	82	58	72			38
	Distance from Pile in meters				15		58		172		400				
Date:	**8/30/2011**														
TTP#3 - 36"	Lat.	47° 45.077'	9:53:27-10:13:28	Un-weighted	102	108	77	84	81	92			38	119	
	Long.	122° 43.428'		A-weighted	89	101	61	71	72	89					53
	Distance from Pile in meters				15		361		186		268				
TTP#3 - 36"	Lat.	47° 45.077'	10:42:36-10:48:25	Un-weighted	92	103	71	81	75	82			21	67	
	Long.	122° 43.428'		A-weighted	86	92	59	79	68	75					19
	Distance from Pile in meters				15		361		186		268				
TP#3 - 36"	Lat.	47° 45.116'	13:11:17-13:20:10	Un-weighted	95	105	83	91	76	85			27	84	
	Long.	122° 43.473'		A-weighted	89	101	73	86	69	80					53
	Distance from Pile in meters				15		442		223		356				
TP#7 - 36"	Lat.	47° 45.071'	14:39:48-14:55:48	Un-weighted	93	105	70	78	72	84			27	84	
	Long.	122° 43.483'		A-weighted	88	102	60	73	67	81					60
	Distance from Pile in meters				15		295		250		290				
Date:	**8/31/2011**														
TTP#4 - 36"	Lat.	47° 45.011'	9:19:02-9:25:35	Un-weighted	95	103	83	93	73	82			20	64	
	Long.	122° 43.455'		A-weighted	88	97	69	78	69	79					34
	Distance from Pile in meters				15		86		286		179				
TTP#4 - 36"	Lat.	47° 45.011'	9:40:35-9:57:01	Un-weighted	99	106	82	91	74	83			31	99	
	Long.	122° 43.455'		A-weighted	89	95	70	76	66	76					27
	Distance from Pile in meters				15		86		286		179				
TP#13 - 48"	Lat.	47° 45.010'	11:59:01-12:10:27	Un-weighted	100	108	79	90	76	84			36	112	
	Long.	122° 43.508'		A-weighted	93	101	66	79	69	76					54
	Distance from Pile in meters				15		272		337		231				
TP#12- 36"	Lat.	47° 45.012'	14:23:00-14:31:00	Un-weighted	96	104	75	89	72	82			25	79	
	Long.	122° 43.520'		A-weighted	89	96	61	78	66	75					31
	Distance from Pile in meters				15		82		350		244				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS								Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
					Barge		WRA Boat		North Shore		South Shore				
					Avg	Max	Avg	Max	Avg	Max	Avg	Max			
Date:	**9/8/2011**														
TP#3 RP#3 - 36"	Lat.	47° 45.118'	14:34:08-15:06:46	Un-weighted	91	105			73	86			26	82	
	Long.	122° 43.468'		A-weighted	86	101			67	82					51
	Distance from Pile in meters				15		92		223		356				
TP#3 RP#2 - 36"	Lat.	47° 45.118'	16:16:34-16:32:06	Un-weighted	91	100	84	93	77	86			16	49	
	Long.	122° 43.468'		A-weighted	84	97	79	89	71	79					33
	Distance from Pile in meters				15		167		223		356				
TP#3 RP#2 - 36"	Lat.	47° 45.118'	16:46:08-16:57:34	Un-weighted	91	101	83	93	78	88			16	50	
	Long.	122° 43.468'		A-weighted	85	95	78	90	73	84					27
	Distance from Pile in meters				15		87		223		356				
Date:	**9/10/2011**														
TP#3 RP#1 - 36"	Lat.	47° 45.118'	10:45:51-11:00:20	Un-weighted					75	84					
	Long.	122° 43.468'		A-weighted					70	82					
	Distance from Pile in meters				15		107		223		356				
TP#2 - 36"	Lat.	47° 45.134'	12:54:52-13:05:03	Un-weighted					74	82					
	Long.	122° 43.485'		A-weighted					68	74					
	Distance from Pile in meters				15		66		241		392				
Date:	**9/17/2011**														
TP#2 - 36"	Lat.	47° 45.134'	11:21:07-11:38:04	Un-weighted	90	98			73	80	66	74	12	39	
	Long.	122° 43.485'		A-weighted	85	92			65	72	57	66			18
	Distance from Pile in meters				15		103		241		392				
TP#3 MP#1 - 36"	Lat.	47° 45.120'	12:24:06-12:35:27	Un-weighted	90	98	82	96	72	80	68	76	12	37	
	Long.	122° 43.466'		A-weighted	81	89	73	81	64	69	57	66			14
	Distance from Pile in meters				15		92		223		356				
TTP#2 - 36"	Lat.	47° 45.151'	14:04:48-14:24:05	Un-weighted	92	100	82	100	75	83	68	78	15	46	
	Long.	122° 43.425'		A-weighted	87	97	72	82	72	82	59	71			32
	Distance from Pile in meters				15		133		172		400				
TP#3 MP#3 - 36"	Lat.	47° 45.119'	14:51:28-15:03:41	Un-weighted	90	100	81	94	71	80	67	75	15	48	
	Long.	122° 43.480'		A-weighted	83	95	72	85	64	75	58	69			27
	Distance from Pile in meters				15		93		223		356				
TP#7 - 36"	Lat.	47° 45.071'	15:25:21-15:40:16	Un-weighted	93	103	83	95	72	84	70	79	20	65	
	Long.	122° 43.483'		A-weighted	89	100	80	93	68	78	64	75			46
	Distance from Pile in meters				15		75		250		290				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS								Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
					Barge		WRA Boat		North Shore		South Shore				
					Avg	Max	Avg	Max	Avg	Max	Avg	Max			
TP#3 MP#2 - 36"	Lat.	47° 45.113'	19:09:26-16:17:20	Un-weighted	91	101	82	92	72	83	67	80	17	53	
	Long.	122° 43.469'		A-weighted	87	98	78	90	66	78	59	72			39
	Distance from Pile in meters				15		85		223		356				
Date:	**9/21/2011**														
TP#10 - 36"	Lat.	47° 45.032'	13:38:53-13:48:06	Un-weighted	95	105	80	90	71	80	73	82	26	81	
	Long.	122° 43.540'		A-weighted	90	100	75	86	65	74	65	74			49
	Distance from Pile in meters				15		117		348		288				
TP#10 - 36"	Lat.	47° 45.032'	16:47:16-17:00:12	Un-weighted	94	104	81	92	76	88	76	87	22	71	
	Long.	122° 43.540'		A-weighted	89	100	74	84	64	74	65	74			45
	Distance from Pile in meters				15		117		348		288				
TP#9 - 36"	Lat.	47° 45.043'	16:47:16-17:00:12	Un-weighted	94	104	78	88	70	78	72	84	24	74	
	Long.	122° 43.544'		A-weighted	89	100	73	82	64	74	64	73			49
	Distance from Pile in meters				15		145		344		304				
Date:	**9/22/2011**														
TP#8 - 36"	Lat.	47° 45.069'	9:08:23-9:29:36	Un-weighted	94	102	85	102	72	82	70	78	19	59	
	Long.	122° 43.531'		A-weighted	86	96	76	84	65	75	61	72			28
	Distance from Pile in meters				15		71		309		323				
TP#11 - 48"	Lat.	47° 45.014'	15:18:20-15:31:25	Un-weighted	93	104	79	92	71	80	73	88	24	76	
	Long.	122° 43.551'		A-weighted	85	99	69	80	62	74	64	77			42
	Distance from Pile in meters				15		112		375		279				
Date:	**9/23/2011**														
TP#6 - 48"	Lat.	47° 45.088'	8:54:48-9:08:56	Un-weighted	96	103	87	102	74	81	72	79	21	65	
	Long.	122° 43.511'		A-weighted	88	95	74	85	67	76	62	74			27
	Distance from Pile in meters				15		109		278		334				
TP#5 - 48"	Lat.	47° 45.091'	11:21:56-11:39:51	Un-weighted	98	107	87	103	75	83	75	84	32	101	
	Long.	122° 43.545'		A-weighted	90	100	77	84	65	71	63	73			50
	Distance from Pile in meters				15		110		316		365				
TP#4, Batter - 36"	Lat.	47° 45.113'	15:36:58-16:15:20	Un-weighted	97	108	88	99	74	86	72	85	39	123	
	Long.	122° 43.507'		A-weighted	89	100	82	95	68	78	64	75			49
	Distance from Pile in meters				15		80		266		371				
Date:	**9/24/2011**														
TP#10 - 36"	Lat.	47° 45.032'	14:46:28-15:01:00	Un-weighted	90	102			70	80	71	82	19	61	
	Long.	122° 43.540'		A-weighted	83	98			62	72	62	74			37
	Distance from Pile in meters				15		118		348		288				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS								Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
					Barge		WRA Boat		North Shore		South Shore				
					Avg	Max	Avg	Max	Avg	Max	Avg	Max			
TP#9 RP#3 - 36"	Lat.	47° 45.043'	15:59:38- 16:14:19	Un-weighted	91	101	78	88	71	82	71	82	16	50	
	Long.	122° 43.544'		A-weighted	85	98	72	85	65	77	64	76			39
	Distance from Pile in meters				15		150		344		304				
Date:	**9/26/2011**														
TP#8 - 36"	Lat.	47° 45.069'	10:25:57- 10:47:39	Un-weighted	92	100			73	84	77	91	16	49	
	Long.	122° 43.531'		A-weighted	86	96			66	75	66	75			31
	Distance from Pile in meters				15		147		309		323				
TP#9 RP#1 - 36"	Lat.	47° 45.043'	11:16:20- 11:30:41	Un-weighted	94	100			72	82	72	82	16	50	
	Long.	122° 43.544'		A-weighted	92	99			68	78	67	77			42
	Distance from Pile in meters				15		140		344		304				
Date:	**9/29/2011**														
TP#12 - 36"	Lat.	47° 45.012'	11:14:00 11:29:35	Un-weighted	92	103	80	93	69	79	75	84	21	65	
	Long.	122° 43.520'		A-weighted	84	98	75	91	63	75	68	81			36
	Distance from Pile in meters				15		81		350		244				
TP#9 RP#2 - 36"	Lat.	47° 45.043'	12:09:31 12:18:50	Un-weighted	93	105	79	85	76	87	78	86	25	80	
	Long.	122° 43.544'		A-weighted	89	104	71	82	64	72	66	76			73
	Distance from Pile in meters				15		140		344		304				
TP#11 - 48"	Lat.	47° 45.014'	16:27:16- 16:43:42	Un-weighted	91	102	76	88	70	83	73	84	18	58	
	Long.	122° 43.551'		A-weighted	82	98	69	85	62	74	65	78			37
	Distance from Pile in meters				15		120		375		279				
TP#9 MP#1 - 36"	Lat.	47° 45.043'	17:02:44- 17:09:26	Un-weighted	91	102	78	87	69	80	75	87	18	58	
	Long.	122° 43.544'		A-weighted	81	97	69	82	60	72	64	77			32
	Distance from Pile in meters				15		140		344		304				
Date:	**9/30/2011**														
TP#13 - 48"	Lat.	47° 45.010'	10:39:49- 10:55:35	Un-weighted	93	104	82	92	75	85	79	90	24	74	
	Long.	122° 43.508'		A-weighted	86	98	68	79	65	73	70	79			36
	Distance from Pile in meters				15		270		337		231				
TP#9 MP#2 - 36"	Lat.	47° 45.041'	11:29:35- 11:39:19	Un-weighted	93	100	79	89	70	78	75	81	16	49	
	Long.	122° 43.563'		A-weighted	88	98	73	82	64	74	67	77			37
	Distance from Pile in meters				15		145		344		304				
TP#5 - 48"	Lat.	47° 45.091'	14:23:19- 14:47:04	Un-weighted	94	104	80	93	71	80	74	86	24	74	
	Long.	122° 43.545'		A-weighted	88	98	71	79	61	72	66	77			39
	Distance from Pile in meters				15		190		316		365				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS								Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
					Barge		WRA Boat		North Shore		South Shore				
					Avg	Max	Avg	Max	Avg	Max	Avg	Max			
TP#9 MP#3 - 36"	Lat.	47° 45.053'	15:11:05-15:16:14	Un-weighted	97	104	82	90	73	80	76	85	23	72	
	Long.	122° 43.557'		A-weighted	92	100	76	85	67	77	69	78			46
	Distance from Pile in meters				15		145		344		304				
Date:	**10/3/2011**														
TP#6 - 48"	Lat.	47° 45.088'	13:58:49-14:17:22	Un-weighted	90	97	78	95					11	35	
	Long.	122° 43.511'		A-weighted	82	89	67	73							13
	Distance from Pile in meters				15		155		278		334				
TP#4 - 36"	Lat.	47° 45.113'	17:50:23-18:04:08	Un-weighted	89	97	75	84	72	80	67	77	11	34	
	Long.	122° 43.508'		A-weighted	80	92	69	80	67	73	60	71			19
	Distance from Pile in meters				15		200		266		371				
Date:	**10/4/2011**														
TP#4 - 36"	Lat.	47° 45.113'	10:43:06-11:09:20	Un-weighted	91	100			72	81	70	80	15	48	
	Long.	122° 43.508'		A-weighted	85	97			65	78	64	75			32
	Distance from Pile in meters				15		215		266		371				
TTP#1 - 24"	Lat.	47° 45.171'	15:48:31-16:08:10	Un-weighted	90	96			75	82	66	77	9	30	
	Long.	122° 43.359'		A-weighted	82	88			67	74	57	66			11
	Distance from Pile in meters				15		300		123		426				
Date:	**10/5/2011**														
TP#1 - 36"	Lat.	47° 45.228'	16:25:04-16:52:25	Un-weighted			80	87							
	Long.	122° 43.483'		A-weighted			71	80							
	Distance from Pile in meters				N/A		205		310		556				
Date:	**10/8/2011**														
TP#1 - 36"	Lat.	47° 45.228'	16:06:48-16:20:27	Un-weighted											
	Long.	122° 43.483'		A-weighted											
	Distance from Pile in meters				N/A		1600		310		556				
Date:	**10/17/2011**														
TP#3 MP#3 - 36"	Lat.	47° 45.119'	12:57:55-13:07:01	Un-weighted			78	85							
	Long.	122° 43.480'		A-weighted			71	81							
	Distance from Pile in meters				N/A		105		223		356				
TP#3 MP#2 - 36"	Lat.	47° 45.113'	15:16:43-15:25:32	Un-weighted			79	91							
	Long.	122° 43.469'		A-weighted			74	88							
	Distance from Pile in meters				N/A		105		223		356				
TP#3 - 36"	Lat.	47° 45.116'	16:12:49-16:20:32	Un-weighted			80	93							
	Long.	122° 43.473'		A-weighted			74	89							
	Distance from Pile in meters				N/A		105		223		356				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS								Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
					Barge		WRA Boat		North Shore		South Shore				
					Avg	Max	Avg	Max	Avg	Max	Avg	Max			
Date:	**10/18/2011**														
TP#3 RP#3 - 36"	Lat.	47° 45.118'	11:21:27-11:39:04	Un-weighted			79	88							
	Long.	122° 43.468'		A-weighted			74	85							
	Distance from Pile in meters				N/A		118		223		356				
TP#3 RP#1 - 36"	Lat.	47° 45.118'	14:13:46-14:30:03	Un-weighted			81	89							
	Long.	122° 43.468'		A-weighted			75	88							
	Distance from Pile in meters				N/A		118		223		356				
TP#3 RP#2 - 36"	Lat.	47° 45.118'	13:13:42-13:31:02	Un-weighted			81	92							
	Long.	122° 43.468'		A-weighted			76	89							
	Distance from Pile in meters				N/A		103		223		356				
TP#3 MP#1 - 36"	Lat.	47° 45.120'	15:10:36-15:21:07	Un-weighted			79	90							
	Long.	122° 43.466'		A-weighted			74	86							
	Distance from Pile in meters				N/A		108		223		356				
Date:	**10/19/2011**														
TP#9 MP#2 - 36"	Lat.	47° 45.041'	8:31:48-8:37:15	Un-weighted			74	81							
	Long.	122° 43.563'		A-weighted			66	77							
	Distance from Pile in meters				N/A		137		344		304				
TP#9 MP#2 - 36"	Lat.	47° 45.041'	10:18:36-10:56:03	Un-weighted			75	86							
	Long.	122° 43.563'		A-weighted			67	83							
	Distance from Pile in meters				N/A		137		344		304				
TP#9 MP#3 - 36"	Lat.	47° 45.053'	13:28:04-13:40:01	Un-weighted			74	87							
	Long.	122° 43.557'		A-weighted			68	84							
	Distance from Pile in meters				N/A		169		344		304				
TP#9 MP#1 - 36"	Lat.	47° 45.043'	14:30:42-14:40:00	Un-weighted			73	85							
	Long.	122° 43.544'		A-weighted			65	81							
	Distance from Pile in meters				N/A		169		344		304				
TP#9 - 36"	Lat.	47° 45.043'	15:51:37-16:12:33	Un-weighted			76	89							
	Long.	122° 43.544'		A-weighted			69	81							
	Distance from Pile in meters				N/A		169		344		304				
Date:	**10/20/2011**														
TP#9 RP#3 - 36"	Lat.	47° 45.043'	8:41:08-8:55:53	Un-weighted			77	94							
	Long.	122° 43.544'		A-weighted			71	94							
	Distance from Pile in meters				N/A		146		344		304				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS								Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
					Barge		WRA Boat		North Shore		South Shore				
					Avg	Max	Avg	Max	Avg	Max	Avg	Max			
TP#9 RP#1 - 36"	Lat.	47° 45.043'	10:46:25-11:02:20	Un-weighted			75	81							
	Long.	122° 43.544'		A-weighted			68	76							
	Distance from Pile in meters				N/A		146		344		304				
TP#9 RP#2 - 36"	Lat.	47° 45.043'	11:42:12-11:55:24	Un-weighted			76	86							
	Long.	122° 43.544'		A-weighted			68	83							
	Distance from Pile in meters				N/A		146		344		304				
TTP#4 - 36"	Lat.	47° 45.011'	13:29:21-13:39:45	Un-weighted			78	87							
	Long.	122° 43.455'		A-weighted			72	82							
	Distance from Pile in meters				N/A		128		286		179				
TTP#4 - 36"	Lat.	47° 45.011'	14:03:24-14:13:43	Un-weighted			79	88							
	Long.	122° 43.455'		A-weighted			74	80							
	Distance from Pile in meters				N/A		128		286		179				
TTP#3 - 36"	Lat.	47° 45.077'	15:22:42-15:36:16	Un-weighted			79	93							
	Long.	122° 43.428'		A-weighted			74	91							
	Distance from Pile in meters				N/A		150		186		268				

Key: N/A = Measurement site not in use

Table 11. Summary of Airborne Sound Levels During Impact Driving

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS								Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
					Barge		WRA Boat		North Shore		South Shore				
					Avg	Lmax	Avg	Lmax	Avg	Lmax	Avg	Lmax			
Date:	**9/1/2011**														
TTP#1 = 24"	Lat.	47° 45.171'	11:29:45	Un-weighted	89	110			72	95			47	150	
	Long.	122° 43.359'	11:37:16	A-weighted	85	109			67	93					134
	Distance from Pile in meters				15		527		123		426				
TTP#2 = 36"	Lat.	47° 45.151'	15:40:25	Un-weighted	96	112	75	92	79	96			60	189	
	Long.	122° 43.425'	15:52:06	A-weighted	94	110	69	91	78	96					150
	Distance from Pile in meters				15		415		172		400				
Date:	**9/10/2011**														
TP#7 = 36"	Lat.	47° 45.071'	16:36:38	Un-weighted					75	96					
	Long.	122° 43.483'	16:57:50	A-weighted					69	89					
	Distance from Pile in meters				15		64		250		290				
Date:	**9/15/2011**														
TP#3 RP#3 = 36"	Lat.	47° 45.118'	14:18:04	Un-weighted	94	112	83	100	76	94	75	87	60	189	
	Long.	122° 43.468'	14:34:05	A-weighted	90	110	76	99	69	90	63	83			150
	Distance from Pile in meters				15		92		223		356				
Date:	**9/16/2011**														
TP#3 RP#2 = 36"	Lat.	47° 45.118'	10:44:24	Un-weighted			82	107	73	96	68	87	75	238	
	Long.	122° 43.468'	10:53:40	A-weighted			73	98	64	88	57	79			237
	Distance from Pile in meters				15		90		223		356				
TP#3 RP#1 = 36"	Lat.	47° 45.118'	15:02:45	Un-weighted			78	98	73	93	71	87	74	233	
	Long.	122° 43.468'	15:10:58	A-weighted			67	89	68	88	62	82			84
	Distance from Pile in meters				15		95		223		356				
TP#3 = 36"	Lat.	47° 45.116'	16:10:39	Un-weighted			74	93	71	94	65	84	42	132	
	Long.	122° 43.473'	16:16:37	A-weighted			83	85	63	87	54	78			51
	Distance from Pile in meters				15		90		223		356				
Date:	**9/17/2011**														
TP#2 = 36"	Lat.	47° 45.134'	10:26:20	Un-weighted	91	111	80	97	76	91	68	84	52	164	
	Long.	122° 43.485'	10:31:14	A-weighted	88	108	71	93	66	87	58	80			122
	Distance from Pile in meters				15		125		241		392				
Date:	**9/21/2011**														
TTP#3 = 36"	Lat.	47° 45.077'	10:10:18	Un-weighted	91	111	78	96	74	93	70	87	52	164	
	Long.	122° 43.428'	10:20:41	A-weighted	89	110	73	96	70	92	64	86			153
	Distance from Pile in meters				15		123		186		268				

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - RMS								Calculated distance (m) to 100 dB RMS	Calculated distance (m) to 90 dB RMS	Calculated distance (m) to 92 dBA RMS
					Barge		WRA Boat		North Shore		South Shore				
					Avg	Lmax	Avg	Lmax	Avg	Lmax	Avg	Lmax			
Date:	**9/24/2011**														
	Lat.	47° 45.032'	14:05:00	Un-weighted	89	107			71	85	73	92	32	103	
TP#10 = 36"	Long.	122° 43.540'	14:12:24	A-weighted	85	105			62	80	63	86			81
	Distance from Pile in meters				15		118		348		288				
Date:	**9/26/2011**														
	Lat.	47° 45.069'	9:31:38	Un-weighted	89	106			69	83	72	92	29	92	
TP#8 = 36"	Long.	122° 43.531'	9:41:32	A-weighted	86	106			60	80	59	78			89
	Distance from Pile in meters				15		235		309		323				
Date:	**9/29/2011**														
	Lat.	47° 45.012'	10:18:18	Un-weighted	91	106	79	95	70	86	76	91	20	63	
TP#12 = 36"	Long.	122° 43.520'	10:23:13	A-weighted	88	104	73	93	63	82	68	89			52
	Distance from Pile in meters				10		81		350		244				
	Lat.	47° 45.014'	15:03:22	Un-weighted	90	106	80	97	72	86	75	90	30	95	
TP#11 = 48"	Long.	122° 43.551'	15:18:18	A-weighted	87	104	75	94	66	82	69	86			75
	Distance from Pile in meters				15		120		375		279				
Date:	**9/30/2011**														
	Lat.	47° 45.010'	9:52:01	Un-weighted	88	106	74	88	71	87	77	91	30	94	
TP#13 = 48"	Long.	122° 43.508'	9:56:59	A-weighted	85	104	65	85	64	81	68	89			71
	Distance from Pile in meters				15		163		337		231				
	Lat.	47° 45.091'	13:36:18	Un-weighted	93	109	80	93	71	81	73	88	42	134	
TP#5 = 48"	Long.	122° 43.545'	13:40:32	A-weighted	92	108	75	91	63	76	69	87			119
	Distance from Pile in meters				15		194		316		365				
Date:	**10/1/2011**														
	Lat.	47° 45.043'	9:19:11	Un-weighted			69	91	68	88	68	87	49	156	
TP#9 RP#3 - 36"	Long.	122° 43.544'	9:24:05	A-weighted			69	91	59	80	58	83			156
	Distance from Pile in meters				15		142		344		304				
	Lat.	47° 45.043'	11:27:25	Un-weighted			70	92	72	88	77	96	54	172	
TP#9 RP#2 - 36"	Long.	122° 43.544'	11:31:11	A-weighted			70	92	62	82	67	90			172
	Distance from Pile in meters				15		140		344		304				
	Lat.	47° 45.043'	14:07:50	Un-weighted			67	89			74	88	39	123	
TP#9 RP#1 - 36"	Long.	122° 43.544'	14:12:00	A-weighted			67	89			62	84			123
	Distance from Pile in meters				15		140		344		304				
	Lat.	47° 45.043'	16:29:13	Un-weighted			80	91	67	74	73	88	50	159	
TP#9 = 36"	Long.	122° 43.544'	16:34:06	A-weighted			80	91	56	68	69	85			159
	Distance from Pile in meters				15		140		344		304				

Event Description	**Pile Coordinates**		**Time**	**Sensor**	**Measured Sound Pressure Level - RMS**								**Calculated distance (m) to 100 dB RMS**	**Calculated distance (m) to 90 dB RMS**	**Calculated distance (m) to 92 dBA RMS**
					Barge		**WRA Boat**		**North Shore**		**South Shore**				
					Avg	**Lmax**	**Avg**	**Lmax**	**Avg**	**Lmax**	**Avg**	**Lmax**			
Date:	**10/3/2011**														
TP#6 = 48"	Lat.	47° 45.088'	12:04:52 12:11:04	Un-weighted	91	107	76	91					35	111	88
	Long.	122° 43.511'		A-weighted	86	105	69	90							
	Distance from Pile in meters				15		155		278		334				
TP#4 = 36"	Lat.	47° 45.113'	16:44:45 16:50:15	Un-weighted	90	107	75	94			70	88	34	106	81
	Long.	122° 43.508'		A-weighted	87	105	66	89			59	81			
	Distance from Pile in meters				15		200		266		371				
Date:	**10/4/2011**														
TTP#4 = 36"	Lat.	47° 45.011'	15:52:00 14:59:52	Un-weighted	93	108			72	87	75	91	39	123	118
	Long.	122° 43.455'		A-weighted	89	108			65	85	68	88			
	Distance from Pile in meters				15		170		266		371				
Date:	**10/8/2011**														
TP#1 = 36"	Lat.	47° 45.228'	15:04:29 15:17:14	Un-weighted			80	94					Noise levels not from Pile driving	Noise levels not from Pile driving	
	Long.	122° 43.483'		A-weighted			64	80							Noise levels not from Pile driving
	Distance from Pile in meters				N/A		1600		310		556				

Evaluation of Work Plan Objectives

The objectives of the Work Plan were to:

1. Define the size of underwater injury zones.
2. Define the size of airborne injury zones.
3. Define the size of underwater behavioral buffer zones.
4. Define the size of airborne behavioral buffer zones.
5. Measure the effectiveness of the air bubble curtain during impact pile driving.
6. Measure the effectiveness of the air bubble curtain during vibratory driving.
7. Compare "soft-start" sound levels with levels during the initial phase of pile driving.
8. Determine the rates of acoustic spreading loss.

The following discussion addressing the injury and behavioral zones is organized into underwater and airborne sections. Each of these sections discusses the results separately for impact driving and vibratory driving.

Underwater Injury and Behavioral Buffer Zones

The measurement data were used to compute the distances to the boundaries of injury zones defined by the following underwater sound levels[2]:

a. 180 dB RMS for cetaceans (impact and vibratory driving);
b. 190 dB RMS for pinnipeds (impact and vibratory driving);
c. 180 dB Peak for marbled murrelets (impact driving);
d. 206 dB Peak for fish (impact driving);
e. 187 dB SEL for fish greater than or equal to 2 grams (impact driving); and
f. 183 dB SEL for fish less than 2 grams and marbled murrelets (impact driving).

Thresholds (a) – (d) are defined by single-strike levels from individual impact pile strikes and 10-second average levels from vibratory driving. Thresholds (e) – (f) are daily (12-hr) cumulative levels. The distances to these cumulative SEL thresholds were computed for each pile-driving event and are included in **Table 9**. In this section the cumulative SEL is computed for 100 strikes for comparison to predicted levels. Guidance is provided for estimating daily levels during construction of EHW-2 based on the number of daily pile strikes.

Measurement data are used to compute the distances to the boundaries of behavioral disturbance zones defined by the following underwater sound levels:

a. 160 dB RMS for all marine mammals (impact driving);
b. 150 dB RMS for fish and marbled murrelets (impact driving);
c. 120 dB RMS for all marine mammals (vibratory driving).

[2] See Appendix D – *U.S. Navy Test Pile Program and Explosives Handling Wharf-1 Pile Replacement Project Naval Base Kitsap at Bangor Waterfront: Final Acoustic Monitoring Plan*[2]

The behavioral thresholds are defined by the single-strike levels from individual impact pile strikes and by the average levels over the duration of the pile-driving event from vibratory driving.

Vibratory Pile Driving

Data in **Table 6** were used to chart the overall relationships of RMS sound levels versus distance for 24-, 36-, and 48-inch piles. **Table 6** contains RMS sound pressure levels averaged over the duration of each pile-driving event. The acoustic spreading loss curves for each of these conditions are shown in **Figures 42** through **44**. The transmission coefficients were then used to calculate overall distances to the various threshold levels. Note that there were only a few 24-inch diameter piles driven, so the spreading loss charts for those piles are based on a very small data set.

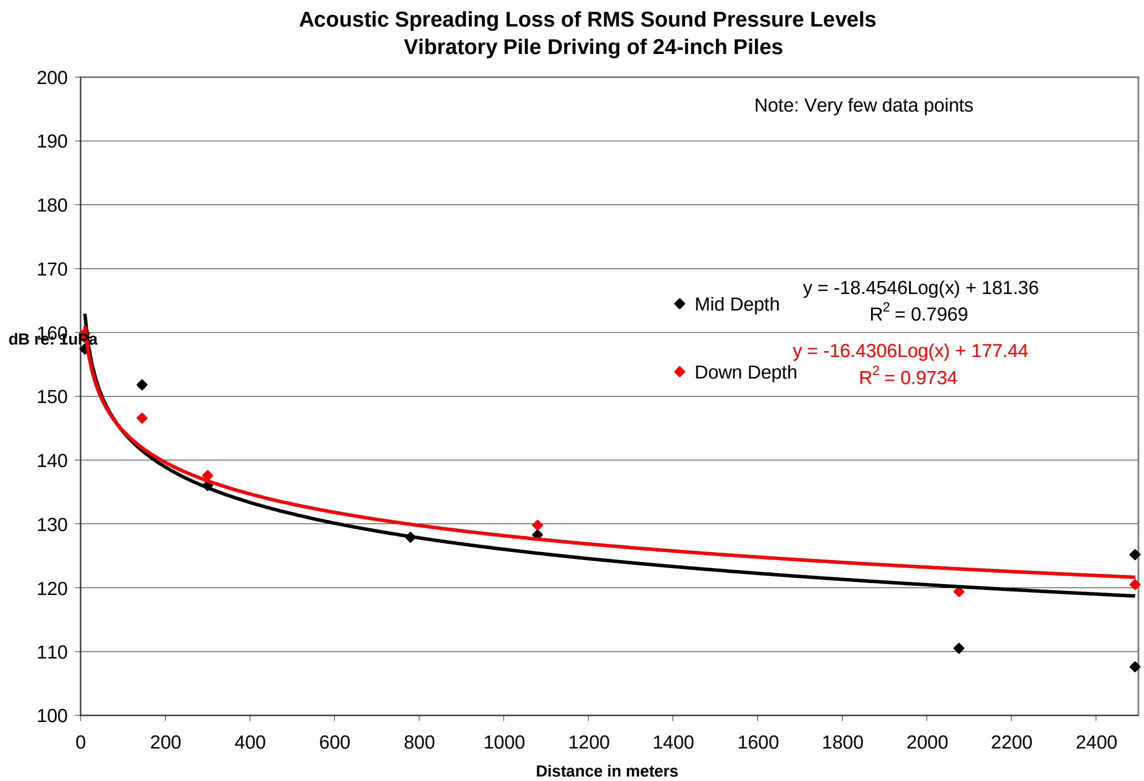

Figure 42. Acoustic Spreading Loss of RMS Levels – 24-inch Piles with Vibratory Hammer

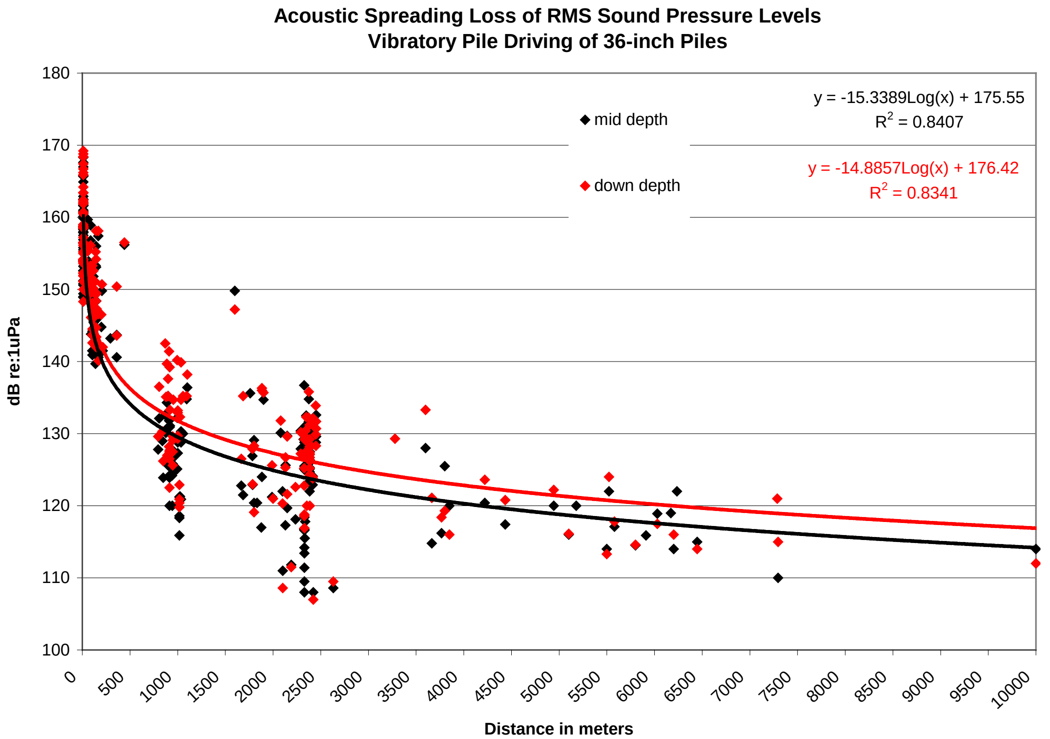

Figure 43. Acoustic Spreading Loss of RMS Levels –36-inch Piles with Vibratory Hammer

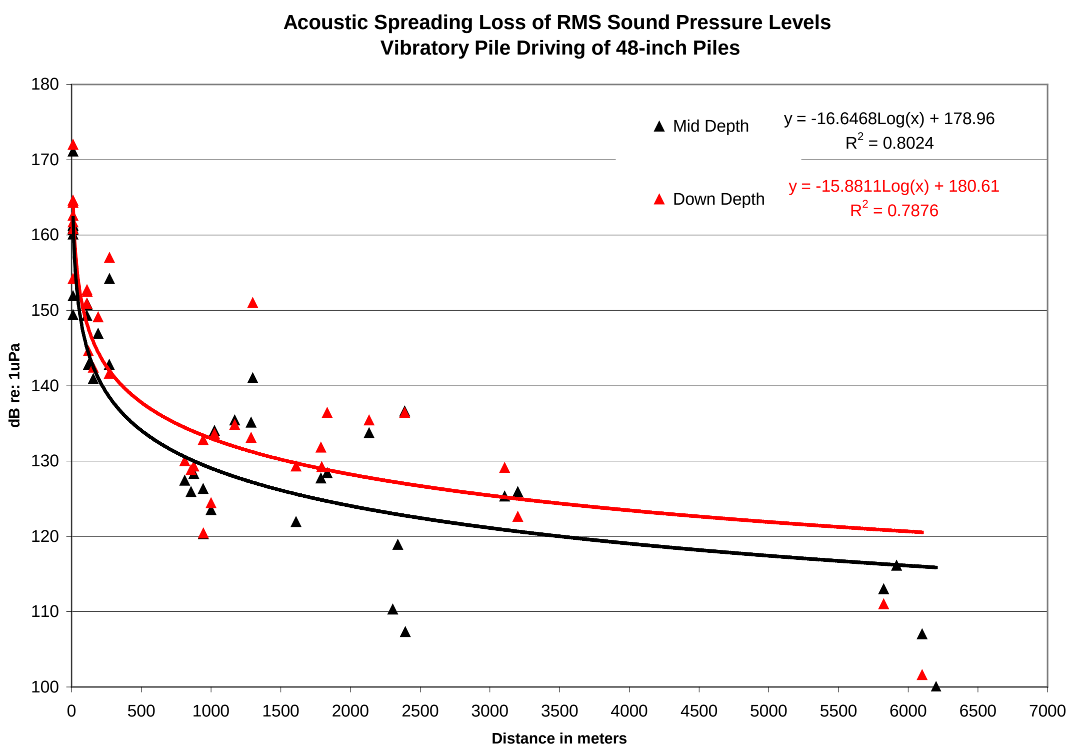

Figure 44. Acoustic Spreading Loss of RMS Levels – 48-inch Piles with Vibratory Hammer

Measured sound pressure levels never exceeded 190 dB RMS at any measurement location. A level of 180 dB RMS was measured once at the 10-meter location on the barge during the driving of TP#3 on August 30, 2011. Maximum levels during vibratory driving were otherwise less than 180 dB at all measurement locations. **Table 12** shows the distances to the 120 dB RMS behavioral threshold for marine mammals. The distances to RMS threshold levels predicted prior to TPP are also shown. Distances shown in bold exceed the levels predicted prior to TPP.

Table 12. Distances to 120 dB RMS Sound Level Threshold From Vibratory Pile Driving

Activity	Distances (m)	
	Deep	**Mid Depth**
	120	120
24" Pile	3,147	2,122
36" Pile	7,499	4,664
48" Pile	6,587	3,505
Predicted - 100,000 m (13.8 km to the north and 6.8 km to the south)		

The distances to where RMS sound pressure levels were 120 dB or higher are reported in **Table 12.** Distances were calculated by computing the propagation rate from all measurements for a certain pile size. This provides an overall distance, but not a distance that would be based on an upper or lower bound number. As shown in the propagation charts (see **Figures 42** through **44**), the curves are the best estimate for all data. There are data points both above and below these curves. As measurements are made further from the pile, the tendency is for the data point to fall at or below the curve. (It should be pointed out that the propagation curves cannot be used to predict a maximum level that will never be exceeded.) While the data summarized in **Table 12** show that distances to the 120-dB RMS sound pressure level ranged from 2,122 to 7,499 meters, the day-to-day estimated range was from 1,200 meters to beyond 8,000 meters. The estimated distances to the 120-dB RMS sound pressure level were up to 18,000 meters, but measurements were never made at distances greater than 7,296 meters. It is important to note that measurements of vibratory pile driving at distances beyond 5,000 meters were attempted for driving of five separate piles and levels were always either below 120 dB or below background and not audible to the observer (an indication that they were below 120 dB). Background was typically the result of current or wave action when the background level exceeded 120 dB.

Impact Pile Driving

Data in **Tables 8** to **18** were used to chart relationships of Peak, RMS, and SEL sound levels versus distance for 24-, 36- and 48-inch piles. Charts were done separately for the conditions with the bubble curtain operating and the bubble curtain off. The acoustic spreading loss curves for each of these conditions are shown in **Figures 45** through **55**. The Peak spreading loss curves are based on the maximum peak level measured during each event. The RMS and SEL curves are based on the average levels measured during each event. It should be noted that the spread between the maximum pile strike and the average pile strikes was usually within 2 dB. The transmission coefficients were then used to calculate distances to the various threshold levels. Again, note that data for 24-inch diameter piles are based on a very small set of measurements.

Table 13 shows the overall distances to the Peak sound pressure level injury thresholds of 206 dB Peak for fish and 180 dB Peak for marbled murrelets. The table also shows buffer distances that were predicted prior to TPP. Numbers in red indicate distances that exceeded predicted distances. The levels in the table are based on the computed propagation rate that was developed using data from all impact pile-driving events (separated by bubble curtain on and off conditions and measurement depth). As with results for vibratory pile driving, individual measurements were lower or higher than those predicted using the propagation curve.

Table 14 shows overall distances to the 190-dB RMS and 180-dB RMS injury thresholds for marine mammals, the 160-dB RMS behavioral disturbance threshold for marine mammals, and the 150-dB RMS behavioral disturbance threshold for fish and marbled murrelets. The distances to RMS threshold levels predicted prior to TPP are also shown. Distances shown in red exceed the distances to the behavioral thresholds predicted prior to TPP. As noted above for peak pressure level data, the levels in the table are based on the computed propagation rate that was developed using data from all impact pile-driving events (separated by bubble curtain on and off conditions and measurement depth). Individual measurements were lower or higher.

Table 15 shows distances to various single-strike SEL levels. Threshold levels are in terms of the cumulative SEL. The cumulative SEL is a function of the number of daily impact pile strikes. **Table 16** shows the distances to the 187-dB cumulative SEL injury threshold for fish greater than or equal to 2 grams, the 183-dB cumulative SEL injury threshold for fish weighing less than 2 grams and marbled murrelets, exposed to 100, 200, 400, and 800 daily pile strikes. The table also shows the distances to the cumulative SEL threshold levels predicted prior to TPP based on 100 pile strikes. Distances shown in red exceeded the distances prior to TPP. Note that the actual measured accumulated SELs from TPP impact pile-driving events are shown in **Table 9.** An overview of these distance values is presented in **Table 16.**

The measurement data are used to compute the distances to the boundaries of injury and behavioral buffer zones defined by the following airborne sound levels:

a. airborne injury zone – 92 dBA for marbled murrelets;
b. airborne behavioral buffer zone – 100 dB for all pinnipeds except harbor seals; and
c. airborne behavioral buffer zone – 90 dB for harbor seals.

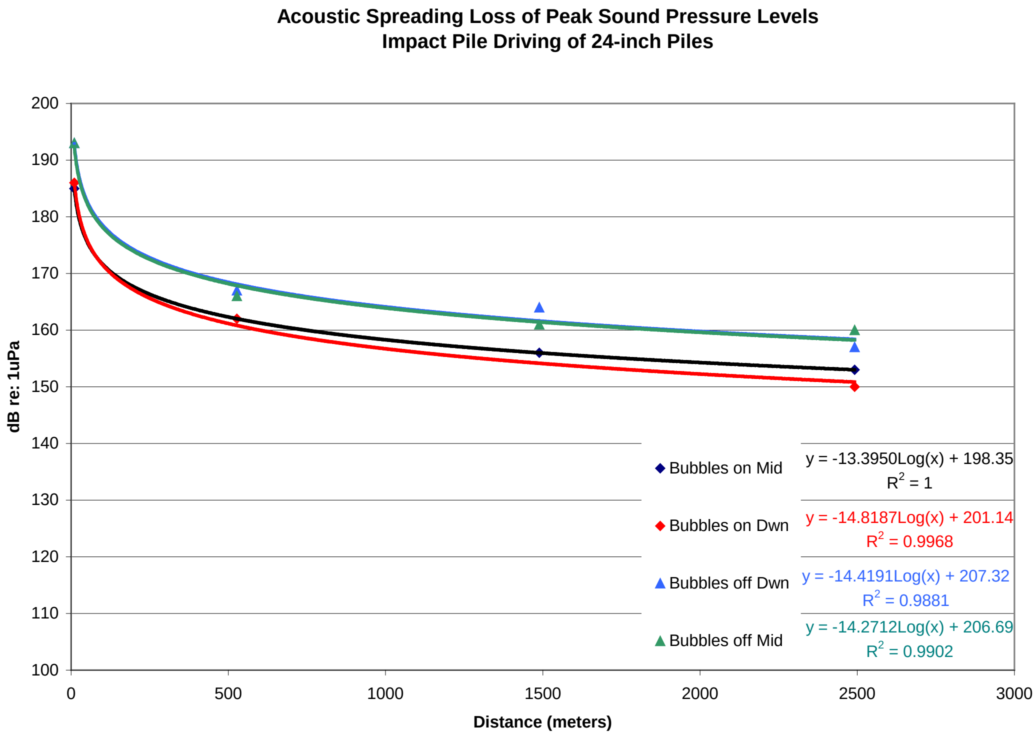

Figure 45. Acoustic Spreading Loss of Peak Levels – 24-inch Piles with Impact Hammer

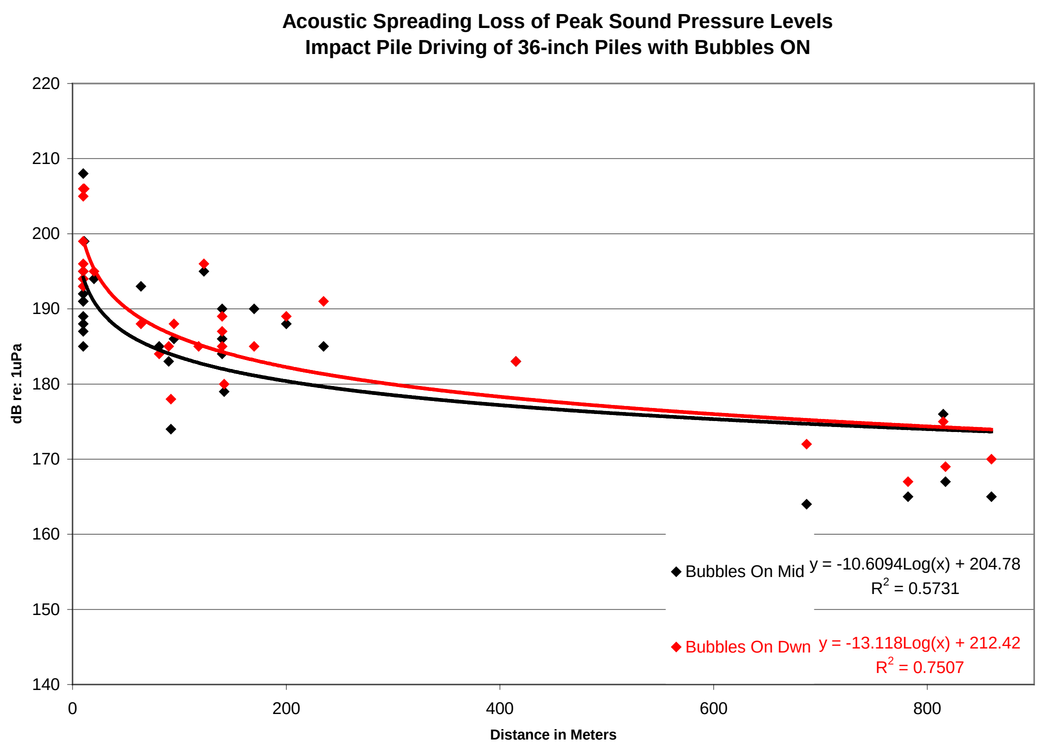

Figure 46. Acoustic Spreading Loss of Peak Levels – 36-inch Piles with Impact Hammer – Bubbles ON

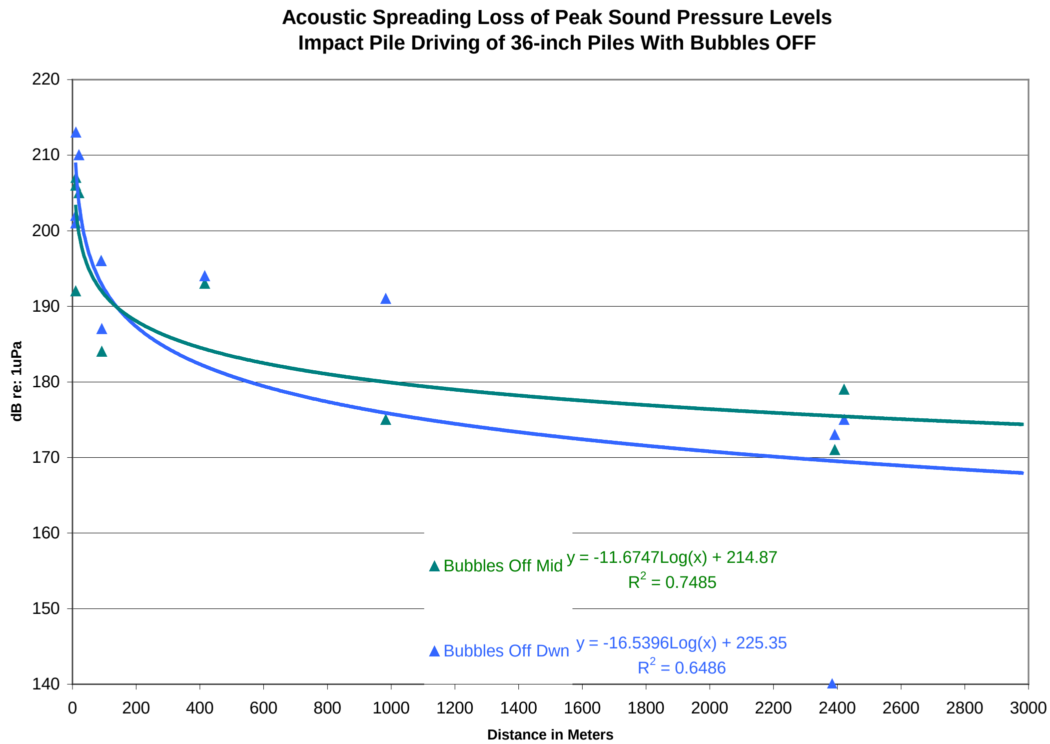

Figure 47. Acoustic Spreading Loss of Peak Levels – 36-inch Piles with Impact Hammer - Bubbles OFF

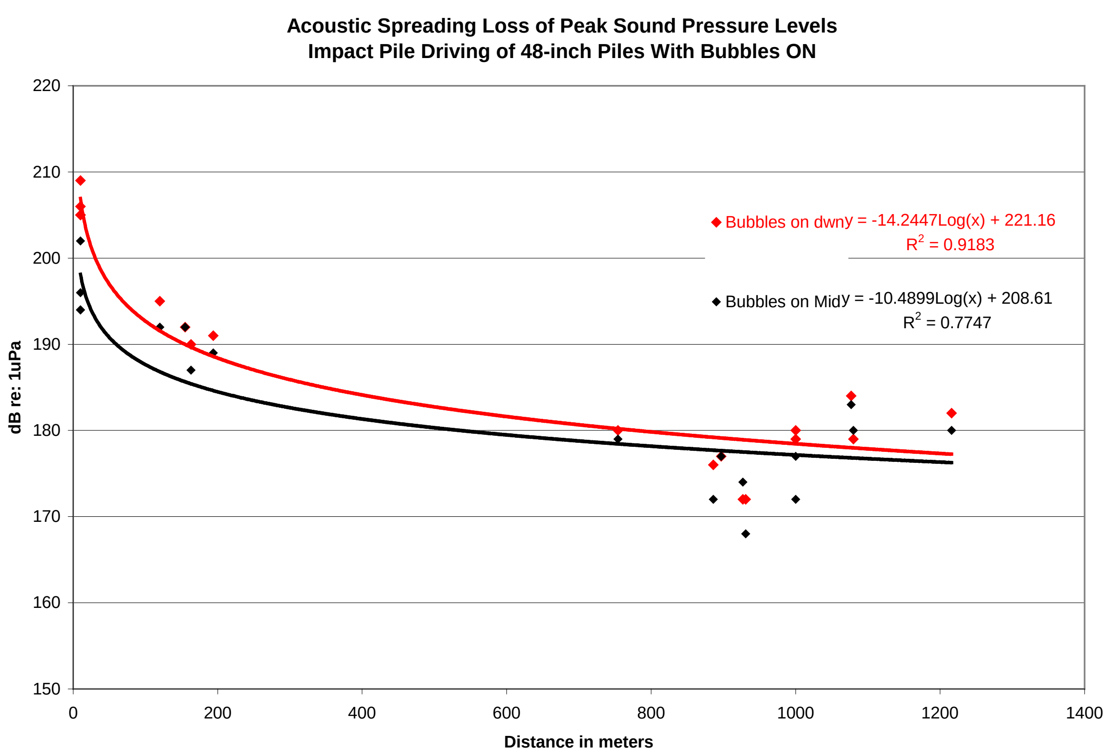

Figure 48. Acoustic Spreading Loss of Peak Levels – 48-inch Piles with Impact Hammer – Bubbles ON

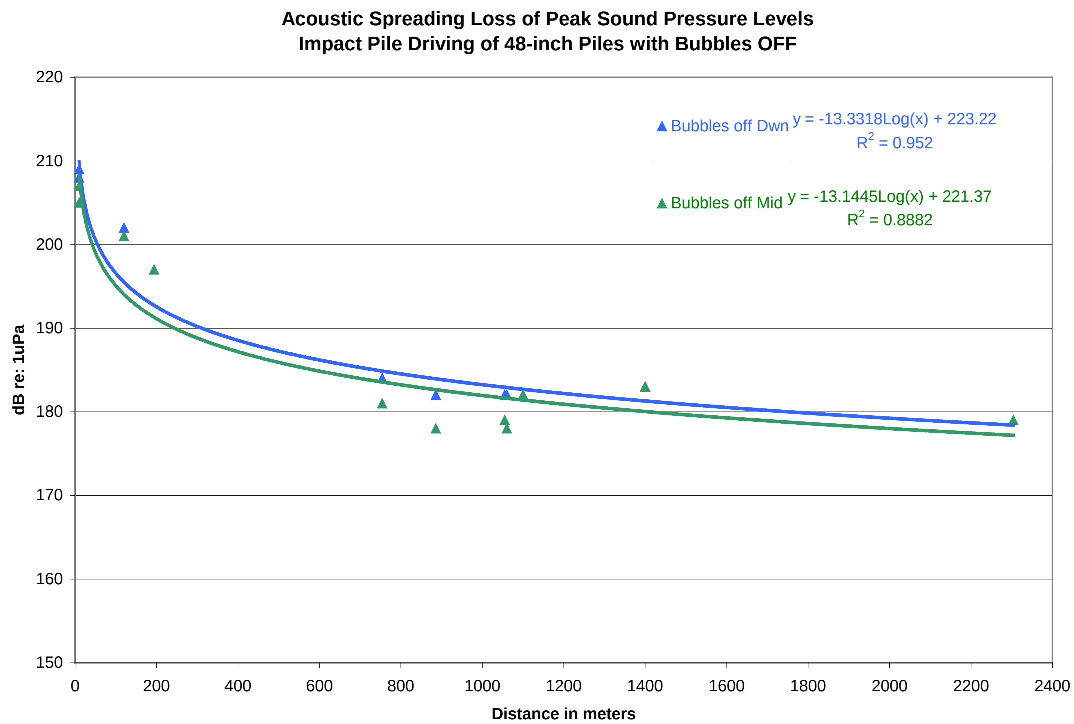

Figure 49. Acoustic Spreading Loss of Peak Levels – 48-inch Piles with Impact Hammer – Bubbles OFF

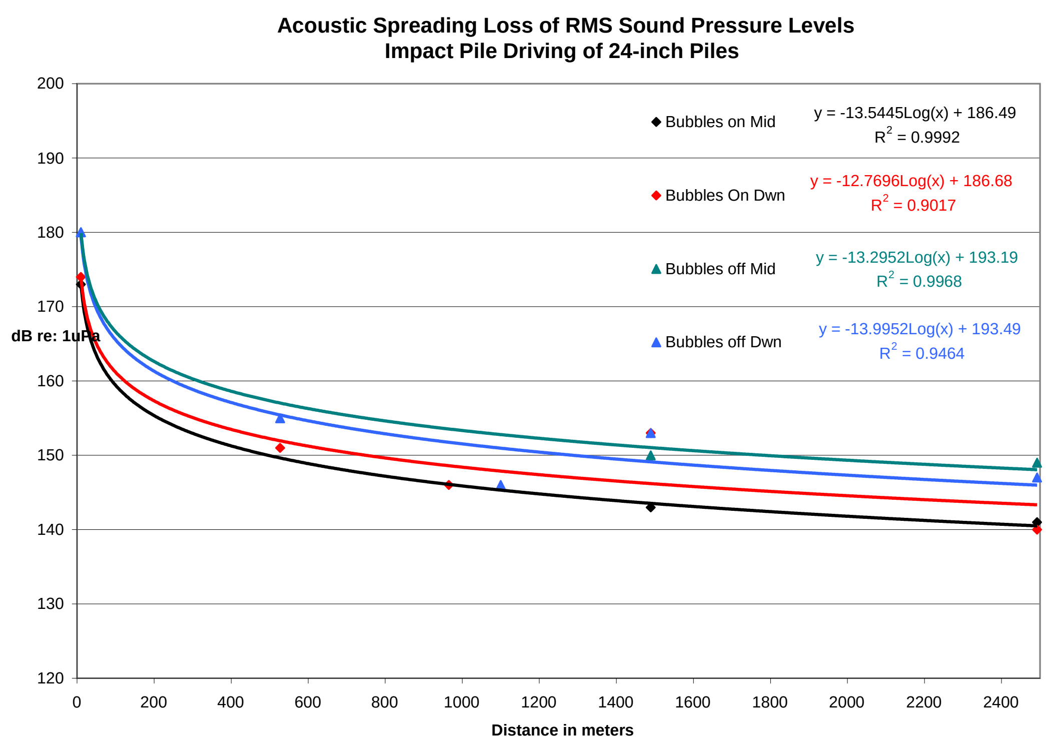

Figure 50. Acoustic Spreading Loss of RMS Levels – 24-inch Piles with Impact Hammer

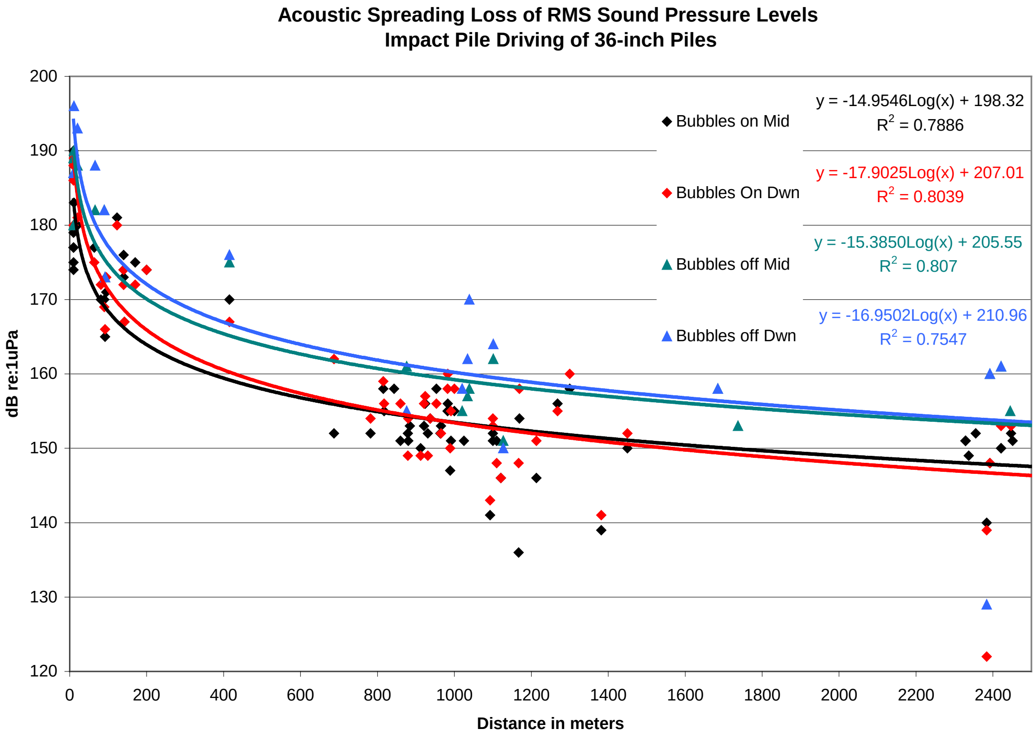

Figure 51. Acoustic Spreading Loss of RMS Levels – 36-inch Piles with Impact Hammer

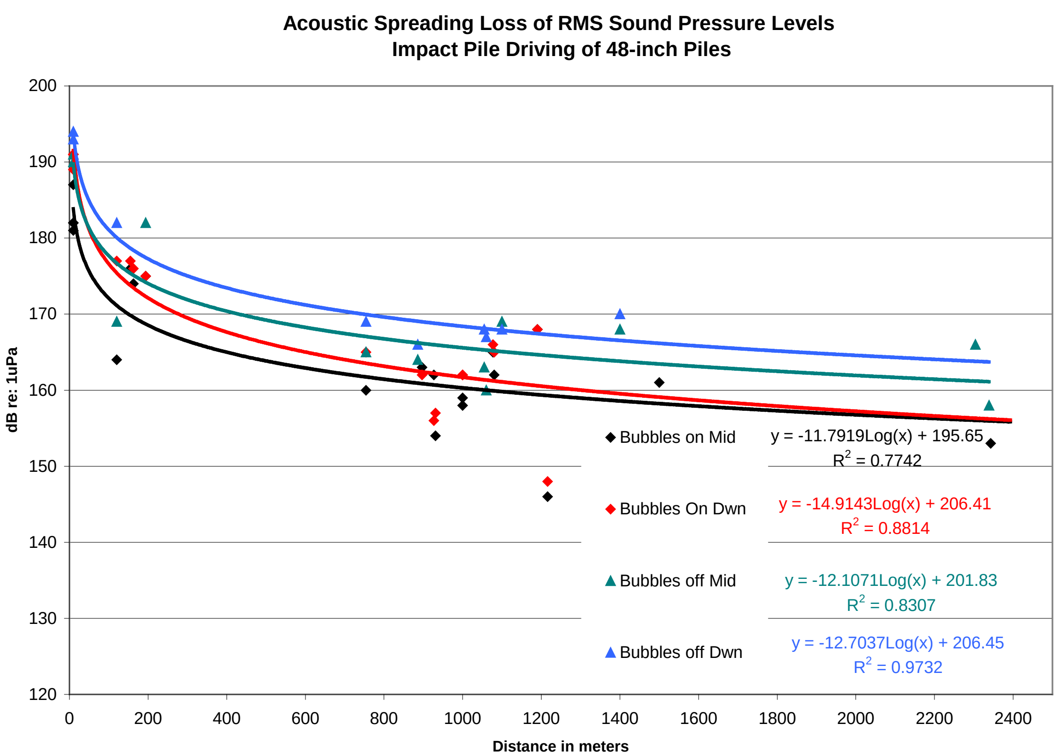

Figure 52. Acoustic Spreading Loss of RMS Levels – 48-inch Piles with Impact Hammer

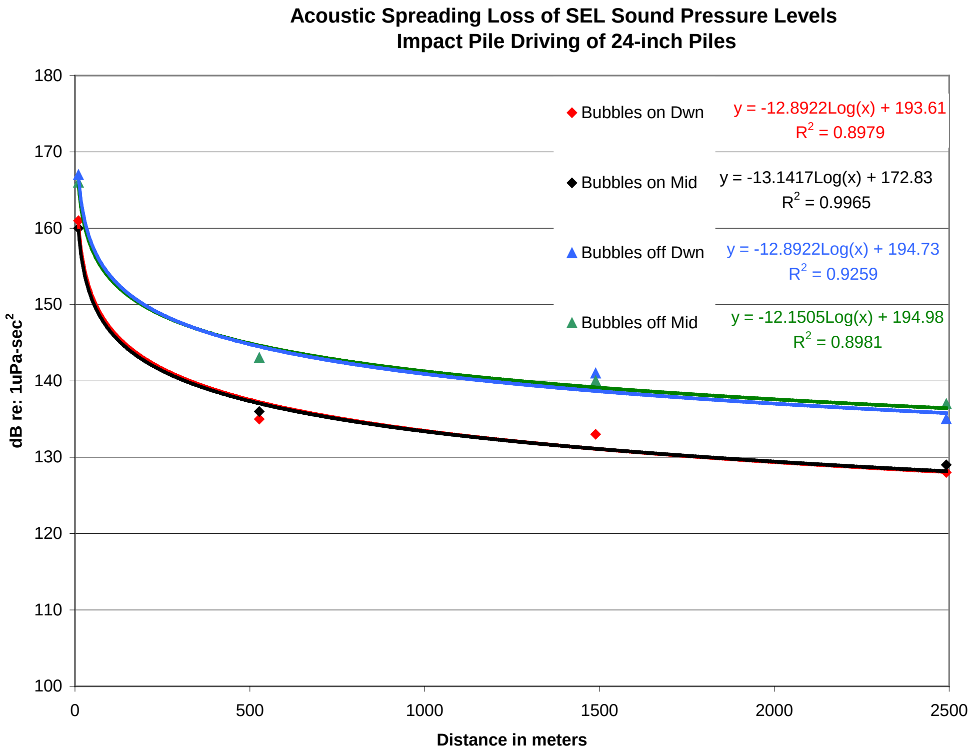

Figure 53. Acoustic Spreading Loss of SEL Levels – 24-inch Piles with Impact Hammer

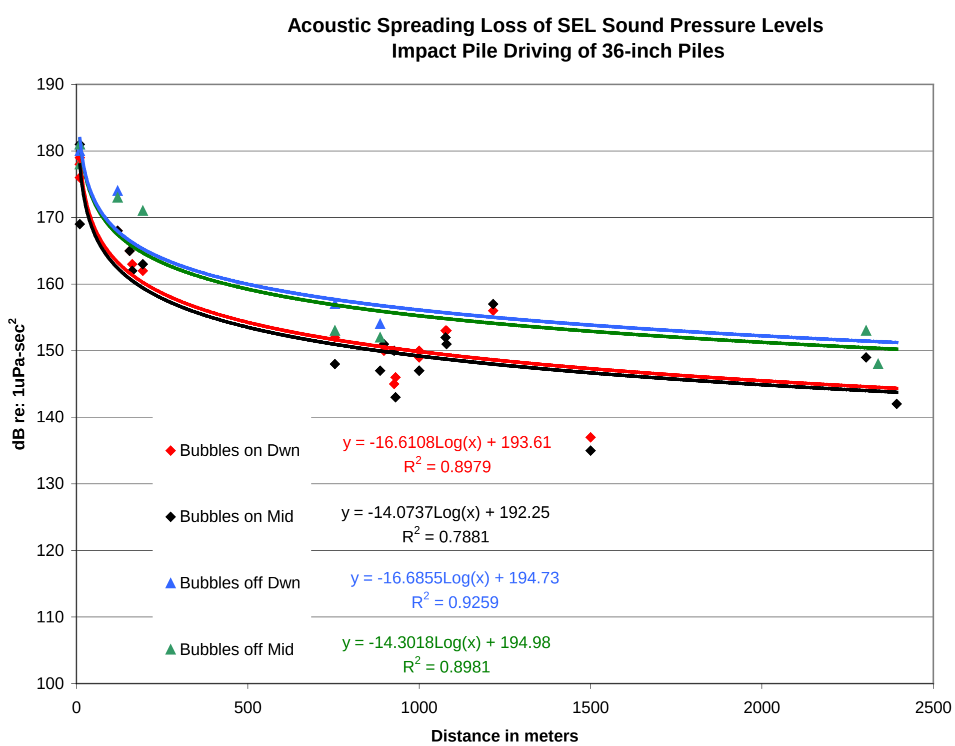

Figure 54. Acoustic Spreading Loss of SEL Levels – 36-inch Piles with Impact Hammer

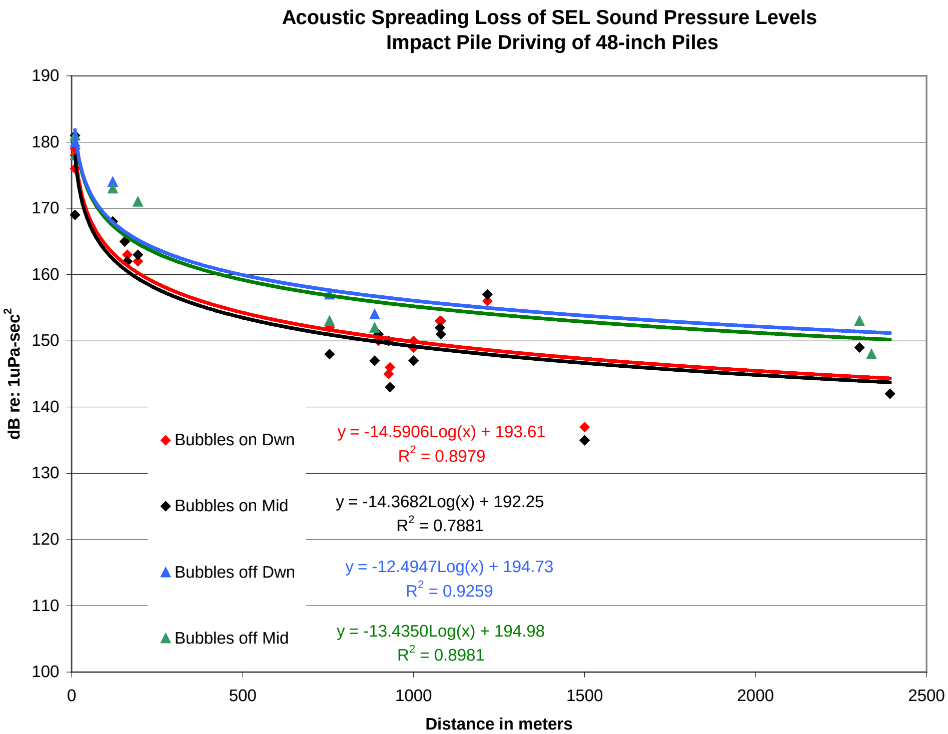

Figure 55. Acoustic Spreading Loss of SEL Levels – 48-inch Piles with Impact Hammer

Table 13. Distances to Peak Sound Level Thresholds From Impact Pile Driving

Activity	Distance (meters)			
	Deep		Mid-Depth	
Threshold	206	180	206	180
24" Bubble Rings On	<10	27	<10	24
24" Bubble Rings Off	<10	79	<10	74
36" Bubble Rings On	<10	297	<10	217
36" Bubble Rings Off	15	554	<10	974
48" Bubble Rings On	<10	**778**	<10	**536**
48" Bubble Rings Off	**20**	**1753**	16	**1410**
Predicted On	**4**	**215**	**4**	**215**
Predicted Off	**18**	**1000**	**18**	**1000**

Table 14. Distances to RMS Sound Level Thresholds From Impact Pile Driving

Activity	Distance (meters)							
	Deep				Mid-Depth			
Threshold	190	180	160	150	190	180	160	150
24" Bubble Rings On	<10	<10	125	750	<10	<10	90	496
24" Bubble Rings Off	<10	<10	250	1,290	<10	10	315	1,780
36" Bubble Rings On	<10	35	425	1,540	<10	20	370	1,710
36" Bubble Rings Off	17	70	1,020	3,970	10	45	920	**4,100**
48" Bubble Rings On	15	60	**1,300**	**6,090**	<10	20	**1,060**	**7,475**
48" Bubble Rings Off	20	120	**4,555**	**27,950**	<10	65	**2,865**	**19,210**
Predicted On	**5**	**22**	**464**	**2154**	**5**	**22**	**464**	**2,154**
Predicted Off	**22**	**100**	**2154**	**10,000**	**22**	**100**	**2154**	**10,000**

Table 15. Distances to Single Strike SEL Levels From Impact Pile Driving

Activity	Distances (meters)							
	Deep				Mid-Depth			
Levels	180	170	160	150	180	170	160	150
24" Bubble Rings On	<10	<10	<10	55	<10	<10	10	60
24" Bubble Rings Off	<10	<10	35	200	<10	<10	30	195
36" Bubble Rings On	<10	25	95	375	<10	15	70	140
36" Bubble Rings Off	15	60	240	945	<10	40	190	930
48" Bubble Rings On	<10	45	205	980	<10	35	175	875
48" Bubble Rings Off	15	90	550	3,440	15	75	415	2,290

Table 16. Distance to Cumulative SEL Levels From Impact Pile Driving

Number of Strikes	Distance to Cumulative SEL Thresholds (meters)							
	100		200		400		800	
	187	183	187	183	187	183	187	183
24" Mid Off	8	16	14	29	24	51	42	90
24" Dwn Off	10	20	16	34	28	57	48	98
24" Mid On	3	7	6	11	9	18	15	30
24" Dwn On	3	6	5	9	8	16	13	27
36" Mid Off	60	115	98	186	158	302	257	489
36" Dwn Off	90	157	136	237	206	359	312	543
36" Mid On	21	40	34	66	56	108	92	176
36" Dwn On	**36**	62	54	94	82	142	124	216
48" Mid Off	124	246	207	412	347	689	580	1,153
48" Dwn Off	150	**313**	260	544	452	946	786	1,644
48" Mid On	**57**	**109**	93	176	150	285	243	461
48" Dwn On	**67**	**126**	107	202	172	324	277	520
Predicted Levels								
Bubbles on	**34**	**63**						
Bubbles Off	**158**	**293**						

Airborne Injury and Behavioral Buffer Zones

Table 17 shows the distances to the airborne sound thresholds during vibratory pile driving. The table also shows the sound levels that were predicted prior to TPP and the corresponding distances to the threshold levels. Distances were calculated from the best available airborne data, assuming a standard airborne sound propagation loss of 6 dB per doubling of distance from the source (20 $\log_{10}$). Sound levels measured during vibratory pile driving were generally higher than the level predicted prior to the project. This is reflected in the table where all distances determined to the thresholds exceeded the predicted distances.

Table 18 shows the distances to the injury and behavioral thresholds measured during impact pile driving. The table also shows buffer distances that were predicted based on the sound levels presumed prior to TPP. Measured sound levels during impact pile driving were lower than the sound level predicted prior to TPP. Distances to the threshold levels were less than distances that corresponded to the predicted level.

Table 17. Distances to Airborne Sound Level Thresholds From Vibratory Pile Driving

Vibratory Pile Driving		**Distance (meters)**		
Threshold		100 dB	90 dB	92 dBA
24"[A]	Min	<10	**30**	11
	Max	**19**	**60**	30
	Average	**14**	**45**	21
36"	Min	**11**	**34**	14
	Max	**39**	**123**	**73**
	Average	**20**	**64**	**37**
48"	Min	**11**	**35**	13
	Max	**36**	**112**	**54**
	Average	**24**	**75**	**37**
Distance to Threshold[B]		**9**	**28**	**24**
Predicted Source Levels - 98 dB @ 11 meters 92 dBA @ 24 meters				

[A] - Data from one pile

[B] - Distances to thresholds are based on average maximum RMS levels measured for the project

Table 18. Distances to Airborne Sound Level Thresholds From Impact Pile Driving

Impact Pile Driving		**Distance (meters)**		
Threshold		100 dB	90 dB	92 dBA
24"[A]	Min	47	150	134
	Max	47	150	134
	Average	47	150	134
36"	Min	20	63	51
	Max	75	238	**237**
	Average	48	150	124
48"	Min	30	94	71
	Max	42	134	119
	Average	34	108	88
Distance to Threshold		**115**	**350**	**157**
Predicted Source Levels - 97 dB @ 160 Meters 96.7 dBA @ 91 meters (300 feet)				

[A] - Data from one pile

Bubble Curtain Effectiveness

Predictions of injury and behavioral buffer distances during impact driving made prior to TPP were based on the assumption that the bubble curtain used during TPP would provide 10 dB of attenuation during impact driving. There are several aspects of bubble curtain performance considered when evaluating its effectiveness. The first measure is to compare the attenuation provided by the bubble curtain to the 10-dB attenuation factor assumed prior to TPP. The attenuation performance of the bubble curtain is measured close to the pile-driving activity. For this project, data used to analyze bubble curtain attenuation were gathered at the measurement locations on the barge and the WRA boat. Another consideration in evaluating bubble curtain effectiveness is to compare distances to the injury and behavioral threshold levels with and without the bubble curtain operating.

Effect on Injury and Behavioral Zones Based on Peak Pressure

Table 19 summarizes the sound attenuation measured during the seven bubble curtain on/off tests conducted during impact pile driving. All the comparisons are included regardless of the number of pile strikes available to measure the differences. At the barge, of the 12 measurements combined at both depths, four provide 10 dB or more of attenuation and eight provided less than 10 dB of attenuation. At the WRA boat, out of the 11 available data sets, four provided 10 dB or more of attenuation and seven provided less than 10 dB of attenuation. Acoustic monitoring personnel did not have access to the barge during pile driving, so it was not possible to visually observe the performance of the air bubble curtain. The variability in performance could be due to several factors. Sometimes, when bubble curtains are deployed, the lower rings are not deployed all the way at the bottom of the water column, leaving the bottom portion of the pile exposed. Conversely, there are instances when the bottom ring sinks into the mud with the same result. It is also possible that there was an uneven distribution of air to the rings, or a variable distribution of air to the rings that resulted in variability in measured attenuation. Another possibility is that there was insufficient bubble flux for the current conditions, resulting in "holes or tears" in the coverage of the bubbles around the pile.

Table 19. Bubble Curtain Attenuation of Peak Sound Pressure Levels During Impact Pile Driving

Test number	Pile ID	Pile Size (inches)	Number of Strikes	Reduction with Bubble Curtain (dB re:1uPa)					
				Barge			WRA		
			On/Off	Distance	Mid	Down	Distance	Mid	Down
1	TTP#1	24	3/7	10	8	7	145	3	5
2	TTP#2	36	40/38	10	5	7	58	11	10
3	TP#7	36	47/40	20	15	11	66	6	12
4	TP#3 RP#3	36	9/10	10	4	7	92	10	9
5[A]	TP#3 / TP#3 RP#1	36	30/25	10	14	--	90/95	10	8
6	TP#11	48	38/33	10	11	3	120	9	7
7	TP#5	48	35/32	10	11	3	194	8	--

[A] Test completed on two different piles

The predicted distances to the limits of the injury and behavioral buffer zones with and without the bubble rings are shown in **Table 7**. Distances to the cumulative SEL threshold levels for different numbers of daily pile strikes are shown in **Table 9**.

The computed distance to the 206 dB peak threshold for fish is relatively small with the air bubble curtain, always 10 meters or less. However, measurement for individual pile-driving events indicate that peak pressures exceeded 206 dB at 10 meters during two of the 22 piles driven when the air bubble curtain was operating (TTP#3, a 36-in. diameter pile and TP#13, a 48-inch diameter pile). When the bubble curtain was not operating, the computed distance to the 206-dB peak level was up to 20 meters during driving of 48-inch piles. Measurements indicate that a peak pressure exceeding 206 dB at 20 meters with the air bubble curtain operating occurred one time (TP#7, a 36-inch diameter pile) out of seven pile-driving events.

When the air bubble curtain was operating, the computed distance to the 180-dB peak level ranged from 120 meters for 36-inch diameter piles at 10-meter or mid depth to 650 meters for 48-inch piles at the deeper depths. Based on measurements for individual pile-driving events with the air bubble curtain operating, peak levels of 180 dB were exceeded at distances beyond those predicted in **Table 13** on most of the 22 pile-driving events. Most of the measurements within the WRA (e.g., 100 to 300 meters from pile) were higher than predicted using the overall computed propagation rate shown in **Figure 47**, while levels outside the WRA were mostly below those based on the computed propagation. In other words, the measurement data set provided poor correlation between peak sound level and distance from the pile. When the air bubble curtain was not operating, the computed distance to the 180-dB peak level ranged from about 550 meters for 36-inch diameter piles at 10-meter depth to 1,745 meters for 48-inch piles at the deeper depths. A review of the measurements for individual pile-driving events indicates that the 180-dB peak pressure level fell within the level predicted using the overall propagation rate obtained from these measurements. There were two cases where peak pressures of 180 dB occurred at distances about equal or slightly higher than would be predicted. The range to the maximum distance to the 180 dB peak injury threshold for marbled murrelets illustrates the effect of the bubble curtain on the size of the buffer distance. It reduced the distance from the pile to the perimeter of the injury threshold to nearly one-third. For example, at the deep hydrophone position when 48-inch diameter piles were driven, the distance was reduced from 1,745 meters to 650 meters, and at the mid-depth, from 1,173 meters to 417 meters.

Effect on Injury and Behavioral Zones Based on RMS Sound Pressure Level

Data in **Table 8** shows significant reductions in the size of the behavioral buffer zones when the bubble curtain was operating.

When the air bubble curtain was not operating (during OFF tests), the computed propagation rates shown in **Figures 50** through **51** indicate the 190-dB RMS level extended out to 20 meters. However, levels of 190 dB or greater extended beyond this distance for four of the 7 individual measurements. Levels of 190 dB RMS or higher were estimated to extend out to 50 to 60 meters for two of the pile-driving events with the air bubble curtain off. When the air bubble curtain was operating, the extent of the predicted 190-dB RMS level was estimated to extend out from less than 10 to 15 meters, depending on depth and pile size. Data collected from individual pile-driving events indicate levels were mostly in this range except for about 2 to 4 events. The extent of the 190-dB level for individual events with the air bubble curtain operating was usually 10 meters or less and did not appear to extend beyond 20 meters.

The 180-dB RMS levels were estimated to extend out 45 to 120 meters, depending on depth and pile size when the air bubble curtain was not operating. Data from the individual measurements indicate that RMS sound pressure levels exceeded 180 dB at distances of 50 to 300 meters. Individual measurements indicate that 180-dB RMS levels exceeded those predicted using the overall propagation rate on 4 of the 7 pile-driving events with the air bubble curtain off. When the air bubble curtain was operating, the extent of the predicted 180-dB RMS level was estimated to extend out from less than 20 to 60 meters, depending on depth and pile size. Data collected from individual pile-driving events indicate levels were mostly in this range except for about 9 events. The extent of the 180-dB level with the air bubble curtain operating was usually within 100 meters or less but appeared to extend out to 200 meters for one pile-driving event (TP#3, a 36-inch pile).

The distance to the 160-dB RMS level was estimated from the propagation curves to extend out 920 to 4,555 meters, depending on depth and pile size, when the air bubble curtain was not operating. The measurements for individual pile-driving events indicate that levels of up to 160 dB extended out to 5,000 meters. However, the estimate of 5,000 meters is about 2,700 meters beyond the most distant measurement. The extent of the 160-dB RMS level was 500 to 2,500 meters for 36-inch diameter piles and 3,000 to 4,000 meters for the two 48-inch diameter piles when the bubble curtain was not operating. Individual measurements indicate that the 160-dB RMS level was above those estimated with the air bubble curtain off for 4 of the 7 pile-driving events.

When the air bubble curtain was operating, the distance to the 160-dB RMS level was reduced from 4,555 meters to 1,300 meters for the driving of 48-inch piles and from 1,020 meters to 425 meters during the driving of 36-inch piles. These distances are based on the propagation curves developed from the overall data set. Estimates of the extent of the 160-dB RMS level for individual pile-driving events sometimes exceeded this range in one direction or another.

The extent of the 150-dB RMS level was also computed based on the propagation curves. These levels typically extended well beyond the measurement positions. The TPP focused on measuring impact zones out to about 160 dB RMS, where the 150-dB RMS level could extend well beyond these zones (i.e., several kilometers or more). For the most part, 150-dB RMS levels were estimated to extend out 1,500 to 7,500 meters when the air bubble curtain was operating, depending on the water depth and pile size. When the air bubble curtain was not operating, these distances were computed to be much greater. However, measurements for impact pile driving were not made beyond 2,900 meters. Measurements made at the RFT at about 2,500 meters never exceeded 159 dB RMS and were typically below 155 dB RMS when the air bubble curtain was operating. This indicates that 150-dB RMS levels were typically within 5,000 meters.

Effect on Injury and Behavioral Zones Based on Accumulated SEL

The effect of the bubble curtain upon the cumulative sound exposure level thresholds is also substantial. The distances to the threshold levels are similarly reduced by about one-half to one-third the distance without the bubble curtain operating. The accumulated SEL is dependent on the number of pile strikes and source level. There were very few pile strikes in any given pile-driving event or day during the TPP. As a result, the areas encompassed by accumulated SELs of 183 and 187 dB were relatively small. **Table 15** provides the estimate of distances to different single-strike SEL levels based on the propagation curves shown in **Figures 53** through **55**. When the air bubble curtain was not operating, a single-strike SEL of 180 dB was predicted to be 15 meters from the pile, while an SEL of 170 dB was anticipated to range from 40 to 90 meters depending on the water depth and pile size. Typically, the SEL at 10 meters was 170 to 180 dB. There were two pile-driving events where SELs slightly exceeded 180 dB at 15 meters (TTP#2 and TP#7, both 36-inch diameter piles).

When the air bubble curtain was operating, a single-strike SEL of 180 dB was estimated to be less than 10 meters from the pile for all cases. An SEL of 170 dB was estimated to range from 15 to 45 meters depending on the water depth and pile size. Results for each measurement indicate that single-strike SELs of 180 dB with the air bubble curtain operating were within 10 meters for all but three events (TP#9 RP#3, TP#9, and TP#6).

<u>*Effect of Air Bubble Curtain on Vibratory Driving*</u>

Table 20 summarizes the attenuation measured during the six bubble curtain on/off tests conducted during vibratory pile driving. The bubble curtain was utilized during the removal of pile TP#2 and the installation of pile TP#3 MP#1 on September 17, 2011. The APE 600 vibratory hammer was used to install and remove the piles. There was no direct comparison of measured sound levels for any one pile with the bubble curtain on and the bubble curtain off. Since sound levels varied considerably during vibratory pile driving, it would have been difficult to assess air bubble curtain performance with an on and off test. However, a review of the data indicate that the bubble curtain provided an estimated 9 dB of reduction during the removal of the pile and 4 to 6 dB of reduction during the driving of the pile.

Table 20. Bubble Curtain Attenuation of Peak Sound Pressure Levels During Vibratory Pile Driving

Pile ID	Vib In/out	Pile Size (inches)	Reduction with Bubble Curtain (dB re:1uPa)		
			Barge		
			Distance	Level	Reduction
TP#2 - Bubbles On	Out	36	10	153	--
TTP#2 - Bubbles Off	Out	36	10	162	-9
TP#7 - Bubbles Off	Out	36	10	162	-9
TP#3 MP#1 - Bubbles On	IN	36	10	153	--
TP#3 MP#2 - Bubbles Off	IN	36	10	157	-4
TP#3 MP#3 - Bubbles Off	IN	36	10	159	-6

Comparison of "Soft-Start" Sound Levels to Levels during Driving

Pile installation and removal activities included soft-start procedures during the installation or removal of the pile with a vibratory hammer and driving with an impact hammer. There was a vibratory soft-start for use of a vibratory hammer and an impact soft-start before the use of an impact hammer. Soft-starts were not required when there was less than 30 minutes between pile-driving events. Soft-starts of both types involved several preliminary hammer strikes, performed at reduced force. Following the soft starts, the pile was driven with repetitive strikes to completion. Soft-starts were intended to provide an opportunity for nearby marine mammals to voluntarily leave the area. For impact driving, there is typically a "dead blow," that is, the dropping of the pile hammer, three times with each dead blow separated by about a one-minute interval. Pile driving was initiated about one minute after the third dead blow. Therefore, impact pile-driving events typically lasted at least 3 minutes, even though a very short amount of that time actually involved pile driving. For vibratory driving, there was a short period of several seconds of vibratory hammer operation, three times, again each separated by about a one-minute interval.

Table 21 shows a representative selection of measurement results during vibratory driving. There was more variation between each soft-start during vibratory driving than during impact driving (discussed below). Data in **Table 21** are provided for first, second, and third soft-starts for each representative pile-driving event. It should be noted that there were significant differences in the time histories between vibratory installation and vibratory removal. Typically, during vibratory installation, sound levels were highest near the end of the drive, whereas with vibratory removal, sound levels were highest during both the beginning and the end of the removal of the pile. Sound levels were typically lower during soft-starts than at the initiation of either a pile-driving event or a pile removal. There was one instance, however, during the installation of pile TP#4 when the soft-start levels were considerably higher than sound levels at the initiation of the drive. It should be noted, however, that during vibratory driving sound levels were always below injury thresholds at the closest measurement position to the pile-driving event. Furthermore, sound levels during soft-starts were always substantially below injury thresholds 10 meters from the pile. In summary, soft starts produced sound levels that could be higher or lower than sounds that occurred when continuous driving commenced.

Table 21. Comparison of Soft Start Levels and Levels at Start of Vibratory Pile Driving

Difference[A] in dB (re:1uPa)															
Pile ID	Pile Size	Soft Start												Start Drive	
		1				2				3					
		Mid		Down		Mid		Down		Mid		Down		Mid	Down
TP#11	48"	150	14	152	13	153	11	155	10	164	0	165	0	164	165
TP#9 RP#1	36"	153	1	154	1	153	1	156	-1	154	0	185	-3	154	155
TP#3 MP#3	36"	157	2	159	1	156	5	160	0	154	5	160	0	159	160
TP#1 Removal	36"	[B]		152	2	[B]		152	2	[B]		153	1	[B]	154
TP#4	36"	163	8	163	7	160	11	162	8	163	8	165	5	171	170
TP#4 Removal	36"	172	0	175	0	171	1	175	0	173	-1	175	0	172	175
TP#4 Installation	36"	165	-14	168	-16	155	-4	153	-1	156	-5	158	-9	151	152
TTP#1	24"	161	0	161	4	160	1	161	4	159	2	161	4	161	165
TP#10	36"	159	4	160	4	162	1	163	1	163	0	163	1	163	164
TP#13	48"	164	4	166	3	161	7	166	3	161	7	166	3	168	169
Average Difference			2				4		3		2		1		

[A] - Difference between levels at beginning of driving and level during soft starts

[B] - Not above background levels

Table 22 shows the differences measured between the Peak sound levels at initiation of driving and the Peak level of soft-starts during impact pile driving measured at the barge. At the mid-depth hydrophone, the difference ranged from 2 dB to 9 dB with an average difference of 4 dB. At the down hydrophone position, the difference ranged from 3 dB to 8 dB with an average difference of 5 dB. Sound levels generated during soft-starts were lower than sound levels measured at the initiation of the driving.

Table 22. Comparison of Soft Start Peak Sound Levels and Levels at Start of Impact Driving

Pile ID	Pile Size	Difference[A] - dB re:1uPa	
		Mid	Down
TP#1	24"	9	7
TP#2	36"	2	5
TP#3	36"	1	7
TP#3 RP#1	36"	6	3
TP#3 RP#2	36"	3	--
TP#3 RP#3	36"	5	7
TP#4	36"	3	6
TP#5	48"	3	7
TP#6	48"	4	3
TP#7	36"	6	4
TP#8	36"	3	3
TP#9	36"	4	4
TP#9 RP#1	36"	3	8
TP#9 RP#2	36"	7	4
TP#9 RP#3	36"	2	3
TP#10	36"	[B]	[B]
TP#11	48"	4	4
TP#12	36"	7	5
TP#13	48"	2	3
TTP#1	24"	[B]	[B]
TTP#2	36"	5	5
TTP#3	36"	5	5
TTP#4	36"	6	4
Average all Piles		4	5

[A] - Difference between level at beginning of driving and level during soft starts
[B] - All Pile strikes were dead blows

Rates of Acoustic Spreading Loss

Sound levels reduce with increasing distance from a sound source. This is called by various names including geometric spreading, transmission loss, and acoustic spreading loss. In order to determine the rate of acoustical spreading loss in the vicinity of the project site, sound levels were measured at varying distances from the pile-driving activities simultaneously. As previously noted, the distance between the pile-driving event and each measurement location was measured by comparing the coordinates of the pile-driving location to the measurement location. The logarithmic coefficients (Log_{10}) shown on the acoustic spreading loss figures are used to define the rate of acoustic spreading loss. The transmission coefficients for impact driving are summarized in **Table 23**. The results of the study demonstrate that for impact pile driving at the project site, the rate of acoustic spreading loss is approximately 14 Log_{10}.

Table 23. Acoustic Spreading Loss Rates for Impact Pile Driving

Pile Size	Acoustic Spreading Loss			
		SEL	RMS	Peak
24"	mid off	12.15	13.30	14.27
	dwn off	12.89	14.00	14.42
	mid on	13.55	13.54	13.36
	dwn on	13.14	12.77	14.82
Average Off		12.52	13.65	14.35
Average ON		13.35	13.16	14.09
Average All		12.93	13.40	14.22
36"	mid off	14.30	15.39	11.67
	dwn off	16.69	16.95	16.54
	mid on	14.07	14.95	14.40
	dwn on	16.61	17.90	16.76
Average Off		15.49	16.17	14.11
Average ON		15.34	16.43	15.58
Average All		15.42	16.30	14.84
48"	mid off	13.44	12.11	13.86
	dwn off	12.49	12.70	13.33
	mid on	14.37	11.79	11.60
	dwn on	14.59	14.91	15.13
Average Off		12.96	12.41	13.59
Average ON		14.48	13.35	13.36
Average All		13.72	12.88	13.48
Average	Off	13.70	14.10	14.00
	On	14.40	14.30	14.30
	All	14.00	14.20	14.20

Acoustic spreading loss rates measured during vibratory driving for the RMS pressure levels are summarized in **Table 24**. Similarly, the acoustic spreading loss for vibratory driving is calculated to be 16 Log_{10}.

Table 24. Acoustic Spreading Loss Rates for Vibratory Pile Driving

Pile Size	Acoustic Spreading Loss	
	Down	Mid Depth
24" Pile	16.43	18.45
36" Pile	14.89	15.34
48" Pile	15.88	16.65
Average	15.73	16.81
Average All	**16.27**	

Section 5 Summary of Findings

This section summarizes the major findings with respect to underwater sound levels during vibratory and impact pile-driving activities. Prior to the TPP, predictions of sound exposure were used to estimate the potential impacts to fish, birds and marine mammals. This section compares those results and summarizes findings with respect to air bubble curtain tests and use of soft starts prior to the continuous pile driving.

Estimates of Safety or Harassment Zones Based on Monitored Data

Section 4 of this report provides estimates of the safety and harassment zones for each pile monitored. Those data were used to estimate impacts of the TPP upon marine species in Hood Canal; detailed findings are presented in separate TPP project reports.

Underwater Sounds from Vibratory Pile Driving

Typical vibratory pile driving during the TPP resulted in sound levels that varied considerably through the driving periods. Vibratory sounds underwater were characterized by the measurement of RMS sound pressure levels. During the TPP there were 67 vibratory driving events (i.e., installation or removal of piles) that were measured. **Table 25** presents a summary of the average RMS sound pressure levels measured near the source (at 10 meters) and the computed propagation rate. Based on these data, the following findings are made:

- On average, the near source level was 159 dB for 36-inch diameter piles and 161 dB for 48-inch diameter piles. The maximum event level from all driving was 172 dB. For the TPP, a near-source level of 180 dB was assumed. This meant that the near-source levels were over predicted for the TPP project.
- The average propagation rate was computed based on the average of all measured sound levels for each pile size. The average propagation loss was computed as a 15.11 Log_{10} for 36-inch diameter piles and 16.26 Log_{10} rate for 48-inch diameter piles. These rates were similar to those used to predict marine mammal harassment zones from the TPP (i.e., zones where sound levels would exceed 190 dB, 180 dB and 120 dB). It should be noted that only data where pile driving sounds could be clearly measured were used to compute these propagation rates. There were many distant measurements that were contaminated by noise from current or weather effects where vibratory sounds could not be measured or heard by the observer. In those instances, sound levels from vibratory driving were likely below 120 dB, but could not be quantified.
- The average and maximum sound level generated by vibratory pile driving did not exceed 180 dB at distances equal or further than 10 meters from the pile.
- Prior to the TPP, the 120-dB behavioral disturbance zone for vibratory driving sounds was predicted to extend out along the main channel about 13,300 meters north where it would end at land in Squamish Harbor and about 7,500 meters south where it would end at Toandos Peninsula. Levels exceeding 120 dB were measured at distances out to 5,500 meters, where the level was 123 dB. However, there were measurements closer than 5,000 meters where sound levels did not exceed 120 dB. Attempts were made to

measure at distances of 7,000 to 8,000 meters; however, vibratory sound levels were not audible during those measurements. The data collected during the TPP cannot accurately estimate the extent of the 120-dB harassment zone, because of the large variability in measured sounds from drive to drive. The data do, however, indicate that levels were not louder than those predicted for the project. Although most measurements were made within the zone predicted to have levels above 120 dB, the measurements made outside of the zone had levels less than 120 dB.

- Using the average near source level and the average propagation rates from measured vibratory sound levels, the distance to the 120-dB zone was 3,505 to 7,500 meters. Only a small amount of data was collected for 24-inch diameter piles, which indicate much lower sound levels.
- Sound levels during soft starts were typically lower than those levels at the initiation and completion of continuous vibratory driving. However, levels during continuous driving varied considerably and were at times lower than those produced during the soft starts. It is difficult to assign a level that describes how much lower the soft start sound levels were than continuous levels.

Table 25. Average of RMS Levels for Vibratory Pile Driving at 10 meters (dB re: 1μPa)

	Average	Maximum
48" Piles		
Maximum	172	179
Minimum	149	165
Average	161	174
Stdev	6.06	4.30
Propagation Loss (Log_{10})	16.26	--
36" Piles		
Maximum	169	180
Minimum	148	156
Average	159	170
Stdev	5.38	4.98
Propagation Loss (Log_{10})	15.11	--
24" Piles		
Maximum	160	168
Minimum	157	166
Average	159	167
Stdev	1.29	1.08
Propagation Loss (Log_{10})	17.44	--

There were two different piles vibrated with the air bubble curtain operating. Because sound levels varied considerably during a vibratory pile-driving event, it is difficult to assess the reduction in sound that the air bubble curtain provided. There was no direct on- and off-measurement where vibratory levels were steady enough to assess the difference in sound levels. The measurements made when the air bubble curtain was operating indicate lower sound levels.

Underwater Sounds from Impact Pile Driving

Impact pile driving was conducted. During the TPP there were 23 impact pile driving events that were measured. Six of these events included a bubble curtain on and off test. Sound levels measured included peak pressures, RMS pulse levels, and SEL pulse levels. Summaries of near source levels (at 10 meters) and the computed propagation rate are provided in **Table 26** for average peak pressures, **Table 27** for average RMS levels and **Table 28** for average per-strike SEL levels. Based on these data, the following findings are made:

Table 26. Average Peak Levels for Impact Pile Driving at 10 meters (dB re 1µPa)

	36"	48"	24"
Bubble On and Off			
Maximum	210	209	193
Minimum	185	194	185
Average	197	203	189
Stdev	6.82	5.60	4.35
Propagation Loss (Log_{10})	14.84	13.48	14.22
Bubble On			
Maximum	208	209	186
Minimum	185	194	185
Average	195	201	186
Stdev	6.09	5.90	0.71
Propagation Loss (Log_{10})	15.58	13.36	14.09
Bubble Off			
Maximum	210	209	193
Minimum	192	205	193
Average	203	207	193
Stdev	5.82	1.71	0.00
Propagation Loss (Log_{10})	14.11	13.59	14.35

The TPP only included the impact driving of a single 24-inch diameter pile. This pile was struck less than 10 times, so the measured data do not provide much insight to the sounds generated by this type of pile or the air bubble curtain performance. Findings based on the measurements of impact pile driving were for 36- and 48-inch diameter piles. Most of the piles driven were 36-inch diameter piles.

Table 27. Average RMS Levels for Impact Pile Driving at 10 meters (dB re 1µPa)

Bubbles On and Off - 36"			Bubbles On and Off - 48"			Bubbles On and Off - 24"		
	Average	**Maximum**		**Average**	**Maximum**		**Average**	**Maximum**
Maximum	196	197	Maximum	194	195	Maximum	180	180
Minimum	174	176	Minimum	181	182	Minimum	173	173
Average	184	185	Average	189	190	Average	177	177
Stdev	6.26	5.97	Stdev	4.48	4.48	Stdev	3.77	3.77
Propagation Loss (Log_{10})	16.30	--	Propagation Loss (Log_{10})	12.88	--	Propagation Loss (Log_{10})	13.40	--
Bubbles On - 36"			**Bubbles On - 48"**			**Bubbles On - 24"**		
	Average	**Maximum**		**Average**	**Maximum**		**Average**	**Maximum**
Maximum	190	192	Maximum	191	192	Maximum	174	174
Minimum	174	176	Minimum	181	182	Minimum	173	173
Average	181	183	Average	187	188	Average	174	174
Stdev	5.45	5.45	Stdev	4.43	4.33	Stdev	0.71	0.71
Propagation Loss (Log_{10})	16.43	--	Propagation Loss (Log_{10})	13.35	--	Propagation Loss (Log_{10})	13.16	--
Bubbles Off - 36"			**Bubbles Off - 48"**			**Bubbles Off - 24"**		
	Average	**Maximum**		**Average**	**Maximum**		**Average**	**Maximum**
Maximum	196	197	Maximum	194	195	Maximum	180	180
Minimum	180	181	Minimum	190	191	Minimum	180	180
Average	189	190	Average	192	193	Average	180	180
Stdev	4.71	4.71	Stdev	1.83	1.71	Stdev	0.00	0.00
Propagation Loss (Log_{10})	16.17	--	Propagation Loss (Log_{10})	12.41	--	Propagation Loss (Log_{10})	13.65	--

Table 28. Average Single Strike SEL for Impact Pile Driving at 10 meters (dB re 1μPa^2 sec)

	36"	48"	24"
Bubbles on and Off			
Maximum	184	181	167
Minimum	162	169	160
Average	173	178	164
Stdev	5.28	3.60	3.51
Propagation Loss (Log_{10})	15.42	13.72	12.93
Bubbles On			
Maximum	180	181	161
Minimum	162	169	160
Average	172	177	161
Stdev	5.07	4.17	0.71
Propagation Loss (Log_{10})	15.34	14.48	13.35
Bubbles Off			
Maximum	184	181	167
Minimum	169	178	166
Average	177	180	167
Stdev	4.57	1.41	0.71
Propagation Loss (Log_{10})	15.49	12.96	12.52

Average Peak Sound Pressures

Prior to the TPP, a near-source level of 210 dB for unattenuated piles was used to predict peak sound pressure levels from both 36- and 48-inch diameter piles. The maximum average peak pressures measured for unattenuated piles were 210 dB. The average for all the unattenuated pile driving events was 203 dB for 36-inch diameter piles and 207 dB for 48-inch diameter piles. The air bubble curtain was anticipated to reduce levels by 10 dB. Average peak pressure levels with the air bubble curtain were 195 dB for 36-inch diameter piles and 201 dB for 48-inch diameter piles. Maximum peak pressures reached 209 dB with the air bubble curtain operating. Peak sound pressures of 206 dB were used to estimate the extent of potential injury to fish and peak pressures of 180 dB were used to assess effects on marbled murrelets.

A practical spreading loss model based on -15.00 Log_{10} or -4.5 dB per doubling of distance from the source was used to predict acoustic spreading loss as sound propagated from the source[3]. The average propagation of measured peak sound pressures with the air bubble curtain operating was computed as a 15.58 Log_{10} for 36-inch diameter piles and 13.36 Log_{10} rate for 48-inch diameter piles. Using the near-source levels and propagation rates, the following findings were made with respect to impact zones:

[3] This practical spreading loss assumption was applied to all acoustic parameters evaluated (i.e., peak, RMS and SEL).

- On average, the extent of the zone of peak pressures of 206 dB or greater with the air bubble curtain operating was less than 10 meters from the pile. The TPP predicted that this zone would extend 4 meters.
- The 180-dB peak pressure injury zone was predicted to extend 215 meters with the air bubble curtain operating. On average, the extent of measured peak pressures of 180 dB or greater with the air bubble curtain operating extended out 188 meters for 36-inch diameter piles and 650 meters for 48-inch diameter piles.
- The slightly higher near-source level and lower propagation rate for 48-inch diameter piles resulted in a larger 180-dB impact zone. On average, measured peak pressures associated with the 36-inch diameter piles were within the zones predicted for the TPP.

Average RMS Sound Pressure Levels

RMS impact pile driving levels were higher than predicted during the TPP and the propagation rate was similar or slightly less than predicted. This resulted in larger impact zones, particularly the behavioral zones that extend several hundred or more meters from the pile.

Prior to the TPP, a near-source level of 195 dB for unattenuated piles was used to predict RMS sound pressure levels from both 36- and 48-inch diameter piles. The maximum average RMS sound pressure levels measured for unattenuated piles was 197 dB and the average was 196 dB for 36-inch diameter piles and 194 dB for 48-inch diameter piles. Again, the air bubble curtain was anticipated to reduce levels by 10 dB, so the near source levels would be 185 dB RMS. Measured average RMS pressure levels with the air bubble curtain were 190 dB for 36-inch diameter piles and 191 dB for 48-inch diameter piles. The maximum of average RMS sound pressure levels reached 192 dB with the air bubble curtain operating.

The average propagation of RMS sound pressures with the air bubble curtain operating was computed as a 16.43 Log_{10} for 36-inch diameter piles and 13.35 Log_{10} rate for 48-inch diameter piles. Using the near-source levels and propagation rates, the following findings were made with respect to impact zones:

- The 190-dB injury zone was predicted to extend less than 10 meters (i.e., 5 meters) with the air bubble curtain operating. Based on the measurement of average levels and the average propagation rate, the zone extended less than 10 meters from the pile for 36-inch diameter piles and 15 meters for 48-inch diameter piles.
- The 180-dB injury zone was predicted to extend 22 meters with the air bubble curtain operating. Based on the measurement of average levels and the average propagation rate, this zone extended 35 meters from the pile for 36-inch diameter piles and 60 meters for 48-inch diameter piles.
- The 160-dB behavioral disturbance zone was predicted to extend 464 meters with the air bubble curtain operating. Based on the measurement of average levels and the average propagation rate, the zone extended 425 meters from the pile for 36-inch diameter piles and 1,300 meters for 48-inch diameter piles.
- The 150-dB behavioral disturbance zone was predicted to extend 2,154 meters with the air bubble curtain operating. Based on the measurement of average levels and the

average propagation rate, the zone was calculated from the closer measurement data to extend 1,710 meters for 36-inch diameter piles and 7,475 meters for 48-inch diameter piles. It should be noted that the estimated distances for the 48-inch diameter piles are mostly well beyond the extent of the measurements, which focused on identifying the 160-dB RMS safety zones.

Average SEL Per Strike Sound Pressure Levels

Most of the TPP piles involved less than 50 hammer strikes, resulting in relatively low accumulated SEL levels when the air bubble curtain was operating. Prior to the TPP, unattenuated SEL levels from impact pile driving were predicted to be 185 dB per strike. On average, unattenuated SEL levels were 177 dB for 36-inch diameter piles and 180 dB for 48-inch diameter piles. The average SEL for the loudest driving event was 184 dB per strike. SEL levels were predicted to be 175 dB SEL per strike with the air bubble curtain. Measured average SEL levels with the air bubble curtain were 172 dB per strike for 36-inch diameter piles and 177 dB for 48-inch diameter piles. The average SEL for the loudest driving event with the air bubble curtain operating was 181 dB.

The average propagation of SEL levels with the air bubble curtain operating was computed as a 15.34 Log_{10} for 36-inch diameter piles and 14.48 Log_{10} rate for 48-inch diameter piles. Using the near-source levels and propagation rates, the following findings were made with respect to impact zones, assuming 100 pile strikes:

- The 187-dB injury zone for 100 pile strikes was predicted to extend to 34 meters with the air bubble curtain operating. Based on the measurement of average levels and the average propagation rate, the zone extended to 36 meters for 36-inch diameter piles and 67 meters for 48-inch diameter piles.
- The 183-dB injury zone for 100 pile strikes was predicted to extend to 63 meters with the air bubble curtain operating. Based on the measurement of average levels and the average propagation rate, the zone extended to 62 meters for 36-inch diameter piles and 126 meters for 48-inch diameter piles.

Marine Species Behavior in Relation to Underwater Sound Produced by Pile Driving Activity

- Four marine mammal species were commonly sighted in the waters near NBK at Bangor in the Hood Canal during the Test Pile Program: the California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), harbor seal (*Phoca vitulina*), and harbor porpoise (*Phocoena phocoena*). Marine mammal behavior was recorded before, during, and after pile driving activity, as well as during non-construction periods. Potential behavioral reactions to underwater sound included moving away from the construction area, looking towards the construction area, sinking, diving, entering the water or vocalizing as pile driving began or stopped. Results showed minimal variation in the frequency at which most behavioral patterns were observed among different construction categories (soft starts, vibratory pile driving, and impact pile driving) and non-construction time periods. Animals were occasionally noted diving in conjunction with the onset of soft start events, then reemerged further away and continued their movements. However, diving behaviors associated with a soft-start event occurred with the same frequency (13% of observations) as diving behaviors during non-pile driving times. Overall, observational data during the TPP did not indicate any adverse reaction of marine mammals to pile driving activities.

- One fish was observed during the TPP that appeared to be in distress and behaving abnormally. A Pacific herring was observed at the surface of the water, intermittently swimming in slow circles and floating motionless at the surface. The sighting was made on 29 August 2011 at 12:20 PM, during vibratory driving of a 24” pile, using an APE 400 vibratory hammer. The fish was located approximately 50 m from the pile, and was lifted from the water by monitoring staff for inspection, identification and measurement. No physical trauma or abnormalities were observed. The fish was released back in the water following the examination, which lasted several seconds. The fish remained motionless in the water and drifted from sight.
- No marbled murrelets were observed in the Waterfront Restricted Area or the Zone of Influence during any pile driving activity (impact or vibratory) at any time over the 8-week observation period. Therefore, no inferences can be made about the behavioral effects of pile driving activity on marbled murrelets in Hood Canal during the TPP.

Airborne Sounds

The Biological Assessment for the Test Pile Program was unclear in what metrics were to be used for the analysis of the airborne noise impacts. RMS can be described in several manners (i.e. RMS $_{Lmax}$, RMS $_{Leq}$ or for any averaged time period). There are significant differences in the sound level between the different descriptors. For this analysis the RMS $L_{eq(driving\ event)}$ level was used for comparison with the airborne vibratory driving thresholds in the BA. This is the energy average of 1-second RMS levels, averaged over the duration of the driving event. For impact driving, the airborne sound levels were the highest RMS levels based on the RMS L_{max} descriptor for each pile driving event. The L_{max} is the highest RMS level measured over a 125-millisecond (1/8 second) time period. This appears to be the same type of data used to describe potential airborne noise effects.

Airborne Sounds from Vibratory Pile Driving

The primary concern with airborne noise from vibratory pile driving is the behavioral harassment buffer zone for marine mammals. **Table 29** provides a summary of the average RMS L_{eq} sound pressure levels measured near the source (at 15 meters) and a 20 Log_{10} (6 dB per doubling distance) propagation rate. For the vibratory driving portion of the project the sound pressure level was predicted to be 98 dB at 11 meters, for all piles. Based on these measured data, the following findings are made:

- Prior to the TPP, the distance to the 100 dB (unweighted) harassment zone was predicted to extend 9 meters from both the 36-inch and the 48-inch diameter piles. Based on the measurement of average RMS L_{eq} levels and applying a 20 Log_{10} propagation rate, the zone extended 20 meters from the pile for 36-inch diameter piles and less than 15 meters for 48-inch diameter piles.

- Prior to the TPP, the distance to the 90 dB harassment zone for harbor seals was predicted to extend 28 meters from the pile. This would be for both the 36-inch and 48-inch diameter piles. Based on the measurement of average levels and applying a $20Log_{10}$ propagation rate, the zone was 60 meters for the 36-inch diameter piles and 38 meters for the 48-inch diameter piles.
- Measurements of vibratory sound near the source were affected at times by other sources, such as the engines powering the crane and hammer.

Table 29. Airborne RMS Levels for Vibratory Pile Driving at 15 meter (dB re: 20 μPa)

	36-inch Piles				48-inch Piles			
	RMS_{Leq}		RMS_{Lmax}		RMS_{Leq}		RMS_{Lmax}	
	A-weighted	Z-weighted	A-weighted	Z-weighted	A-weighted	Z-weighted	A-weighted	Z-weighted
Maximum	93	102	104	108	90	98	100	107
Minimum	80	89	88	96	82	91	95	102
Average	87	93	97	102	87	94	98	104
Stdev	3.22	3.08	3.81	3.04	2.91	2.42	1.78	1.61

Airborne Sounds from Impact Pile Driving

For impact driving the primary concern is the airborne injury zone for marbled murrelets and the behavioral buffer zone for marine mammals. Summaries of near source levels (at 15 meters) for RMS L_{max} levels are shown in **Table 30**. Prior to the TPP, impact driving from the project was predicted to produce sound pressure levels of 97 dB at 160 meters for the marine mammals and 105 dBA for marbled murrelets at 15 meters, for all piles. Based on these data, the following findings are made.

- Prior to the TPP, the distance to the 100 dB harassment zone for pinnipeds (except harbor seals) was predicted to extend 113 meters for both the 36- and 48-inch diameter piles. Based on the measurement of average unweighted RMS L_{max} levels and applying a 20 Log_{10} propagation rate, the zone extended 60 meters from the pile for 36-inch diameter piles and 45 meters for 48-inch diameter piles.
- Prior to the TPP, the distance to the 90 dB harassment zone for was predicted to extend 358 meters for harbor seals for both 36- and 48-inch diameter piles. Based on the measurement of average unweighted RMS L_{max} levels and a 20 Log_{10} propagation rate, the zone was 190 meters for 36-inch diameter piles and 130 meters from the 48-inch diameter piles
- Prior to the TPP, the 92-dBA injury zone for marbled murrelets was predicted to extend 68 meters for both the 36- and 48-inch diameter piles. Based on the measurement of average A-weighted RMS L_{max} levels and applying a 20 Log_{10} propagation rate, the zone extended 115 meters from the pile for 36-inch diameter piles and 90 meters for 48-inch diameter piles.

Table 30. Airborne RMS Levels for Impact Pile Driving at 15 meter (dB re: 20 μPa)

	36-inch Piles				48-inch Piles			
	RMS_{Leq}		RMS_{Lmax}		RMS_{Leq}		RMS_{Lmax}	
	A-weighted	Z-weighted	A-weighted	Z-weighted	A-weighted	Z-weighted	A-weighted	Z-weighted
Maximum	94	96	110	112	92	93	108	109
Minimum	85	89	104	106	85	88	104	106
Average	88	92	107	109	87	90	105	107
Stdev	2.58	2.26	2.51	2.58	3.19	2.06	2.02	1.45

Section 6 Recommendations

The experience gained during the TPP provides valuable insight into how future monitoring efforts in the Hood Canal at the Naval Base should be conducted. Due to the complexities of the environment and security concerns, there are several aspects to consider when planning acoustic monitoring in this area. Water depth is relatively deep in most areas of Hood Canal. The bottom surfaces near the Naval Base slope considerably into the main channel, so the bottom is quite complex. As a result, sound propagates differently for different piles or toward different directions (in terms of direction and depth). It is difficult to assign a specific propagation rate that could be applied to all piles.

Pile-driving activities associated with the TPP lasted about two months. Most of the pile driving involved vibratory pile installation or pile removal. There was very little impact pile driving. As a result, a majority of the monitoring tasks involved measuring pile-driving sounds at relatively far distances from the piles that were being driven. In particular, there was a considerable effort involved in attempting to measure the levels in the environment where sounds from vibratory pile installation or removal were 120 dB RMS. This level is near ambient levels (depending on location and other non-project activity) and not easily discernible from background noise caused by currents and waves or ambient conditions.

Several important lessons were learned and recommendations for future monitoring activities are provided below:

1. Since vibratory pile driving without a bubble curtain produces similar maximum levels for each pile, there is not a need to measure every pile or even a large number of piles. The TPP provides a considerable amount of near-source data for piles that are vibrated, as well as the range that levels vary during a pile installation or removal activity with a vibratory driver.
2. The TPP acoustic monitoring effort involved measurements at or near where sound levels were expected to be near 120 dB RMS. This was found to be problematic, because background noise levels could often exceed 120 dB due to currents or waves. The extent of the 120 dB level varied by pile and most likely by position. Future monitoring efforts should focus on measuring higher levels (e.g., 130 to 140 dB) and make estimates to where 120 dB might be using modeling techniques. Alternatively, very distant measurements should only be attempted during the appropriate conditions (i.e., light currents and calms water conditions).
3. Future monitoring efforts should recognize that the near-source measurements of pile-driving activities that involve an air bubble curtain are the most critical.
4. The monitoring effort did not include attended measurements near the source of the pile driving (i.e., attended measurements at the BRG). These measurements are probably the most critical, since they provide the best indicator of the sound emanating from the source and the effectiveness of attenuation measures. Several measurements at this location were not successful because of accessibility to equipment, fouling of hydrophone lines with barge equipment in shifting currents, equipment failures that could not be observed, damage to equipment, and improper equipment gain settings that could not be

observed during the pile-driving events. Future monitoring efforts should allow for an acoustic specialist to attend measurements to ensure proper equipment operation and note pile-driving operations and conditions.

5. In order to obtain more accurate and reliable data from future bubble curtain on/off tests, it is recommended that (a) at least 30 hammer strikes be employed for each test, in order to obtain sufficient sound attenuation data and allow the hammer sufficient “warm up” time; (b) each on/off test be performed on the same pile, not different piles, and (c) predicted unattenuated sound levels for each pile be reported and compared to actual attenuated sound levels (“bubble on”) in addition to comparison with actual unattenuated levels (”bubble off”). Preferably, the tests should be conducted for several minutes of pile driving to ensure steady source levels.

6. Boats that serve as shared platforms for acoustic and other monitoring will have a lower success rate of gathering appropriate data. Therefore, the consequences of not fulfilling monitoring requirements should be considered when there are competing monitoring objectives.

7. The construction area includes numerous noise sources. Although pile driving is typically the loudest source of noise, it is difficult to characterize from other construction sounds. In order to characterize airborne levels, the measurement positions and methods must be carefully selected to minimize, if possible, other sound sources such as generators or compressors, the construction crane and boats operating in the area. Using unattended SLMs to make these measurements, which were problematic to access, made this task difficult with a low success rate for each pile-driving event. Airborne measurements of pile driving should be conducted as a separate task utilizing attended measurements. Since airborne sound levels from pile driving are fairly consistent and the sound propagation rates are pretty well understood, this effort should only involve a select number of pile-driving events.

Section 7 List of Preparers

This section lists all people who helped prepare this report.

James A. Reyff
Illingworth & Rodkin, Inc.
Acoustic Project Manager

Richard B. Rodkin, P.E.
Illingworth & Rodkin, Inc.
Acoustic Lead Author

Keith Pommerenck
Illingworth & Rodkin, Inc.
Acoustic Lead Field Monitor/Data Analysis/Report Preparation

Carrie Janello
Illingworth & Rodkin, Inc.
Acoustic Data Analysis/Report Preparation

Section 8 Acknowledgements

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Section 9 References

DoN (Department of Navy) (2011). Final Environmental Assessment. Explosives Handing Wharf 1 Pile Replacement Project Naval Base Kitsap at Bangor Silverdale WA. Submitted to National Marine Fisheries Service, Silver Spring, Maryland.

APPENDIX A – VIBRATORY PILE DRIVING RESULTS

8/29/2011 – TPP#1 (Vibratory Installation)

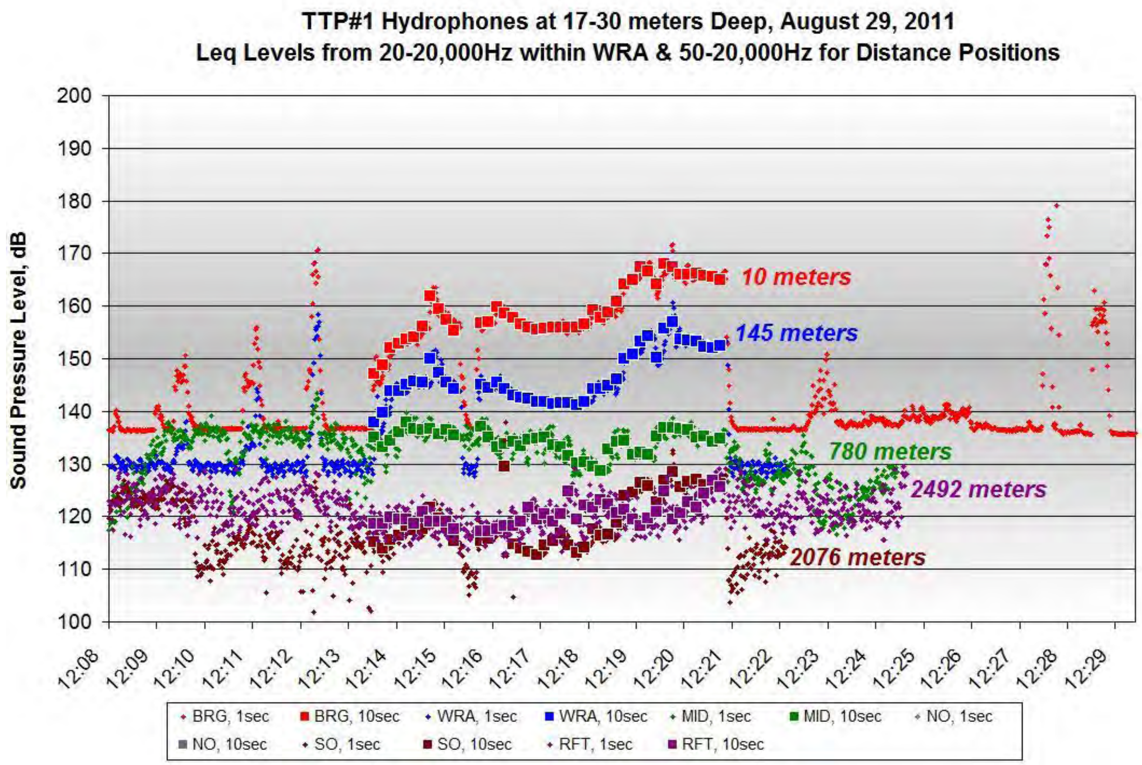

Figure A1. One-second and 10-second Average Data for TTP#1, 12:13-12:22, Measured at Depths of 17-30 meters on August 29, 2011

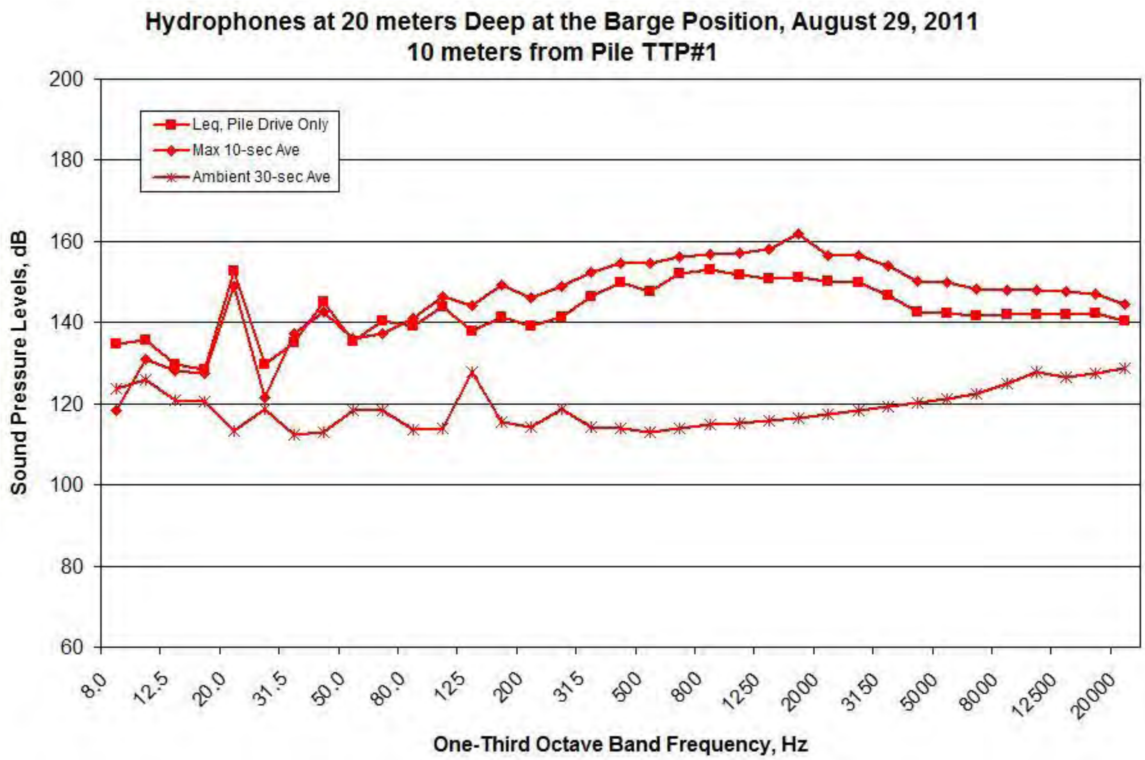

Figure A2. Spectral Data Measured at the BRG Location during TTP#1, 12:13-12:22, Measured at Depths of 20 meters on August 29, 2011

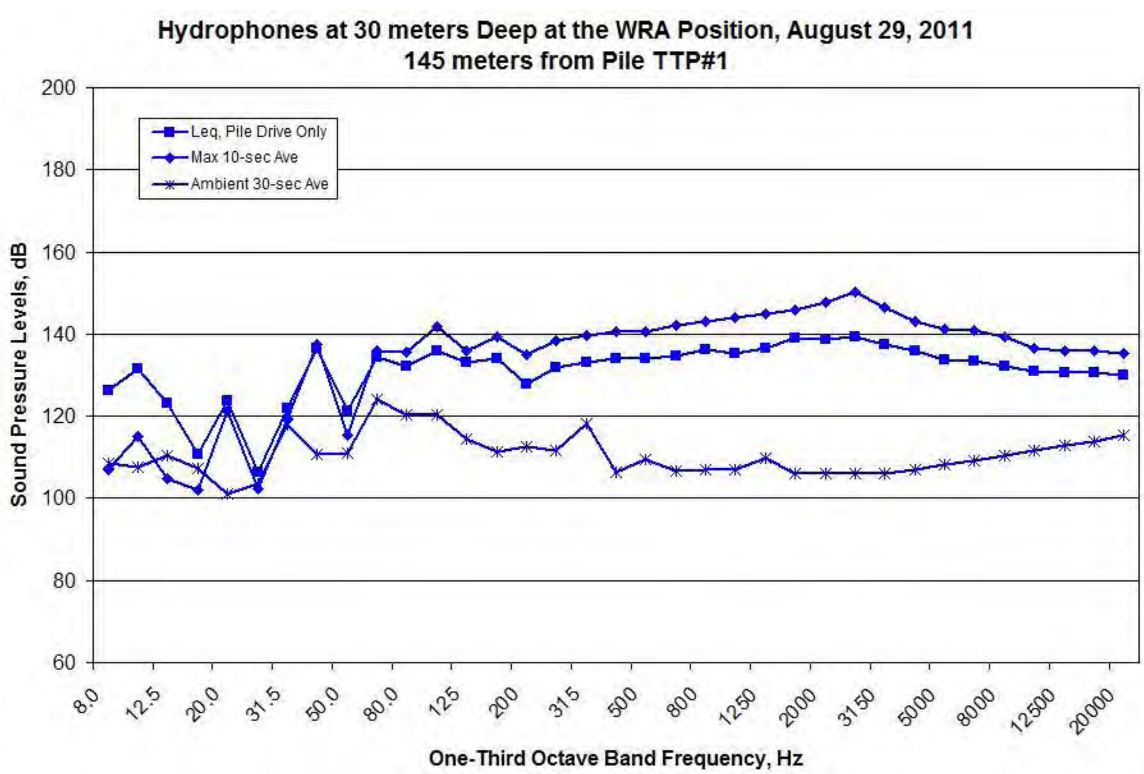

Figure A3. Spectral Data Measured at the WRA Location during TTP#1, 12:13-12:22, Measured at Depths of 30 meters on August 29, 2011

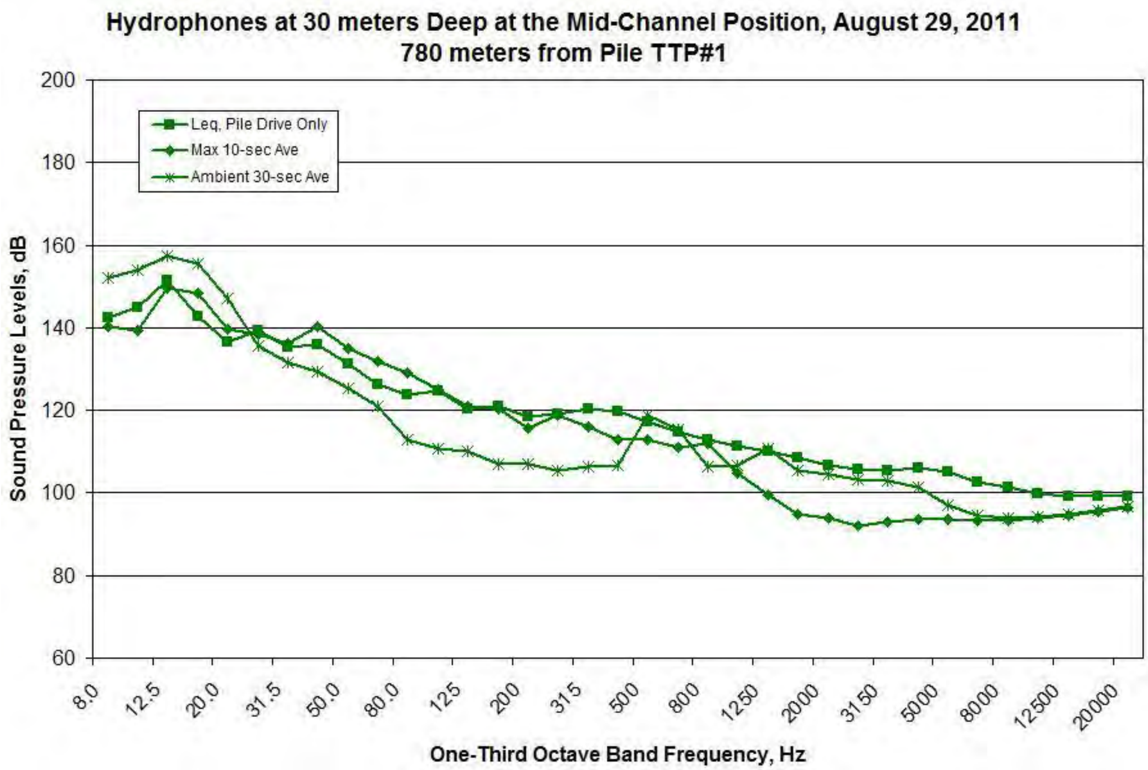

Figure A4. Spectral Data Measured at the MID Location during TTP#1, 12:13-12:22, Measured at Depths of 30 meters on August 29, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS
Figure A5. Spectral Data Measured at the NO Location during TTP#1, 12:13-12:22, Measured at Depths of 30 meters on August 29, 2011

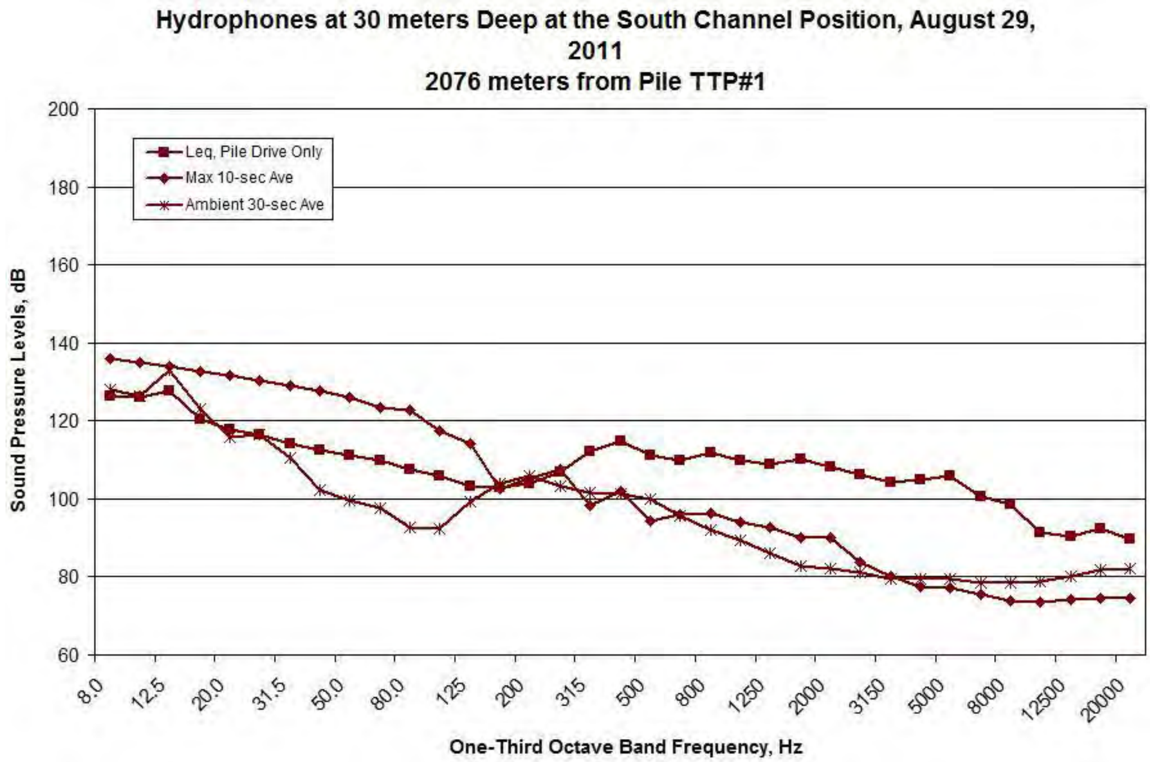

Figure A6. Spectral Data Measured at the SO Location during TTP#1, 12:13-12:22, Measured at Depths of 30 meters on August 29, 2011

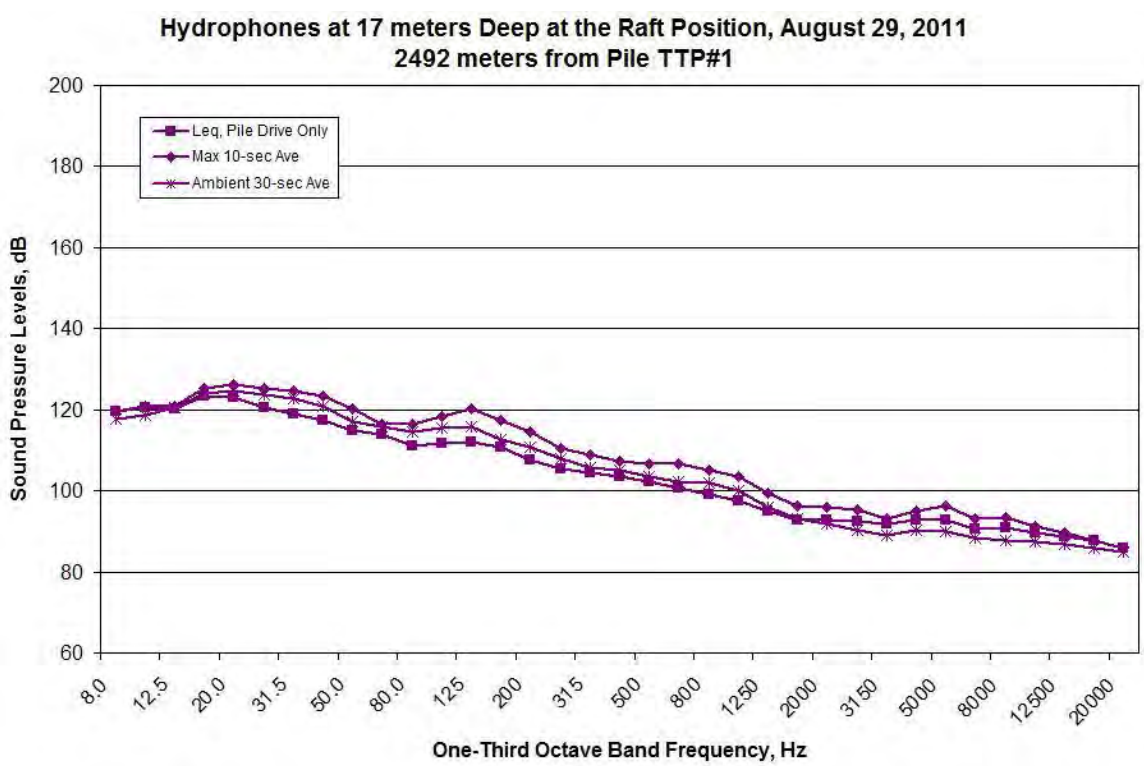

Figure A7. Spectral Data Measured at the RFT Location during TTP#1, 12:13-12:22, Measured at Depths of 17 meters on August 29, 2011

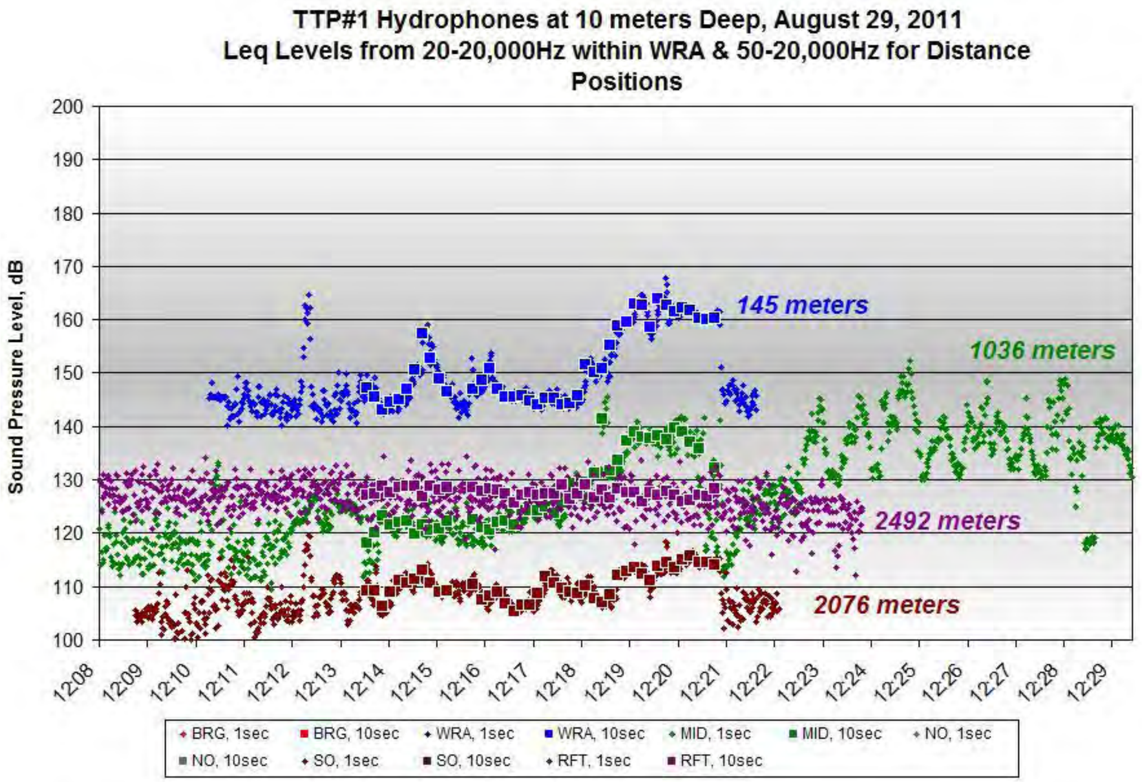

Figure A8. One-second and 10-second Average Data for TTP#1, 12:13-12:22, Measured at Depths of 10 meters on August 29, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A9. Spectral Data Measured at the BRG Location during TTP#1, 12:13-12:22, Measured at Depths of 10 meters on August 29, 2011

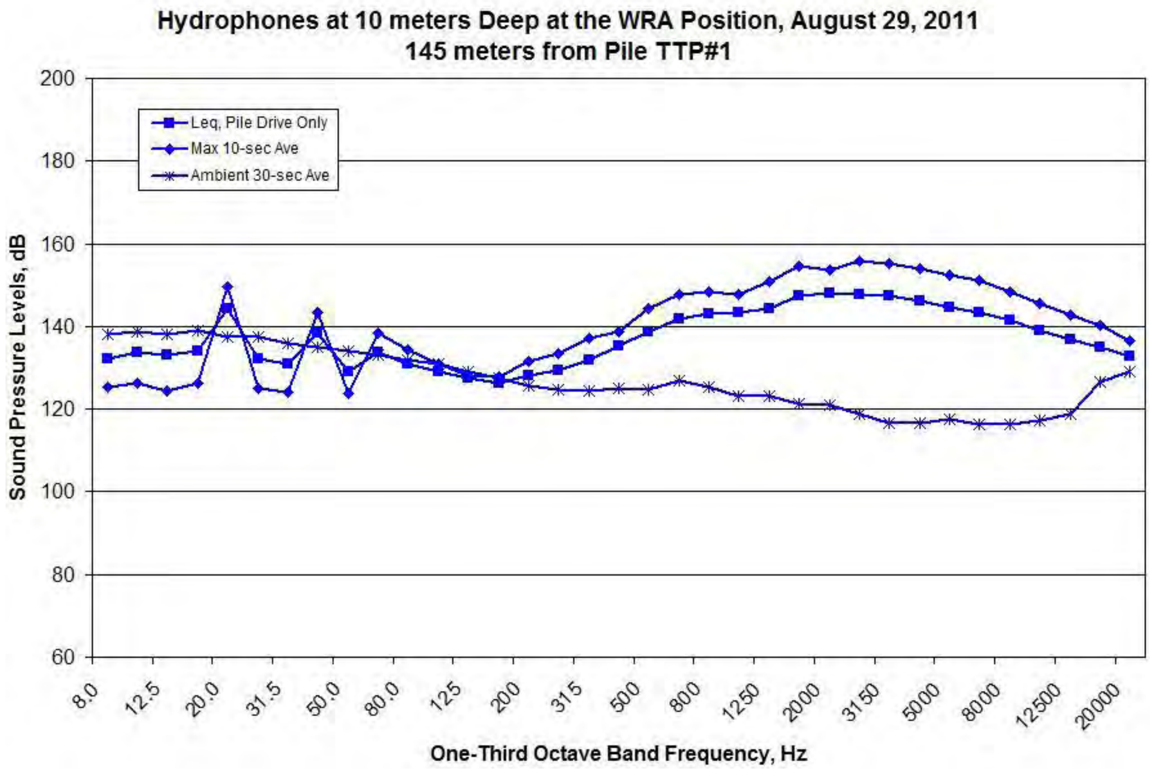

Figure A10. Spectral Data Measured at the WRA Location during TTP#1, 12:13-12:22, Measured at Depths of 10 meters on August 29, 2011

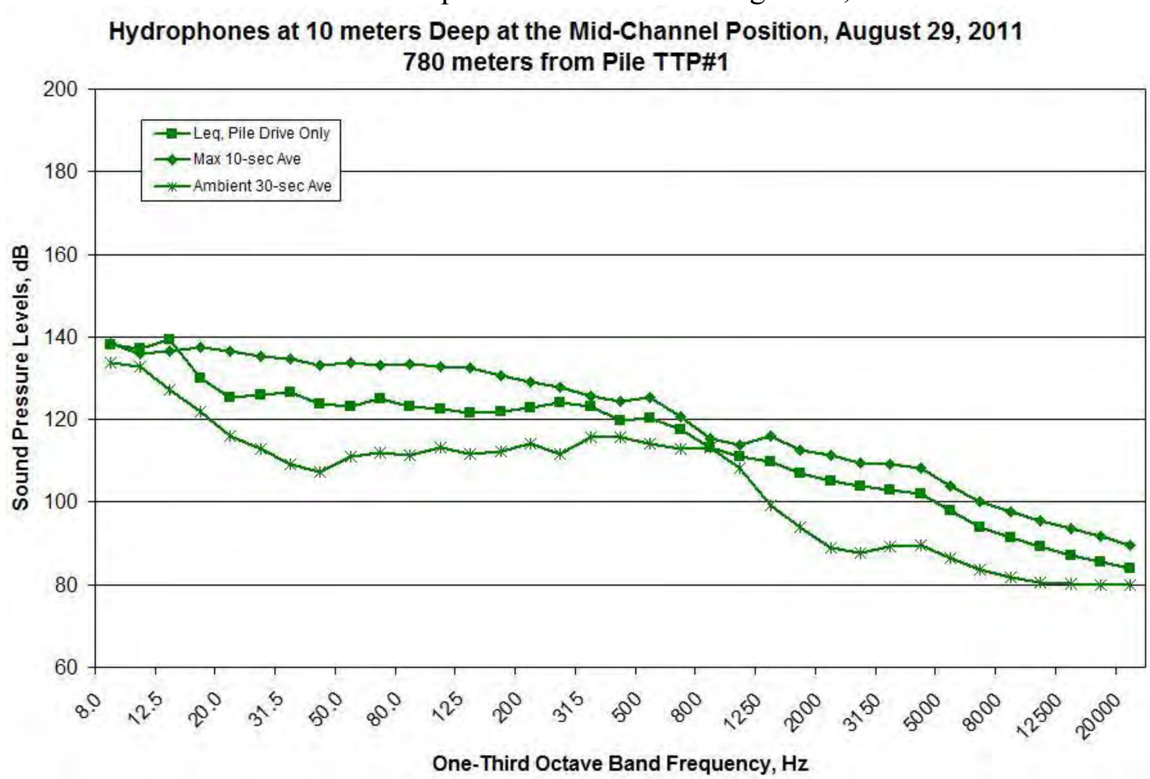

Figure A11. Spectral Data Measured at the MID Location during TTP#1, 12:13-12:22, Measured at Depths of 10 meters on August 29, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A12. Spectral Data Measured at the NO Location during TTP#1, 12:13-12:22, Measured at Depths of 10 meters on August 29, 2011

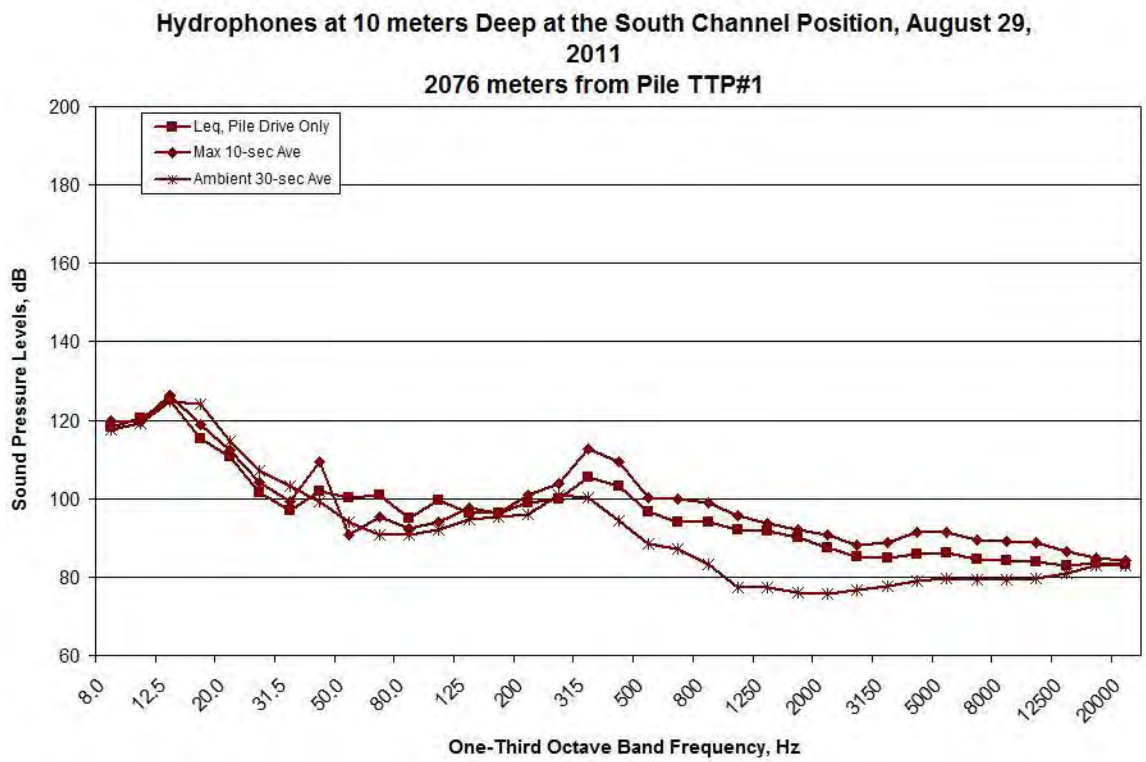

Figure A13. Spectral Data Measured at the SO Location during TTP#1, 12:13-12:22, Measured at Depths of 10 meters on August 29, 2011

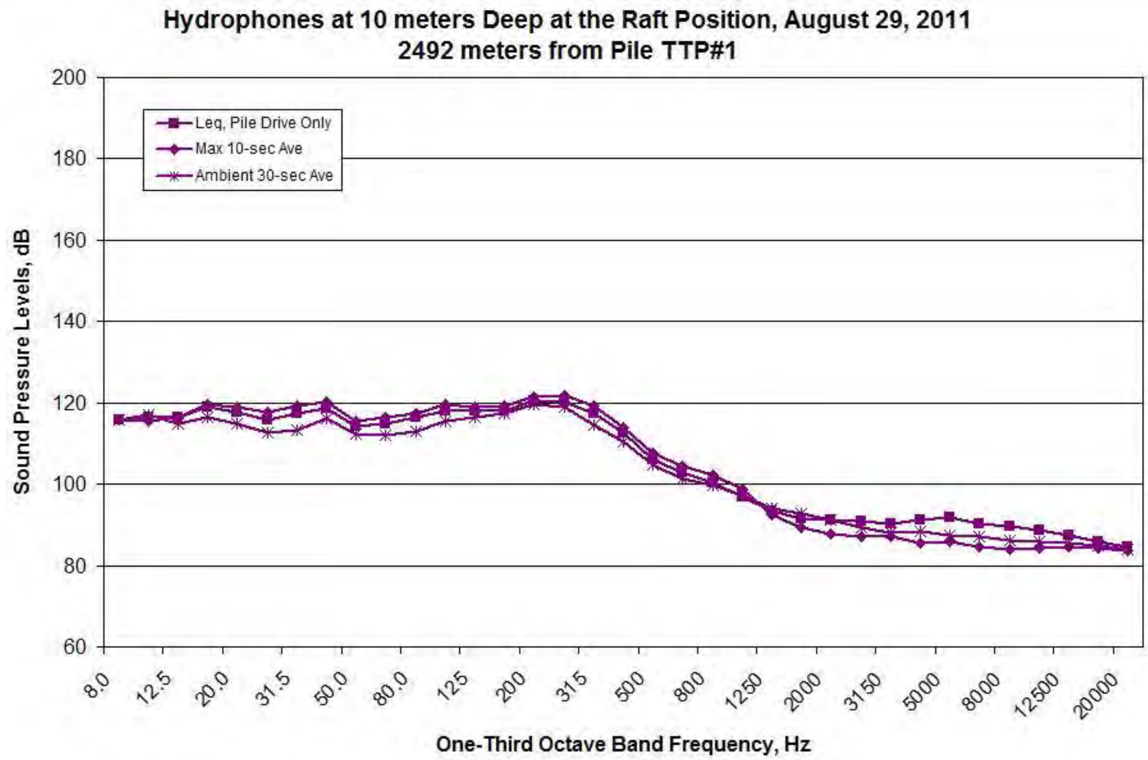

Figure A14. Spectral Data Measured at the RFT Location during TTP#1, 12:13-12:22, Measured at Depths of 10 meters on August 29, 2011

TPP#2 (Vibratory Installation)

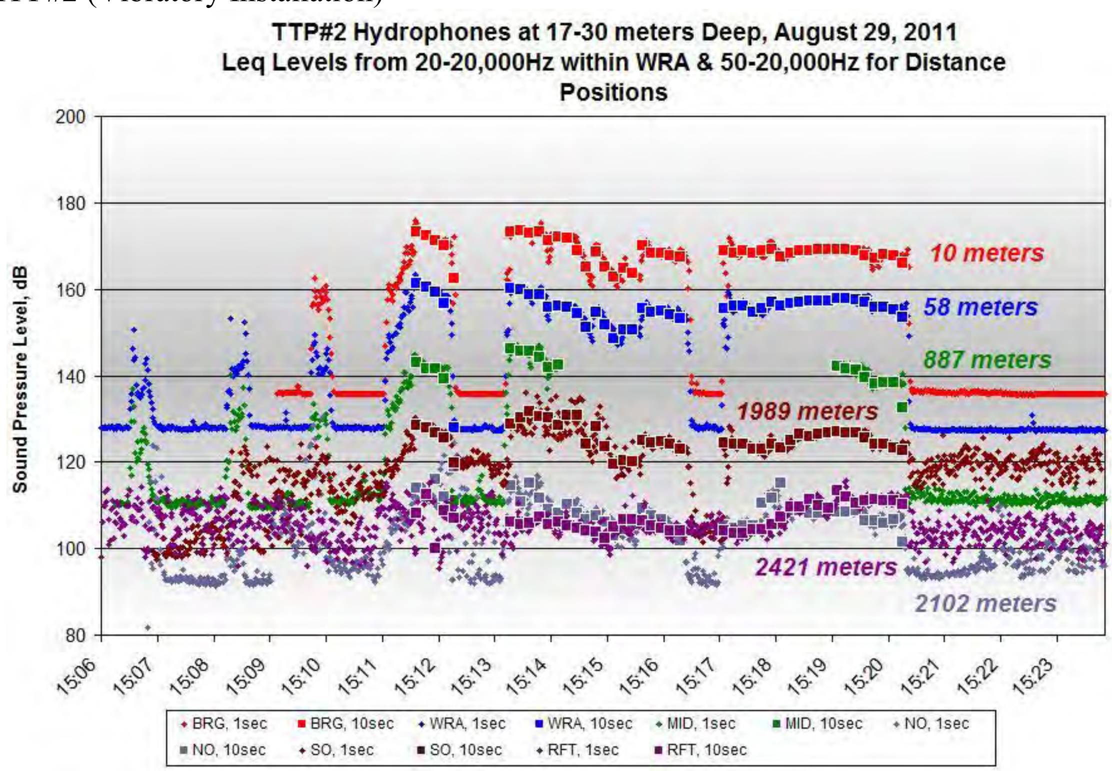

Figure A15. One-second and 10-second Average Data for TTP#2, 15:11-15:20, Measured at Depths of 17-30 meters on August 29, 2011

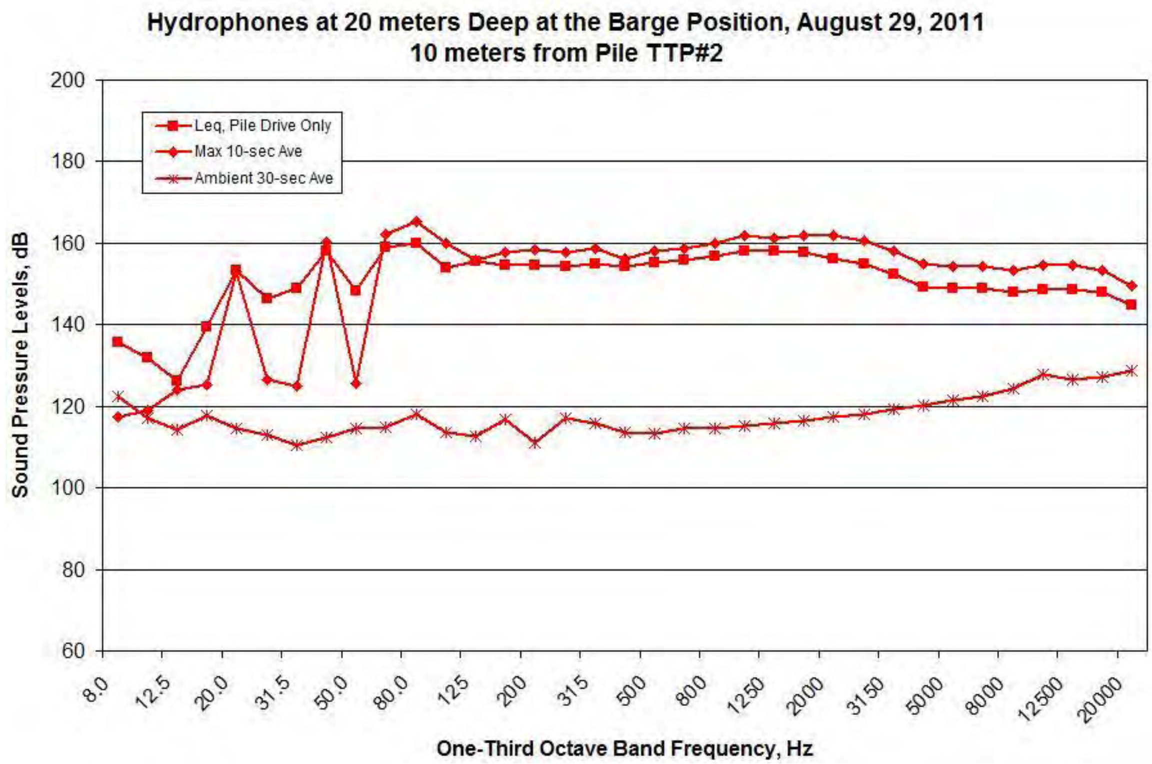

Figure A16. Spectral Data Measured at the BRG Location during TTP#2, 15:11-15:20, Measured at Depths of 20 meters on August 29, 2011

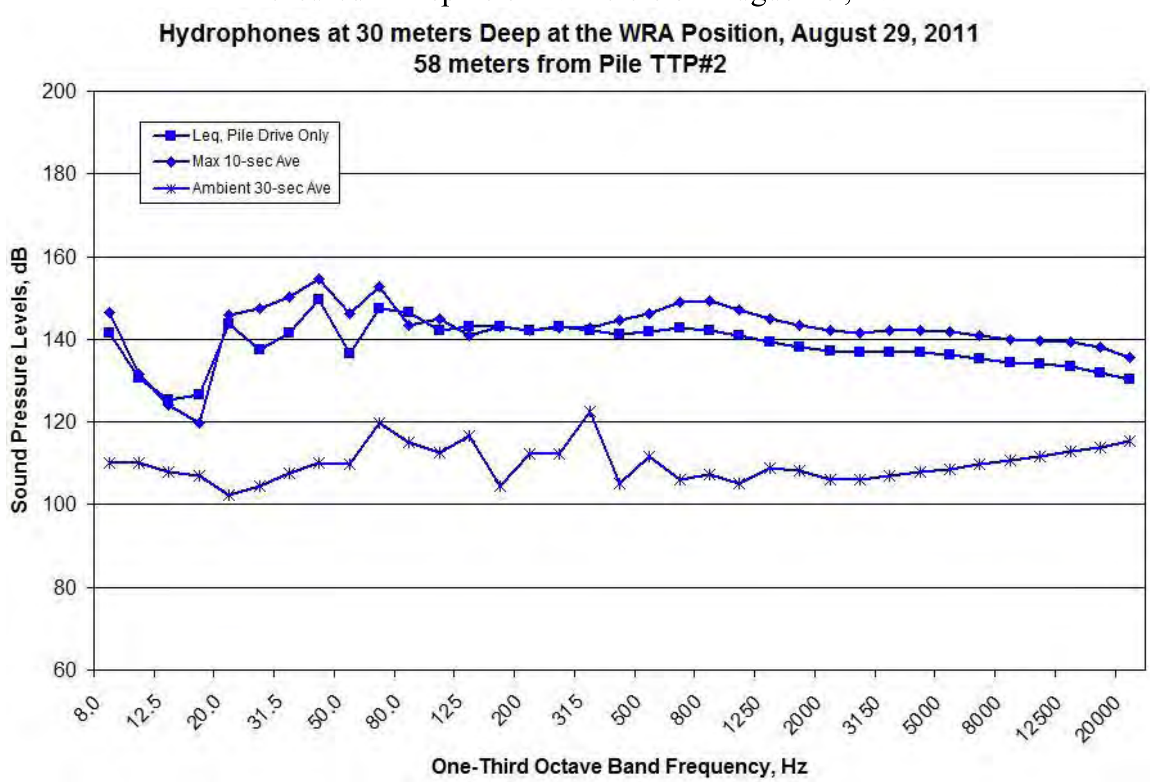

Figure A17. Spectral Data Measured at the WRA Location during TTP#2, 15:11-15:20, Measured at Depths of 30 meters on August 29, 2011

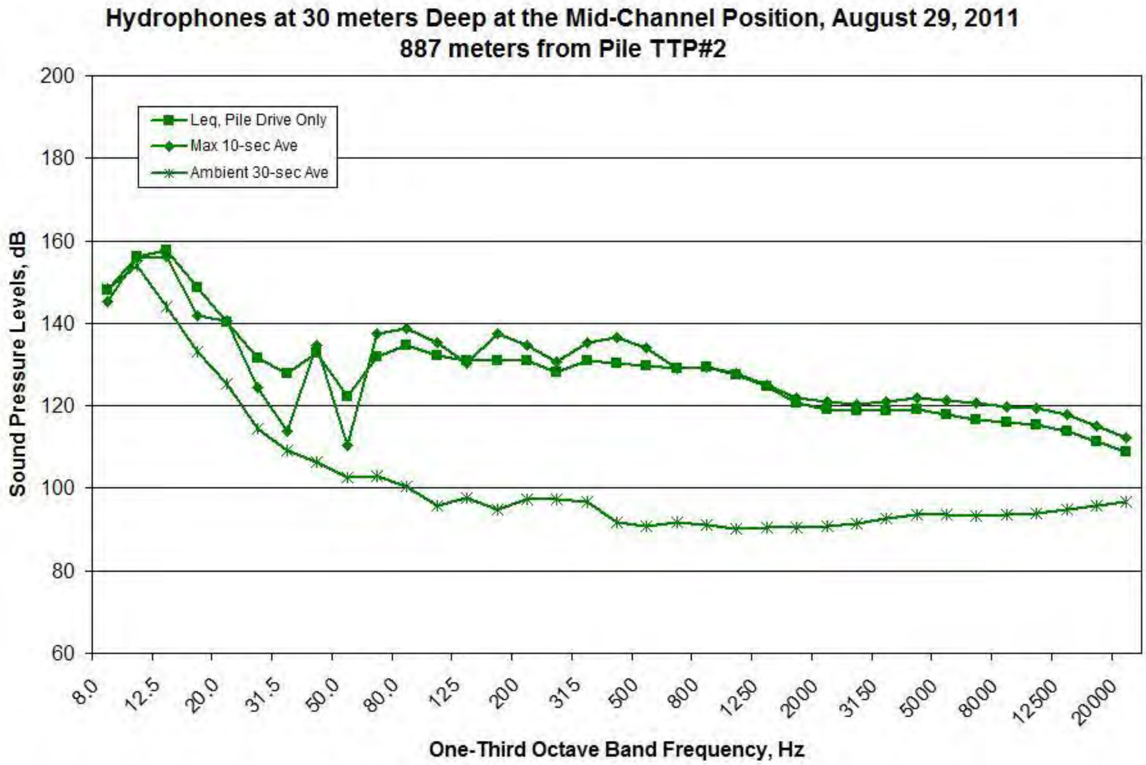

Figure A18. Spectral Data Measured at the MID Location during TTP#2, 15:11-15:20, Measured at Depths of 30 meters on August 29, 2011

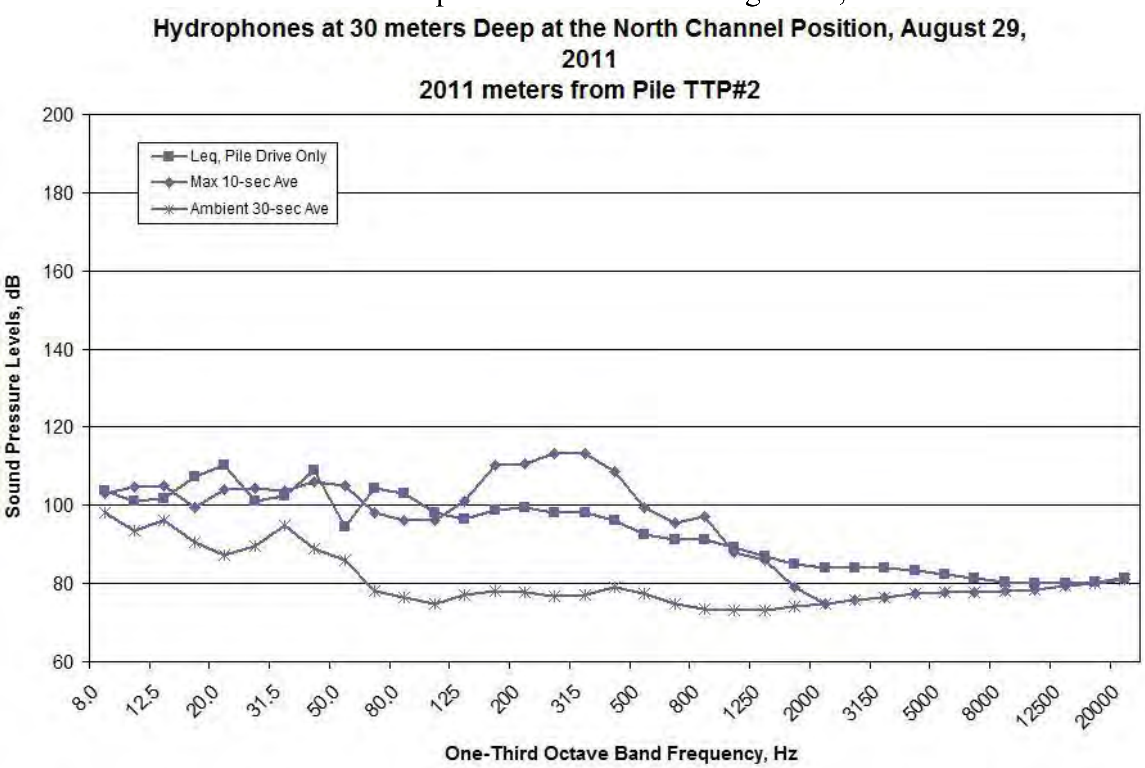

Figure A19. Spectral Data Measured at the NO Location during TTP#2, 15:11-15:20, Measured at Depths of 30 meters on August 29, 2011

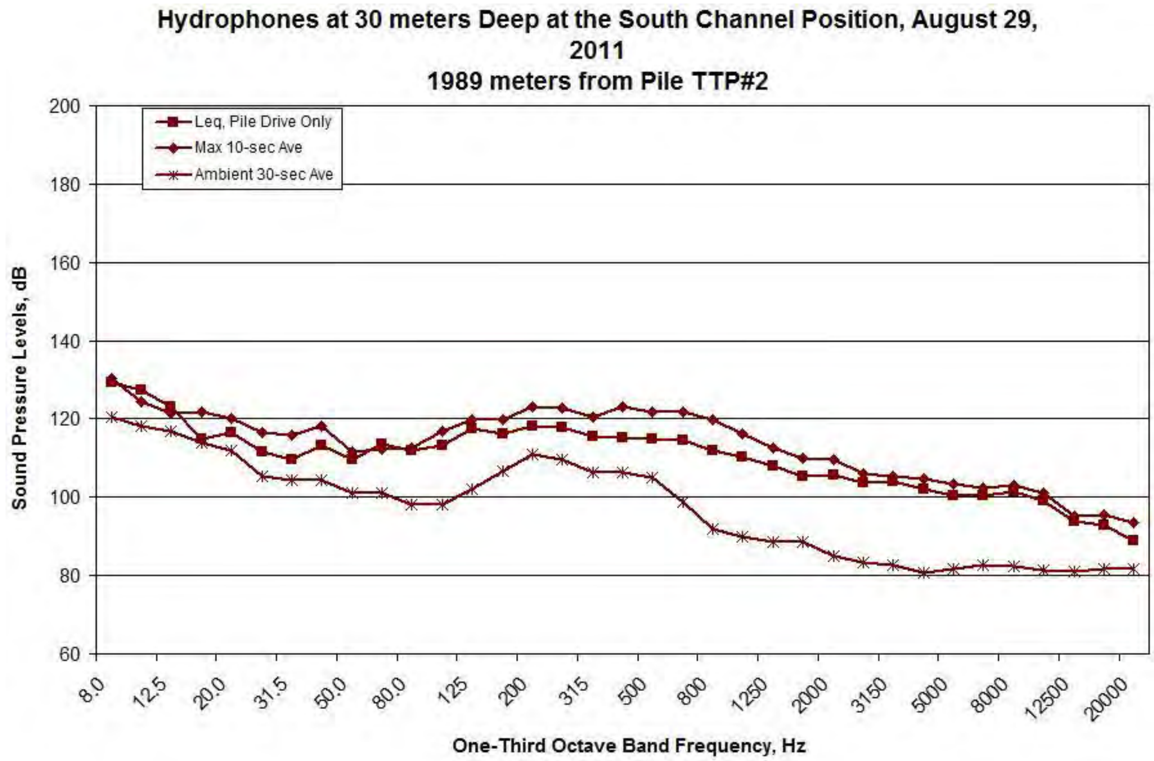

Figure A20. Spectral Data Measured at the SO Location during TTP#2, 15:11-15:20, Measured at Depths of 30 meters on August 29, 2011

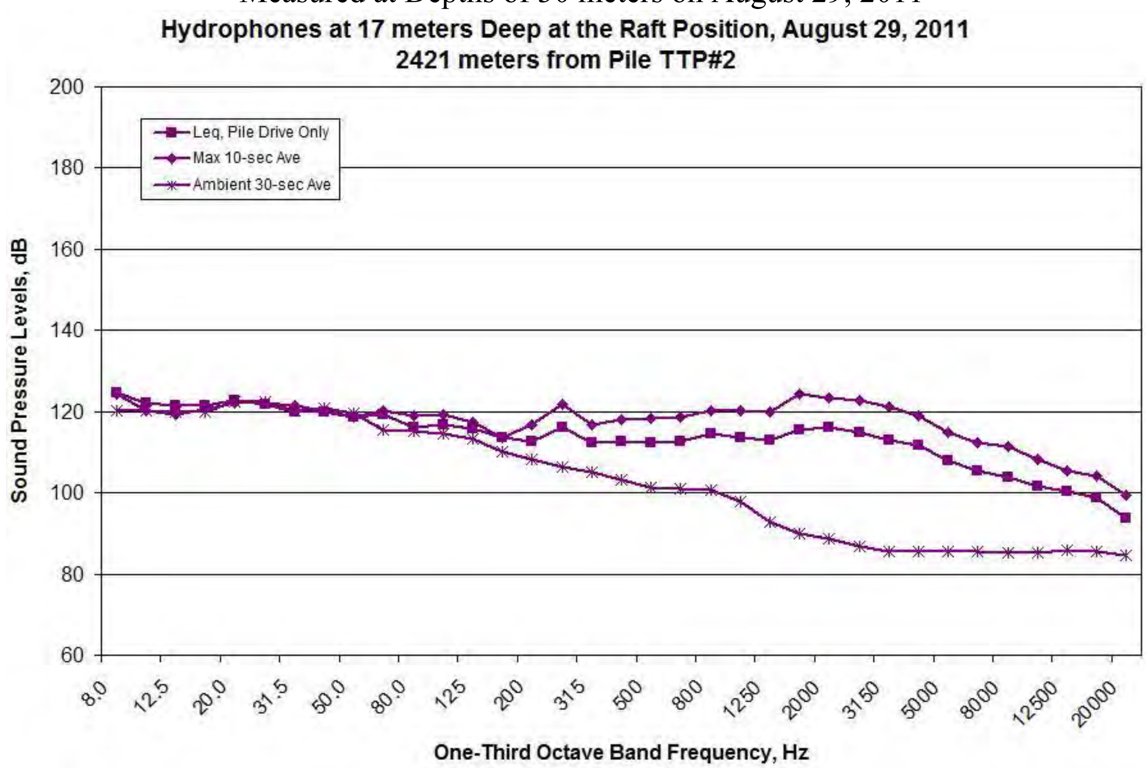

Figure A21. Spectral Data Measured at the RFT Location during TTP#2, 15:11-15:20, Measured at Depths of 17 meters on August 29, 2011

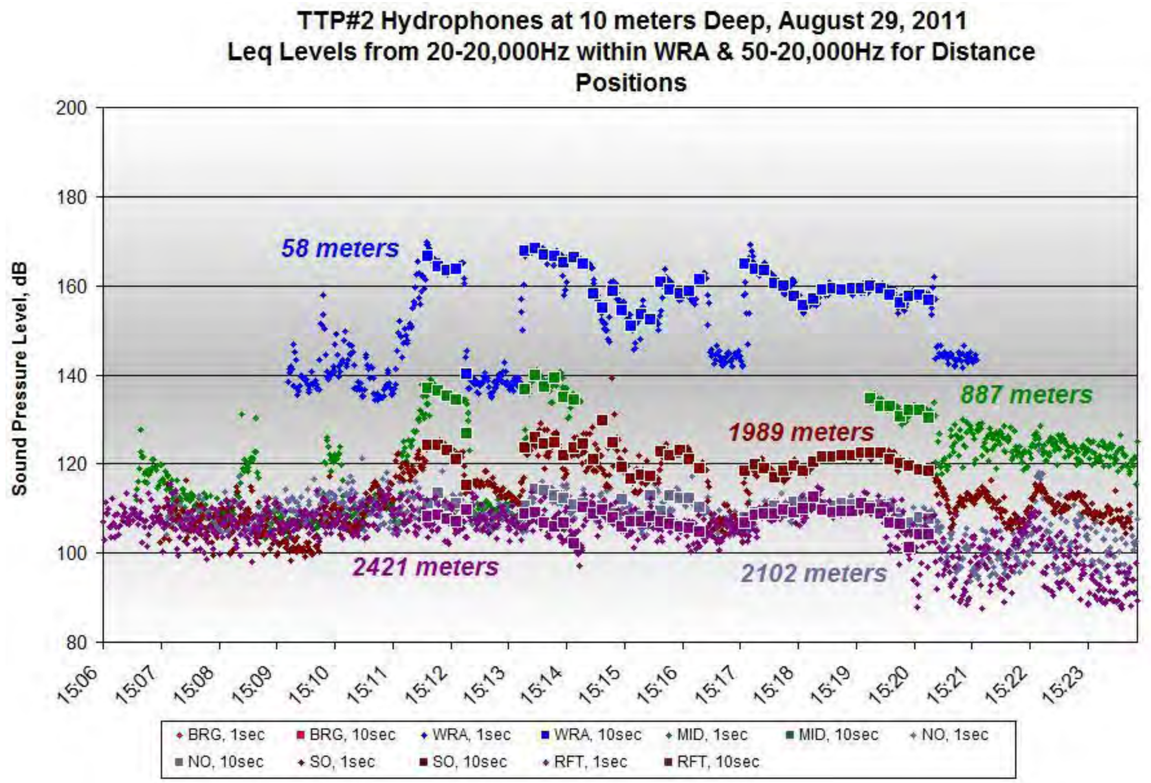

Figure A22. One-second and 10-second Average Data for TTP#2, 15:11-15:20, Measured at Depths of 10 meters on August 29, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A23. Spectral Data Measured at the BRG Location during TTP#2, 15:11-15:20, Measured at Depths of 10 meters on August 29, 2011

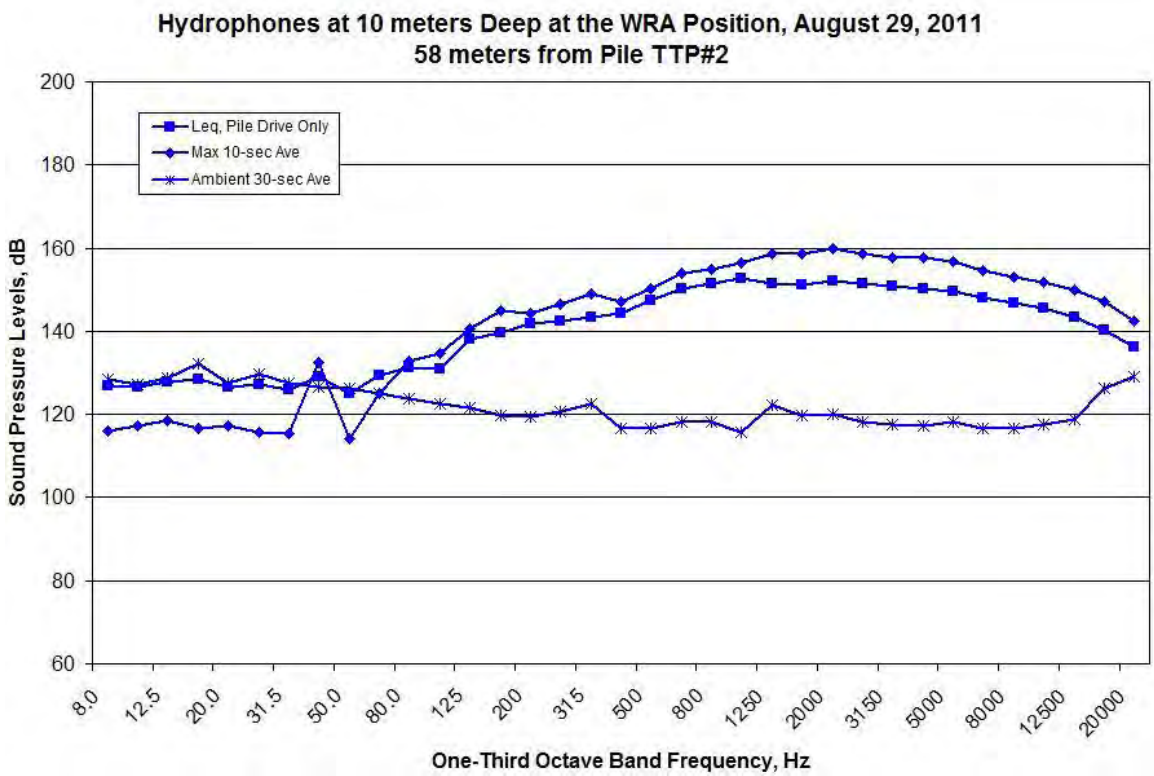

Figure A24. Spectral Data Measured at the WRA Location during TTP#2, 15:11-15:20, Measured at Depths of 10 meters on August 29, 2011

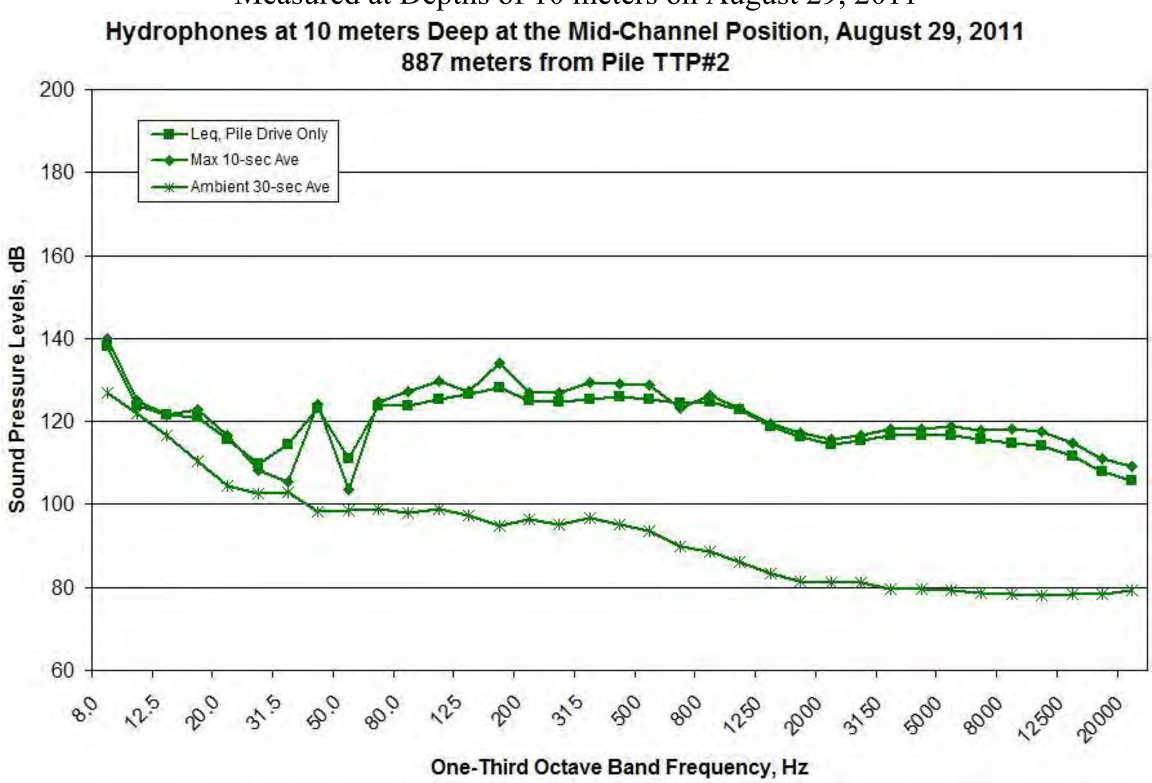

Figure A25. Spectral Data Measured at the MID Location during TTP#2, 15:11-15:20, Measured at Depths of 10 meters on August 29, 2011

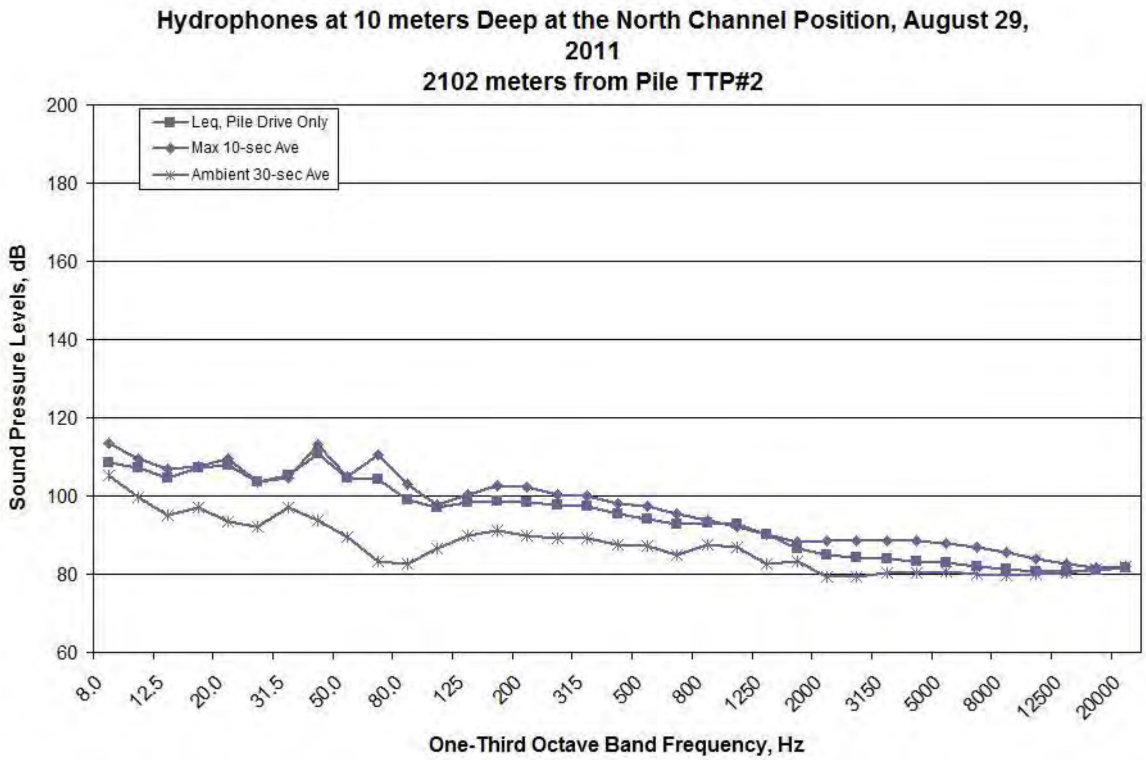

Figure A26. Spectral Data Measured at the NO Location during TTP#2, 15:11-15:20, Measured at Depths of 10 meters on August 29, 2011

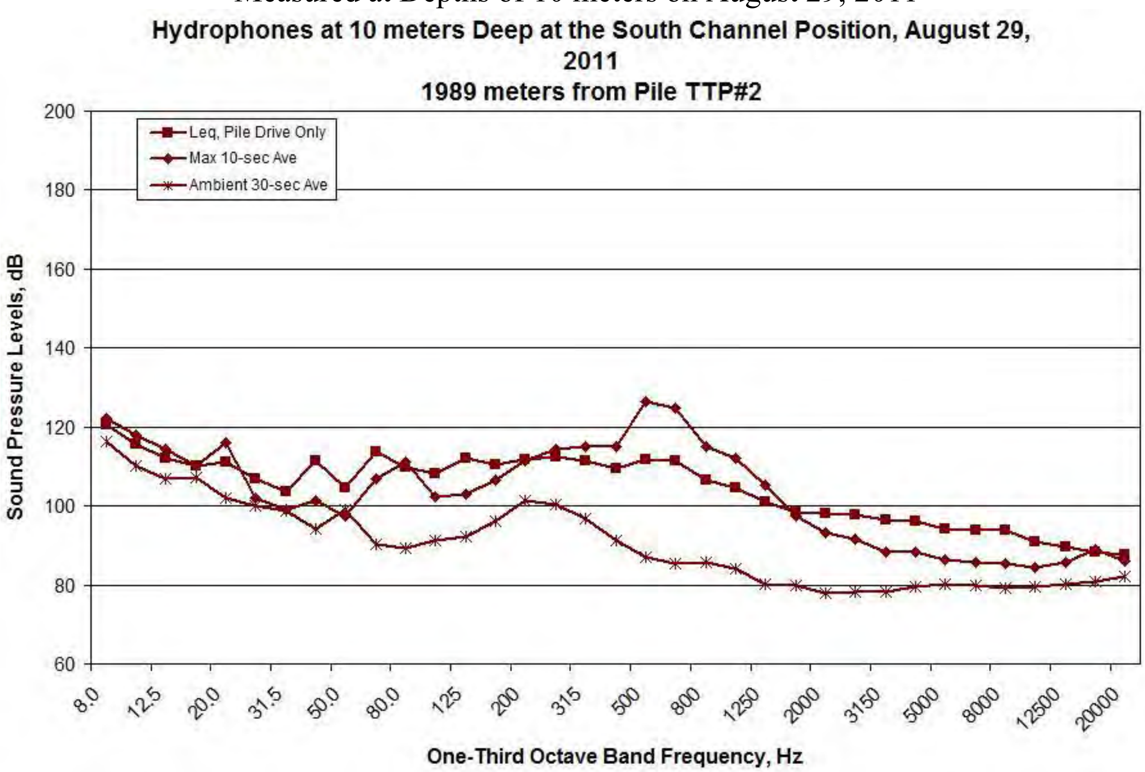

Figure A27. Spectral Data Measured at the SO Location during TTP#2, 15:11-15:20, Measured at Depths of 10 meters on August 29, 2011

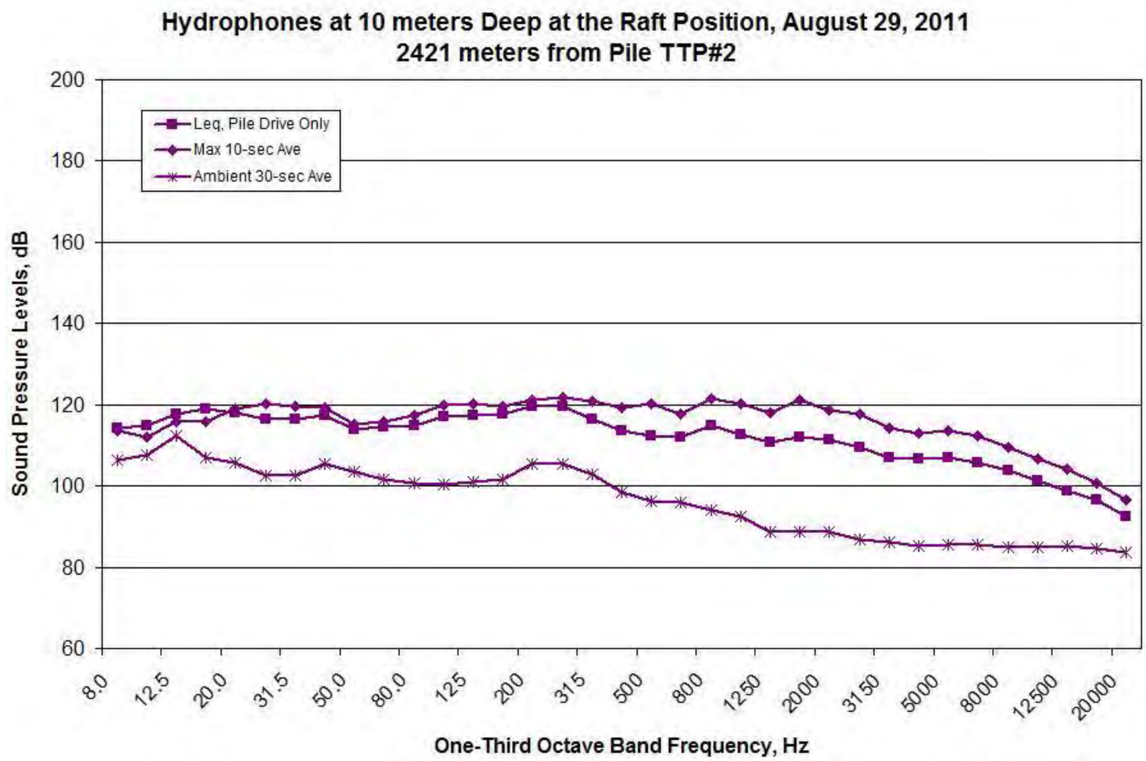

Figure A28. Spectral Data Measured at the RFT Location during TTP#2, 15:11-15:20, Measured at Depths of 10 meters on August 29, 2011

8/30/2011 – TTP#3, 9:57-10:14 (Vibratory Installation)

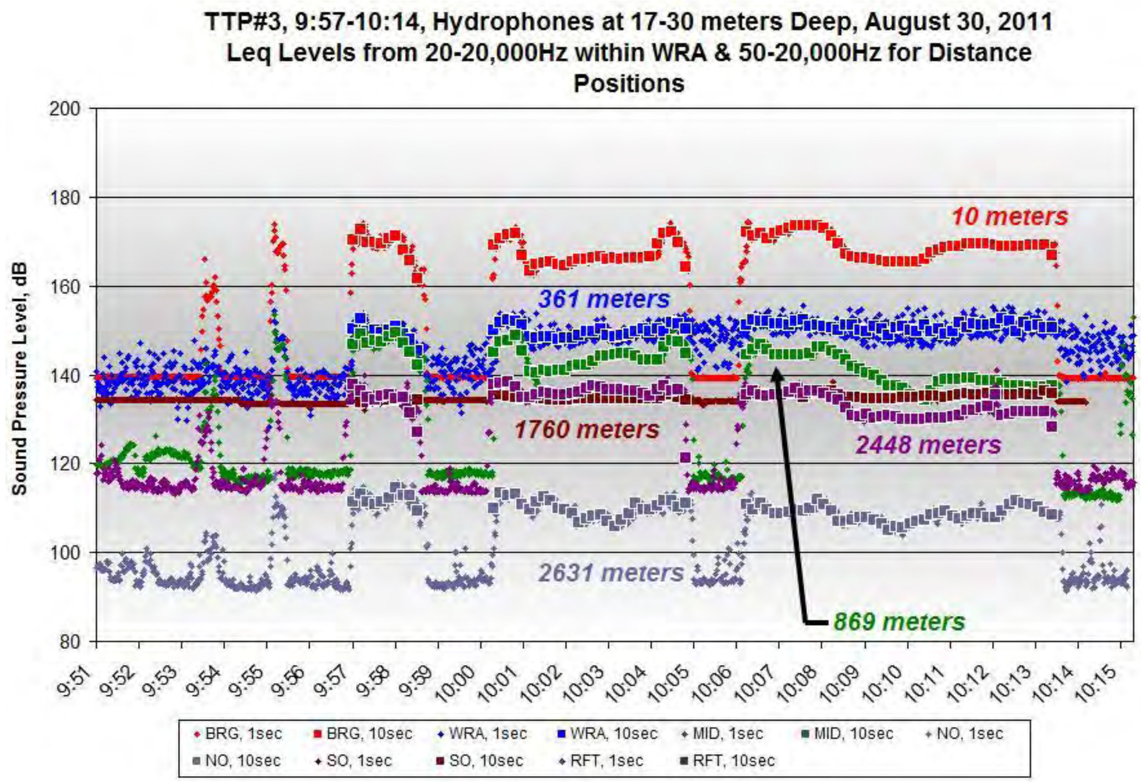

Figure A29. One-second and 10-second Average Data for TTP#3, 9:57-10:14, Measured at Depths of 17-30 meters on August 30, 2011

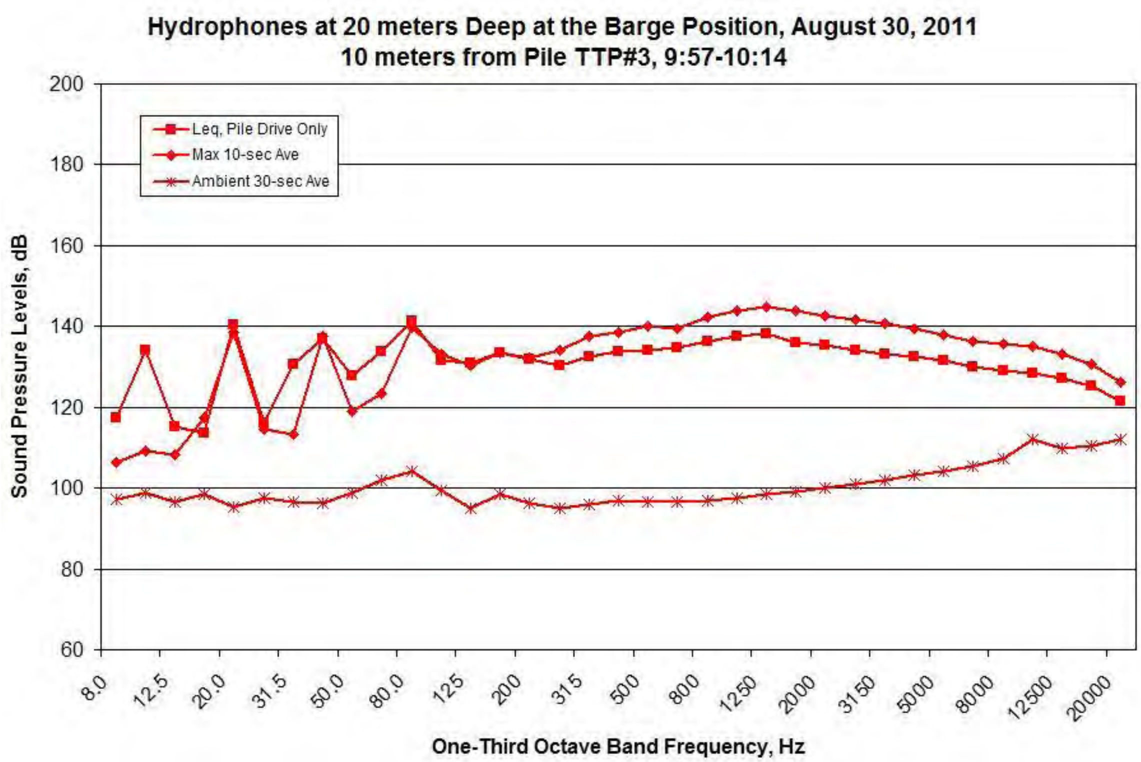

Figure A30. Spectral Data Measured at the BRG Location during TTP#3, 9:57-10:14, Measured at Depths of 20 meters on August 30, 2011

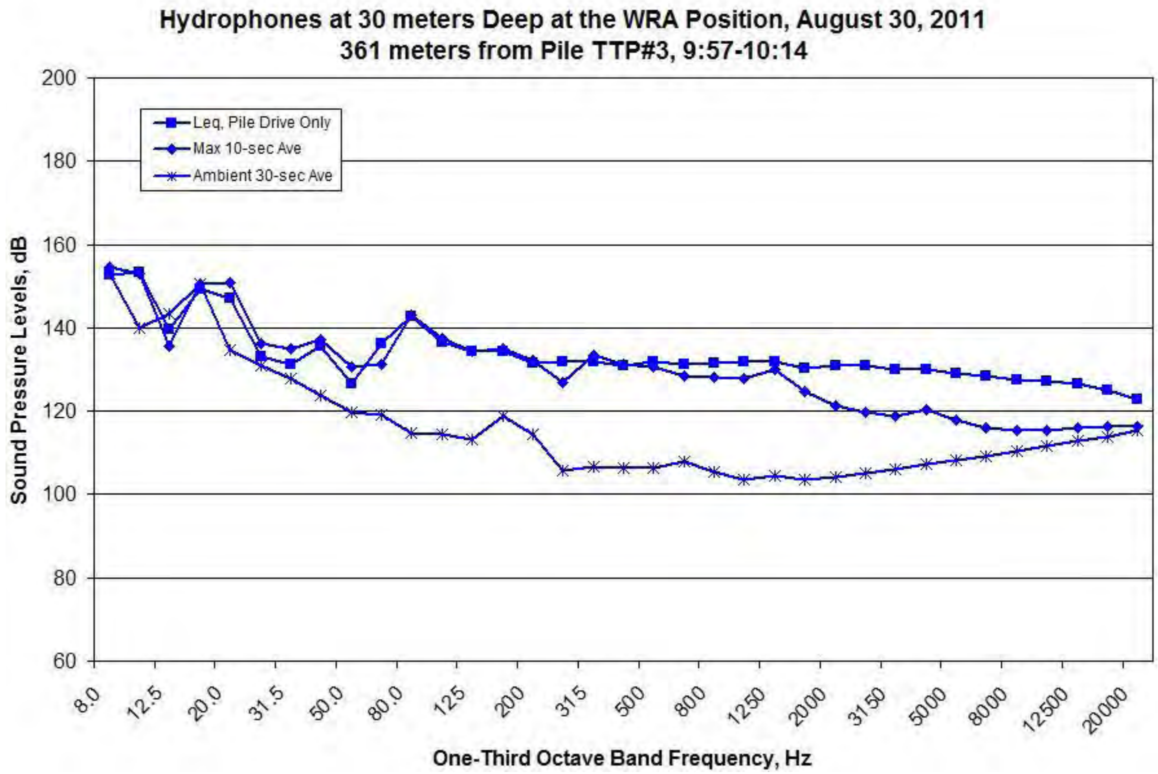

Figure A31. Spectral Data Measured at the WRA Location during TTP#3, 9:57-10:14, Measured at Depths of 30 meters on August 30, 2011

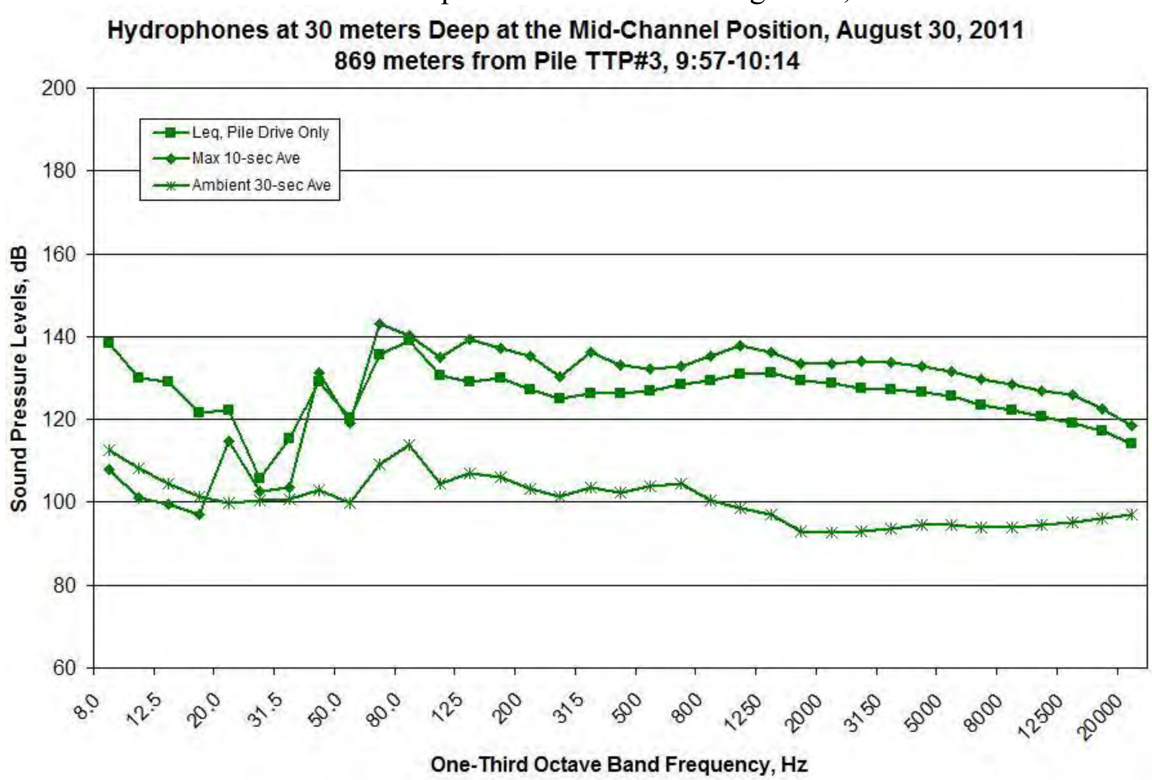

Figure A32. Spectral Data Measured at the MID Location during TTP#3, 9:57-10:14, Measured at Depths of 30 meters on August 30, 2011

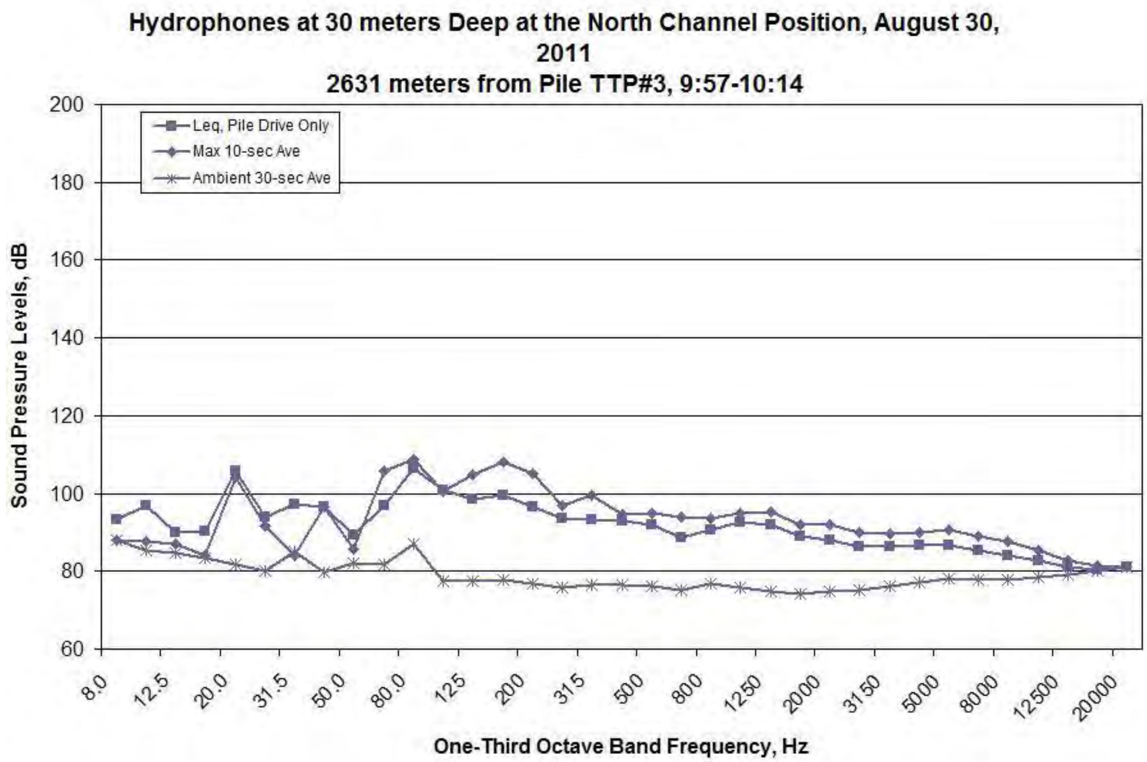

Figure A33. Spectral Data Measured at the NO Location during TTP#3, 9:57-10:14, Measured at Depths of 30 meters on August 30, 2011

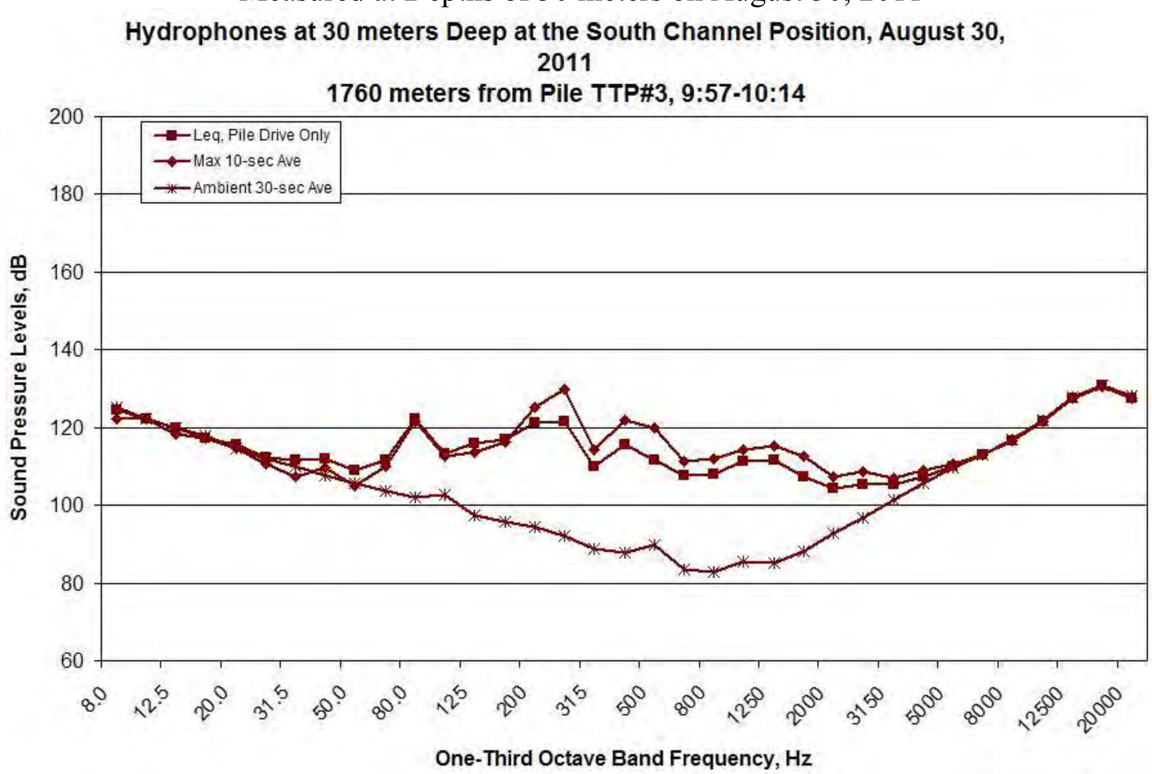

Figure A34. Spectral Data Measured at the SO Location during TTP#3, 9:57-10:14, Measured at Depths of 30 meters on August 30, 2011

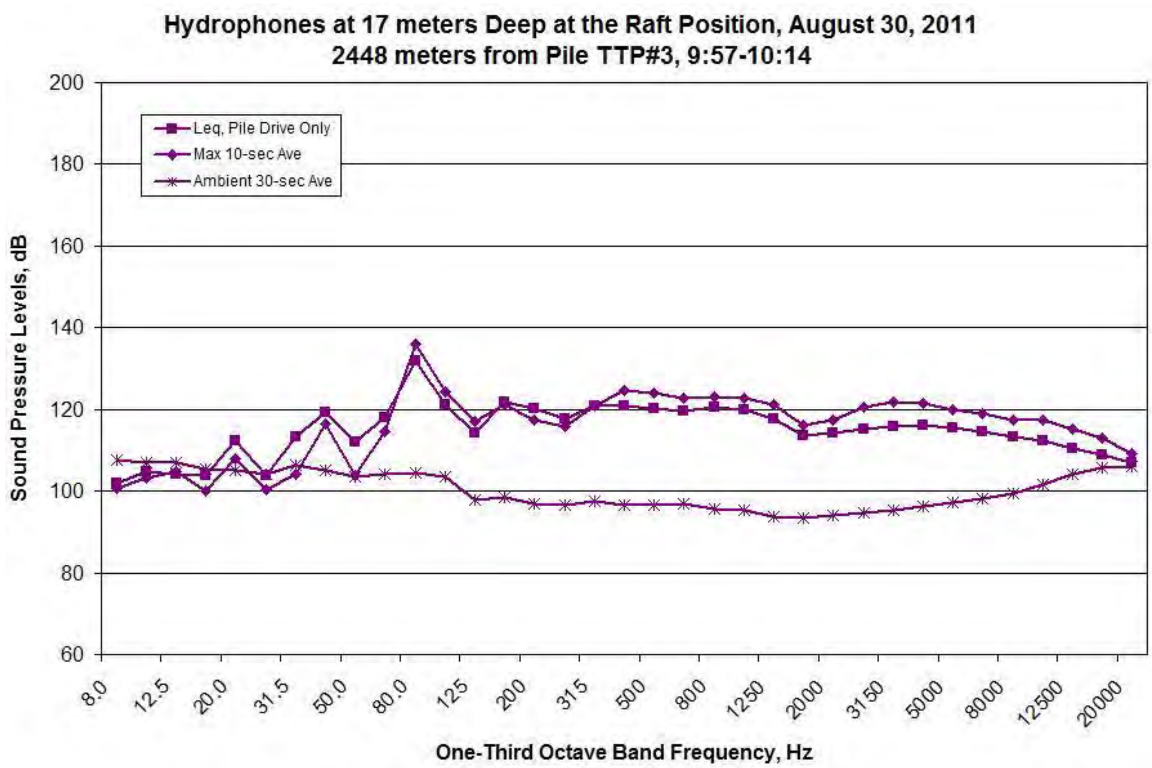

Figure A35. Spectral Data Measured at the RFT Location during TTP#3, 9:57-10:14, Measured at Depths of 17 meters on August 30, 2011

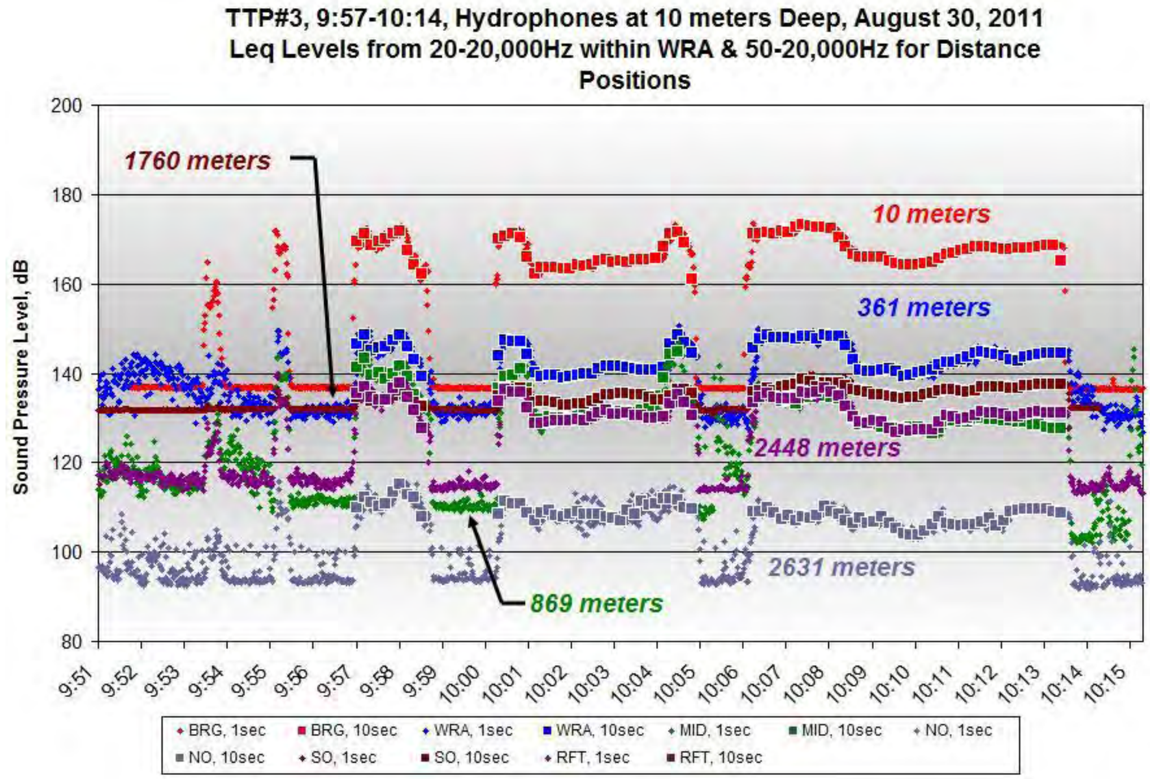

Figure A36. One-second and 10-second Average Data for TTP#3, 9:57-10:14, Measured at Depths of 10 meters on August 30, 2011

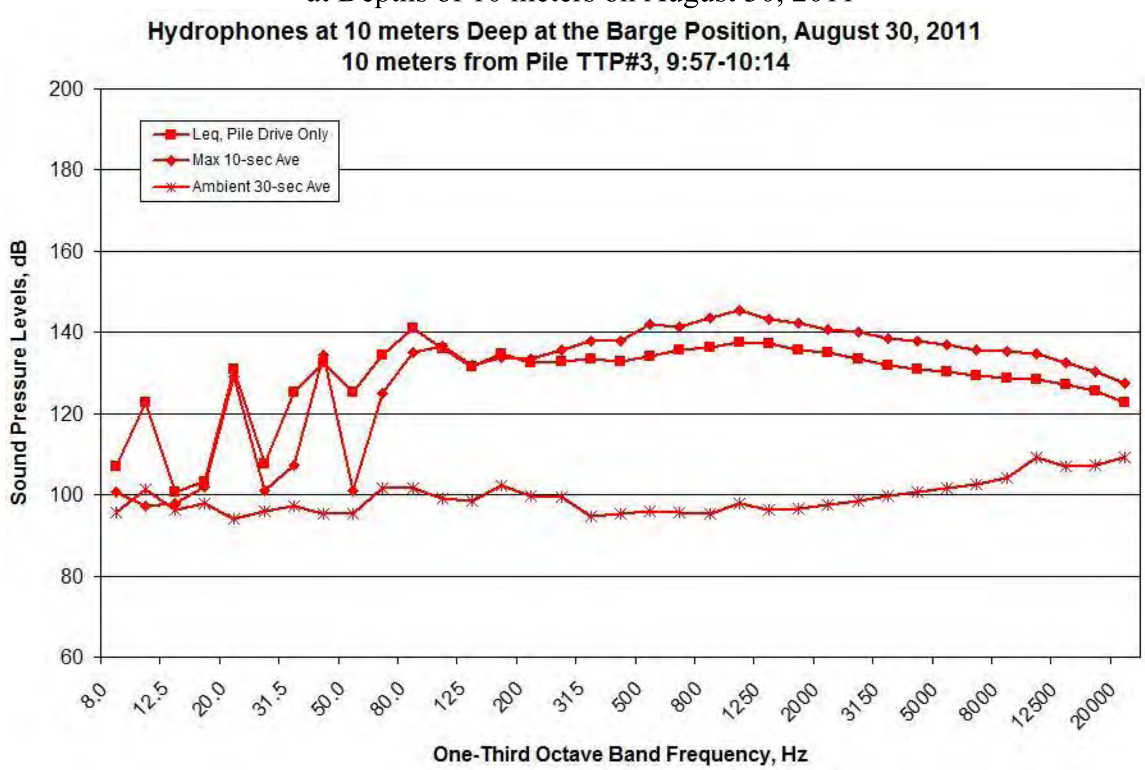

Figure A37. Spectral Data Measured at the BRG Location during TTP#3, 9:57-10:14, Measured at Depths of 10 meters on August 30, 2011

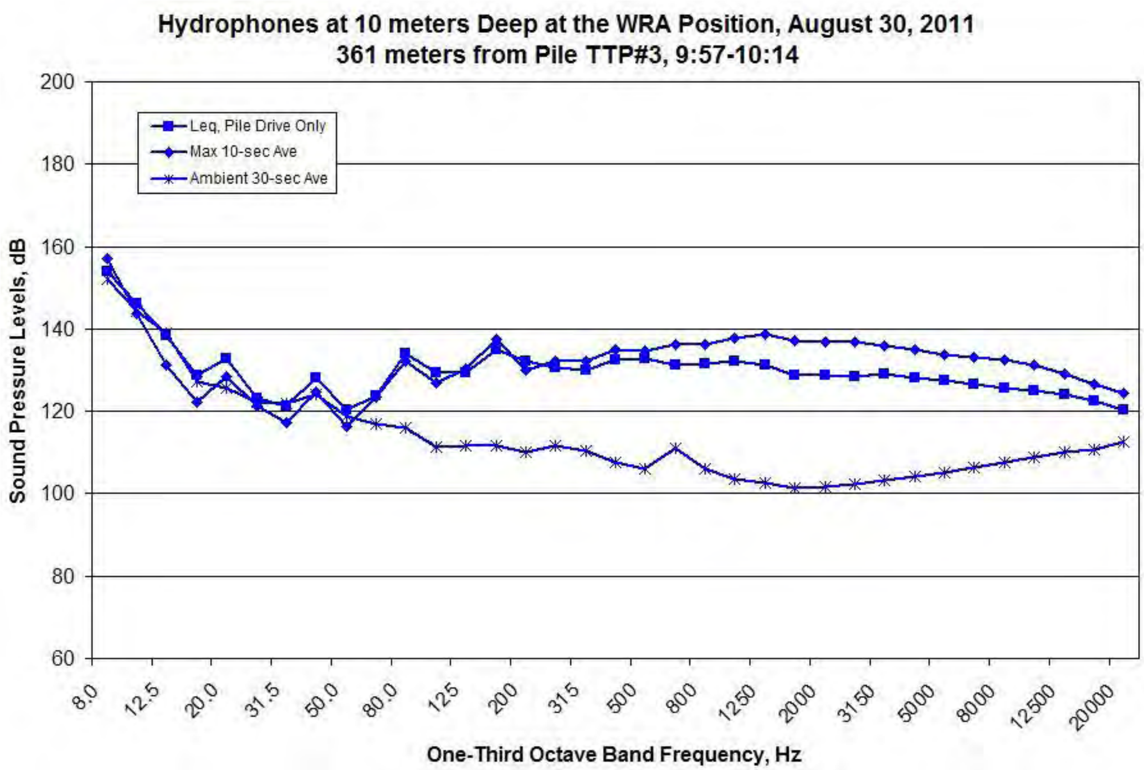

Figure A38. Spectral Data Measured at the WRA Location during TTP#3, 9:57-10:14, Measured at Depths of 10 meters on August 30, 2011

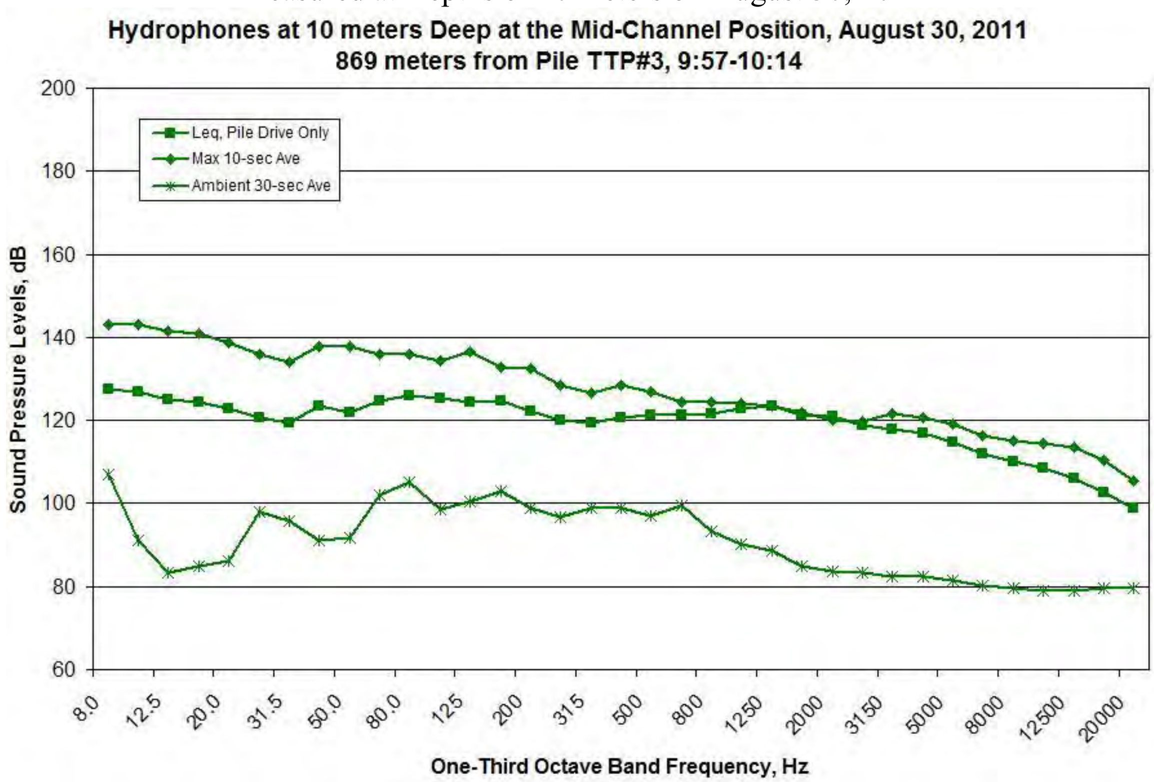

Figure A39. Spectral Data Measured at the MID Location during TTP#3, 9:57-10:14, Measured at Depths of 10 meters on August 30, 2011

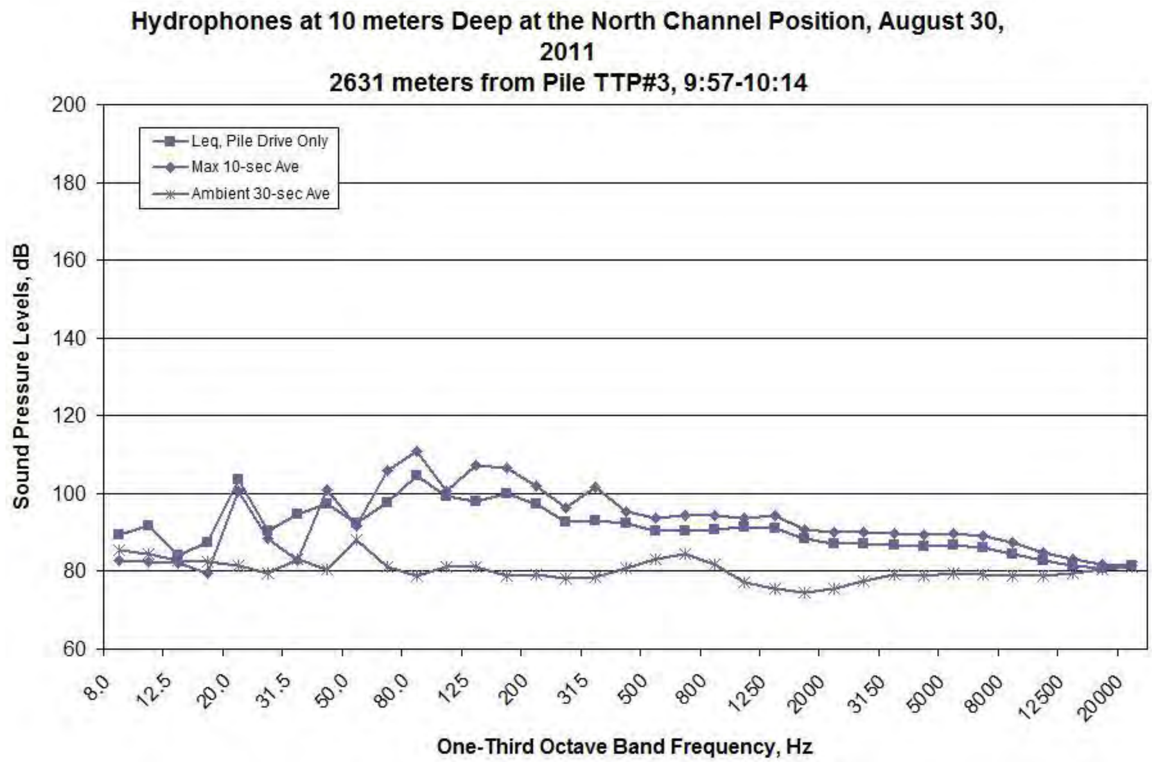

Figure A40. Spectral Data Measured at the NO Location during TTP#3, 9:57-10:14, Measured at Depths of 10 meters on August 30, 2011

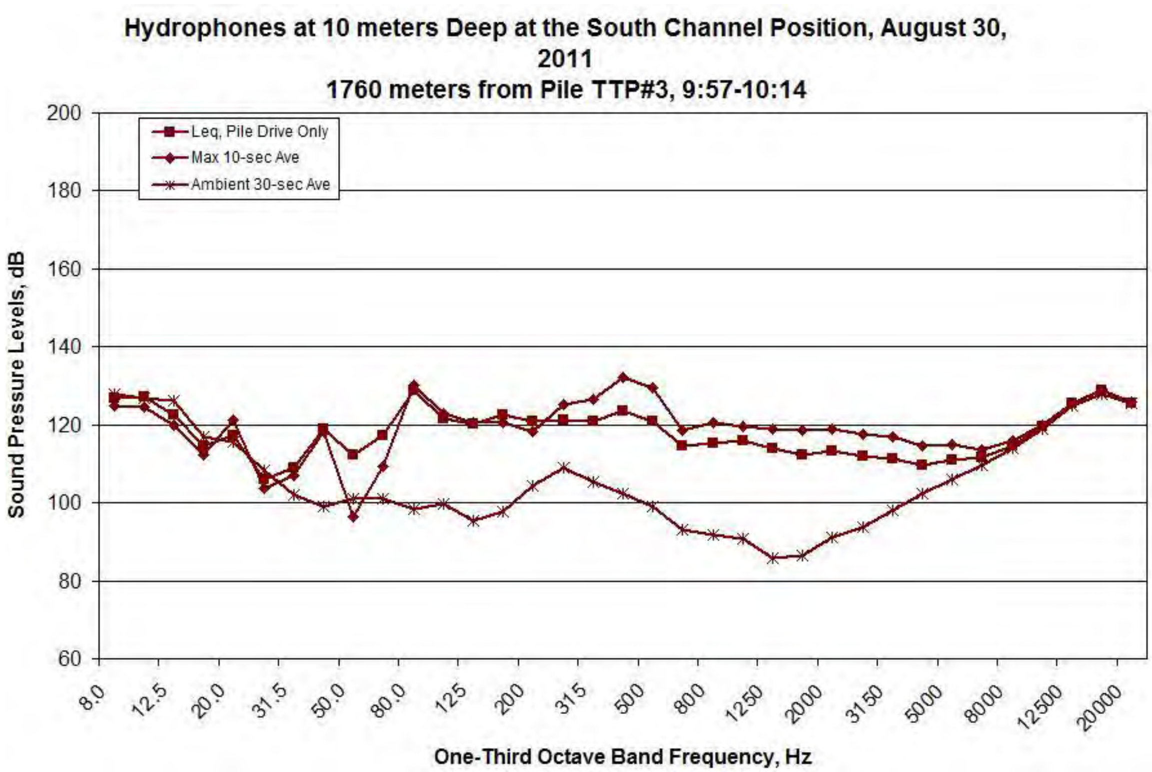

Figure A41. Spectral Data Measured at the SO Location during TTP#3, 9:57-10:14, Measured at Depths of 10 meters on August 30, 2011

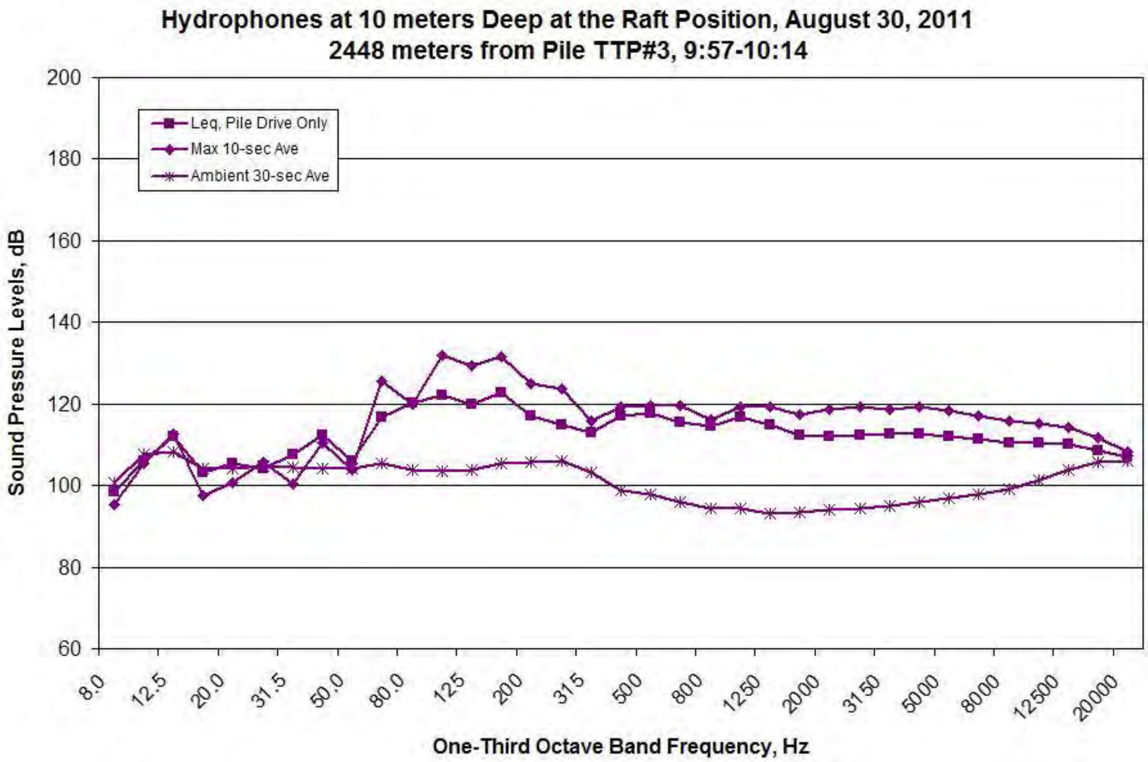

Figure A42. Spectral Data Measured at the RFT Location during TTP#3, 9:57-10:14, Measured at Depths of 10 meters on August 30, 2011

TTP#3, 10:43-10:48 (Vibratory Installation)

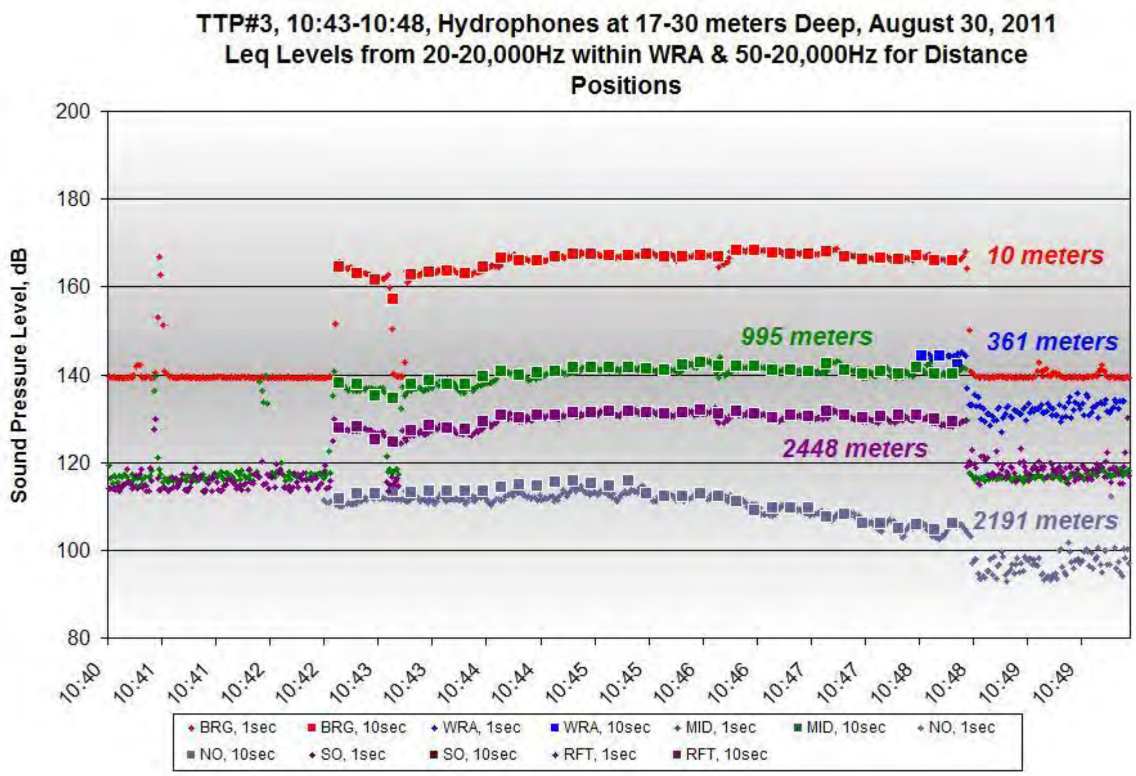

Figure A43. One-second and 10-second Average Data for TTP#3, 10:43-10:48, Measured at Depths of 17-30 meters on August 30, 2011

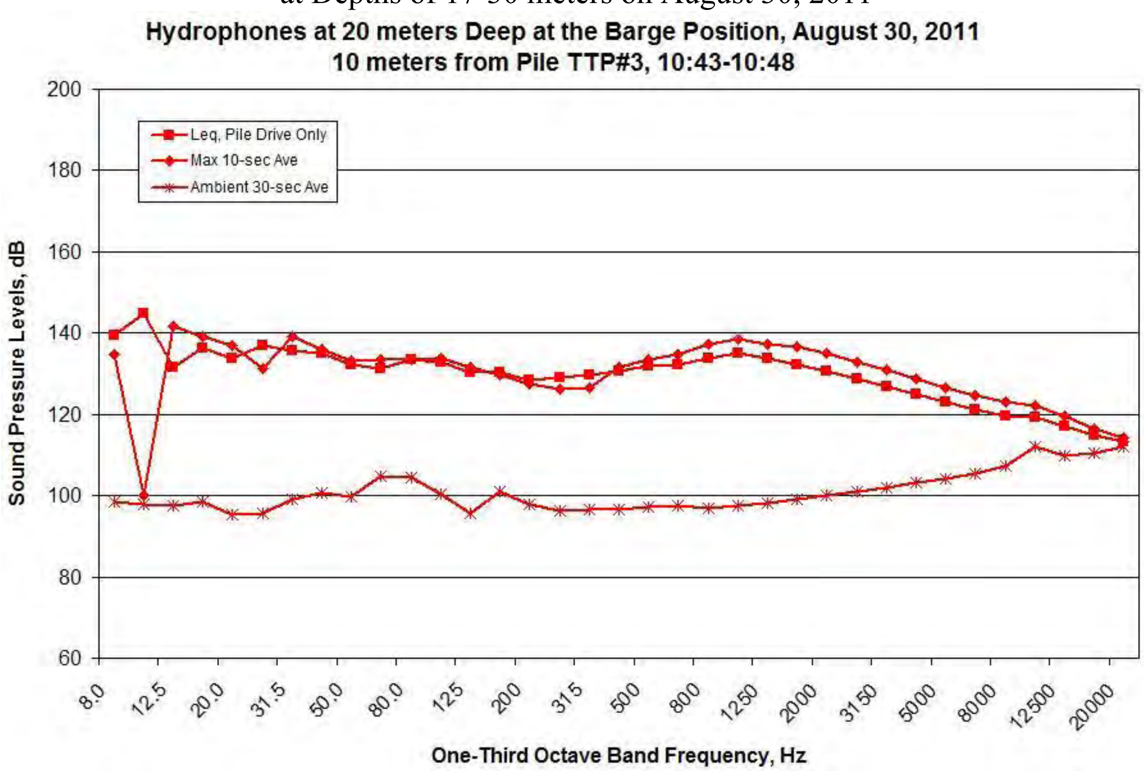

Figure A44. Spectral Data Measured at the BRG Location during TTP#3, 10:43-10:48, Measured at Depths of 20 meters on August 30, 2011

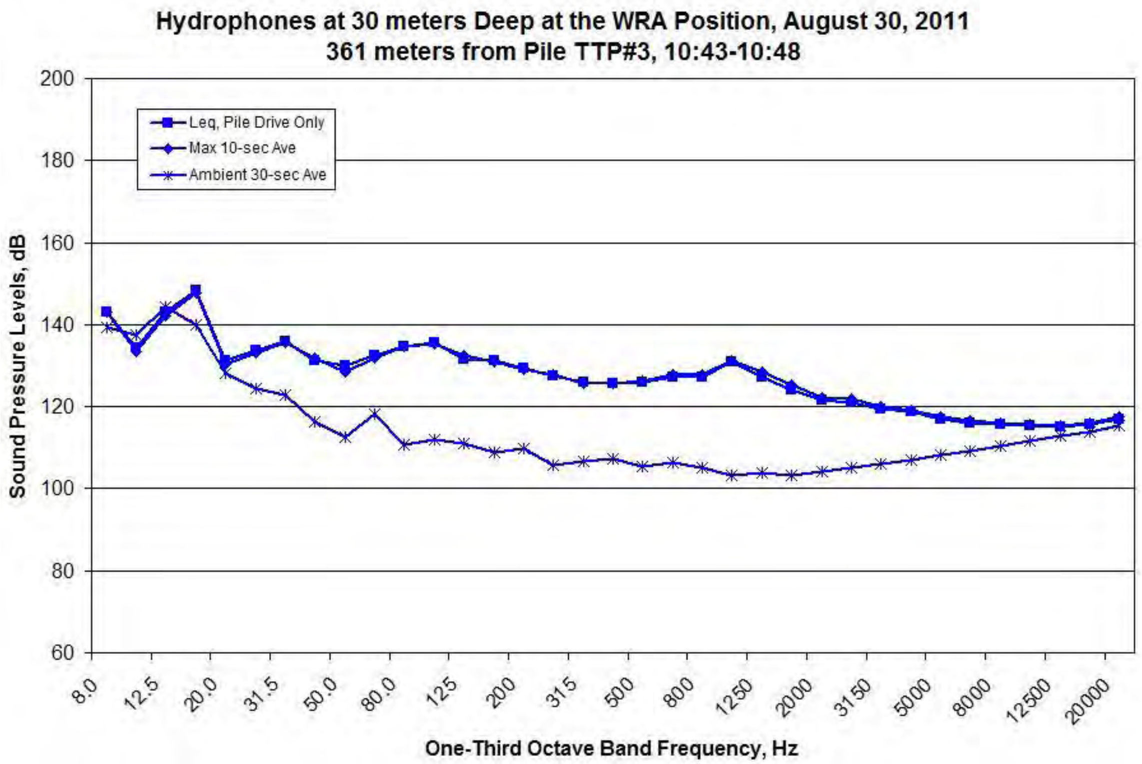

Figure A45. Spectral Data Measured at the WRA Location during TTP#3, 10:43-10:48, Measured at Depths of 30 meters on August 30, 2011

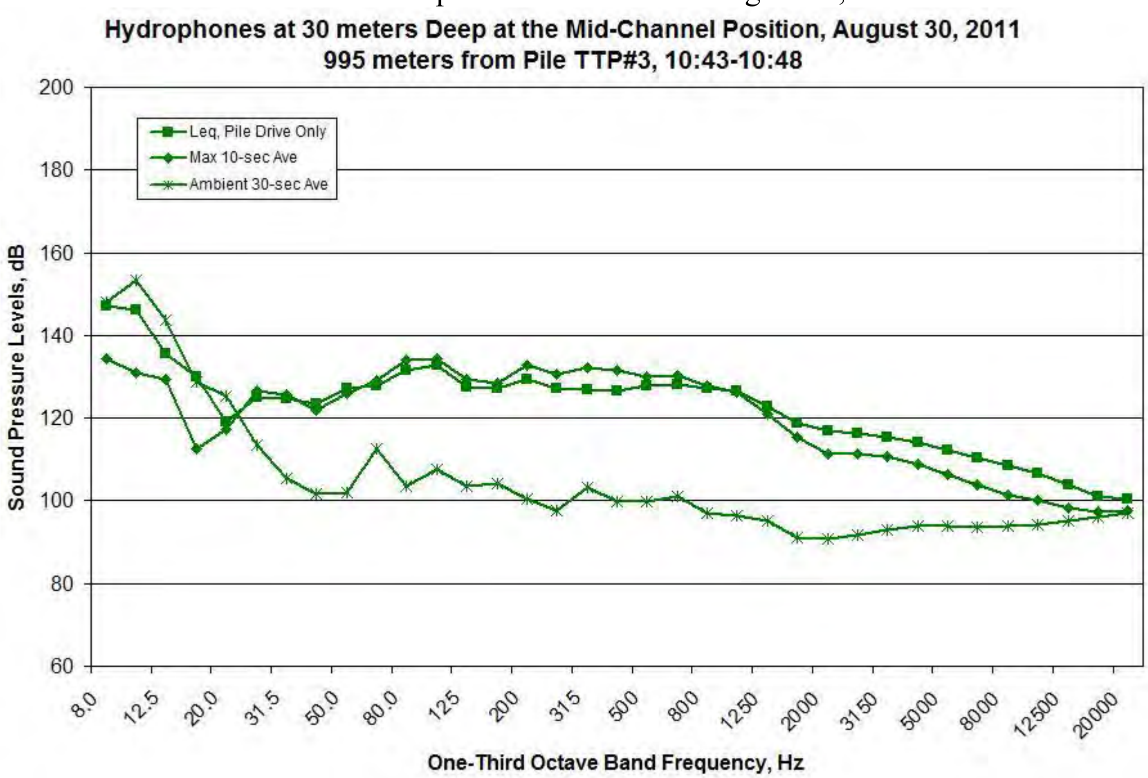

Figure A46. Spectral Data Measured at the MID Location during TTP#3, 10:43-10:48, Measured at Depths of 30 meters on August 30, 2011

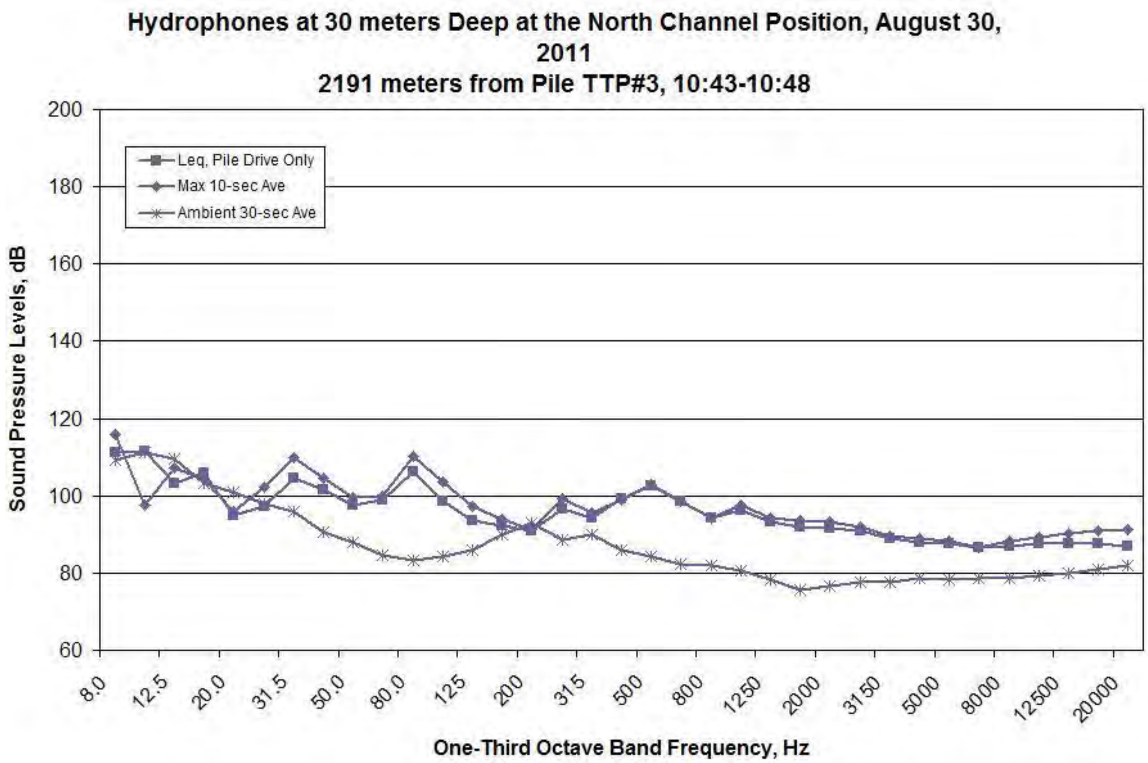

Figure A47. Spectral Data Measured at the NO Location during TTP#3, 10:43-10:48, Measured at Depths of 30 meters on August 30, 2011

NO DATA AVAILABLE DUE TO METERS TURNING OFF DURING TESTING

Figure A48. Spectral Data Measured at the SO Location during TTP#3, 10:43-10:48, Measured at Depths of 30 meters on August 30, 2011

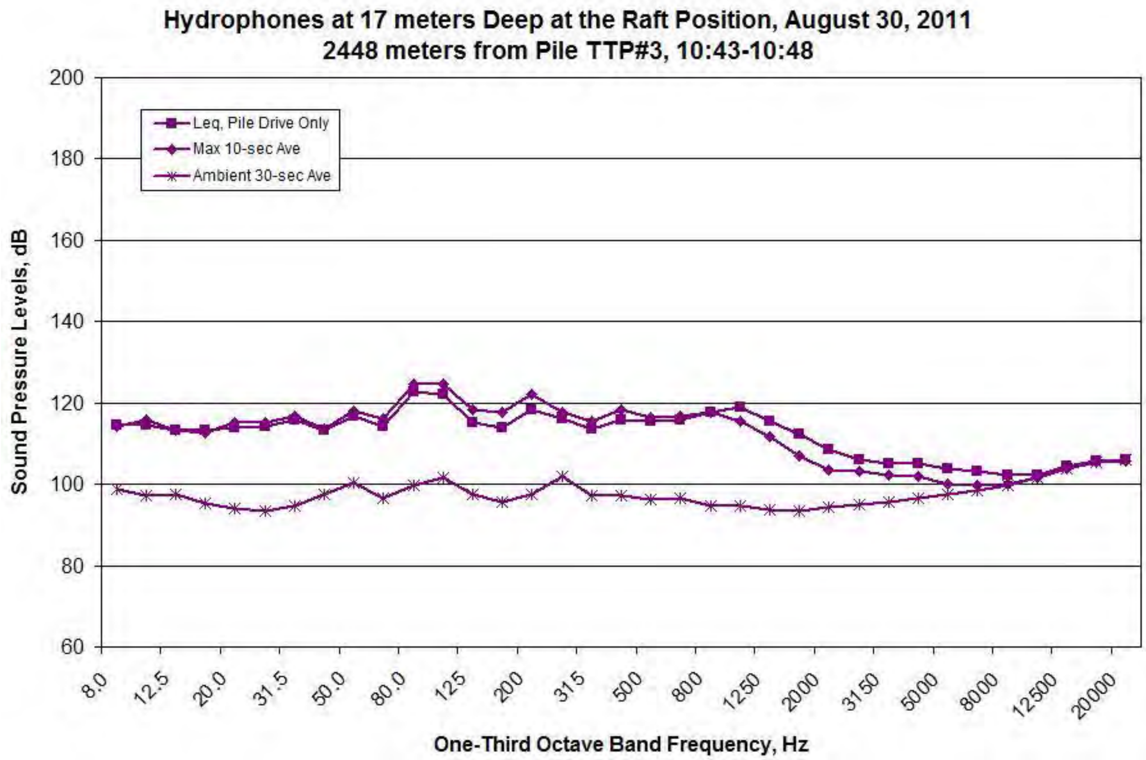

Figure A49. Spectral Data Measured at the RFT Location during TTP#3, 10:43-10:48, Measured at Depths of 17 meters on August 30, 2011

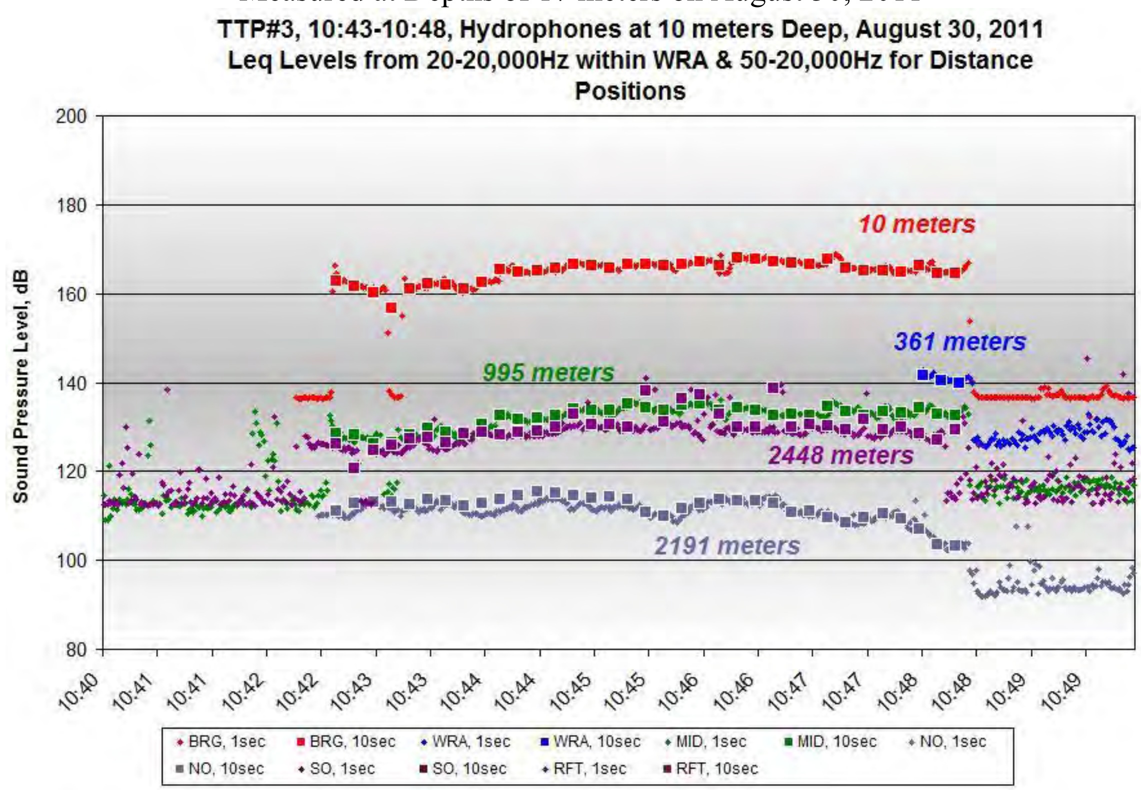

Figure A50. One-second and 10-second Average Data for TTP#3, 10:43-10:48, Measured at Depths of 10 meters on August 30, 2011

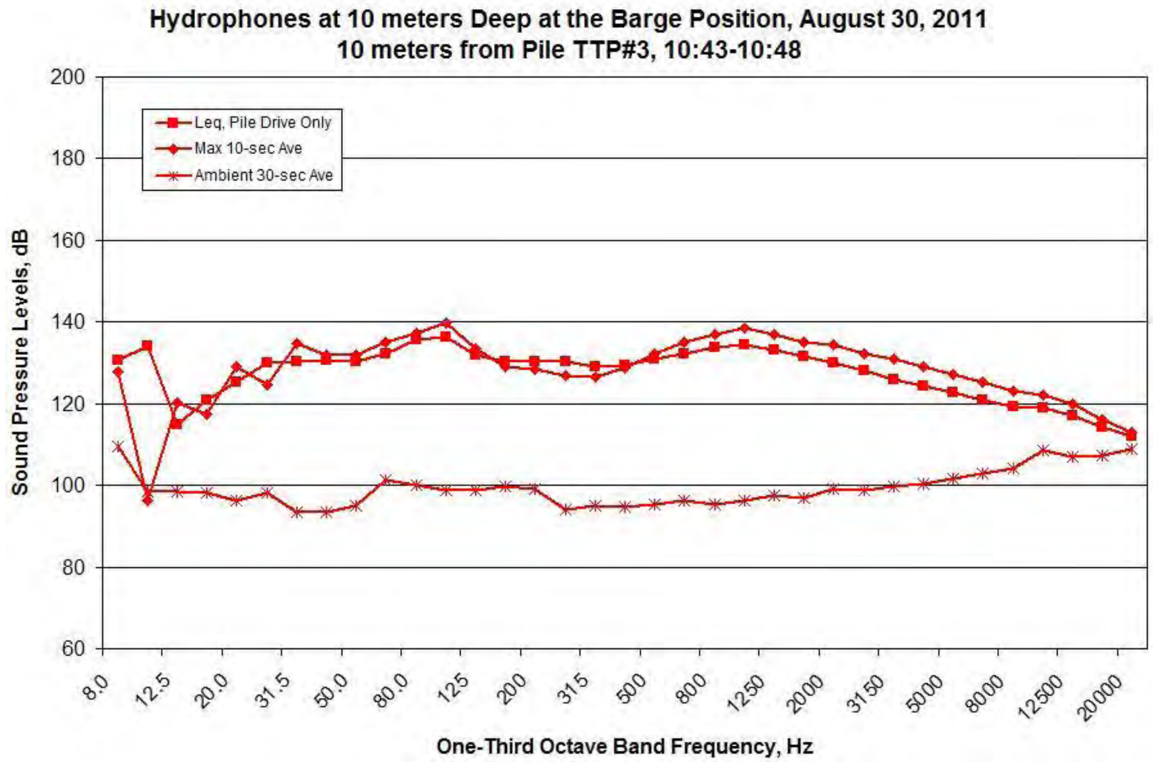

Figure A51. Spectral Data Measured at the BRG Location during TTP#3, 10:43-10:48, Measured at Depths of 10 meters on August 30, 2011

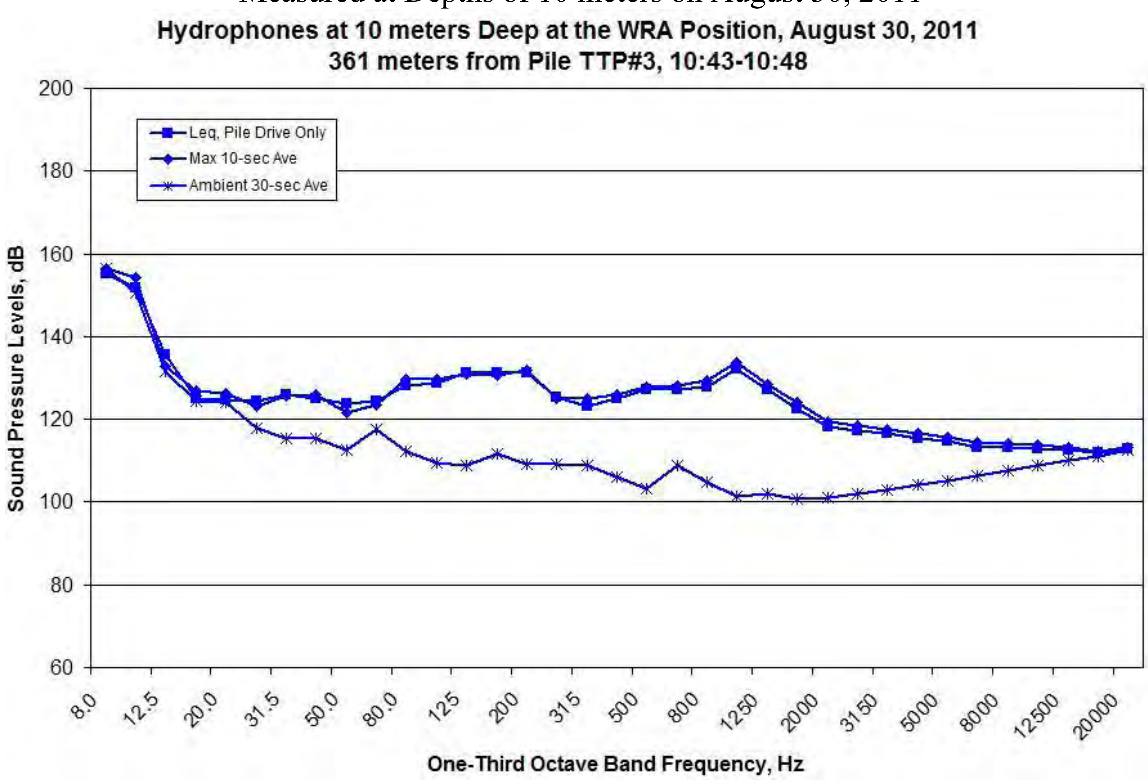

Figure A52. Spectral Data Measured at the WRA Location during TTP#3, 10:43-10:48, Measured at Depths of 10 meters on August 30, 2011

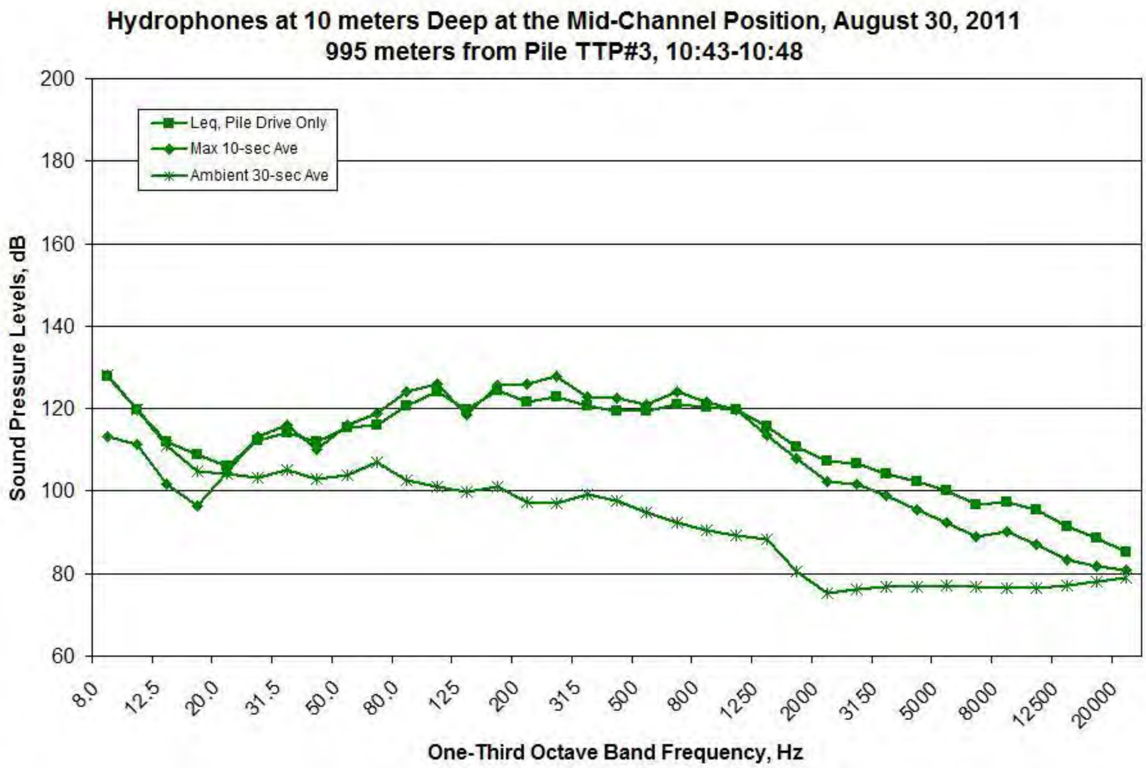

Figure A53. Spectral Data Measured at the MID Location during TTP#3, 10:43-10:48, Measured at Depths of 10 meters on August 30, 2011

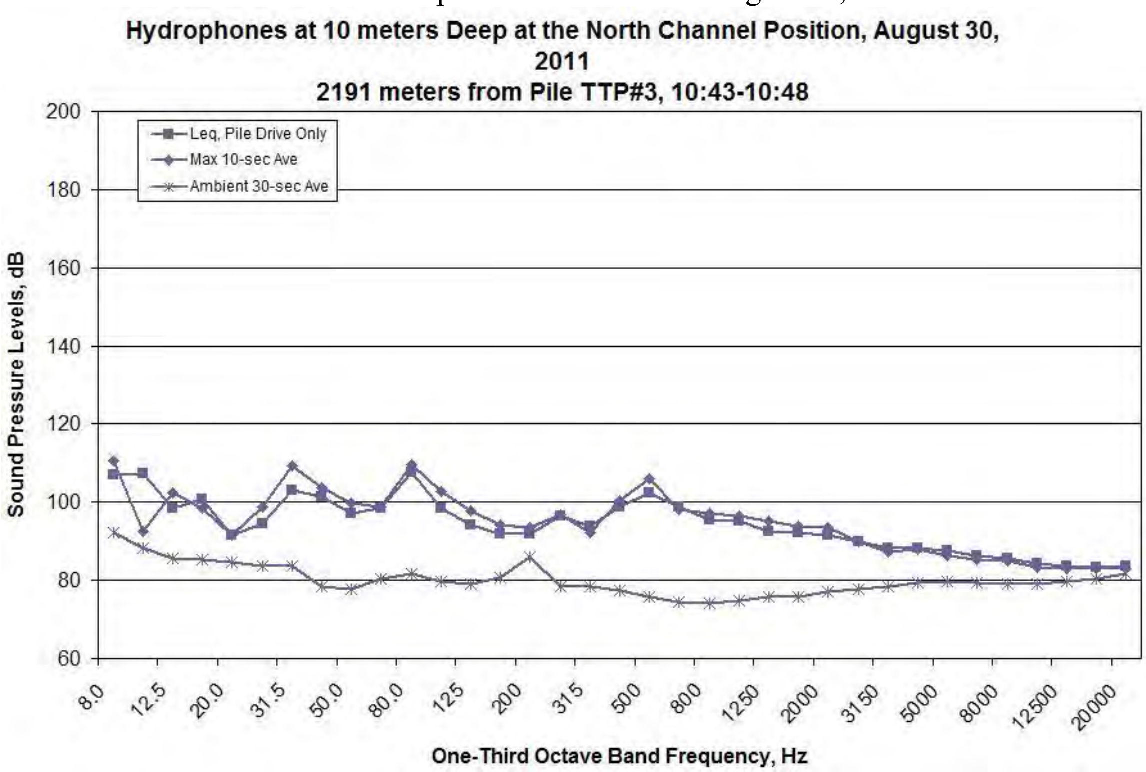

Figure A54. Spectral Data Measured at the NO Location during TTP#3, 10:43-10:48, Measured at Depths of 10 meters on August 30, 2011

NO DATA AVAILABLE DUE TO METERS TURNING OFF DURING TESTING

Figure A55. Spectral Data Measured at the SO Location during TTP#3, 10:43-10:48, Measured at Depths of 10 meters on August 30, 2011

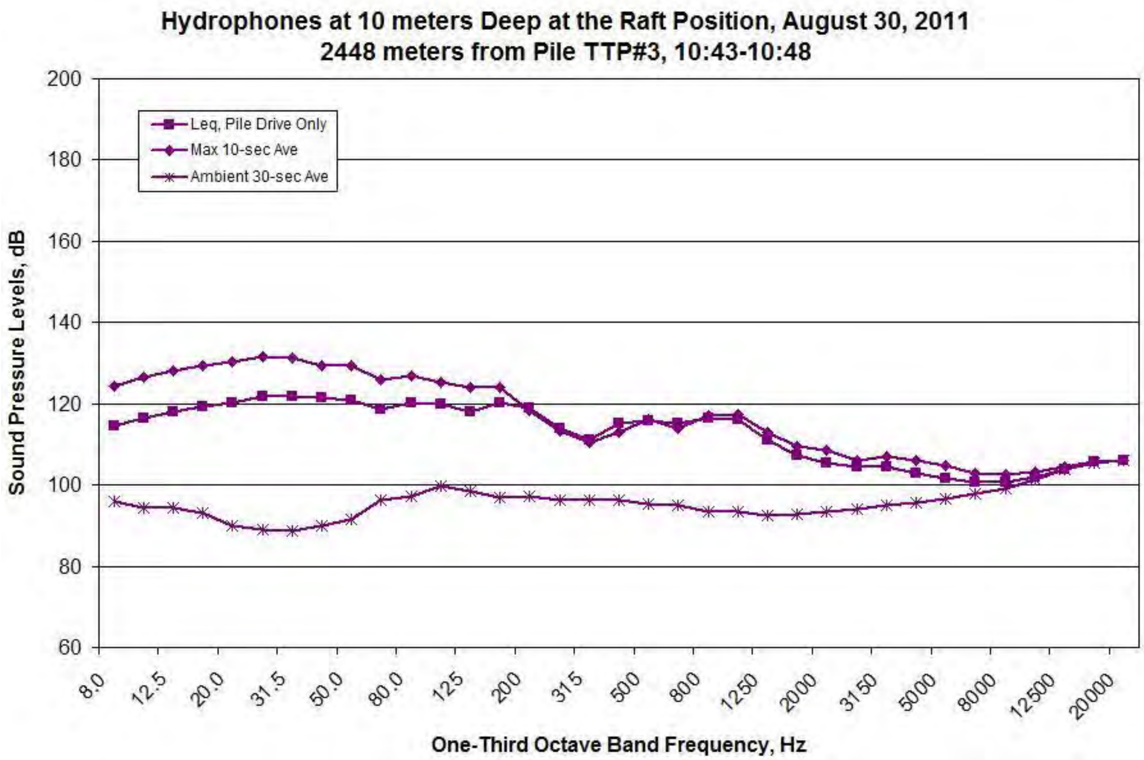

Figure A56. Spectral Data Measured at the RFT Location during TTP#3, 10:43-10:48, Measured at Depths of 10 meters on August 30, 2011

TP#3 (Vibratory Installation)

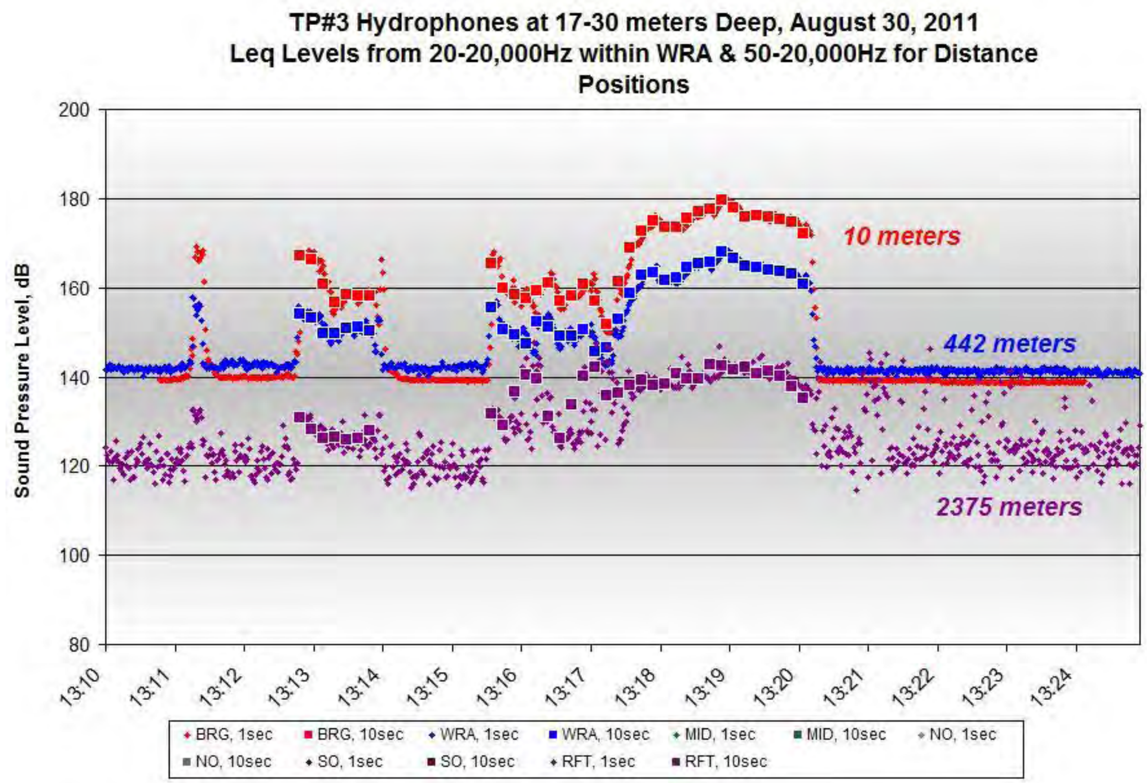

Figure A57. One-second and 10-second Average Data for TP#3, 13:13-13:20, Measured at Depths of 17-30 meters on August 30, 2011

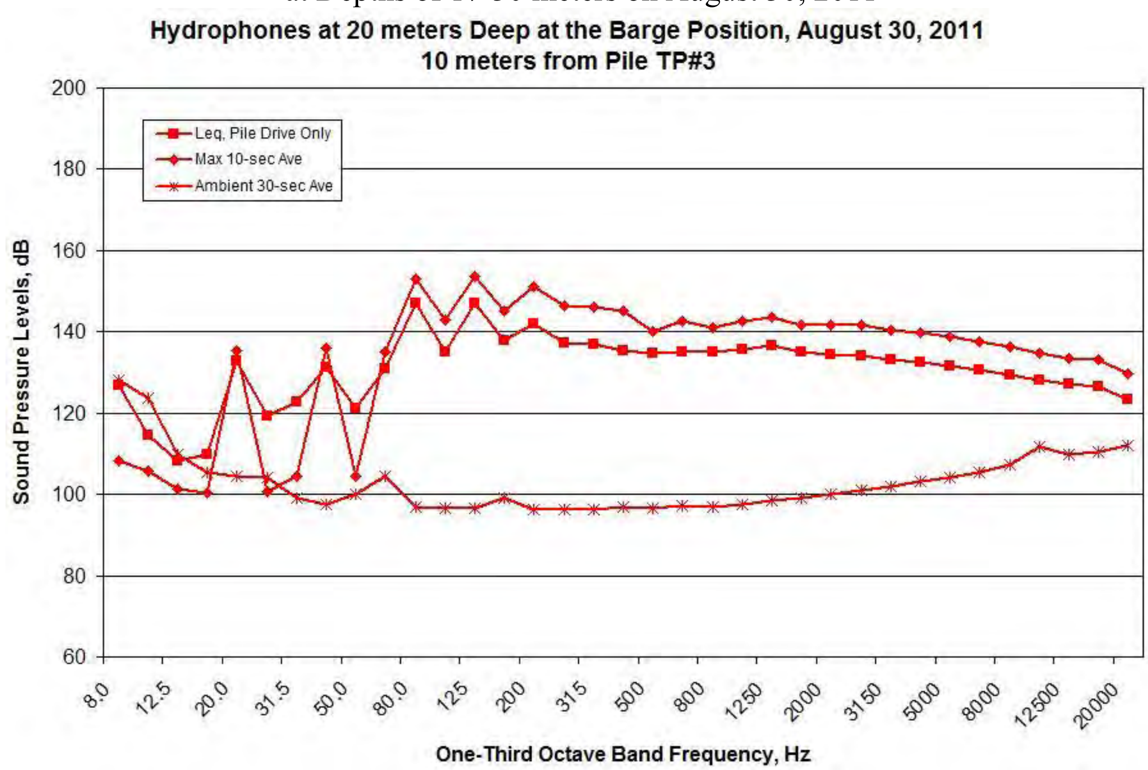

Figure A58. Spectral Data Measured at the BRG Location during TP#3, 13:13-13:20, Measured at Depths of 20 meters on August 30, 2011

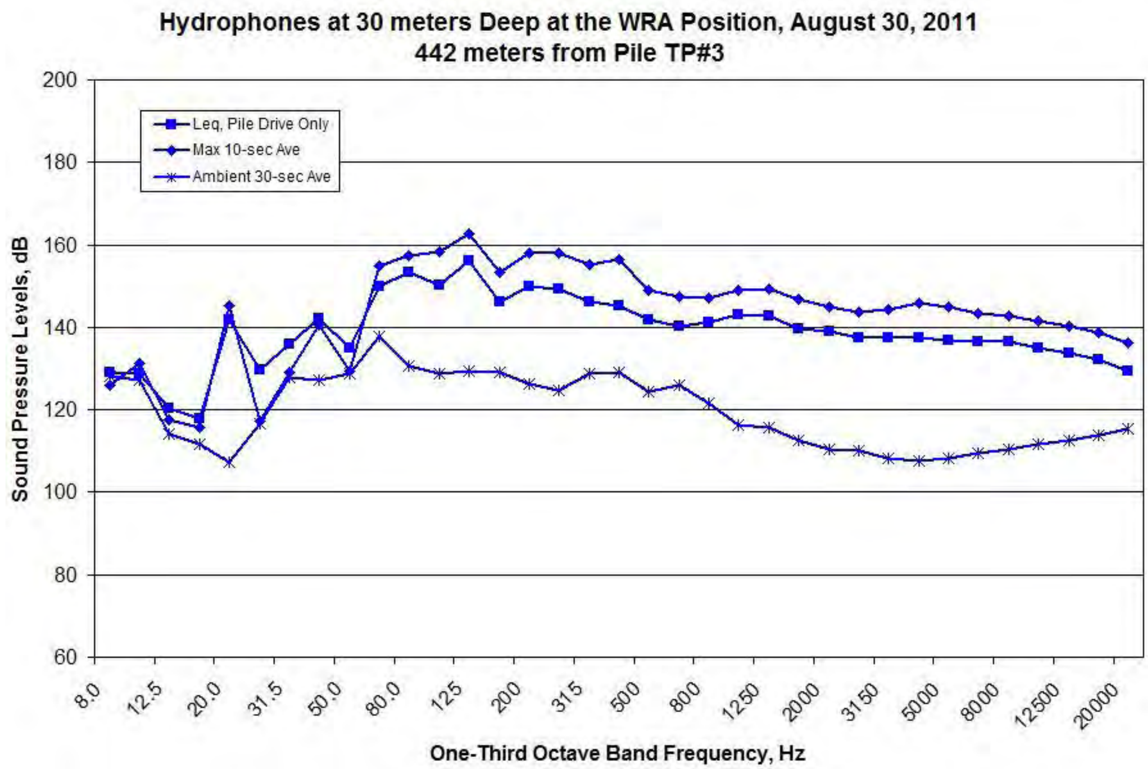

Figure A59. Spectral Data Measured at the WRA Location during TP#3, 13:13-13:20, Measured at Depths of 30 meters on August 30, 2011

NO DATA COLLECTED DUE TO BADGE RENEWAL

Figure A60. Spectral Data Measured at the MID Location during TP#3, 13:13-13:20, Measured at Depths of 30 meters on August 30, 2011

NO DATA COLLECTED DUE TO BADGE RENEWAL

Figure A61. Spectral Data Measured at the NO Location during TP#3, 13:13-13:20, Measured at Depths of 30 meters on August 30, 2011

NO DATA COLLECTED DUE TO BADGE RENEWAL

Figure A62. Spectral Data Measured at the SO Location during TP#3, 13:13-13:20, Measured at Depths of 30 meters on August 30, 2011

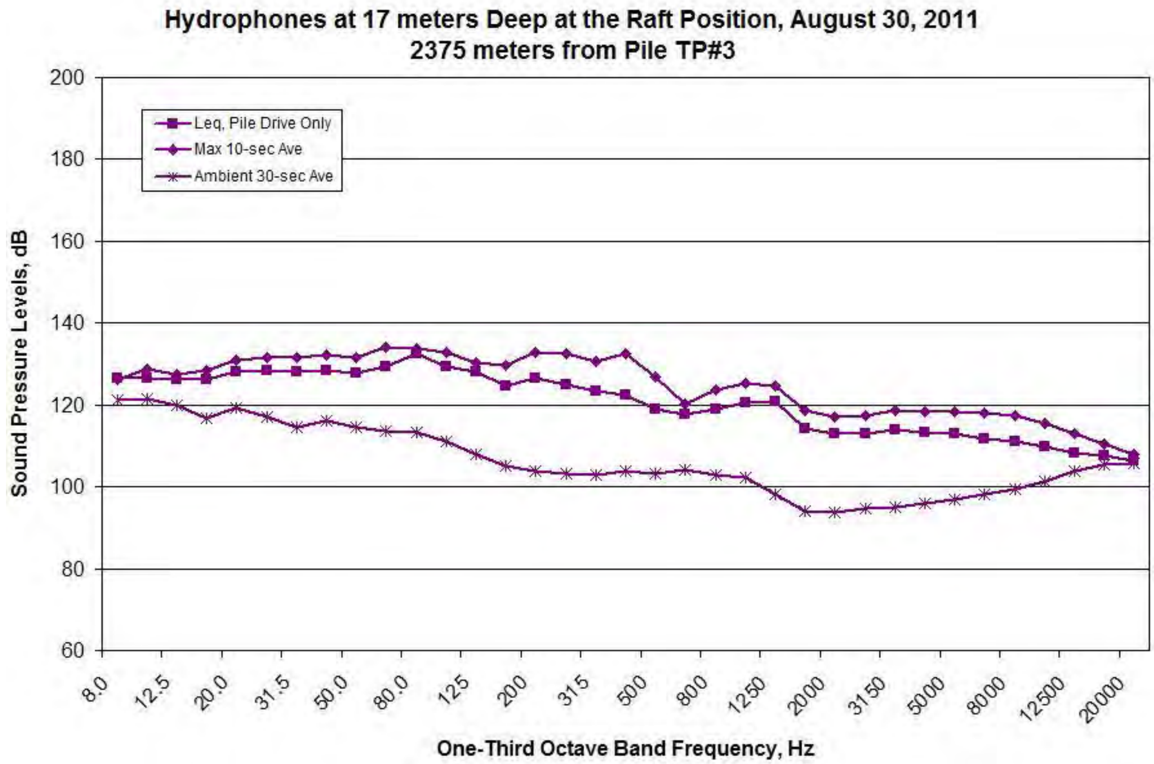

Figure A63. Spectral Data Measured at the RFT Location during TP#3, 13:13-13:20, Measured at Depths of 17 meters on August 30, 2011

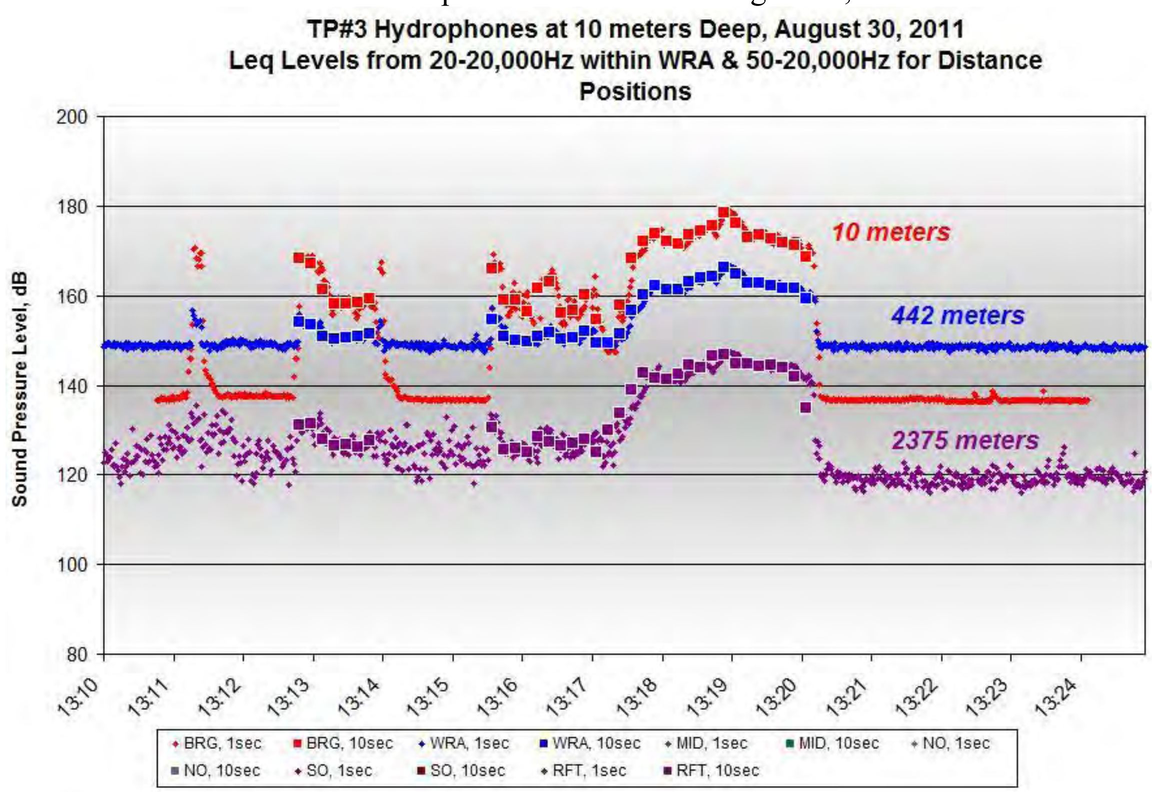

Figure A64. One-second and 10-second Average Data for TP#3, 13:13-13:20, Measured at Depths of 10 meters on August 30, 2011

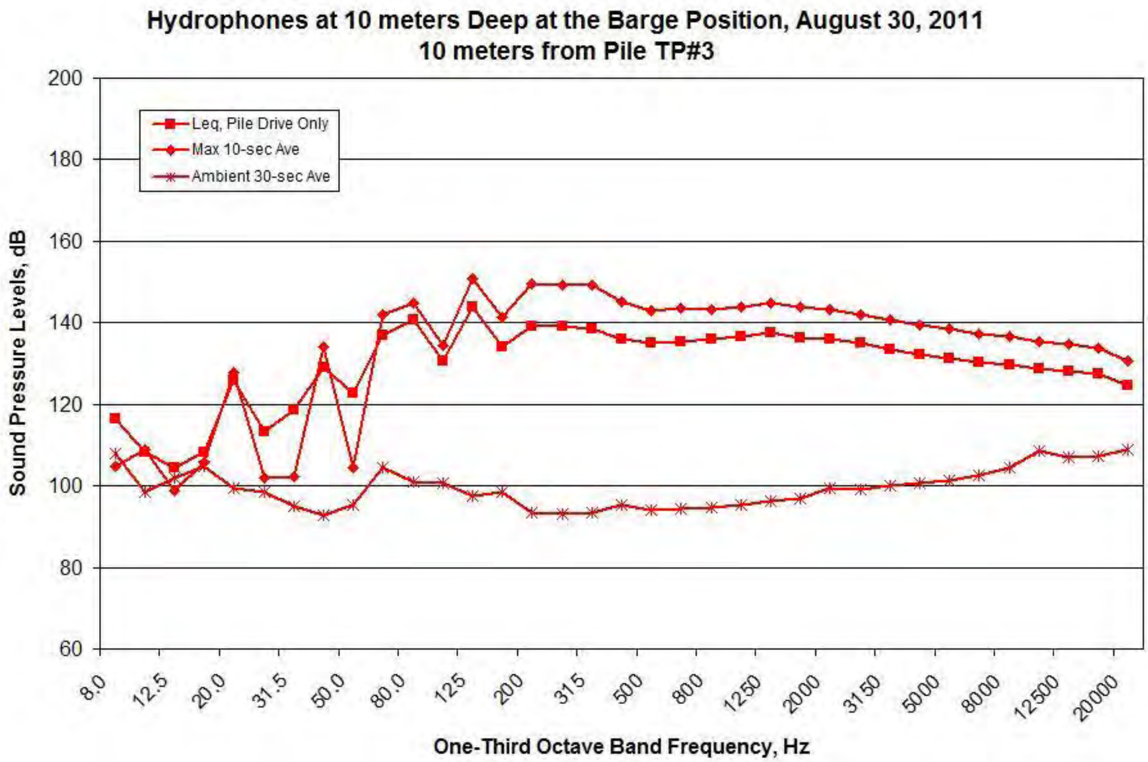

Figure A65. Spectral Data Measured at the BRG Location during TP#3, 13:13-13:20, Measured at Depths of 10 meters on August 30, 2011

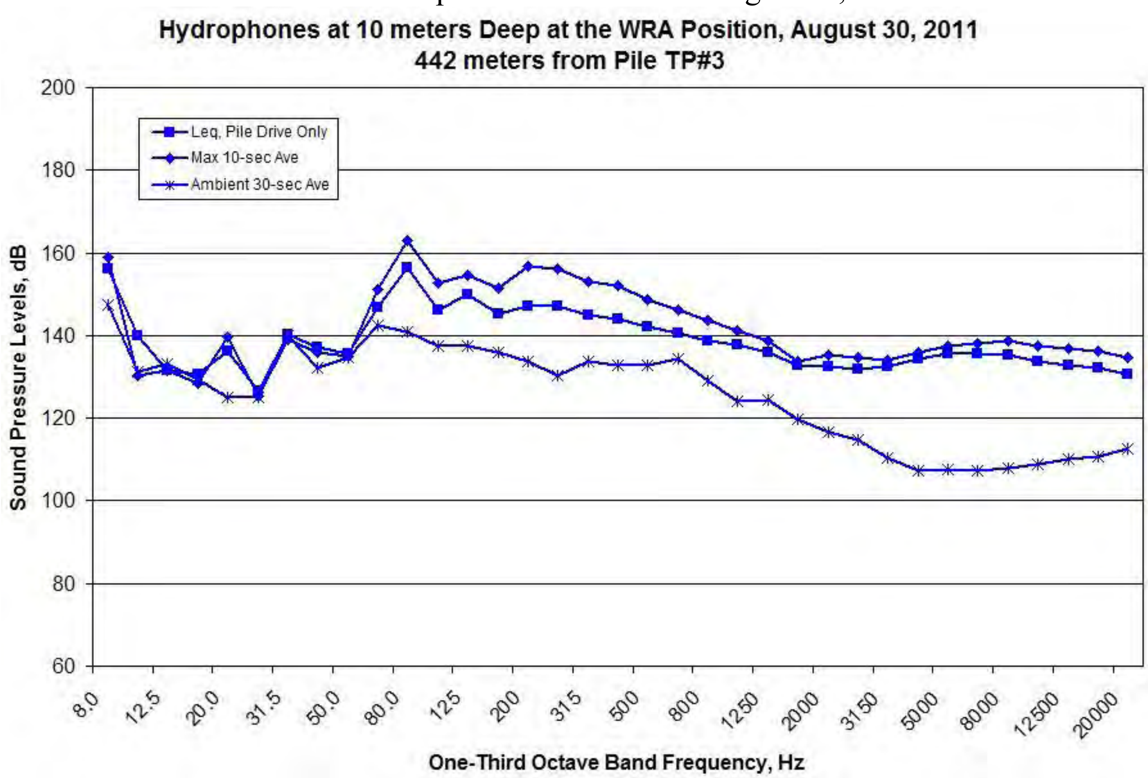

Figure A66. Spectral Data Measured at the WRA Location during TP#3, 13:13-13:20, Measured at Depths of 10 meters on August 30, 2011

NO DATA COLLECTED DUE TO BADGE RENEWAL
Figure A67. Spectral Data Measured at the MID Location during TP#3, 13:13-13:20, Measured at Depths of 10 meters on August 30, 2011

NO DATA COLLECTED DUE TO BADGE RENEWAL
Figure A68. Spectral Data Measured at the NO Location during TP#3, 13:13-13:20, Measured at Depths of 10 meters on August 30, 2011

NO DATA COLLECTED DUE TO BADGE RENEWAL
Figure A69. Spectral Data Measured at the SO Location during TP#3, 13:13-13:20, Measured at Depths of 10 meters on August 30, 2011

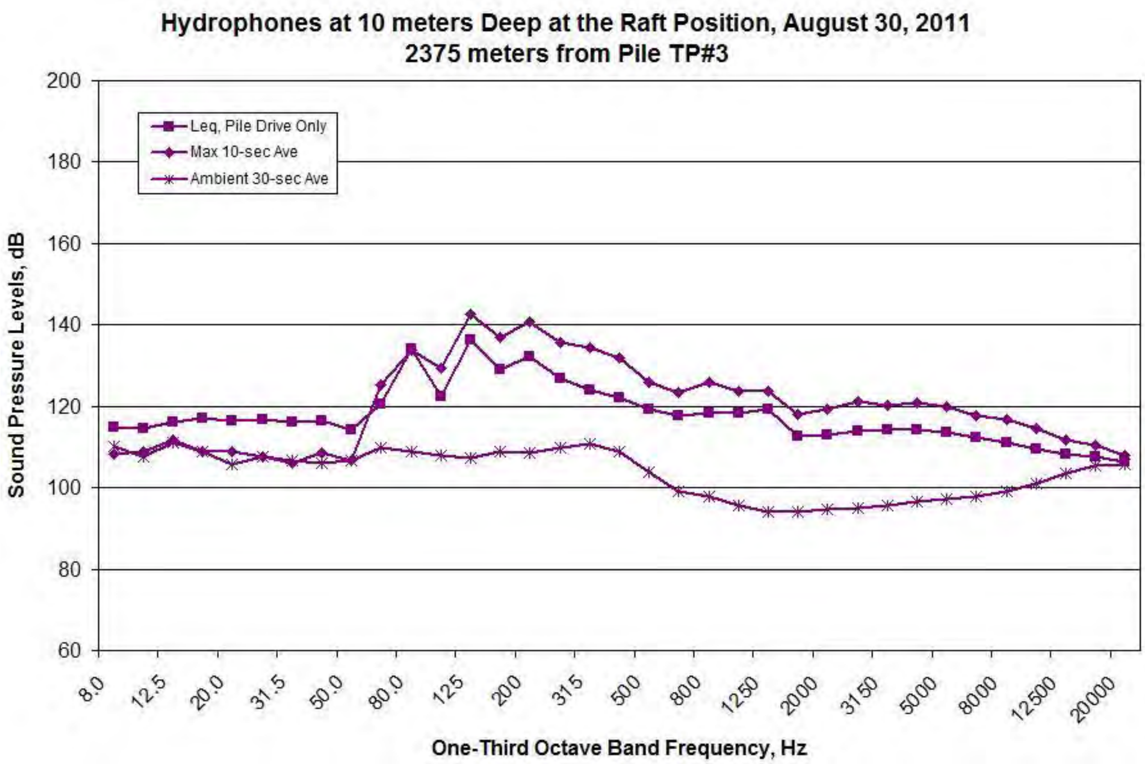

Figure A70. Spectral Data Measured at the RFT Location during TP#3, 13:13-13:20, Measured at Depths of 10 meters on August 30, 2011

TP#7 (Vibratory Installation)

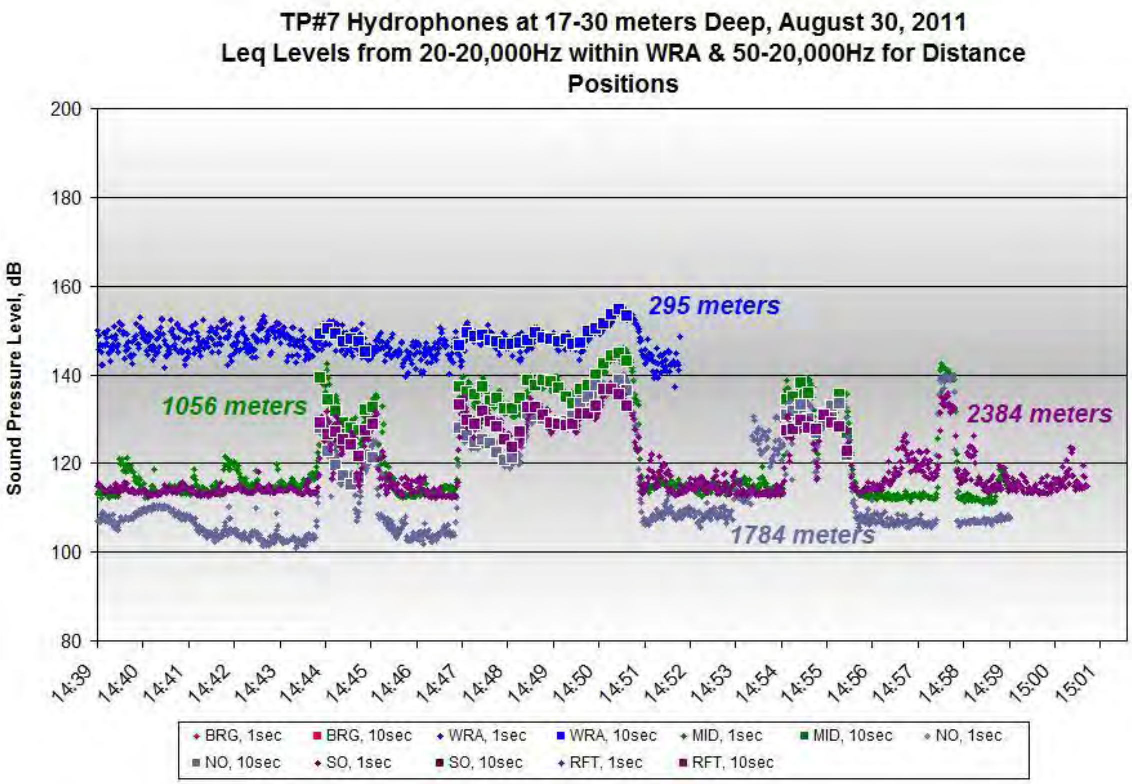

Figure A71. One-second and 10-second Average Data for TP#7, 14:45-14:52, Measured at Depths of 17-30 meters on August 30, 2011

DATA NOT USABLE

Figure A72. Spectral Data Measured at the BRG Location during TP#7, 14:45-14:52, Measured at Depths of 20 meters on August 30, 2011

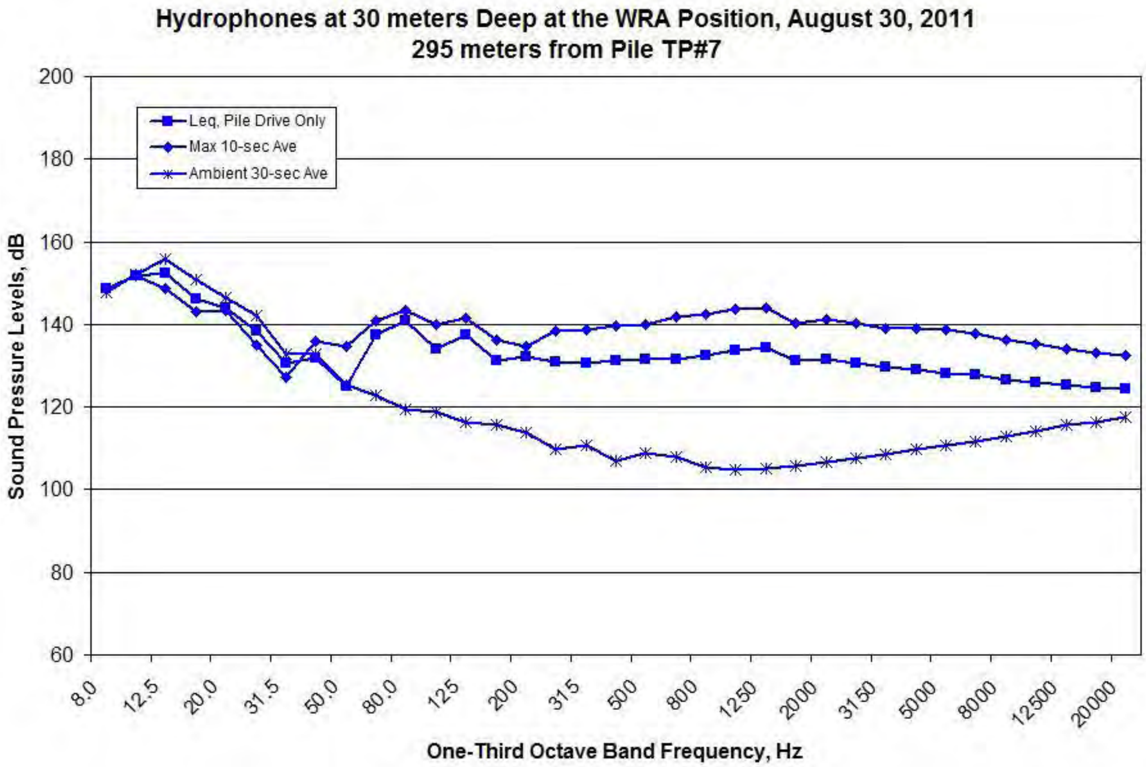

Figure A73. Spectral Data Measured at the WRA Location during TP#7, 14:45-14:52, Measured at Depths of 30 meters on August 30, 2011

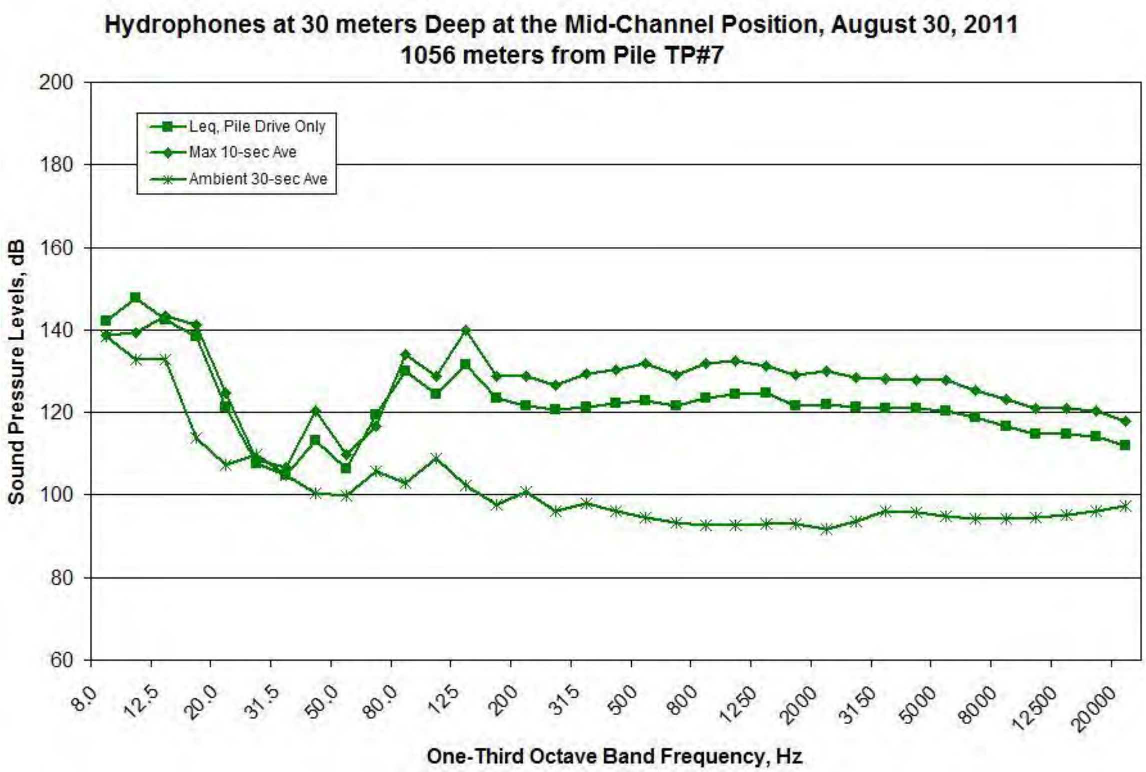

Figure A74. Spectral Data Measured at the MID Location during TP#7, 14:45-14:52, Measured at Depths of 30 meters on August 30, 2011

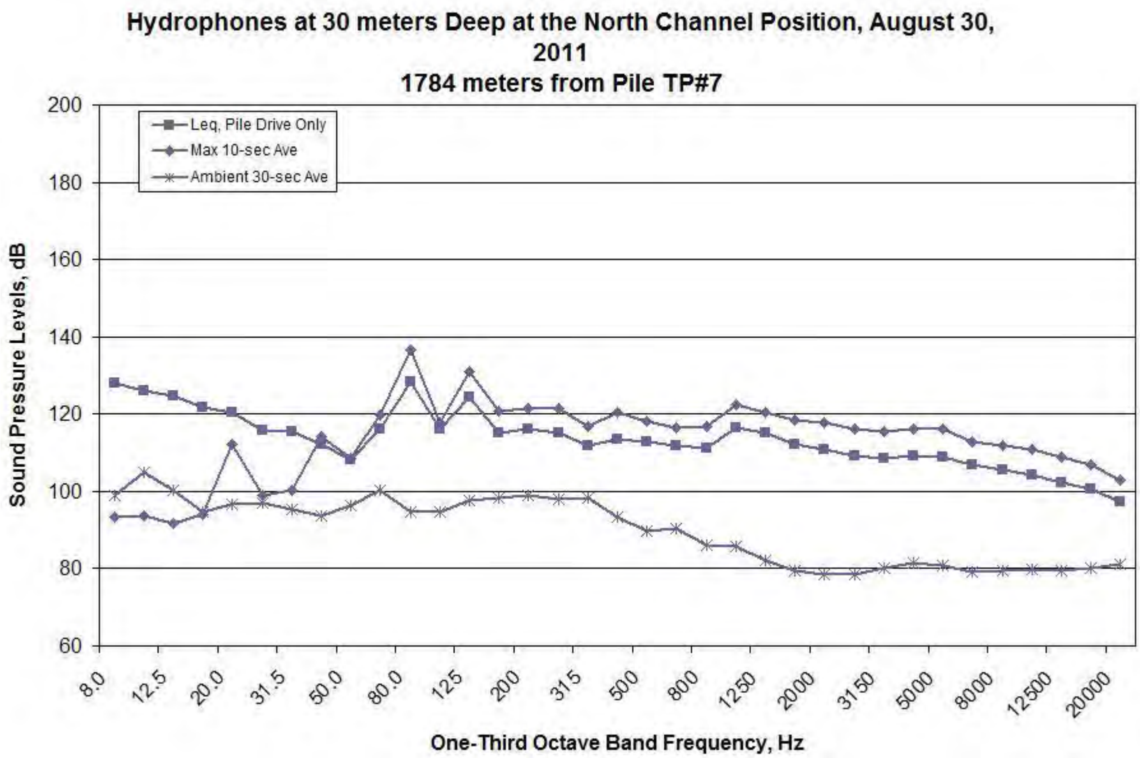

Figure A75. Spectral Data Measured at the NO Location during TP#7, 14:45-14:52, Measured at Depths of 30 meters on August 30, 2011

DATA NOT USABLE

Figure A76. Spectral Data Measured at the SO Location during TP#7, 14:45-14:52, Measured at Depths of 30 meters on August 30, 2011

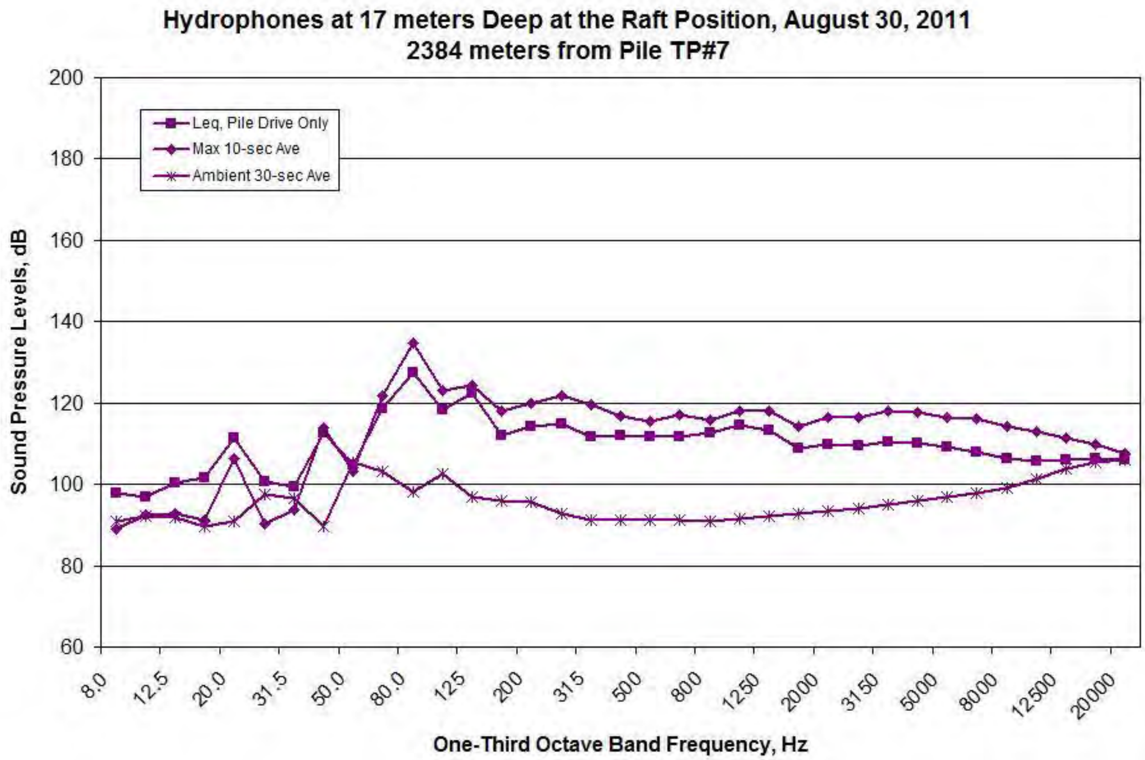

Figure A77. Spectral Data Measured at the RFT Location during TP#7, 14:45-14:52, Measured at Depths of 17 meters on August 30, 2011

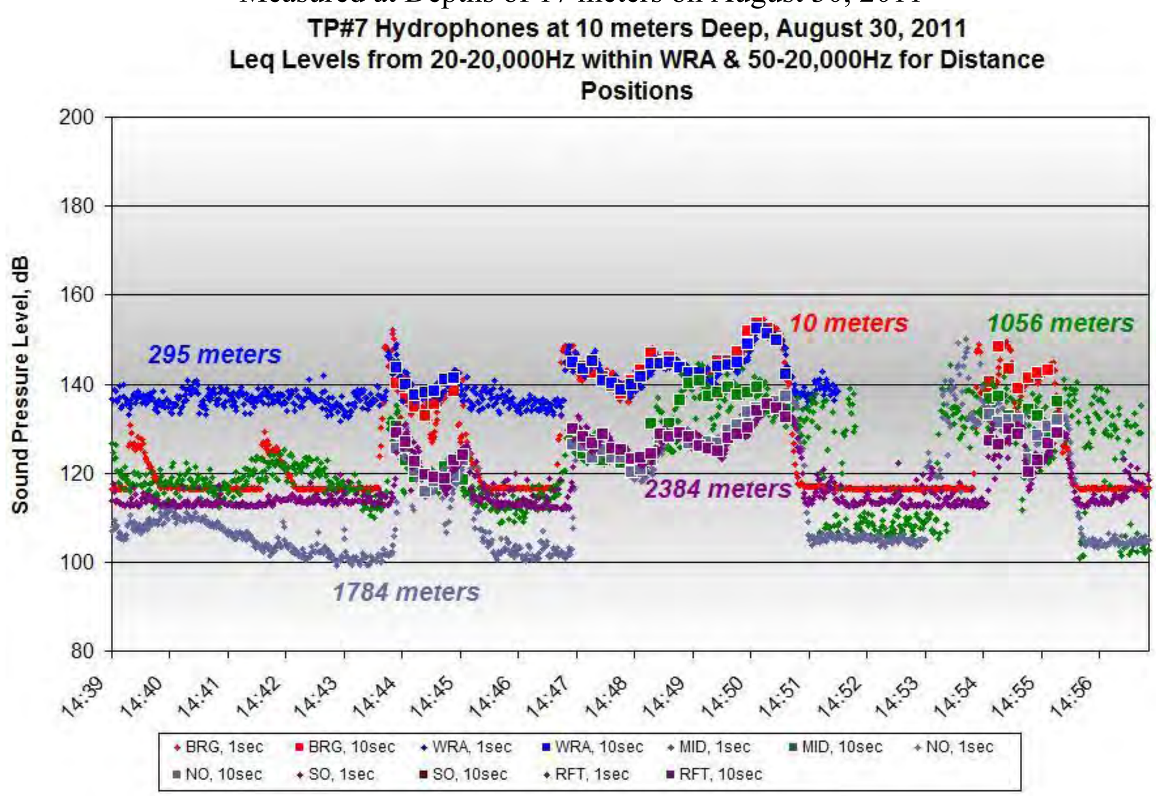

Figure A78. One-second and 10-second Average Data for TP#7, 14:45-14:52, Measured at Depths of 10 meters on August 30, 2011

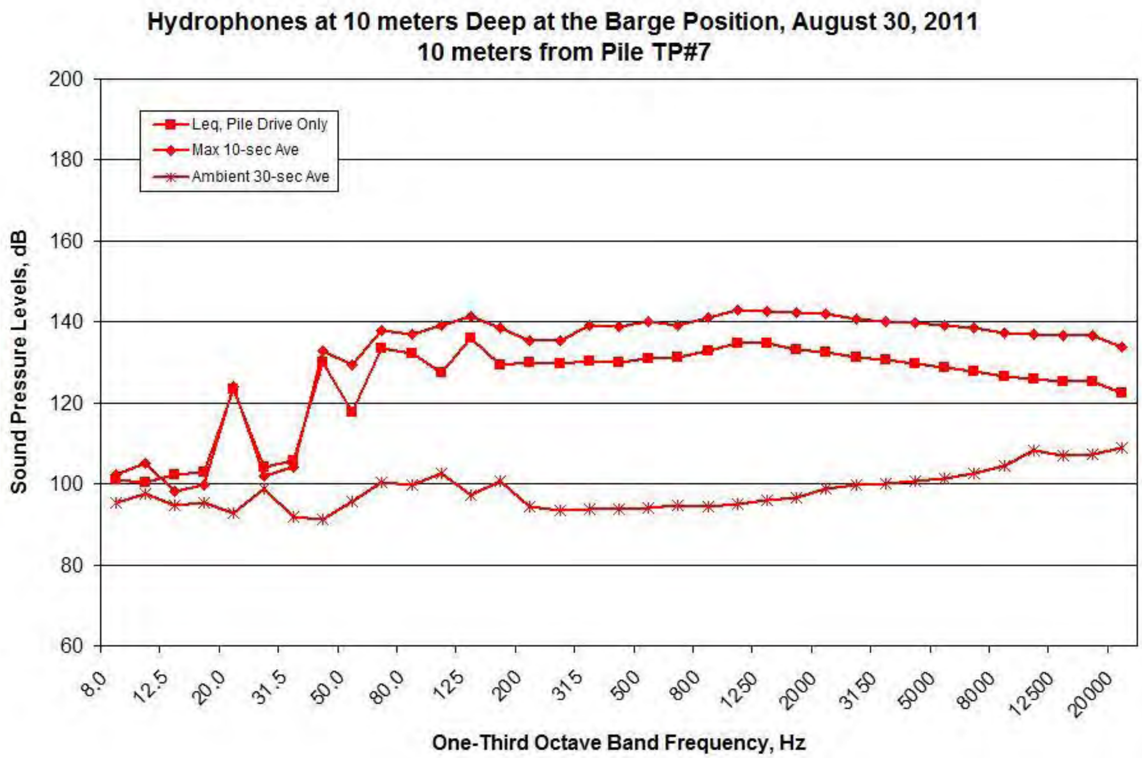

Figure A79. Spectral Data Measured at the BRG Location during TP#7, 14:45-14:52, Measured at Depths of 10 meters on August 30, 2011

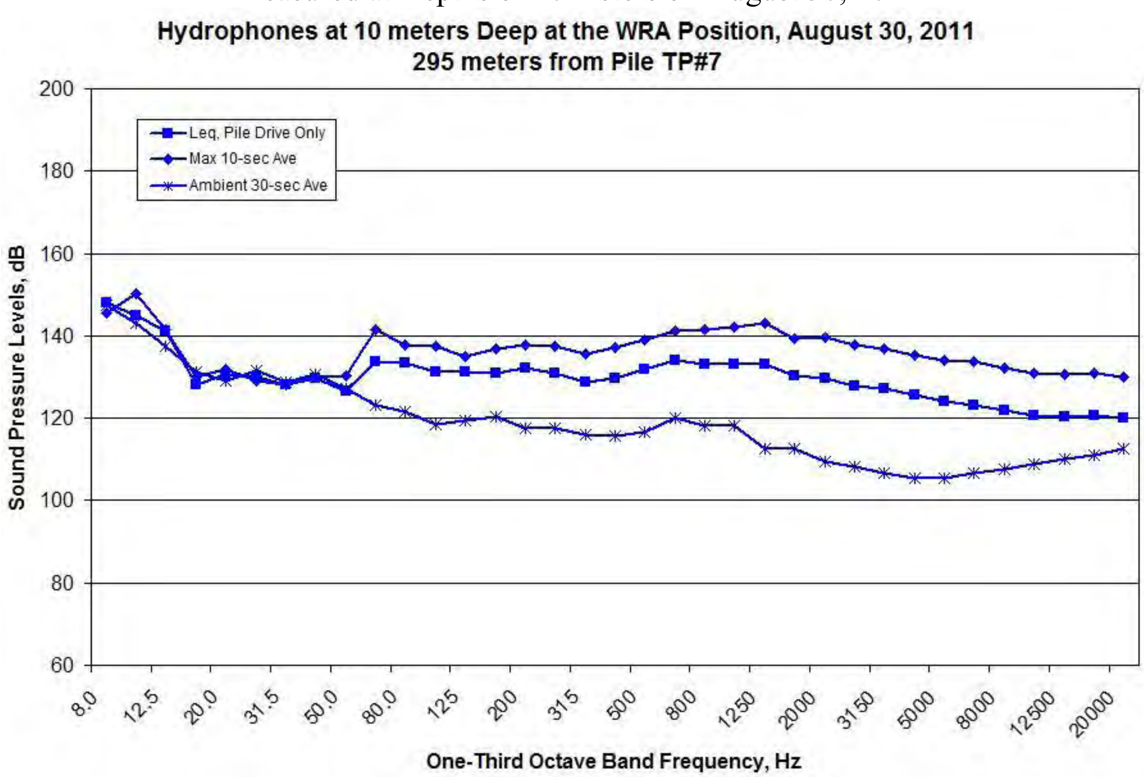

Figure A80. Spectral Data Measured at the WRA Location during TP#7, 14:45-14:52, Measured at Depths of 10 meters on August 30, 2011

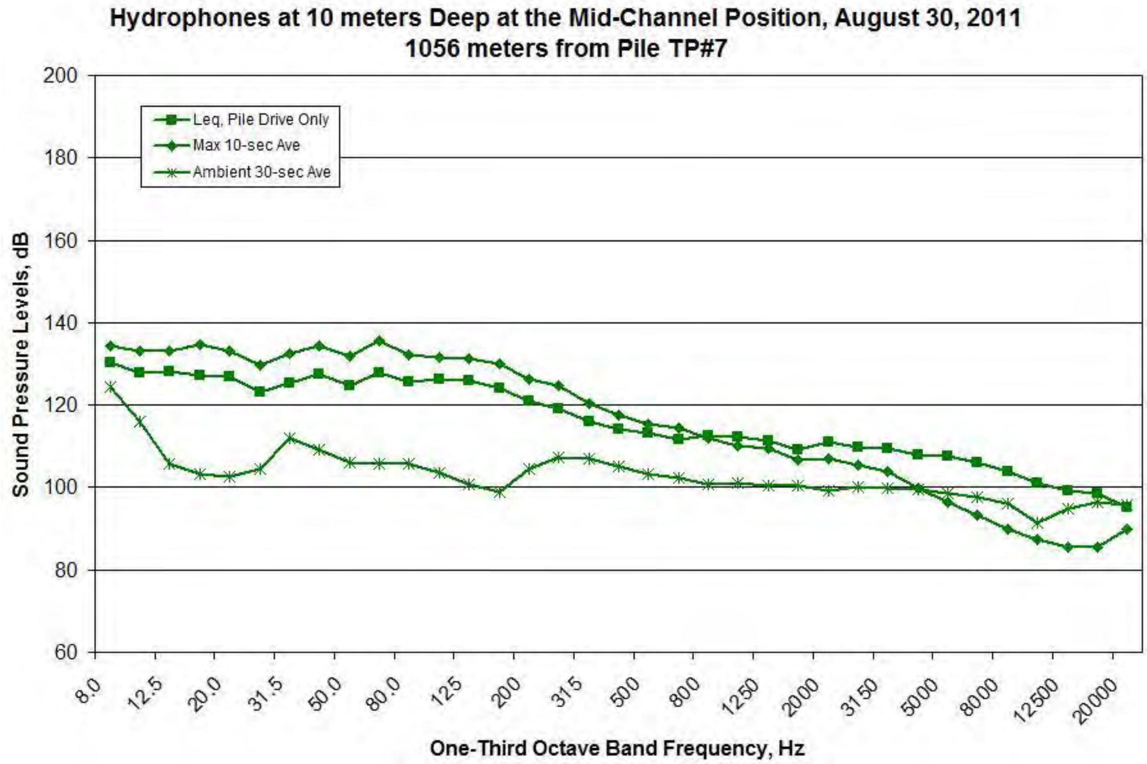

Figure A81. Spectral Data Measured at the MID Location during TP#7, 14:45-14:52, Measured at Depths of 10 meters on August 30, 2011

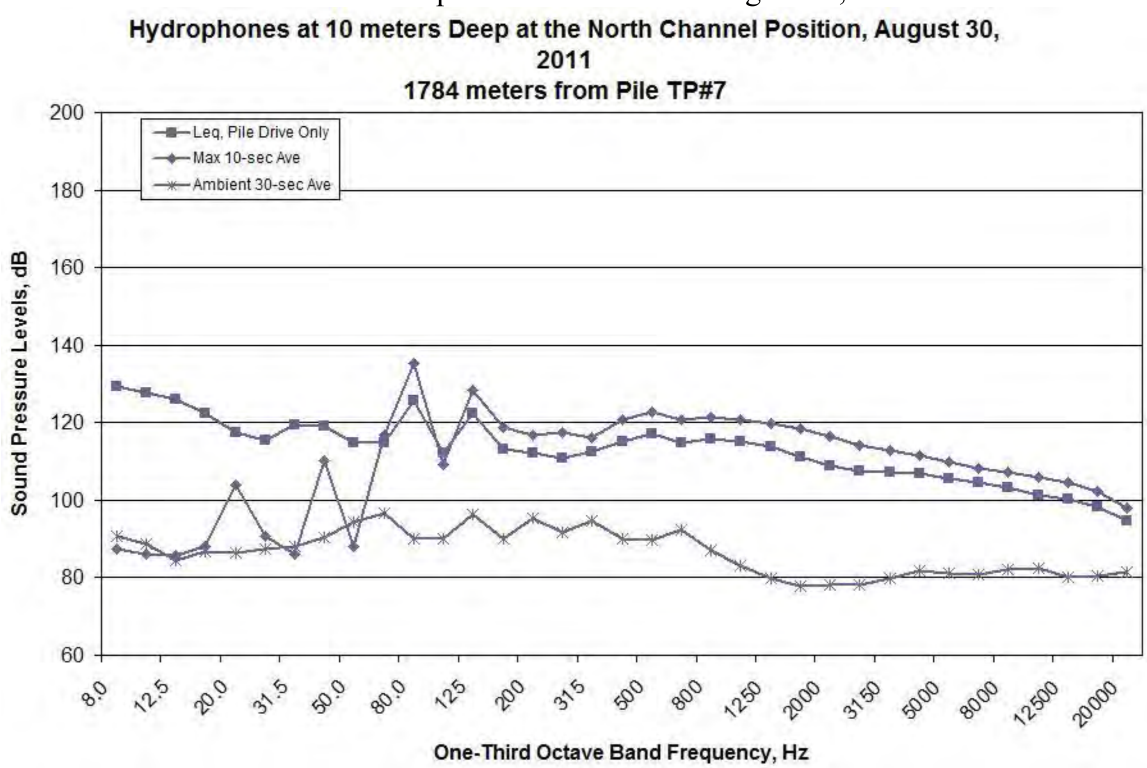

Figure A82. Spectral Data Measured at the NO Location during TP#7, 14:45-14:52, Measured at Depths of 10 meters on August 30, 2011

DATA NOT USABLE

Figure A83. Spectral Data Measured at the SO Location during TP#7, 14:45-14:52, Measured at Depths of 10 meters on August 30, 2011

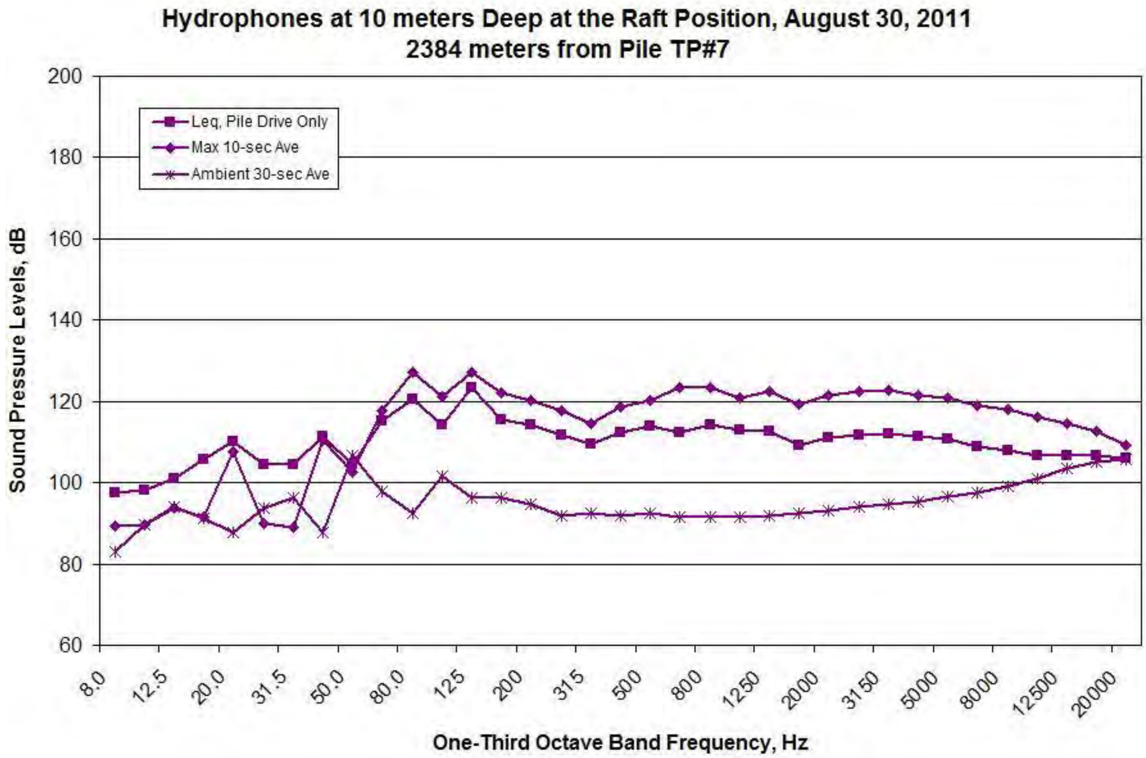

Figure A84. Spectral Data Measured at the RFT Location during TP#7, 14:45-14:52, Measured at Depths of 10 meters on August 30, 2011

8/31/2011 – TTP#4, 9:22-9:26 (Vibratory Installation)

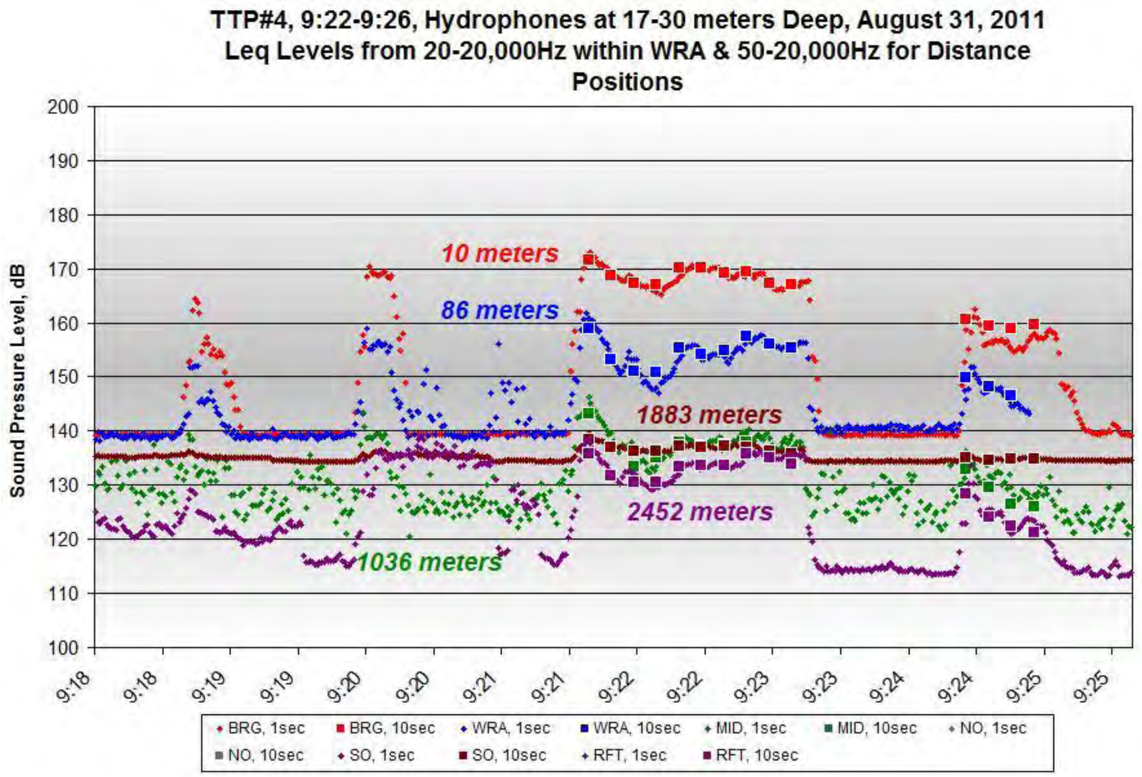

Figure A85. One-second and 10-second Average Data for TTP#4, 9:22-9:26, Measured at Depths of 17-30 meters on August 31, 2011

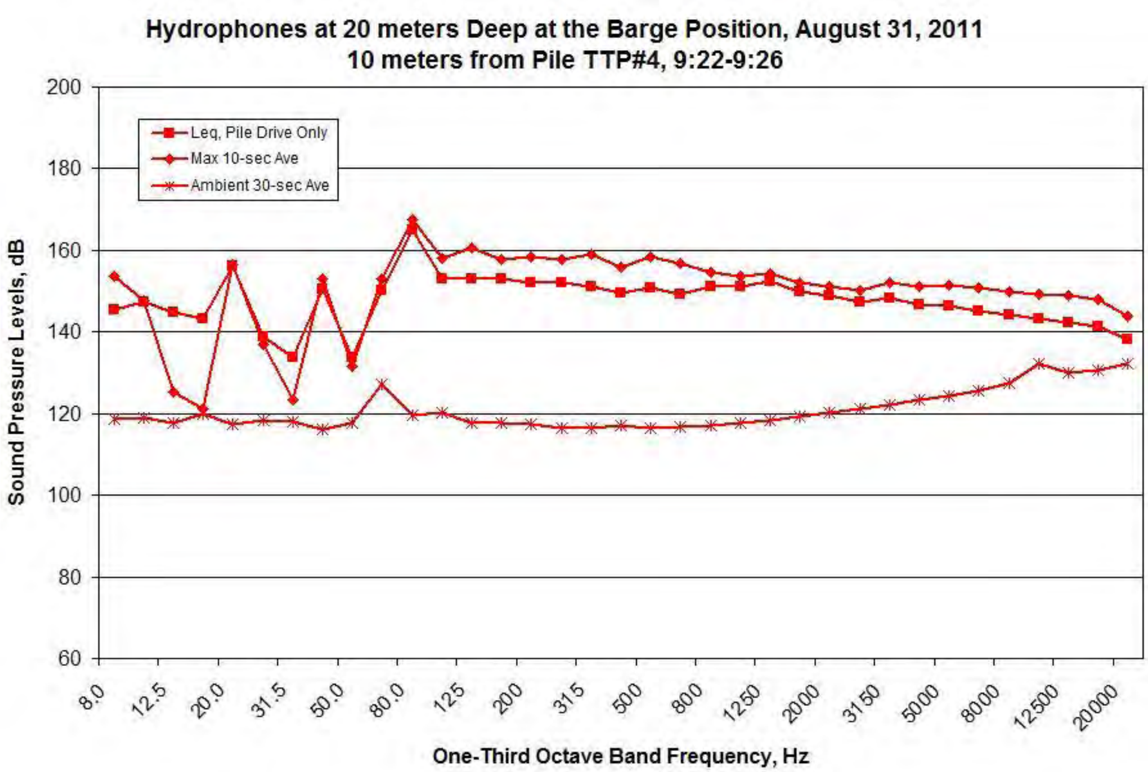

Figure A86. Spectral Data Measured at the BRG Location during TTP#4, 9:22-9:26, Measured at Depths of 20 meters on August 31, 2011

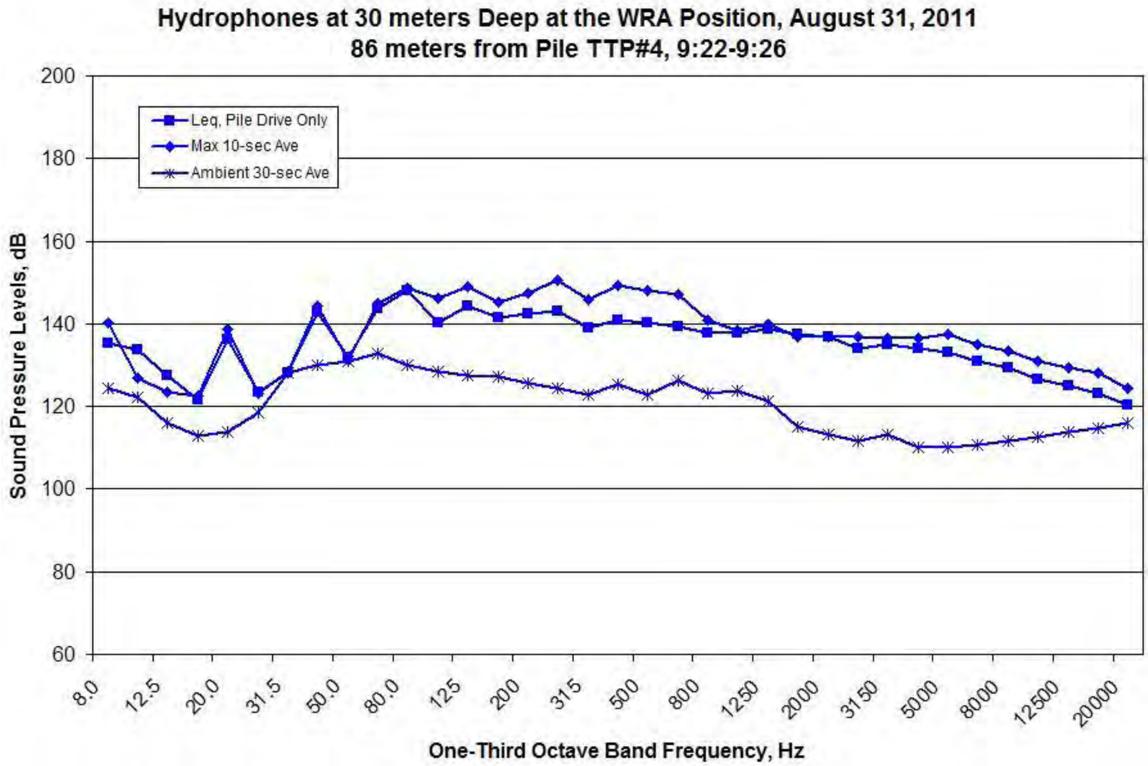

Figure A87. Spectral Data Measured at the WRA Location during TTP#4, 9:22-9:26, Measured at Depths of 30 meters on August 31, 2011

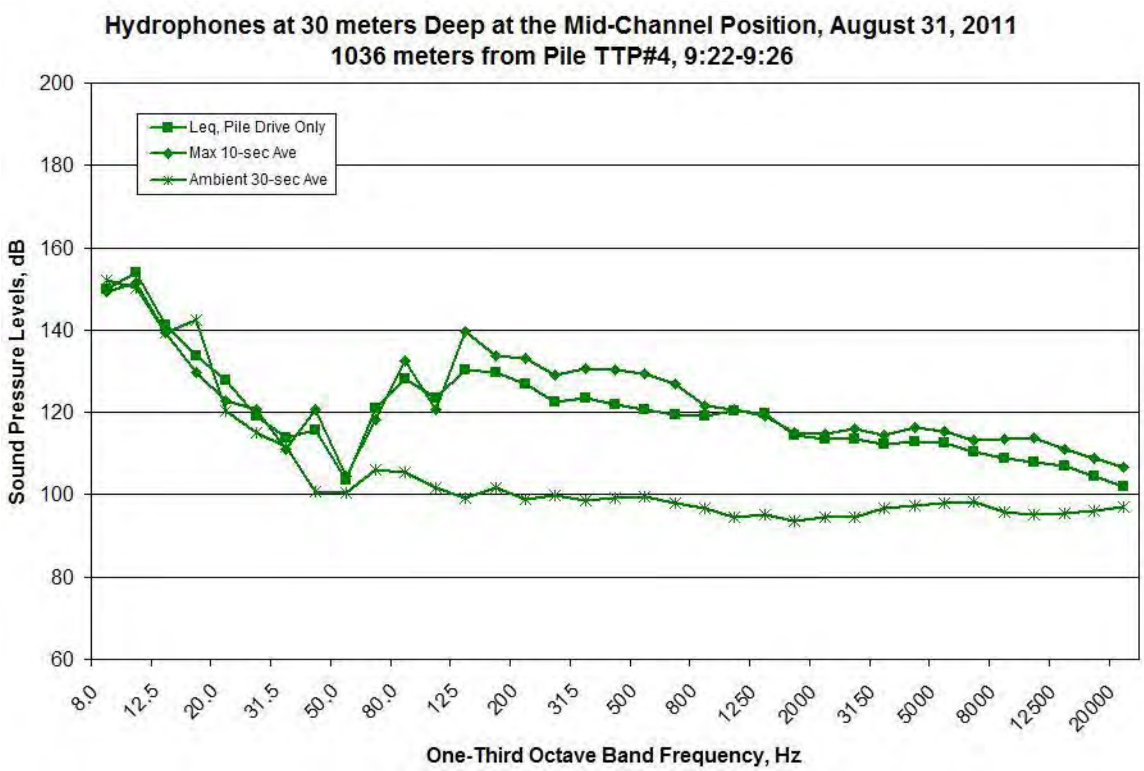

Figure A88. Spectral Data Measured at the MID Location during TTP#4, 9:22-9:26, Measured at Depths of 30 meters on August 31, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A89. Spectral Data Measured at the NO Location during TTP#4, 9:22-9:26, Measured at Depths of 30 meters on August 31, 2011

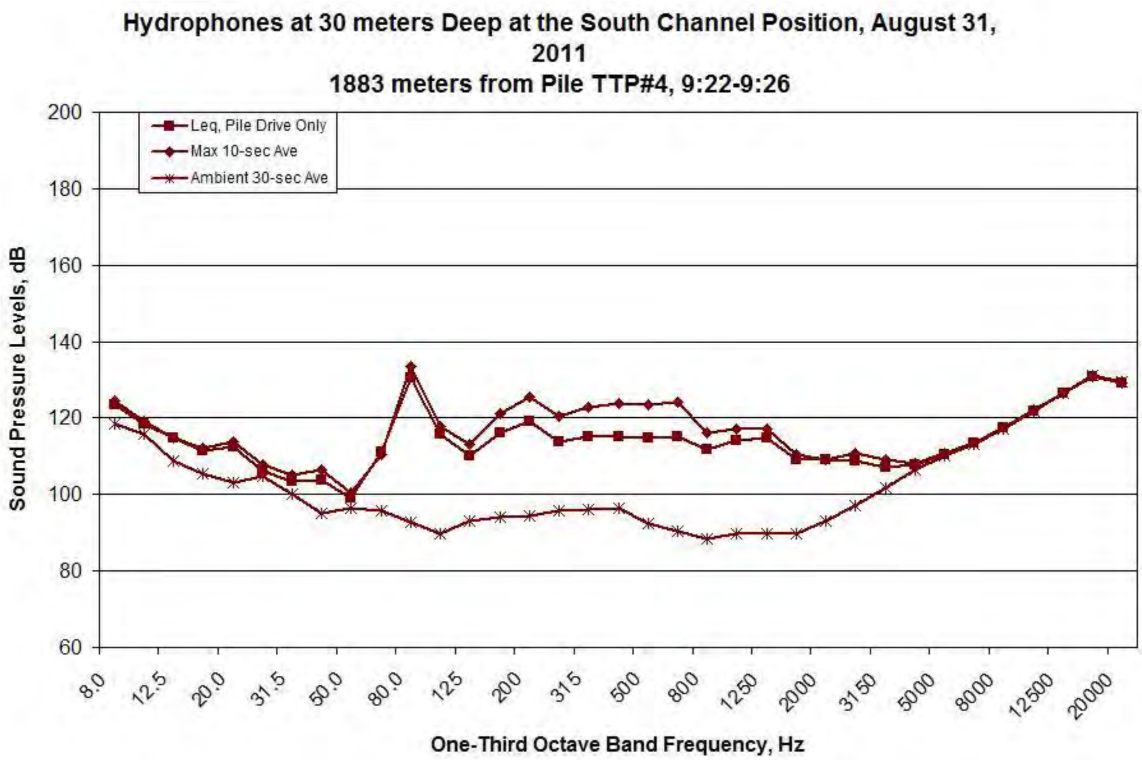

Figure A90. Spectral Data Measured at the SO Location during TTP#4, 9:22-9:26, Measured at Depths of 30 meters on August 31, 2011

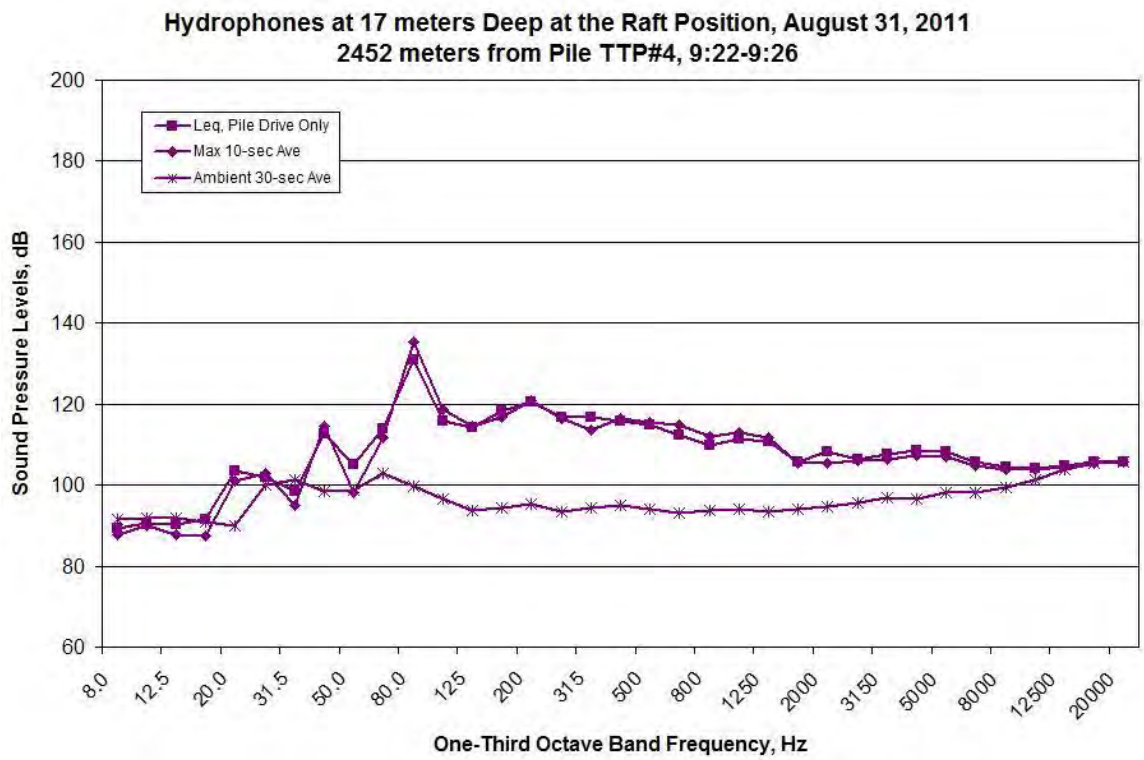

Figure A91. Spectral Data Measured at the RFT Location during TTP#4, 9:22-9:26, Measured at Depths of 17 meters on August 31, 2011

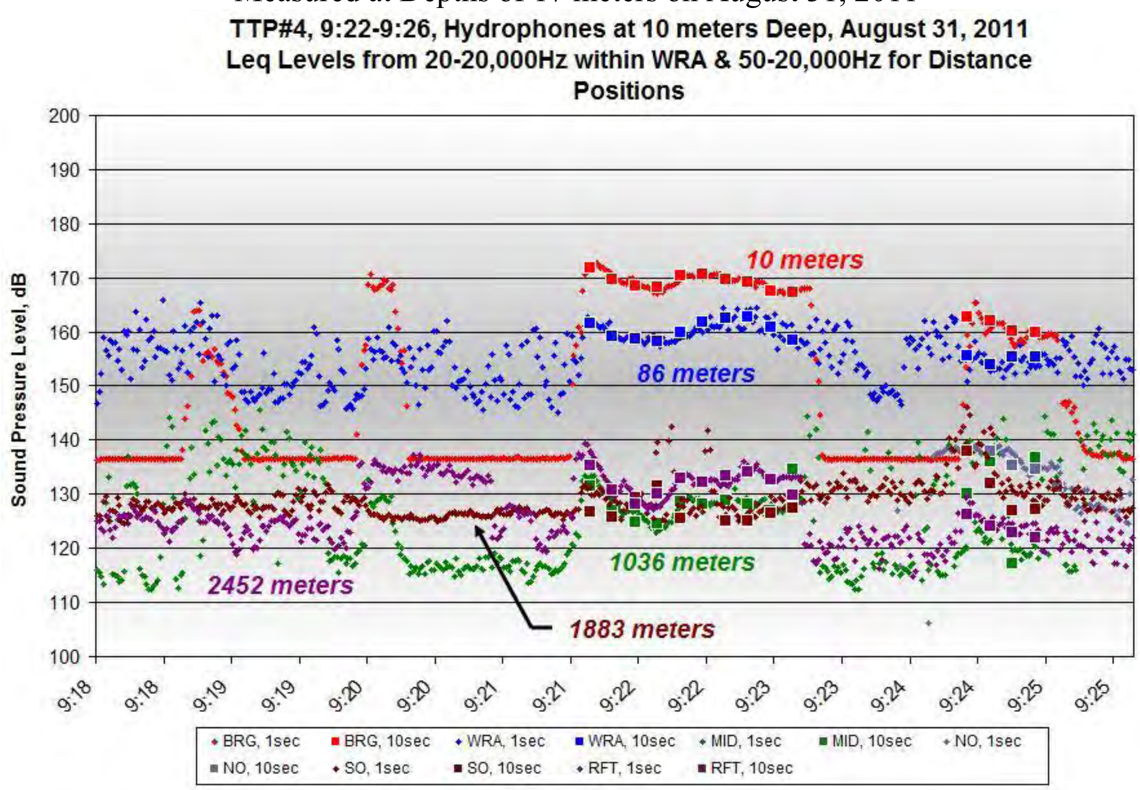

Figure A92. One-second and 10-second Average Data for TTP#4, 9:22-9:26, Measured at Depths of 10 meters on August 31, 2011

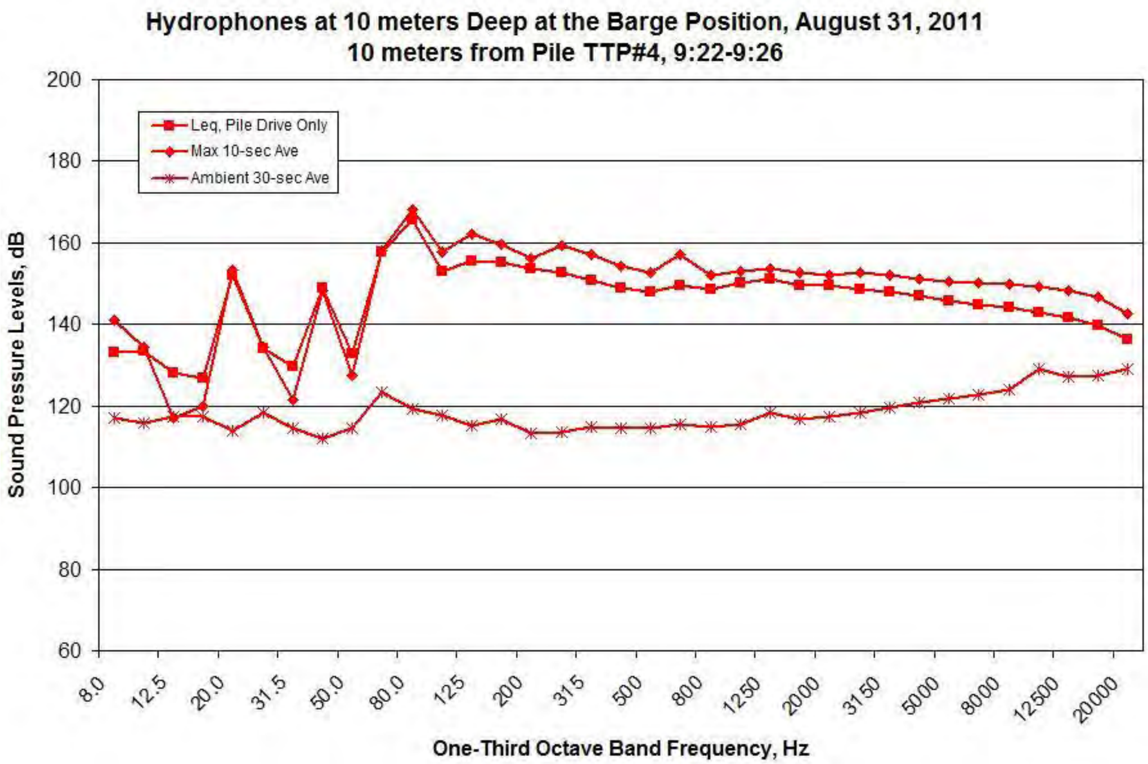

Figure A93. Spectral Data Measured at the BRG Location during TTP#4, 9:22-9:26, Measured at Depths of 10 meters on August 31, 2011

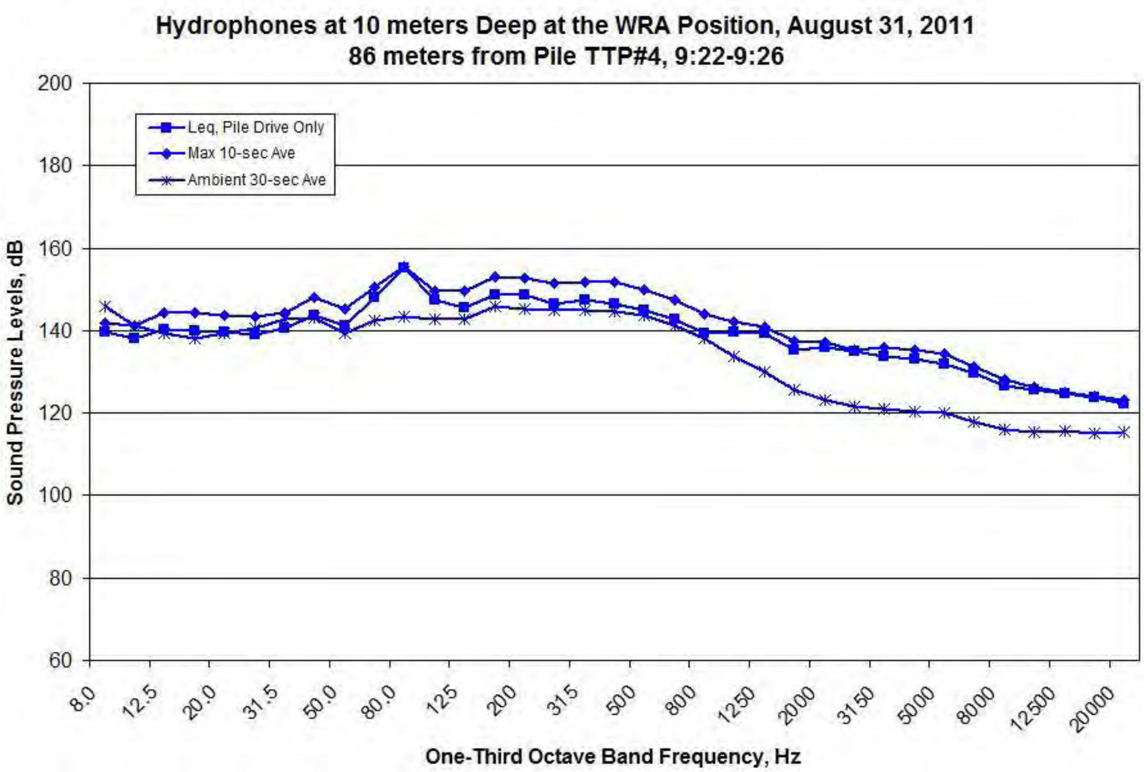

Figure A94. Spectral Data Measured at the WRA Location during TTP#4, 9:22-9:26, Measured at Depths of 10 meters on August 31, 2011

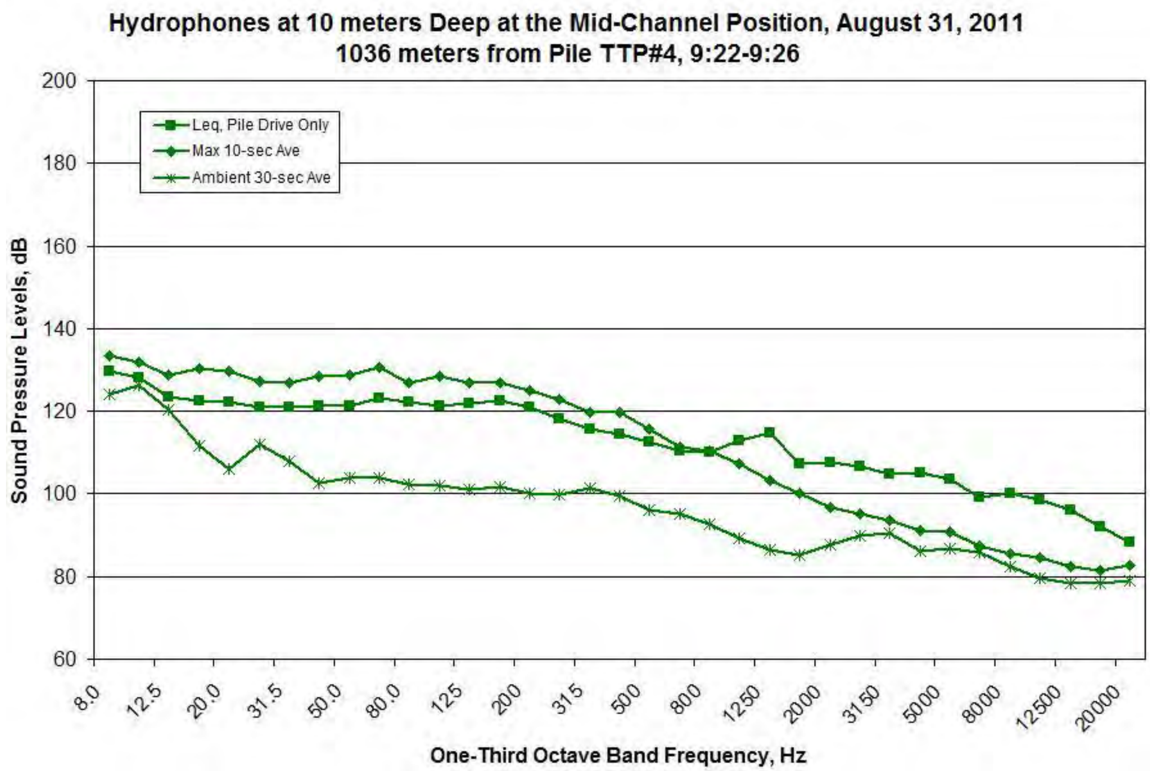

Figure A95. Spectral Data Measured at the MID Location during TTP#4, 9:22-9:26, Measured at Depths of 10 meters on August 31, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A96. Spectral Data Measured at the NO Location during TTP#4, 9:22-9:26, Measured at Depths of 10 meters on August 31, 2011

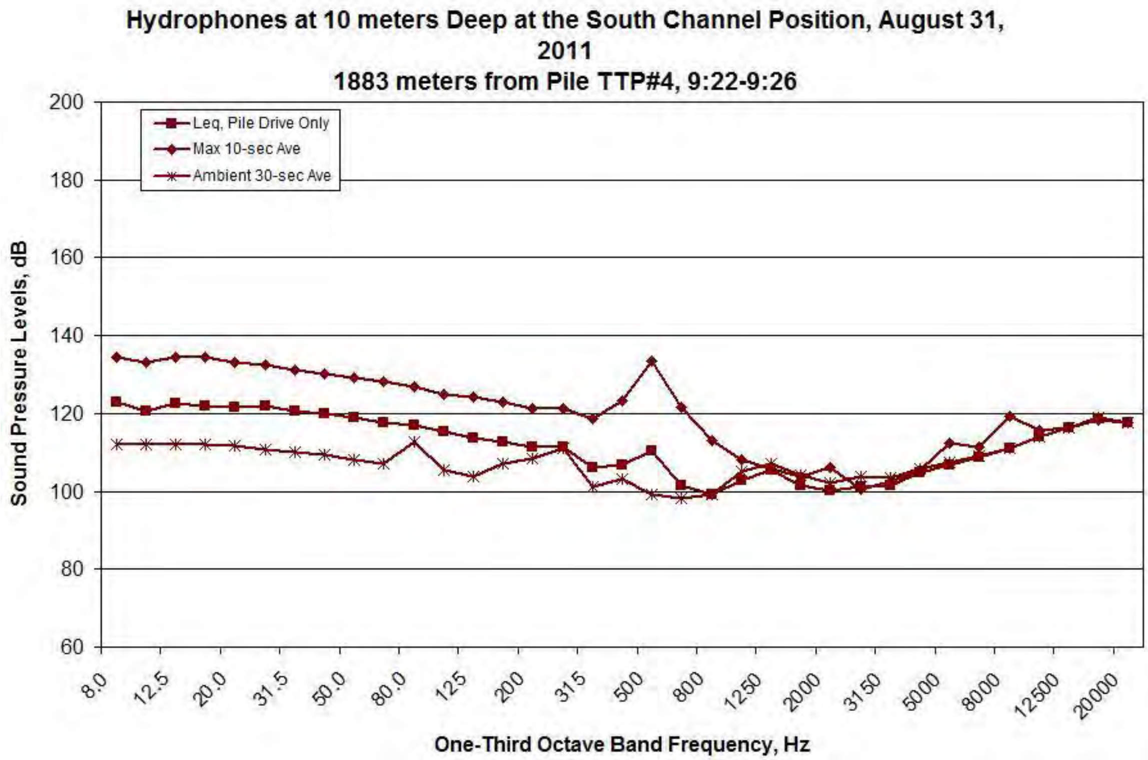

Figure A97. Spectral Data Measured at the SO Location during TTP#4, 9:22-9:26, Measured at Depths of 10 meters on August 31, 2011

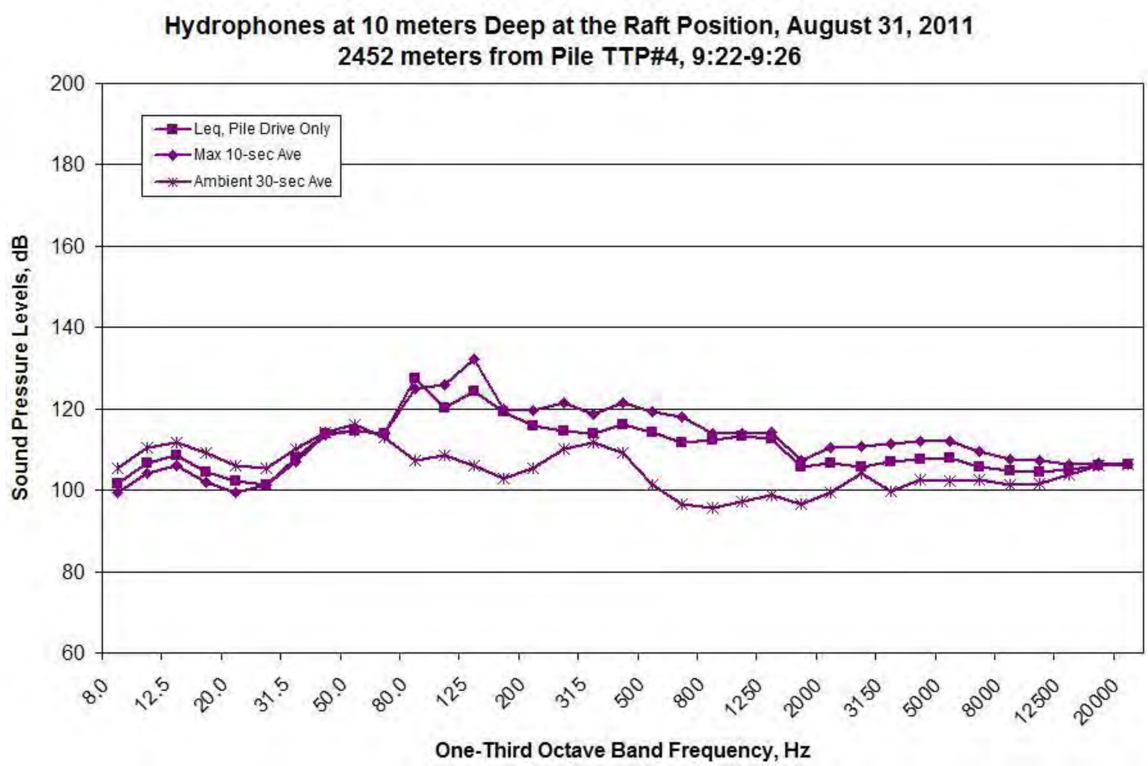

Figure A98. Spectral Data Measured at the RFT Location during TTP#4, 9:22-9:26, Measured at Depths of 10 meters on August 31, 2011

TTP#4, 9:44-9:57 (Vibratory Installation)

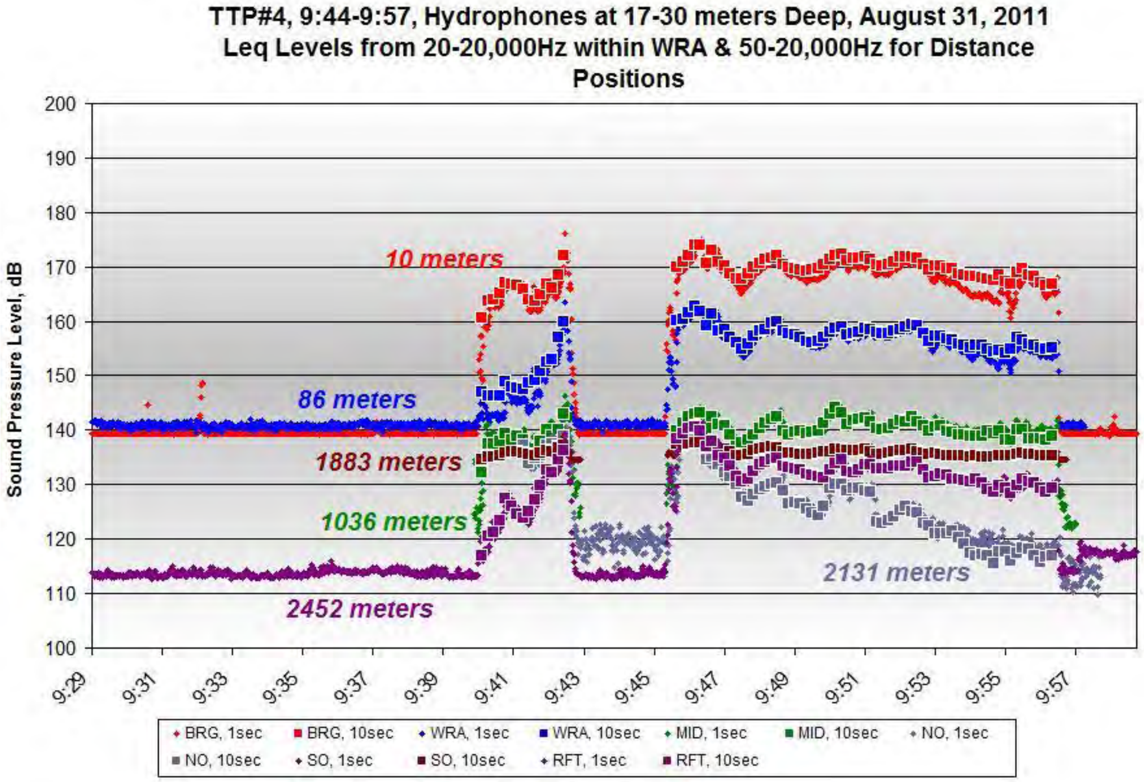

Figure A99. One-second and 10-second Average Data for TTP#4, 9:44-9:57, Measured at Depths of 17-30 meters on August 31, 2011

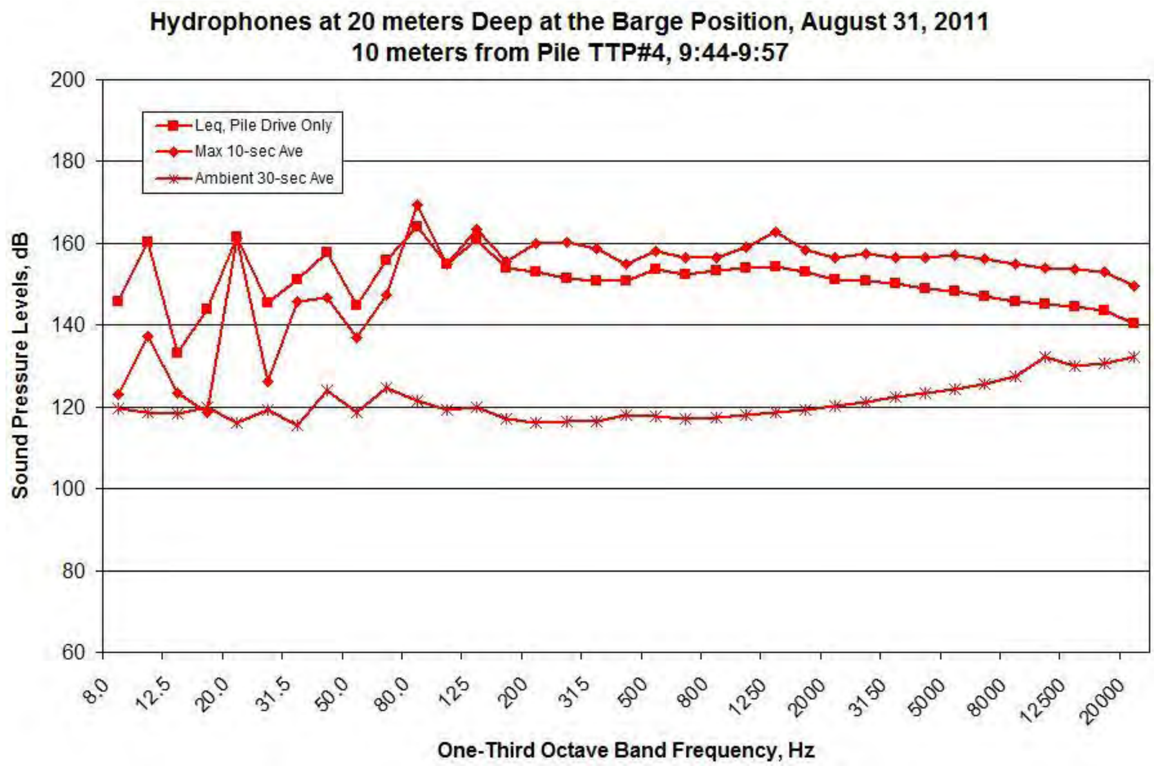

Figure A100. Spectral Data Measured at the BRG Location during TTP#4, 9:44-9:57, Measured at Depths of 20 meters on August 31, 2011

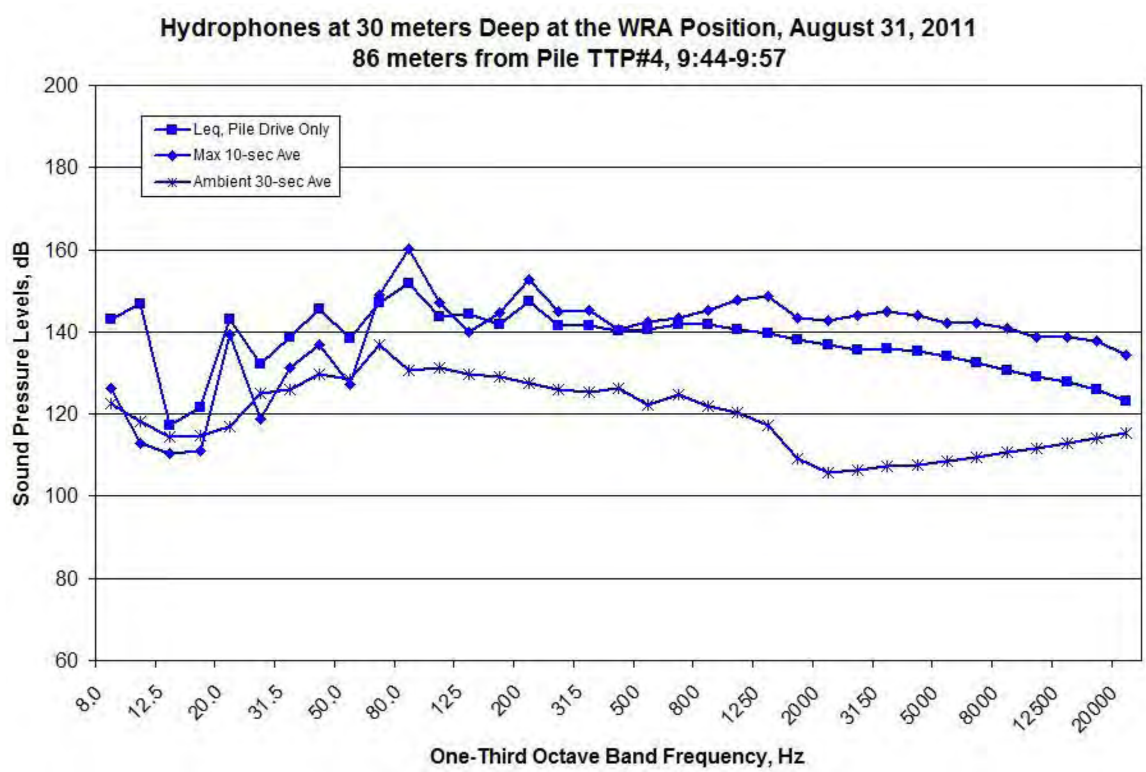

Figure A101. Spectral Data Measured at the WRA Location during TTP#4, 9:44-9:57, Measured at Depths of 30 meters on August 31, 2011

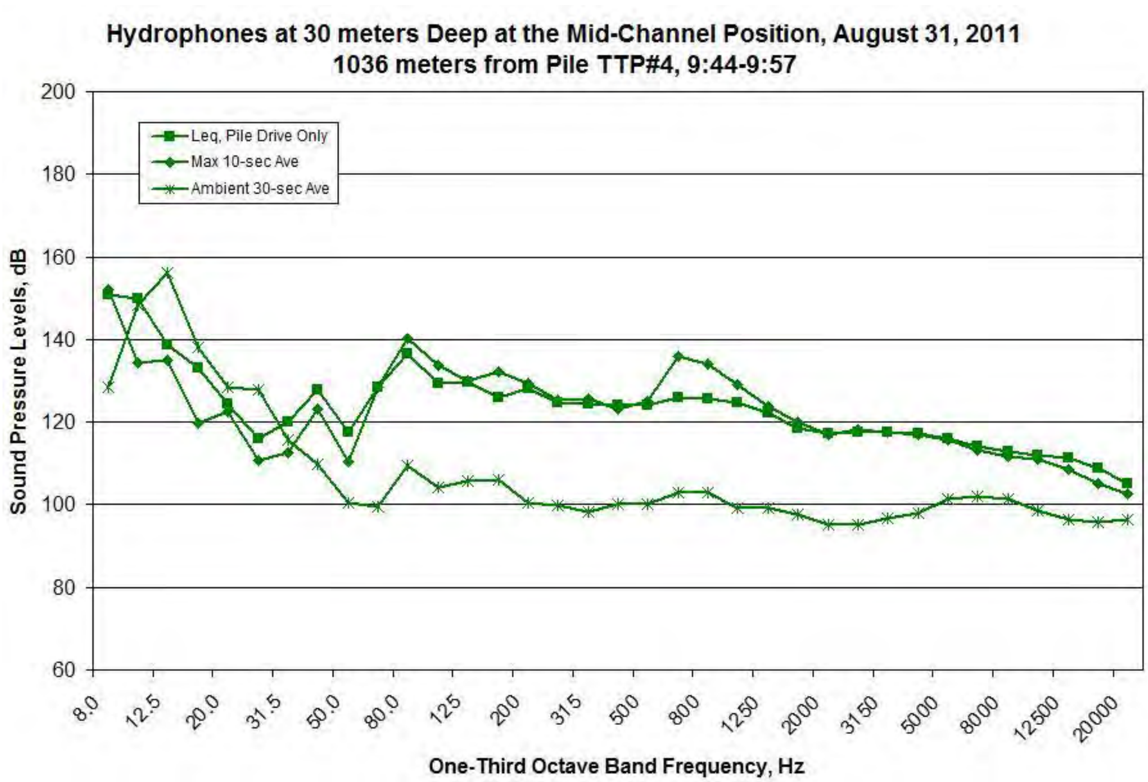

Figure A102. Spectral Data Measured at the MID Location during TTP#4, 9:44-9:57, Measured at Depths of 30 meters on August 31, 2011

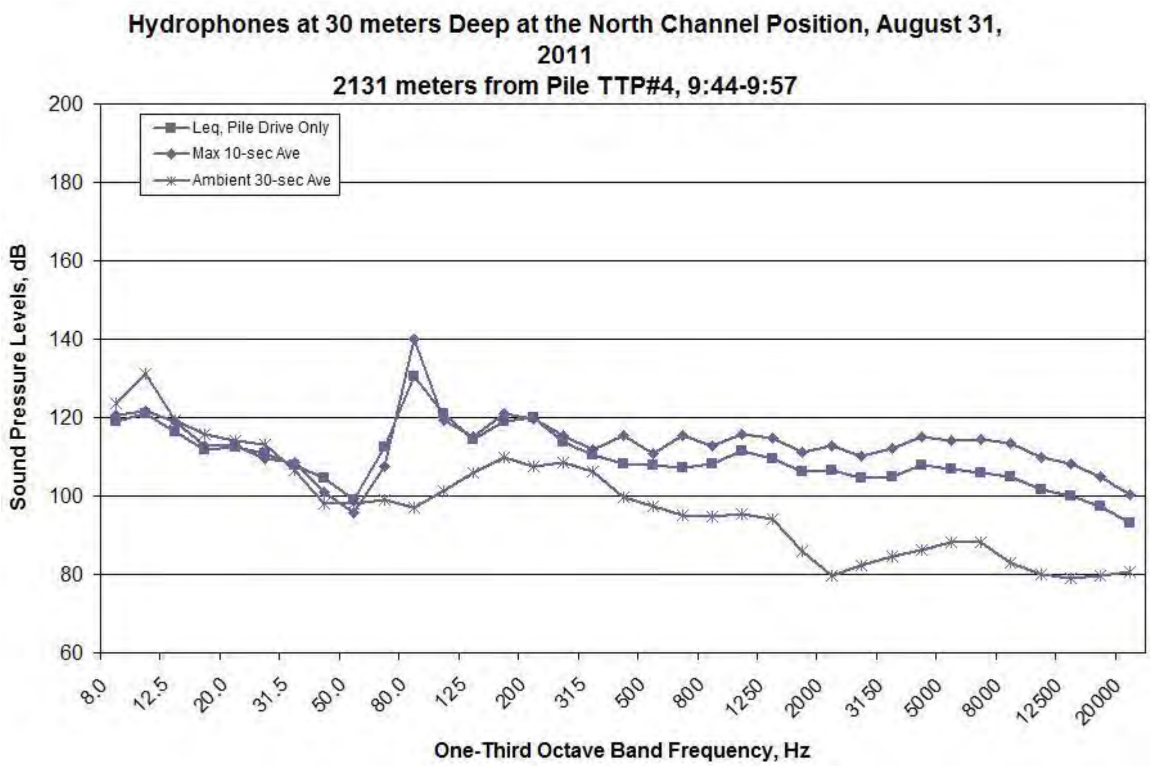

Figure A103. Spectral Data Measured at the NO Location during TTP#4, 9:44-9:57, Measured at Depths of 30 meters on August 31, 2011

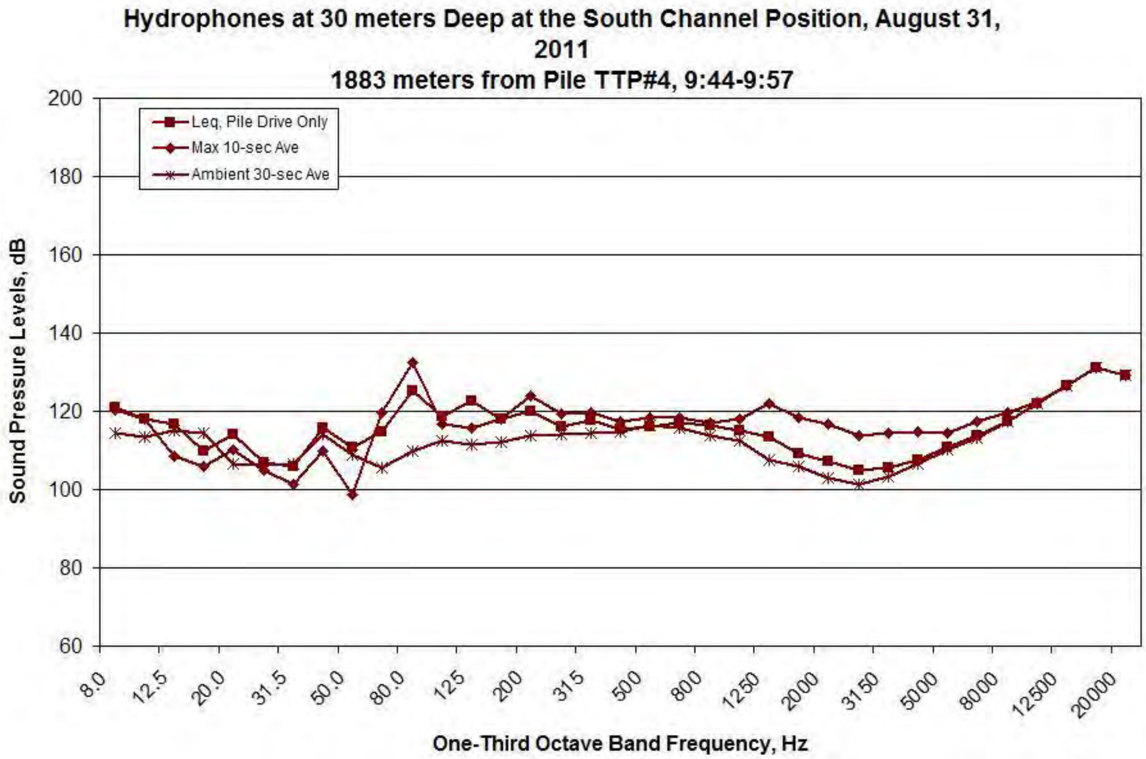

Figure A104. Spectral Data Measured at the SO Location during TTP#4, 9:44-9:57, Measured at Depths of 30 meters on August 31, 2011

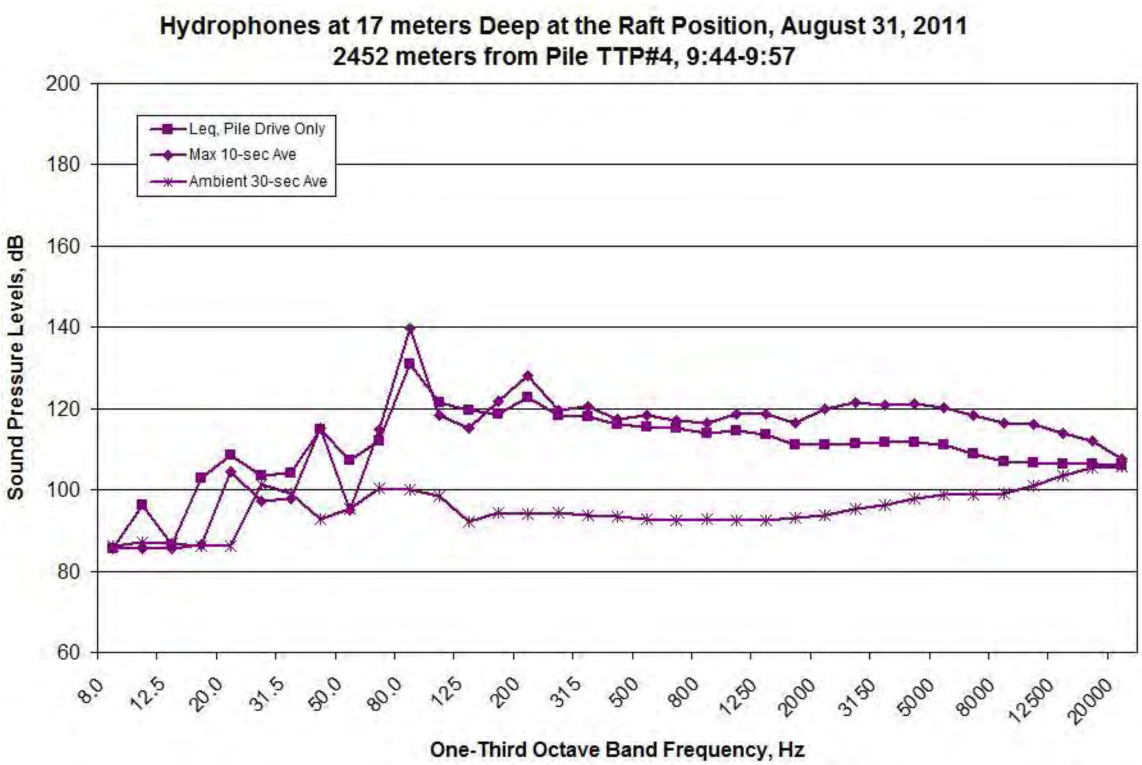

Figure A105. Spectral Data Measured at the RFT Location during TTP#4, 9:44-9:57, Measured at Depths of 17 meters on August 31, 2011

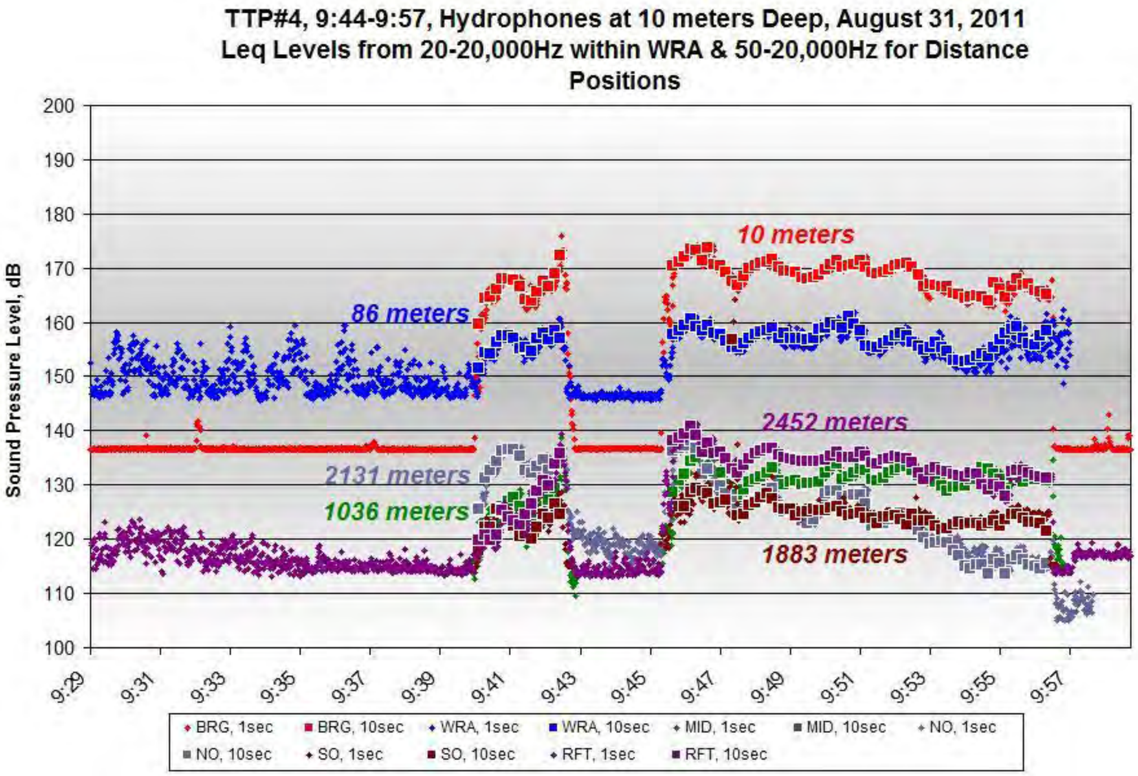

Figure A106. One-second and 10-second Average Data for TTP#4, 9:44-9:57, Measured at Depths of 10 meters on August 31, 2011

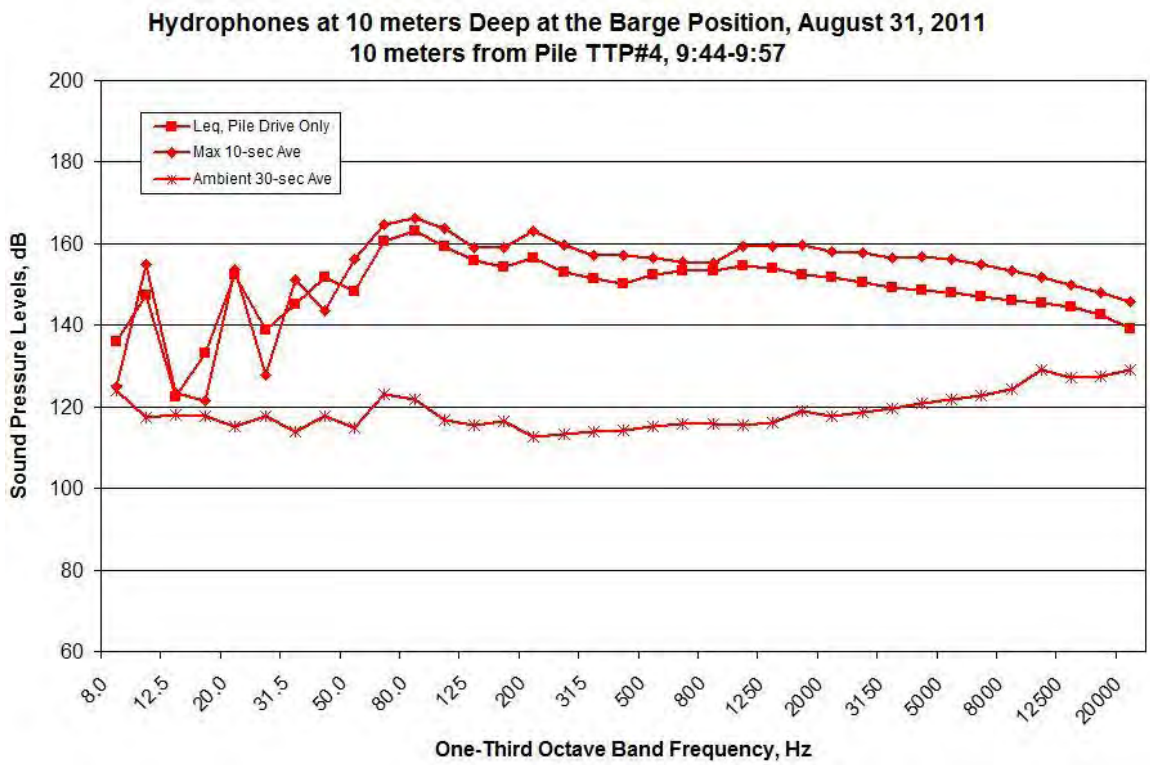

Figure A107. Spectral Data Measured at the BRG Location during TTP#4, 9:44-9:57, Measured at Depths of 10 meters on August 31, 2011

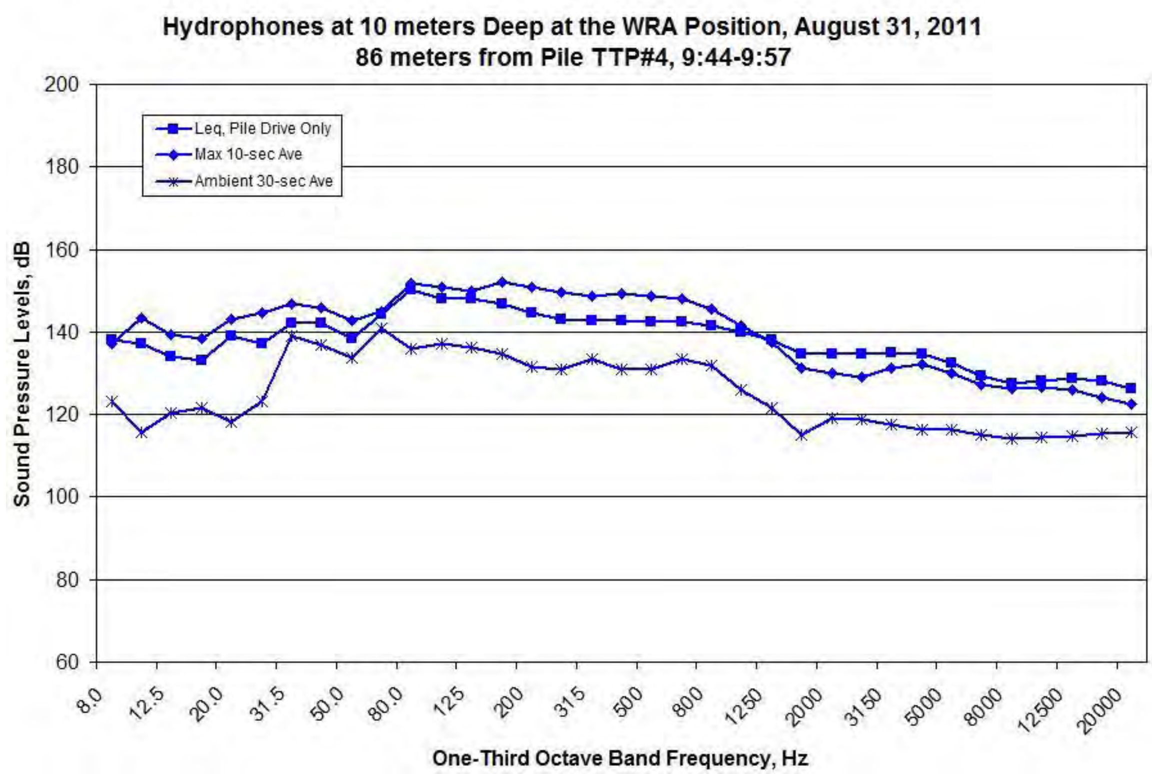

Figure A108. Spectral Data Measured at the WRA Location during TTP#4, 9:44-9:57, Measured at Depths of 10 meters on August 31, 2011

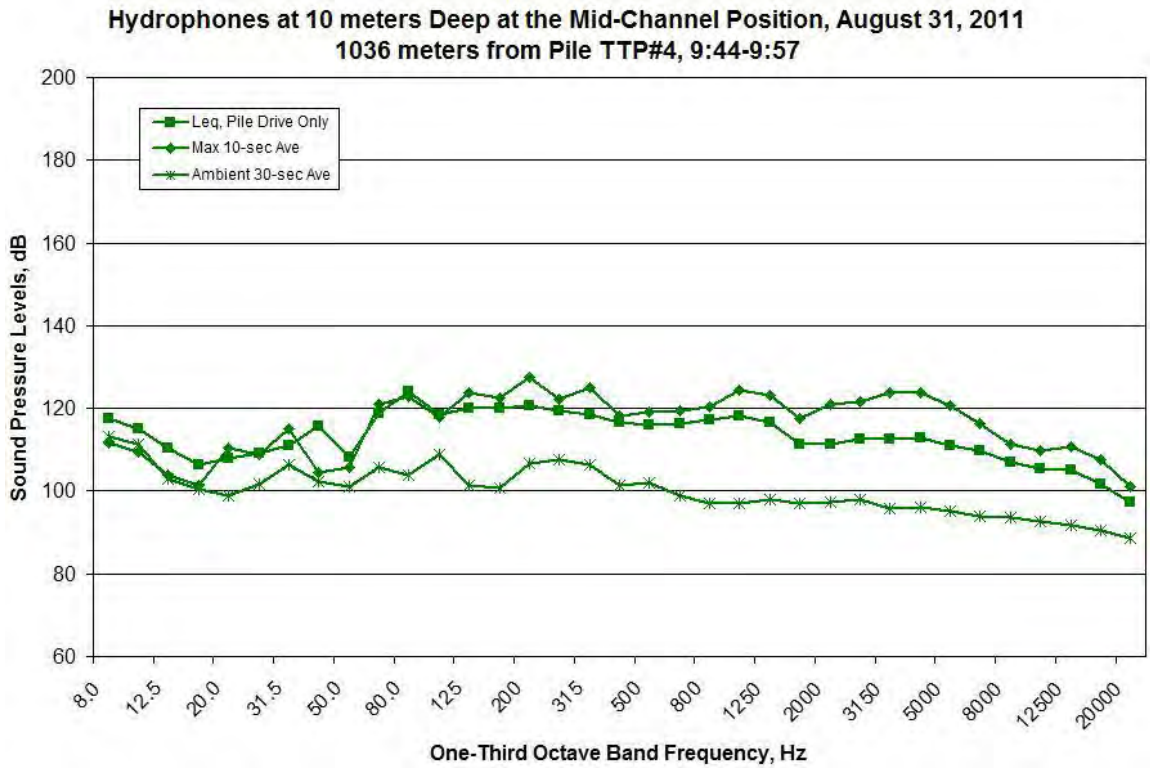

Figure A109. Spectral Data Measured at the MID Location during TTP#4, 9:44-9:57, Measured at Depths of 10 meters on August 31, 2011

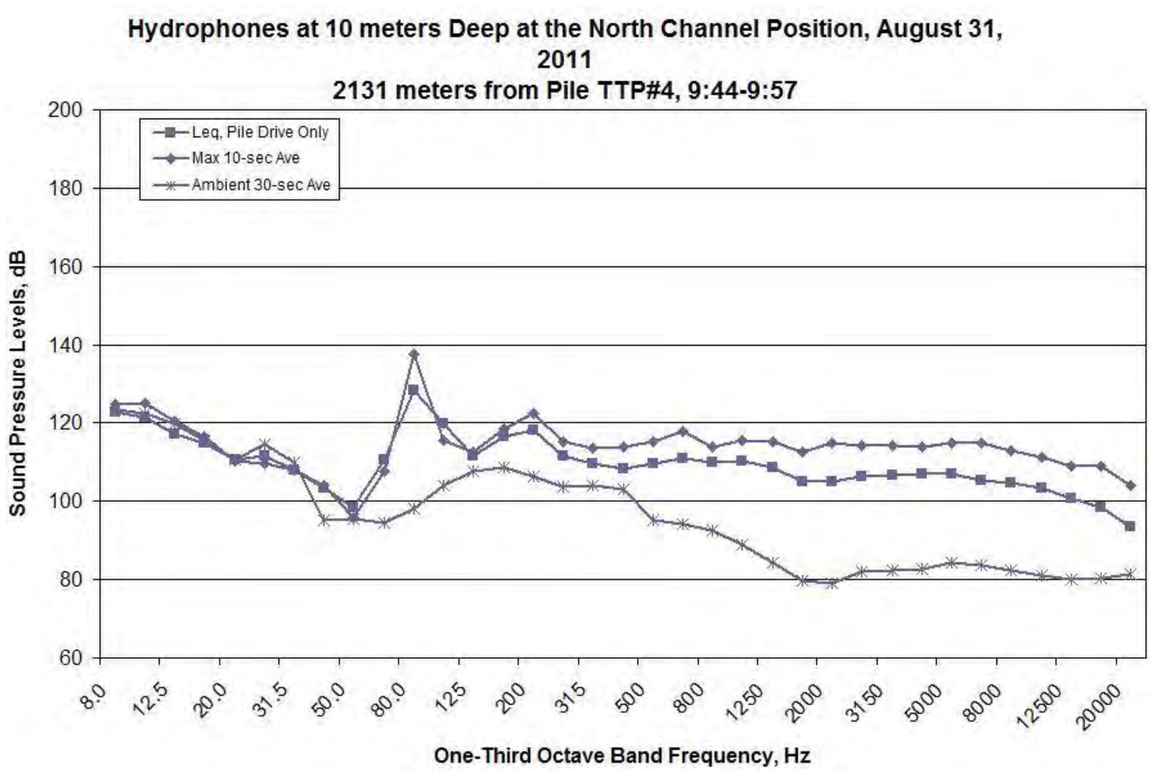

Figure A110. Spectral Data Measured at the NO Location during TTP#4, 9:44-9:57, Measured at Depths of 10 meters on August 31, 2011

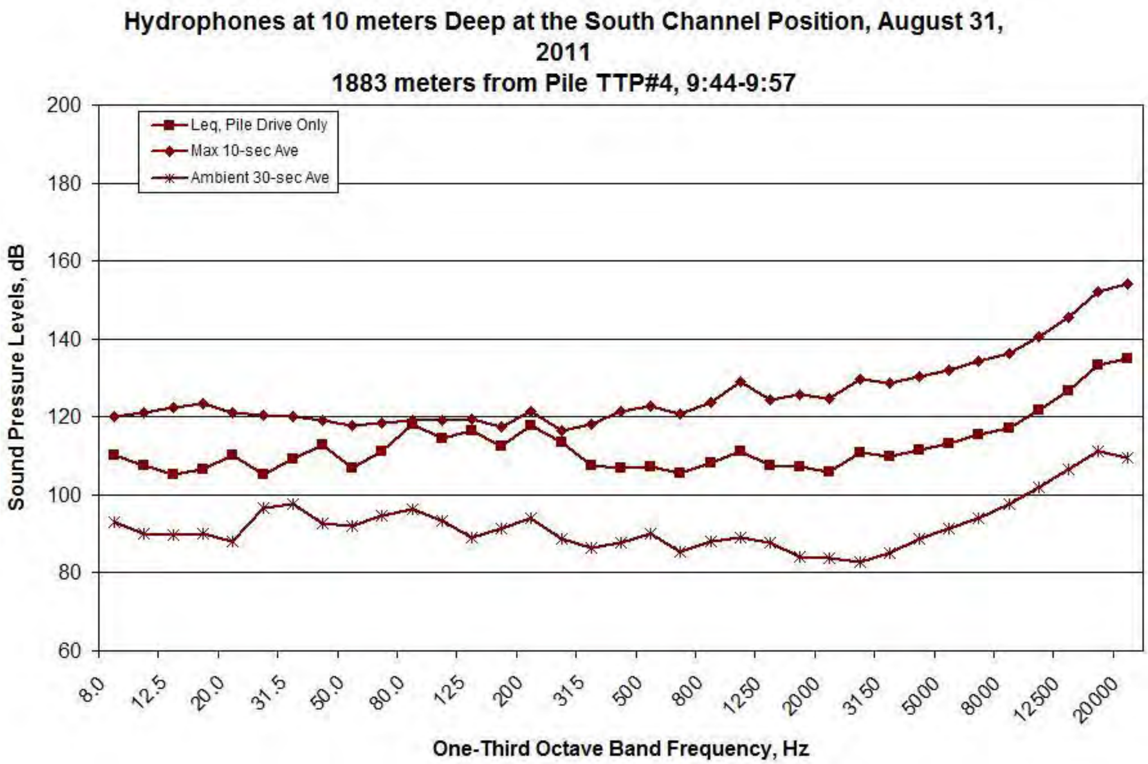

Figure A111. Spectral Data Measured at the SO Location during TTP#4, 9:44-9:57, Measured at Depths of 10 meters on August 31, 2011

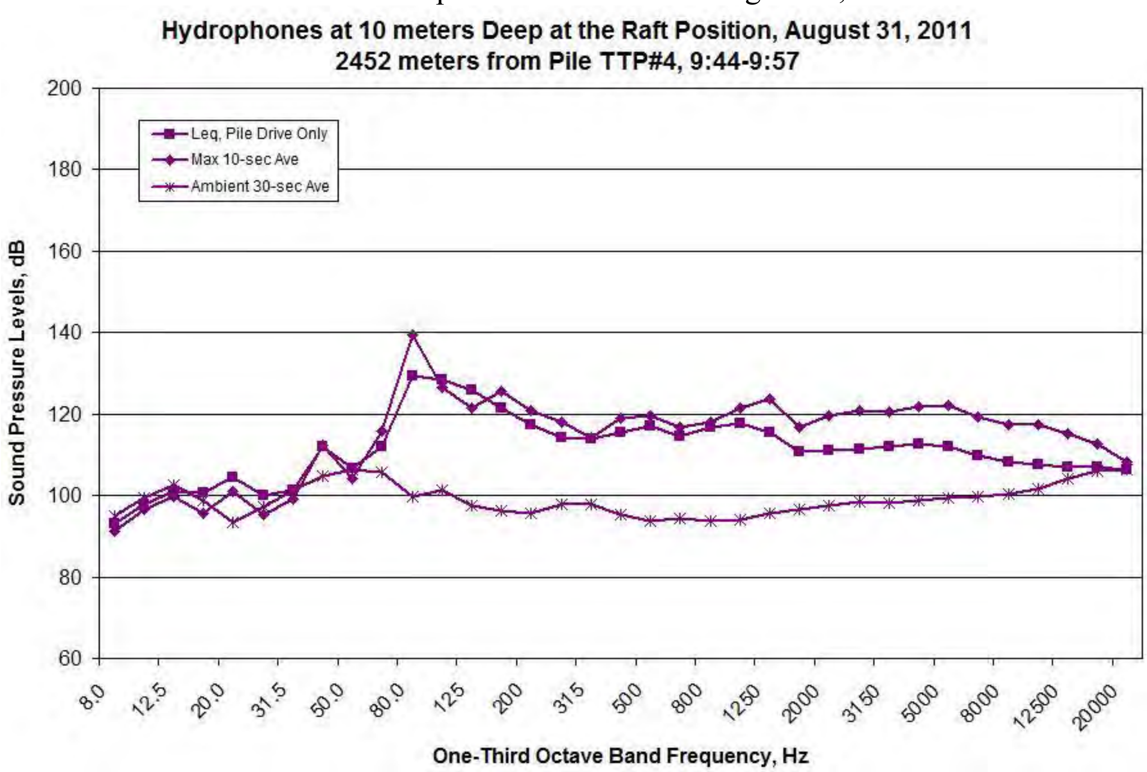

Figure A112. Spectral Data Measured at the RFT Location during TTP#4, 9:44-9:57, Measured at Depths of 10 meters on August 31, 2011

TP#13 (Vibratory Installation)

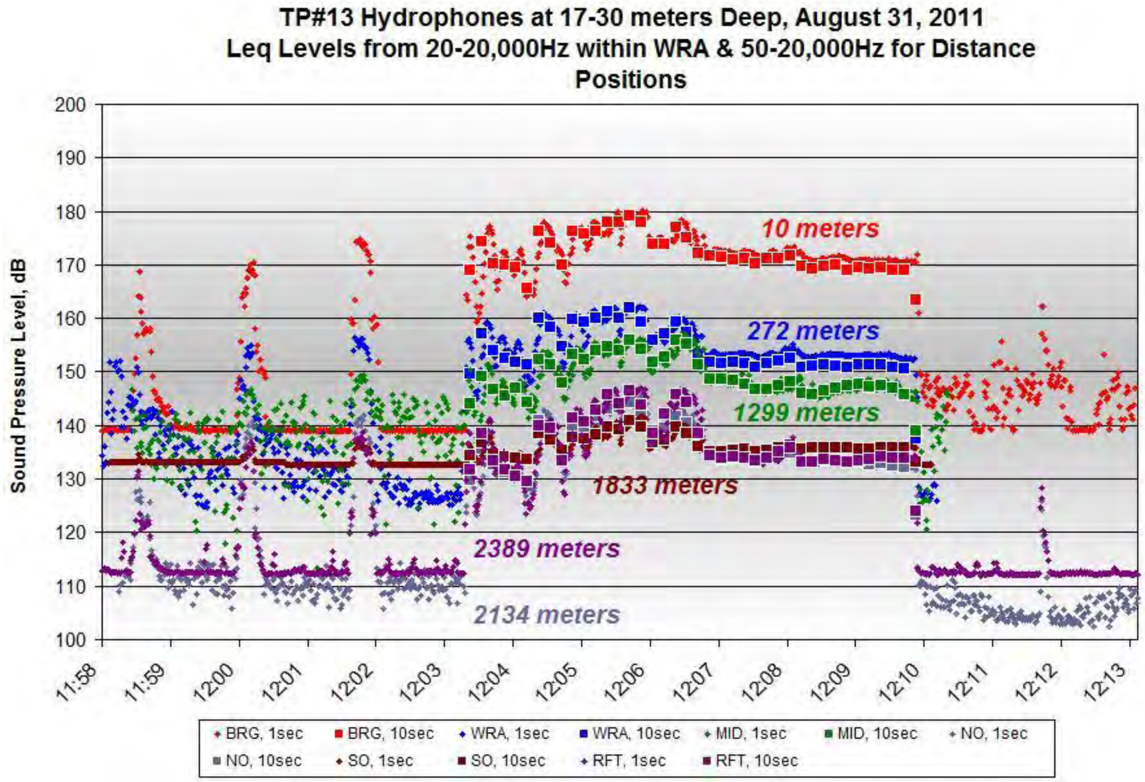

Figure A113. One-second and 10-second Average Data for TP#13, 12:04-12:11, Measured at Depths of 17-30 meters on August 31, 2011

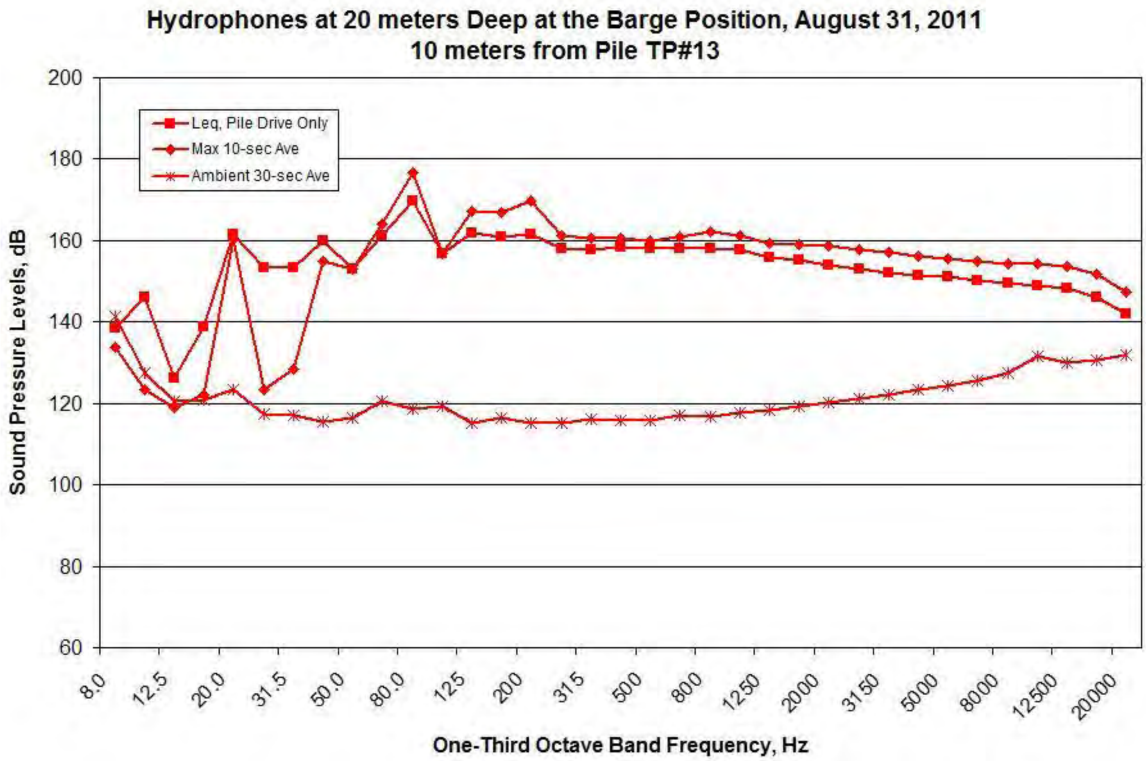

Figure A114. Spectral Data Measured at the BRG Location during TP#13, 12:04-12:11, Measured at Depths of 20 meters on August 31, 2011

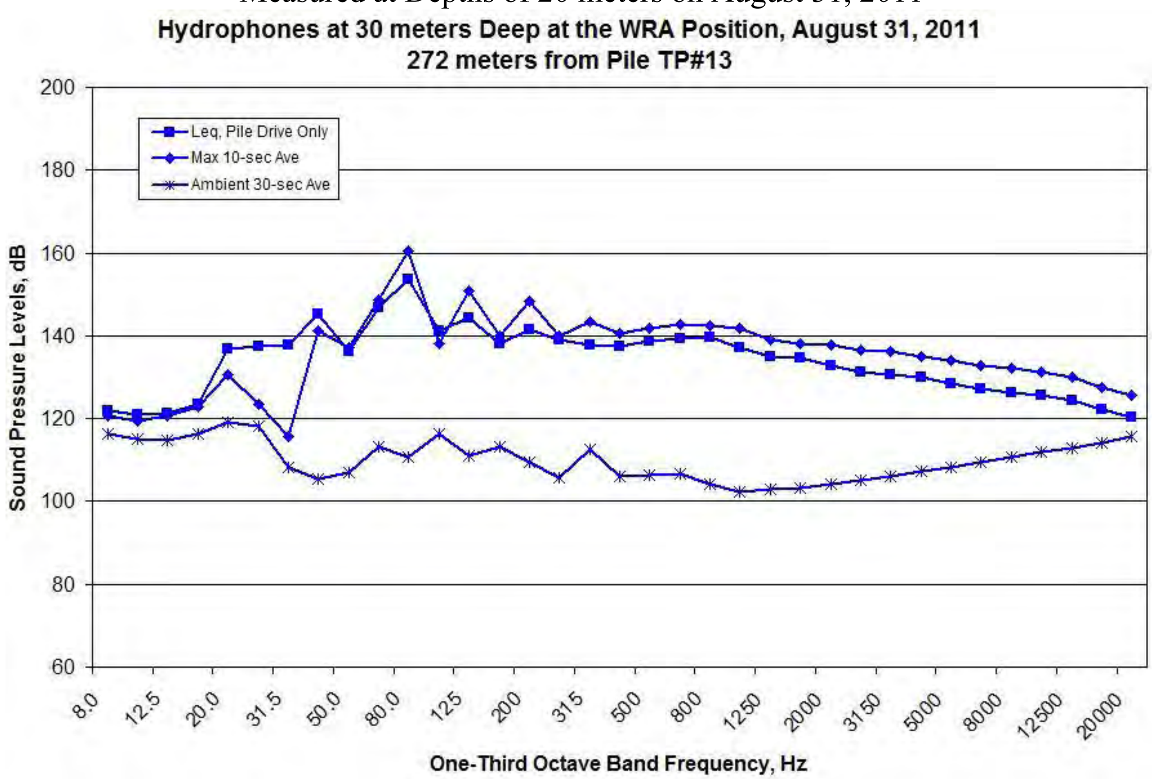

Figure A115. Spectral Data Measured at the WRA Location during TP#13, 12:04-12:11, Measured at Depths of 30 meters on August 31, 2011

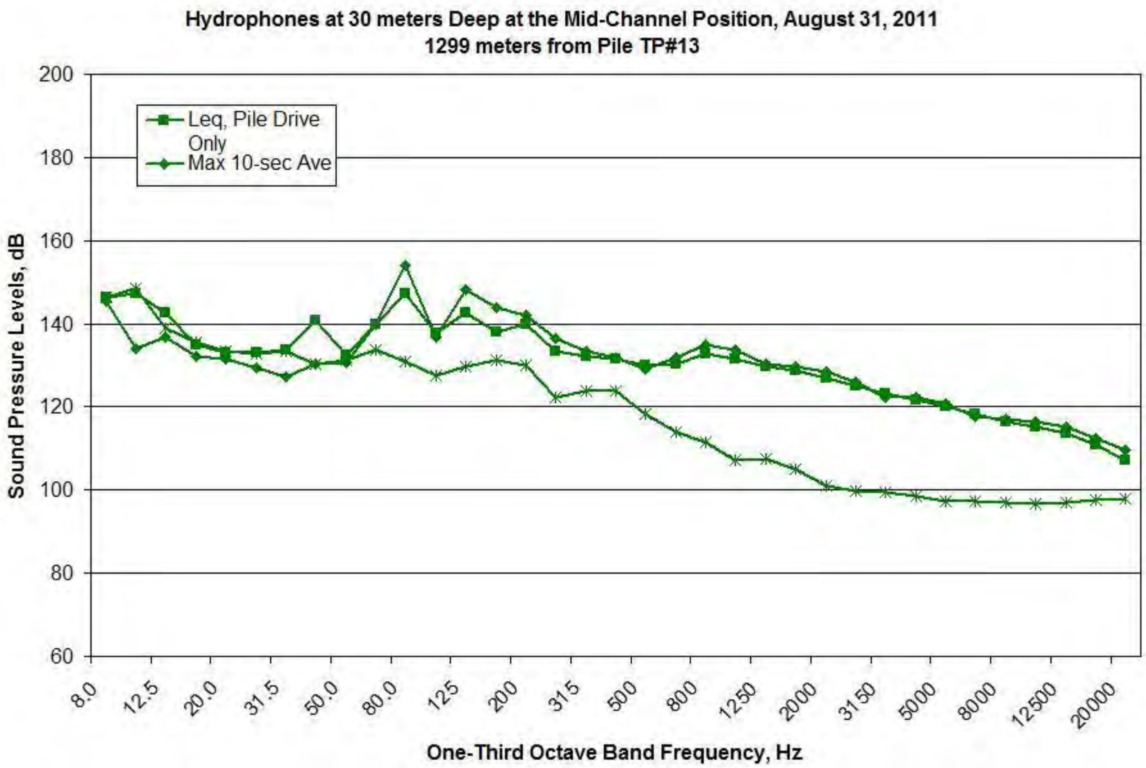

Figure A116. Spectral Data Measured at the MID Location during TP#13, 12:04-12:11, Measured at Depths of 30 meters on August 31, 2011

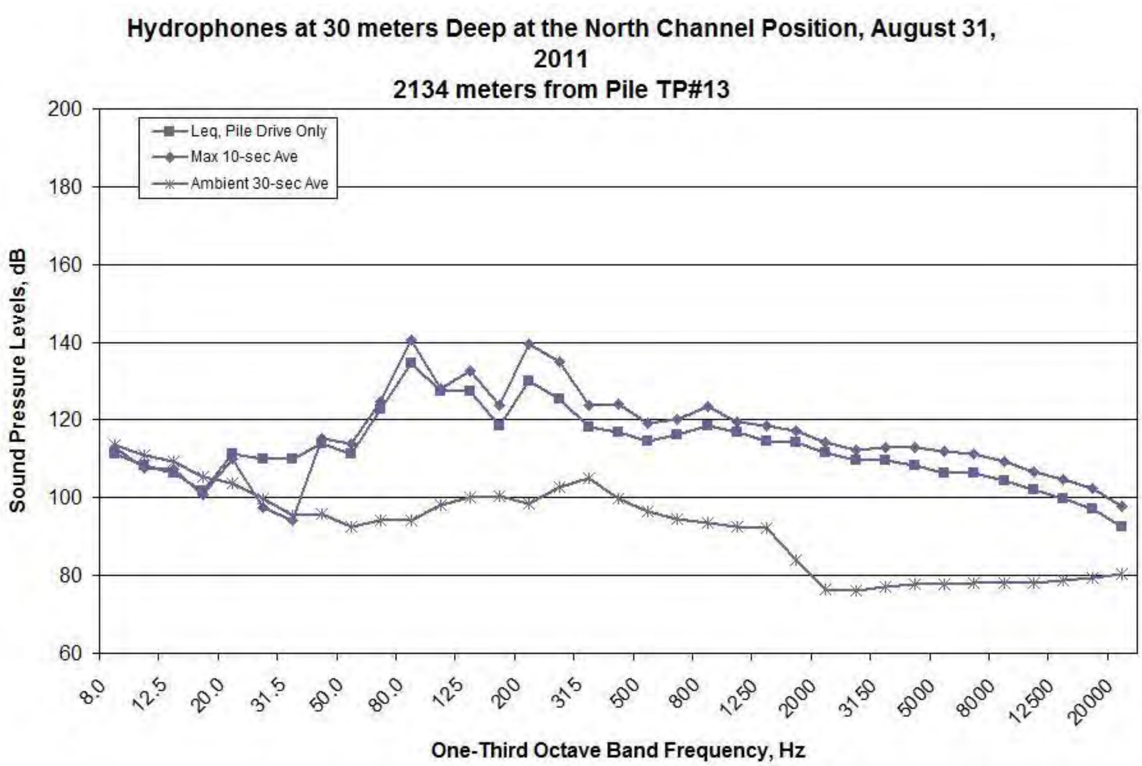

Figure A117. Spectral Data Measured at the NO Location during TP#13, 12:04-12:11, Measured at Depths of 30 meters on August 31, 2011

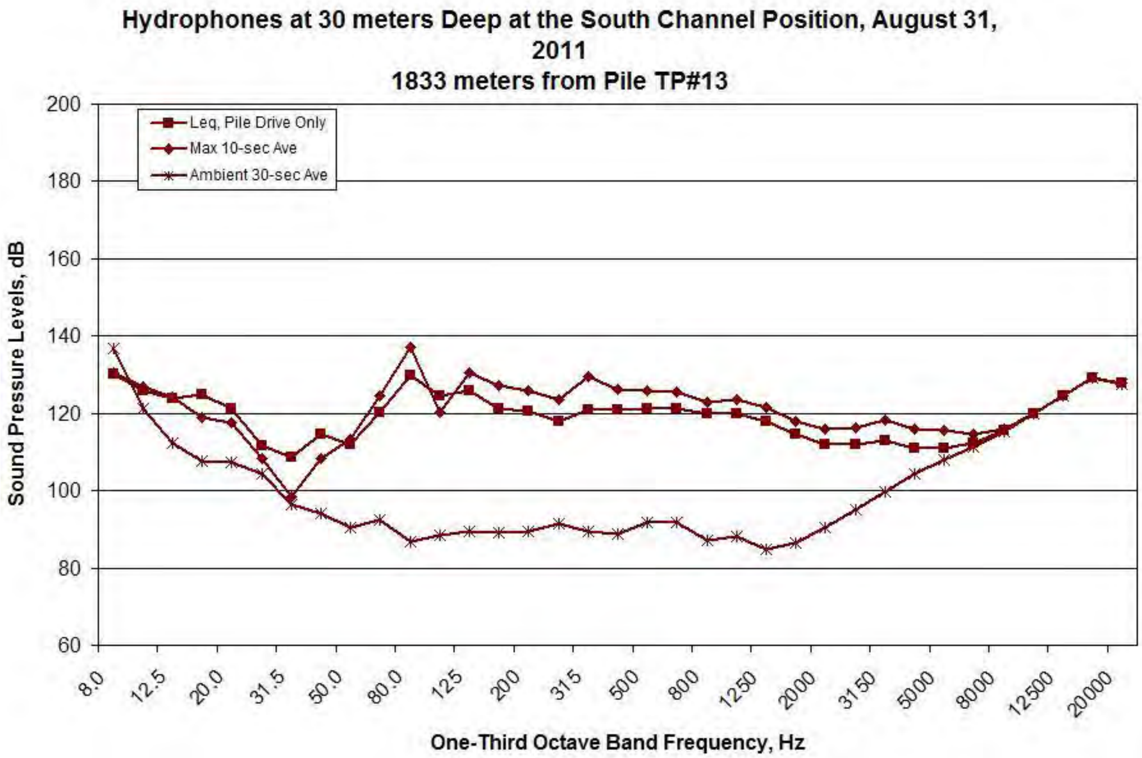

Figure A118. Spectral Data Measured at the SO Location during TP#13, 12:04-12:11, Measured at Depths of 30 meters on August 31, 2011

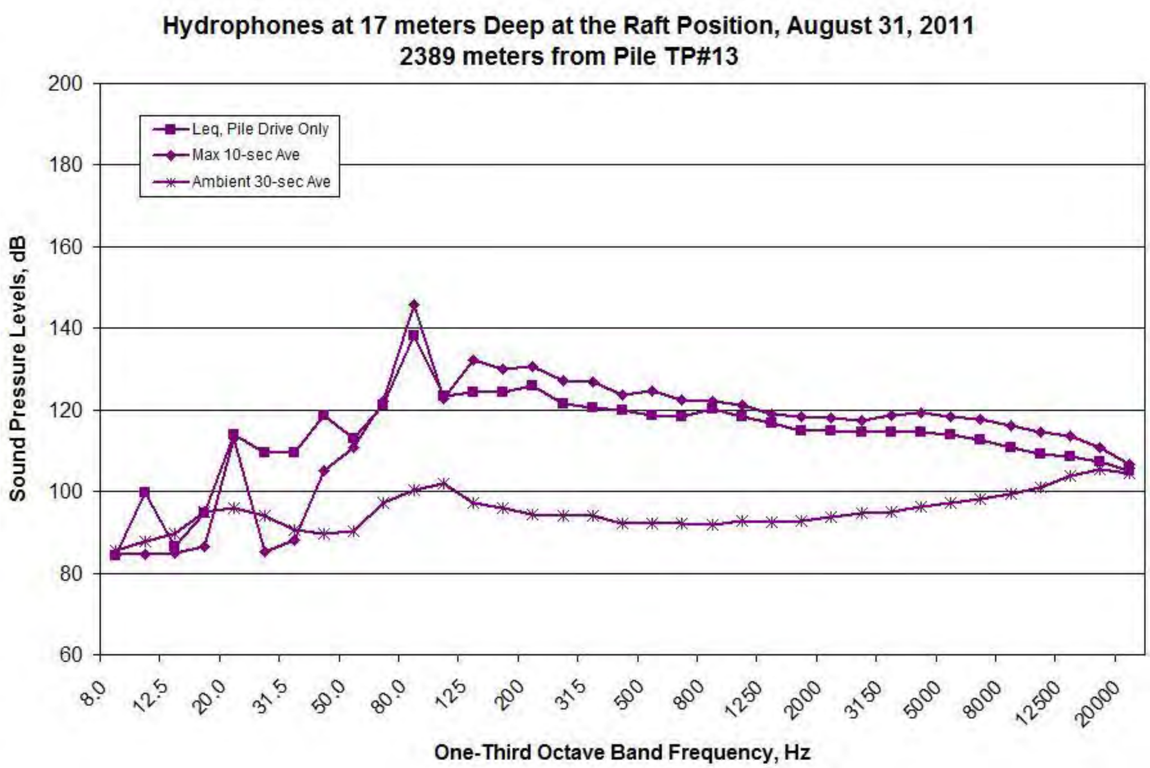

Figure A119. Spectral Data Measured at the RFT Location during TP#13, 12:04-12:11, Measured at Depths of 17 meters on August 31, 2011

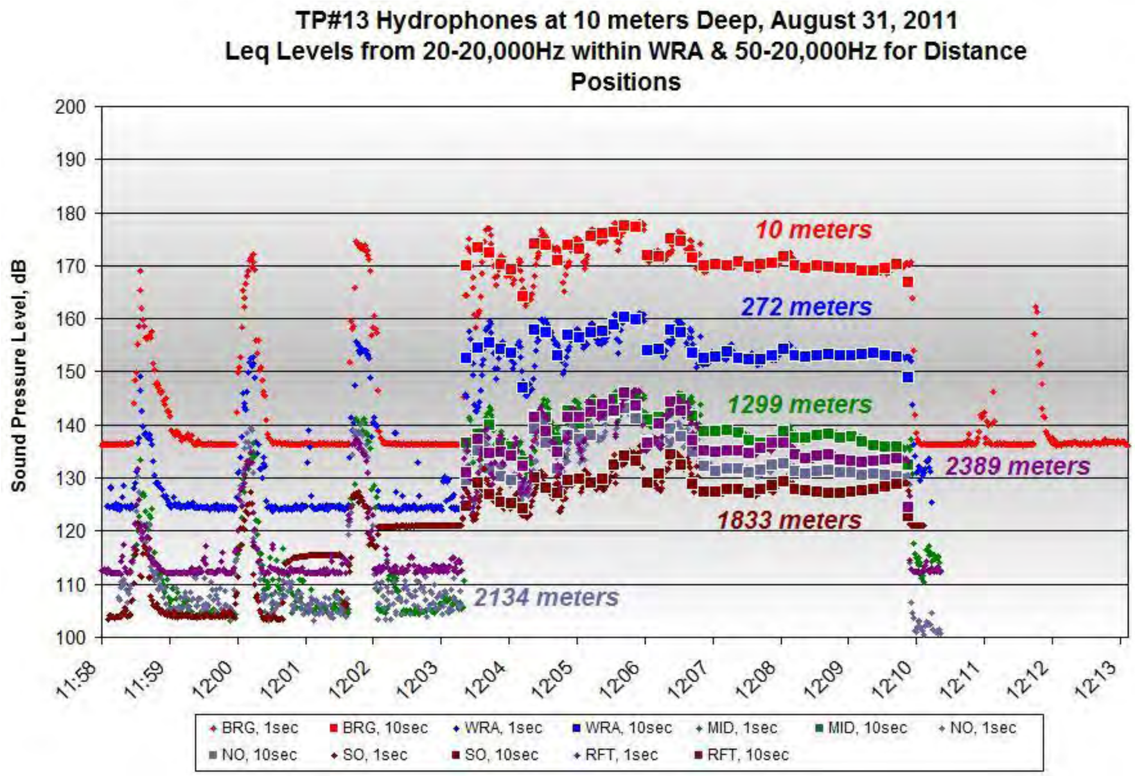

Figure A120. One-second and 10-second Average Data for TP#13, 12:04-12:11, Measured at Depths of 10 meters on August 31, 2011

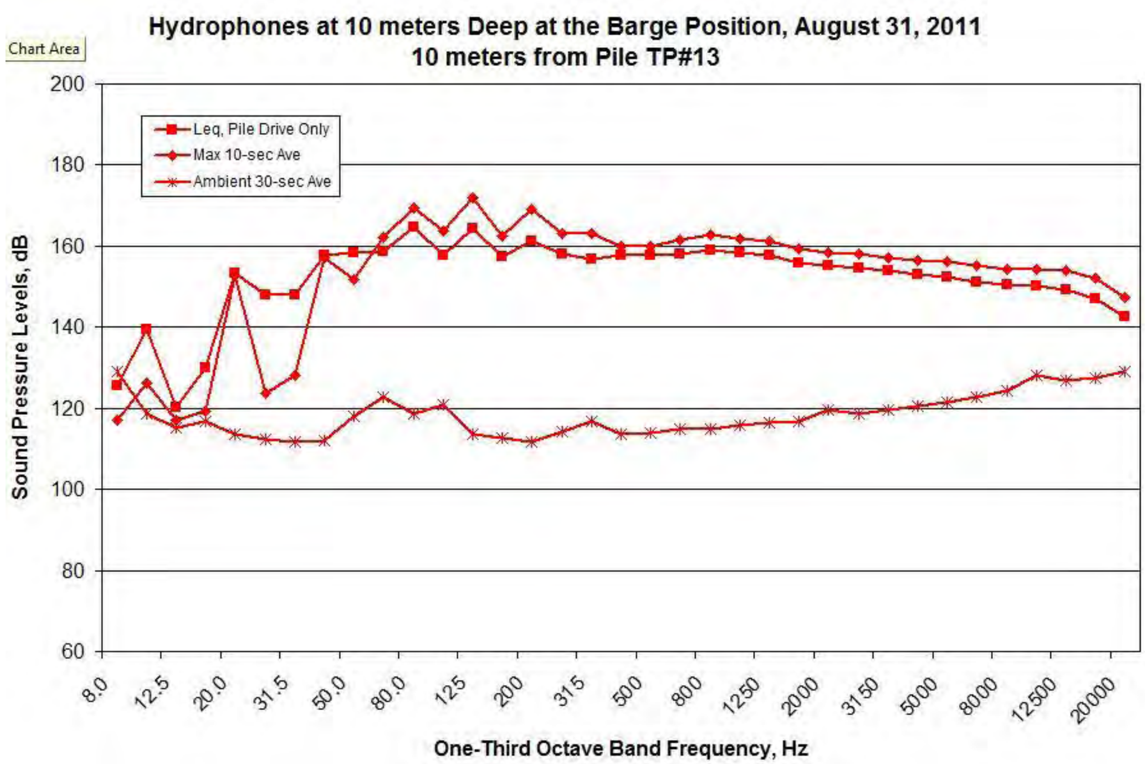

Figure A121. Spectral Data Measured at the BRG Location during TP#13, 12:04-12:11, Measured at Depths of 10 meters on August 31, 2011

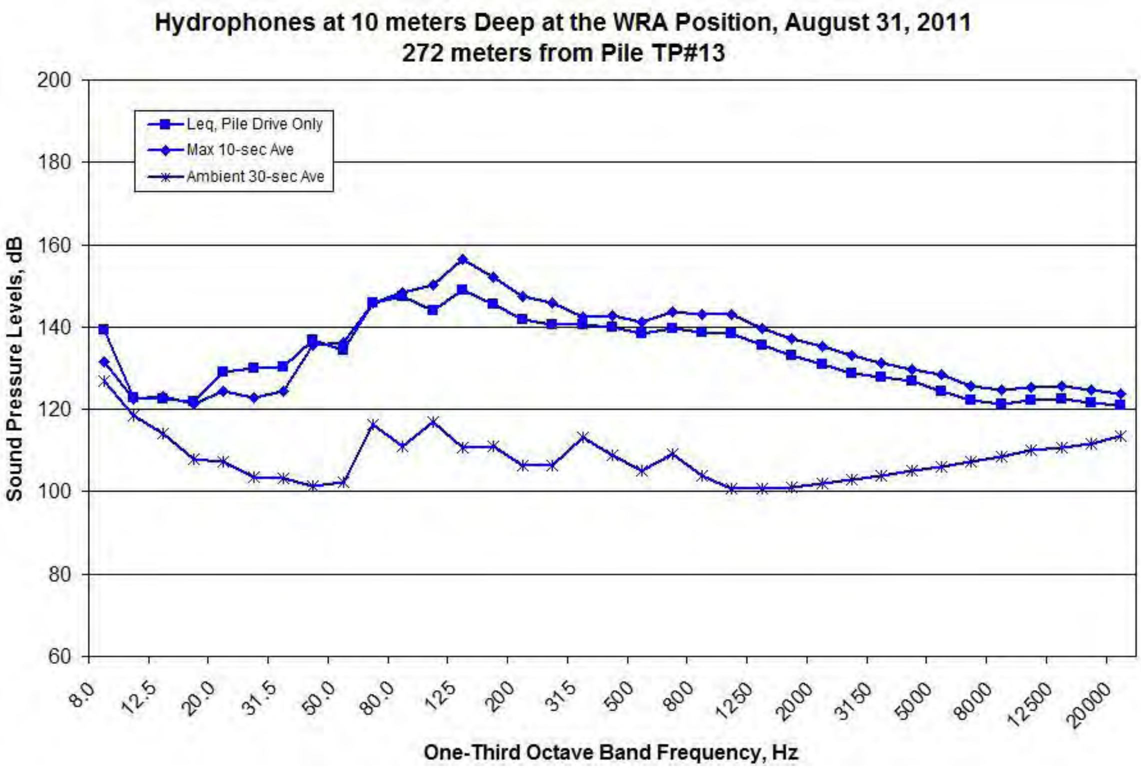

Figure A122. Spectral Data Measured at the WRA Location during TP#13, 12:04-12:11, Measured at Depths of 10 meters on August 31, 2011

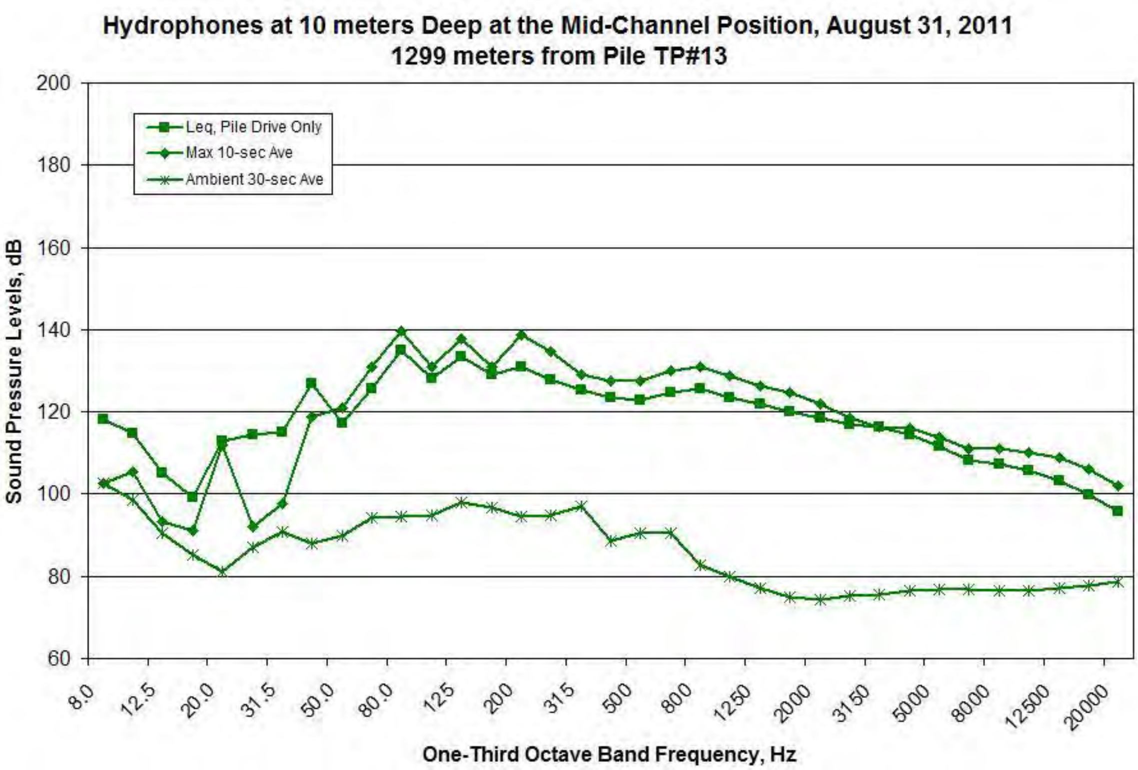

Figure A123. Spectral Data Measured at the MID Location during TP#13, 12:04-12:11, Measured at Depths of 10 meters on August 31, 2011

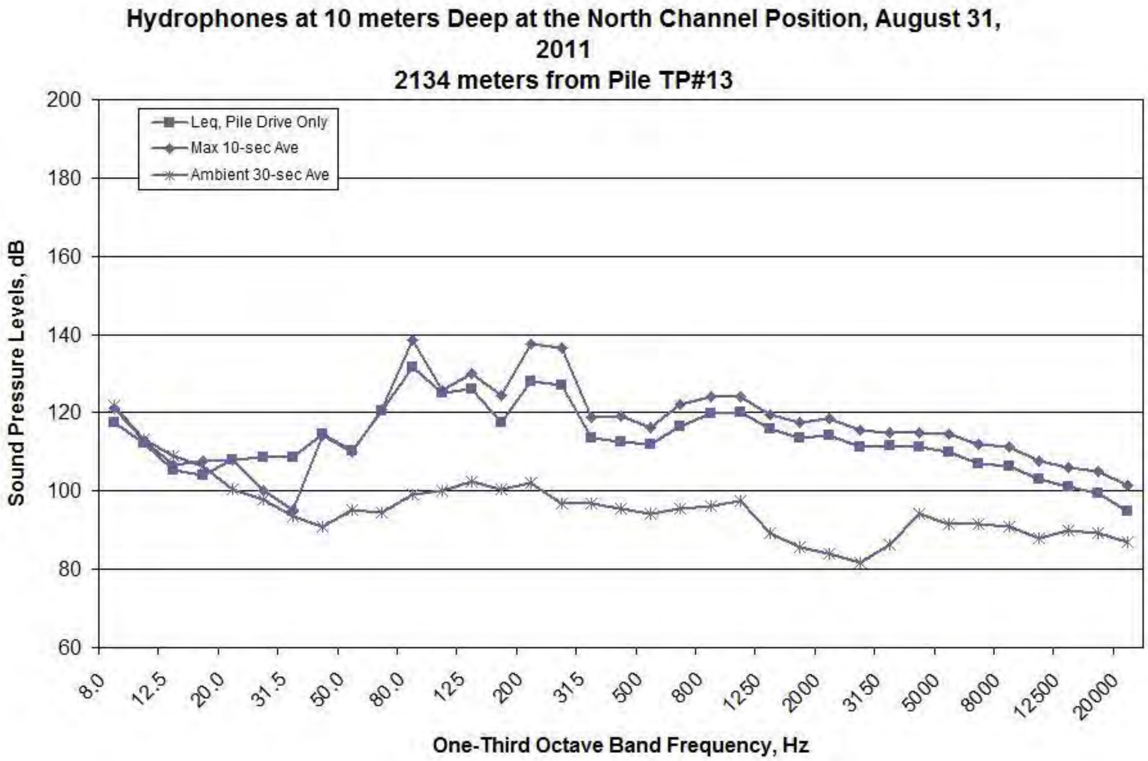

Figure A124. Spectral Data Measured at the NO Location during TP#13, 12:04-12:11, Measured at Depths of 10 meters on August 31, 2011

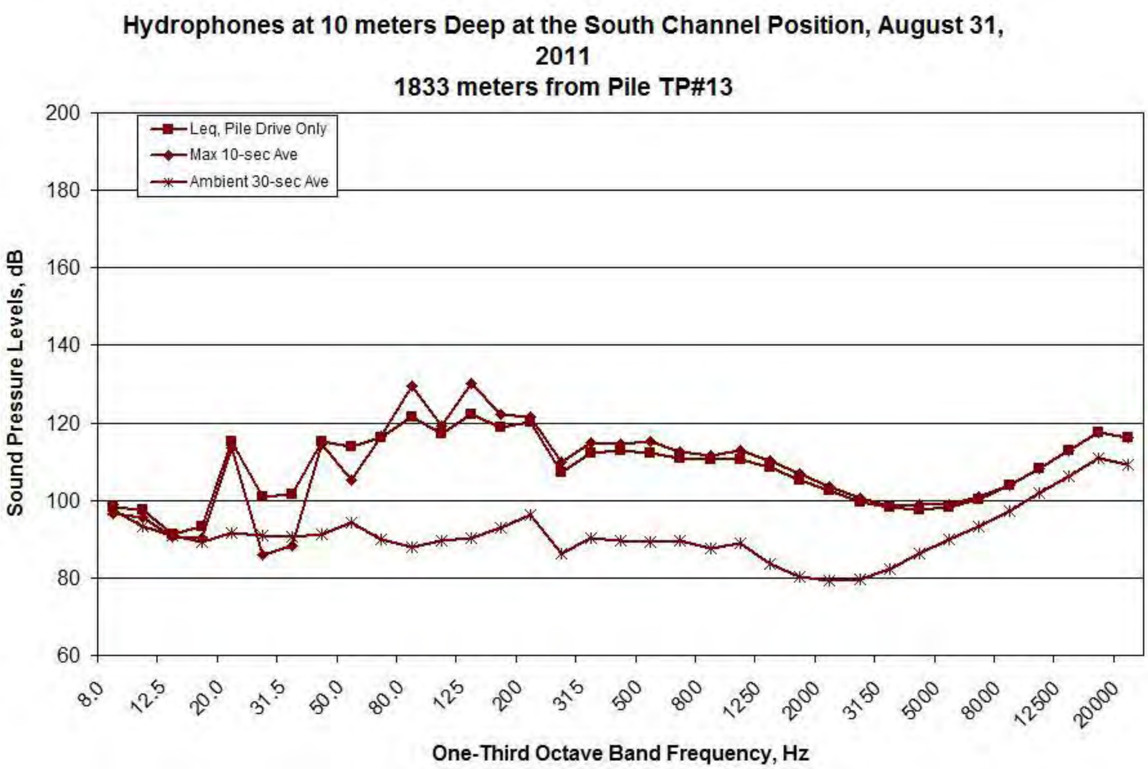

Figure A125. Spectral Data Measured at the SO Location during TP#13, 12:04-12:11, Measured at Depths of 10 meters on August 31, 2011

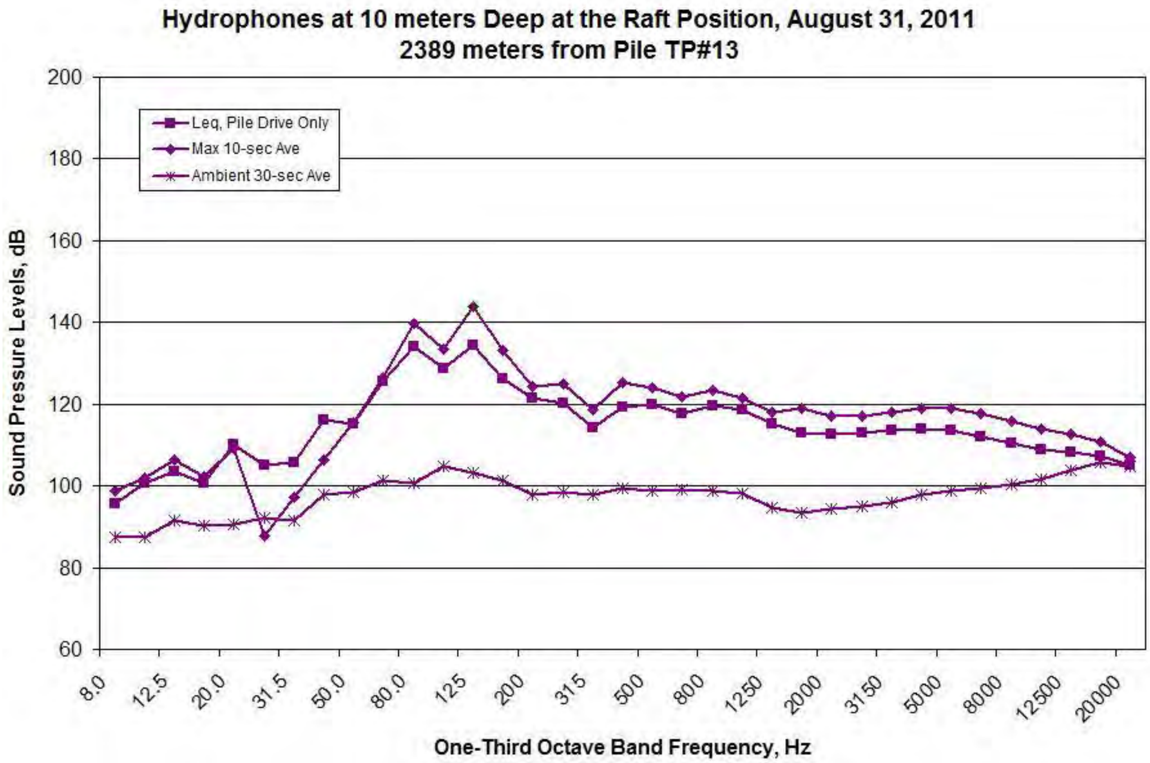

Figure A126. Spectral Data Measured at the RFT Location during TP#13, 12:04-12:11, Measured at Depths of 10 meters on August 31, 2011

TP#12 (Vibratory Installation)

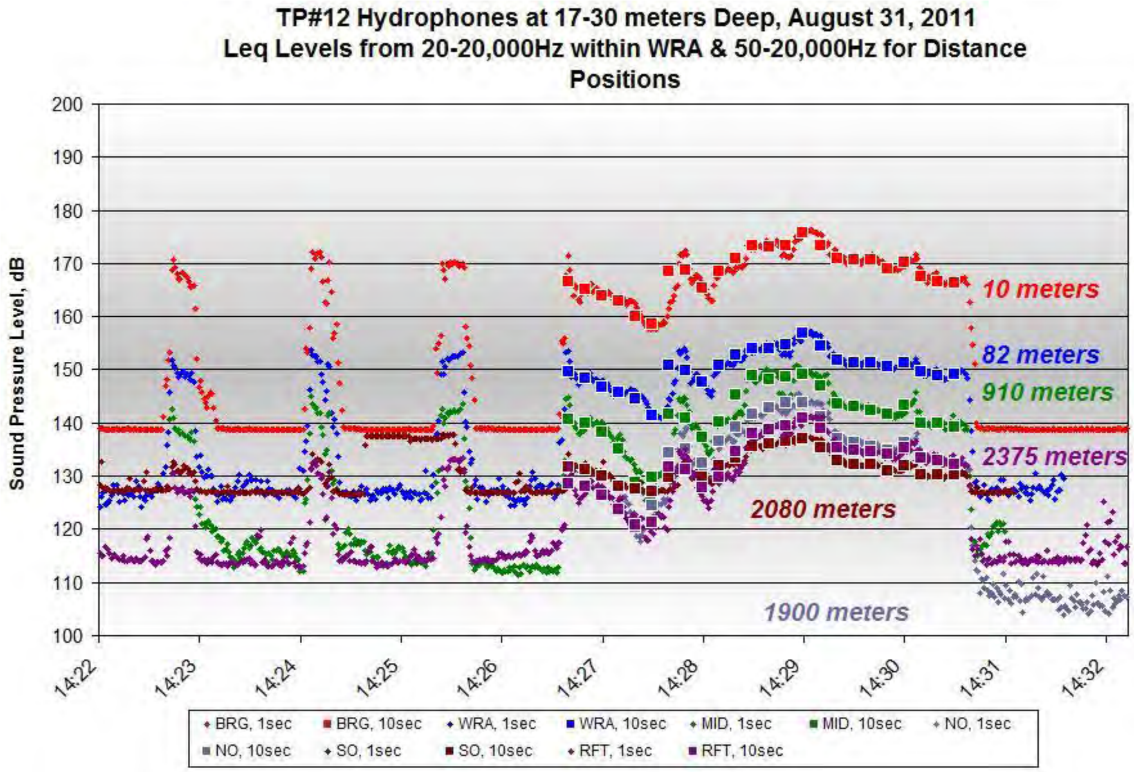

Figure A127. One-second and 10-second Average Data for TP#12, 14:27-14:31, Measured at Depths of 17-30 meters on August 31, 2011

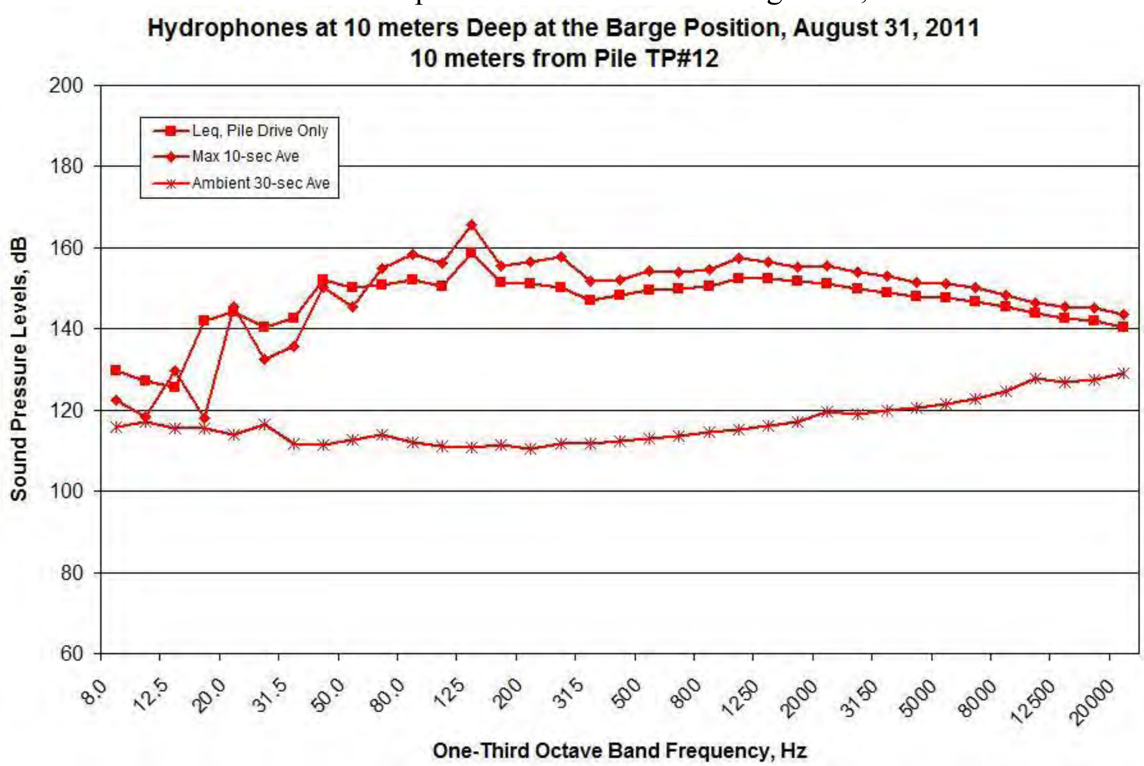

Figure A128. Spectral Data Measured at the BRG Location during TP#12, 14:27-14:31, Measured at Depths of 20 meters on August 31, 2011

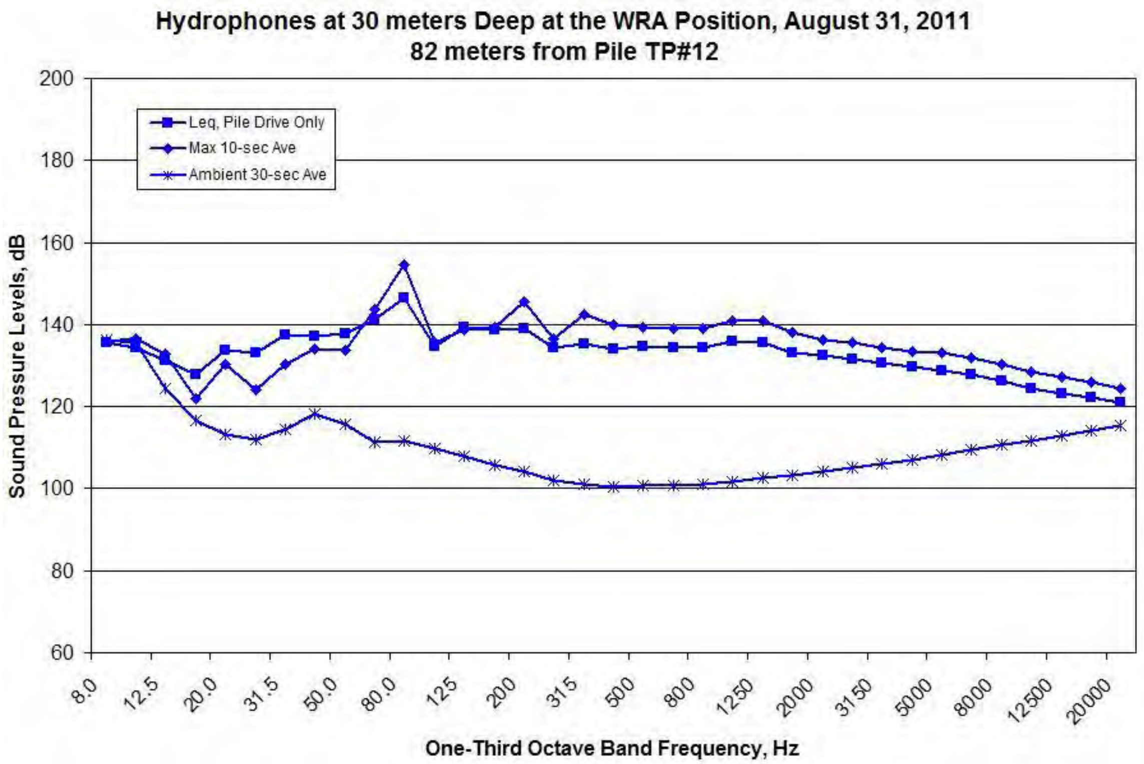

Figure A129. Spectral Data Measured at the WRA Location during TP#12, 14:27-14:31, Measured at Depths of 30 meters on August 31, 2011

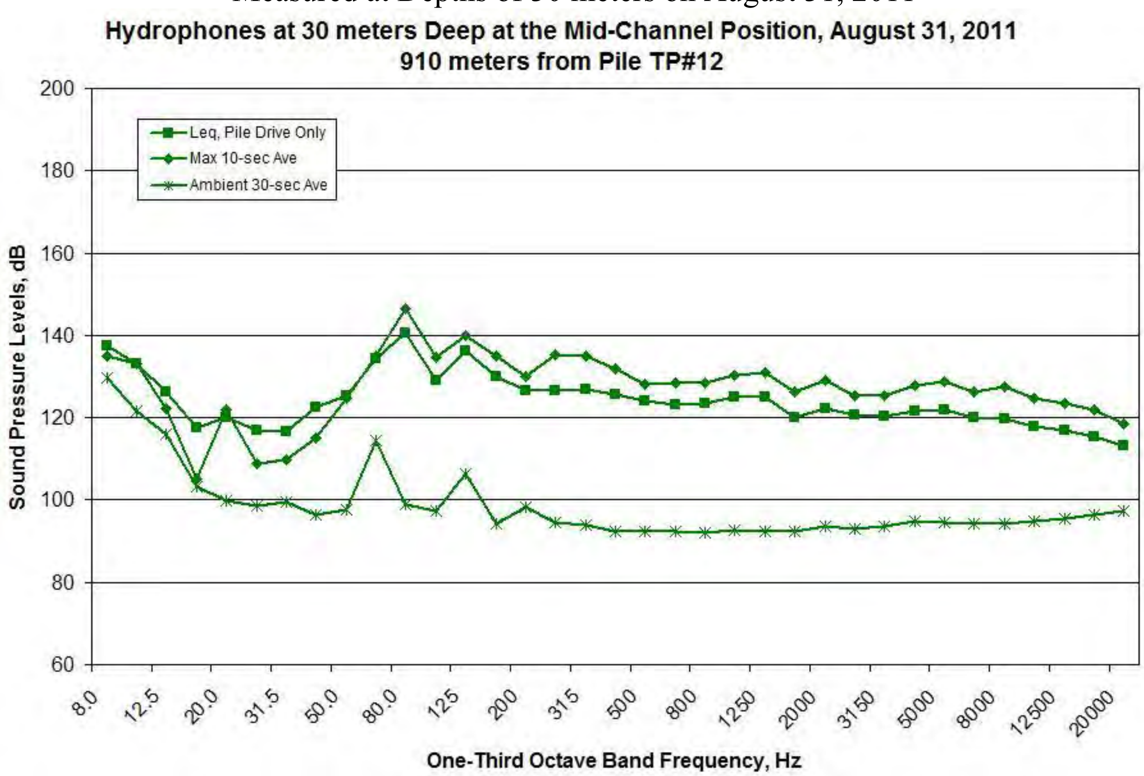

Figure A130. Spectral Data Measured at the MID Location during TP#12, 14:27-14:31, Measured at Depths of 30 meters on August 31, 2011

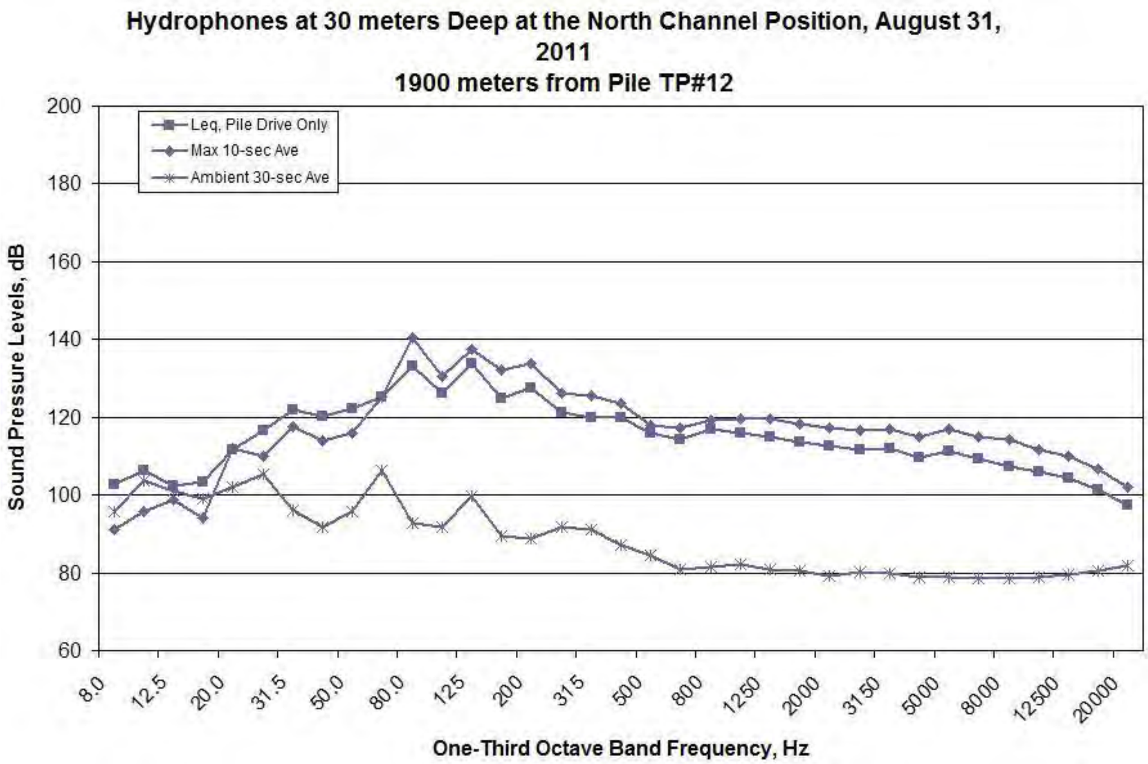

Figure A131. Spectral Data Measured at the NO Location during TP#12, 14:27-14:31, Measured at Depths of 30 meters on August 31, 2011

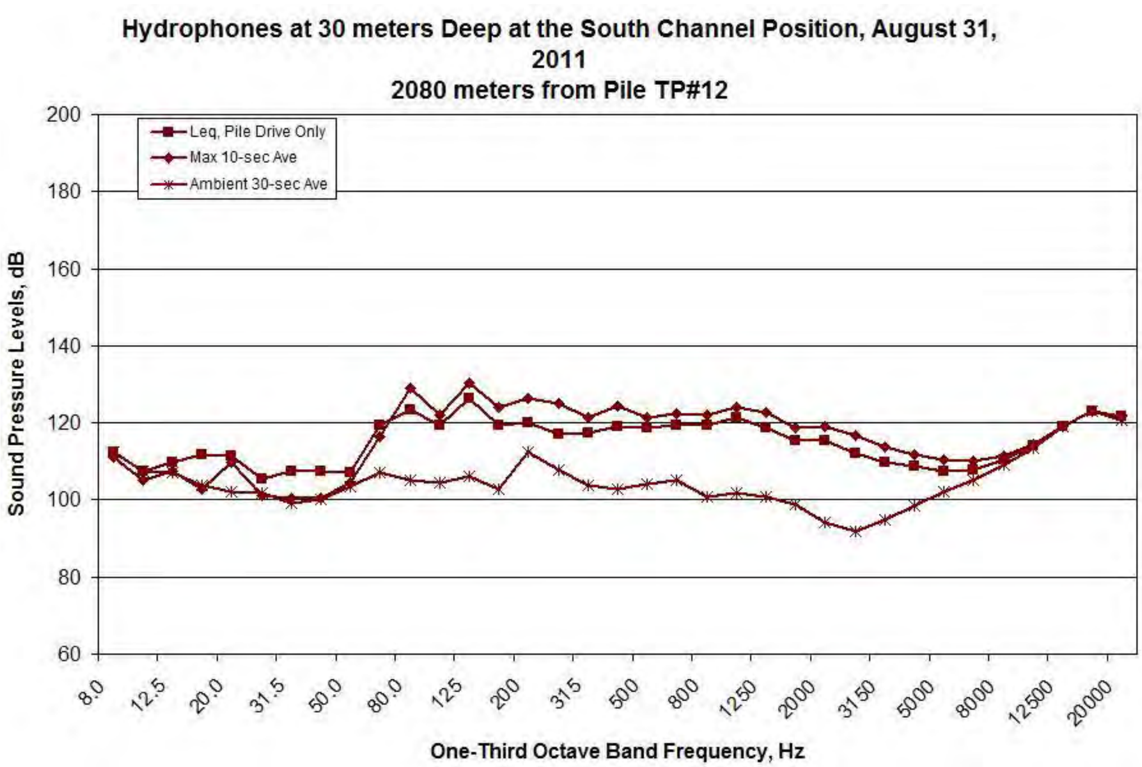

Figure A132. Spectral Data Measured at the SO Location during TP#12, 14:27-14:31, Measured at Depths of 30 meters on August 31, 2011

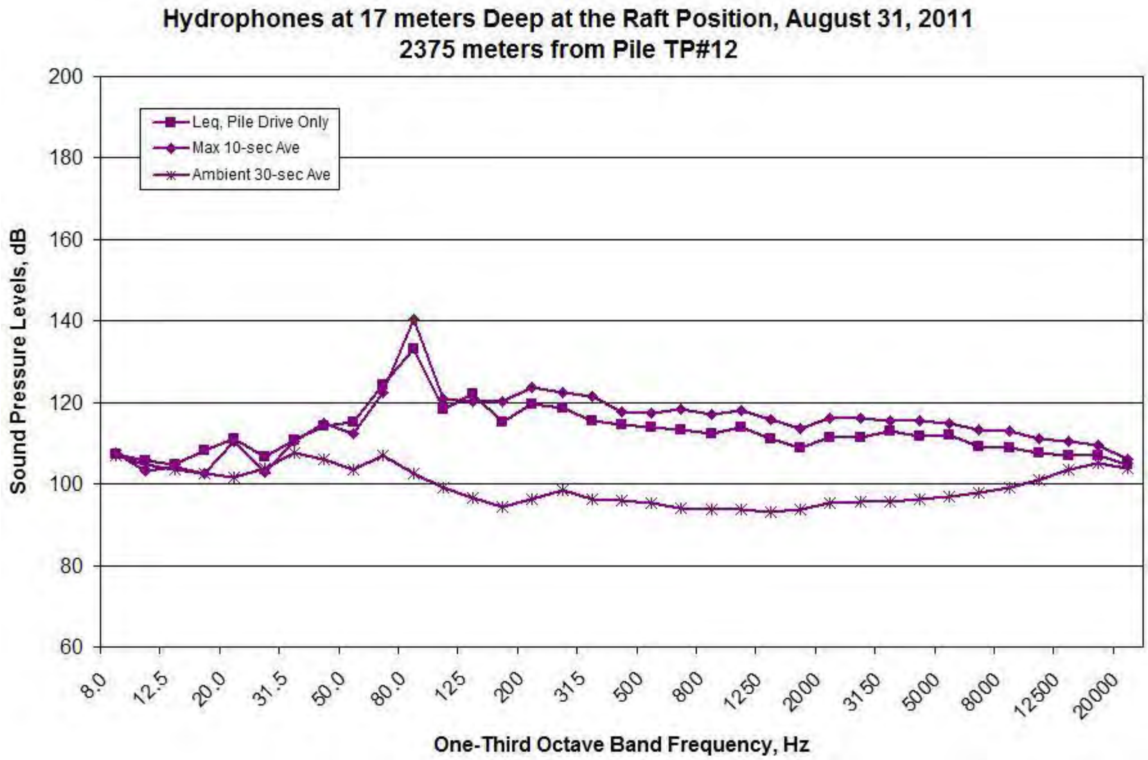

Figure A133. Spectral Data Measured at the RFT Location during TP#12, 14:27-14:31, Measured at Depths of 17 meters on August 31, 2011

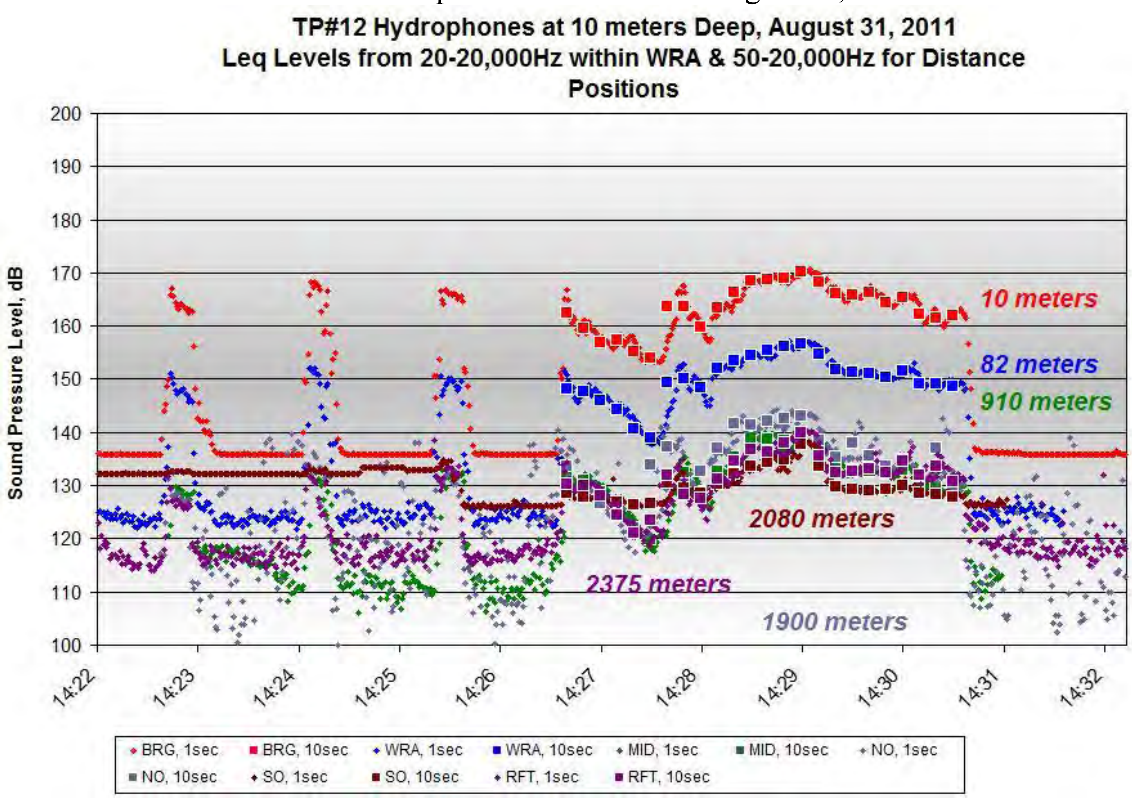

Figure A134. One-second and 10-second Average Data for TP#12, 14:27-14:31, Measured at Depths of 10 meters on August 31, 2011

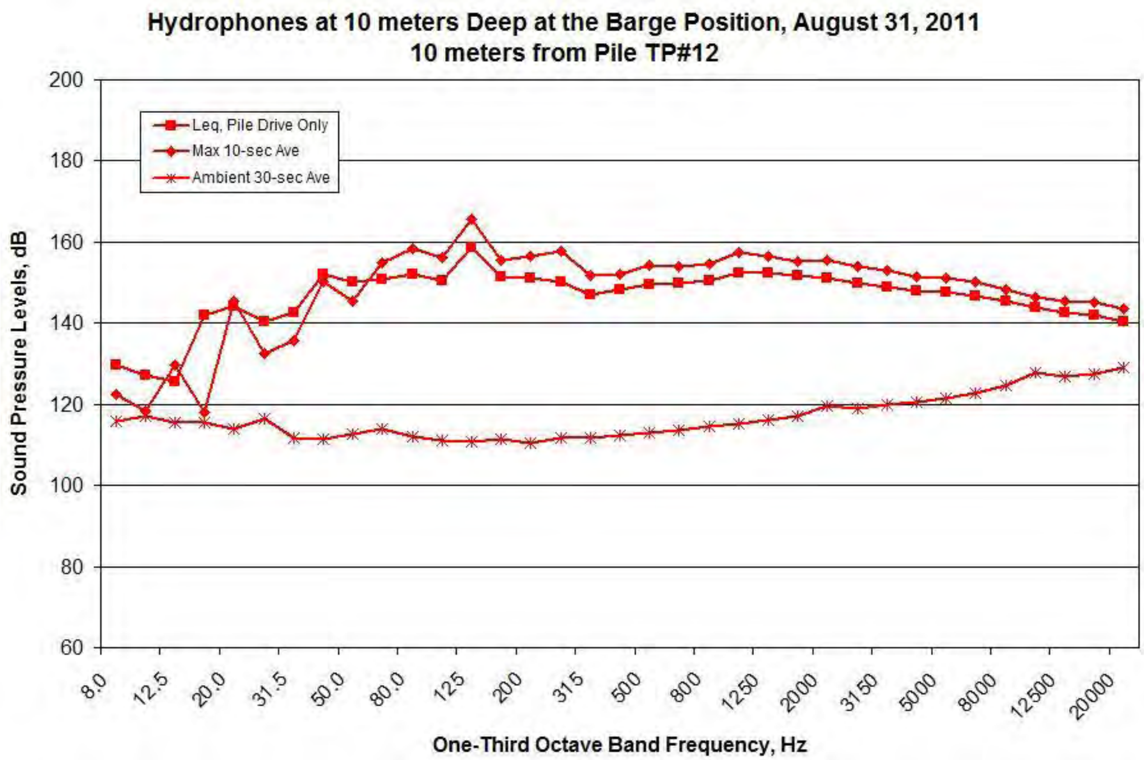

Figure A135. Spectral Data Measured at the BRG Location during TP#12, 14:27-14:31, Measured at Depths of 10 meters on August 31, 2011

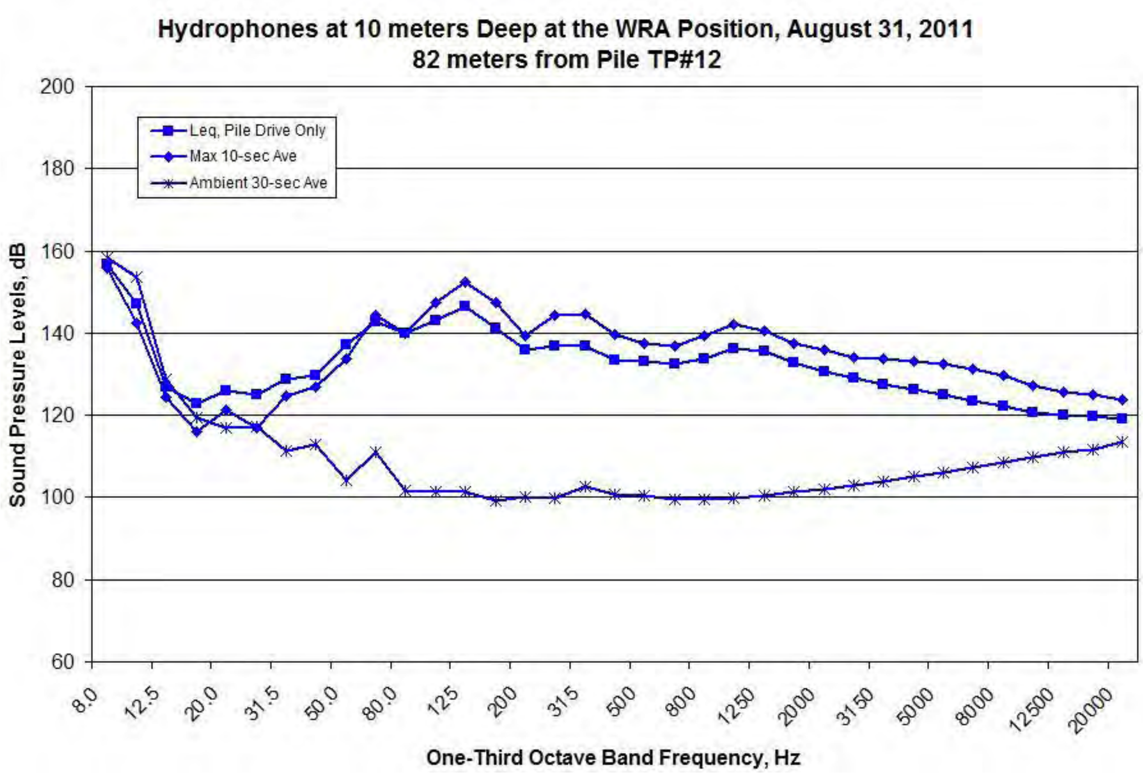

Figure A136. Spectral Data Measured at the WRA Location during TP#12, 14:27-14:31, Measured at Depths of 10 meters on August 31, 2011

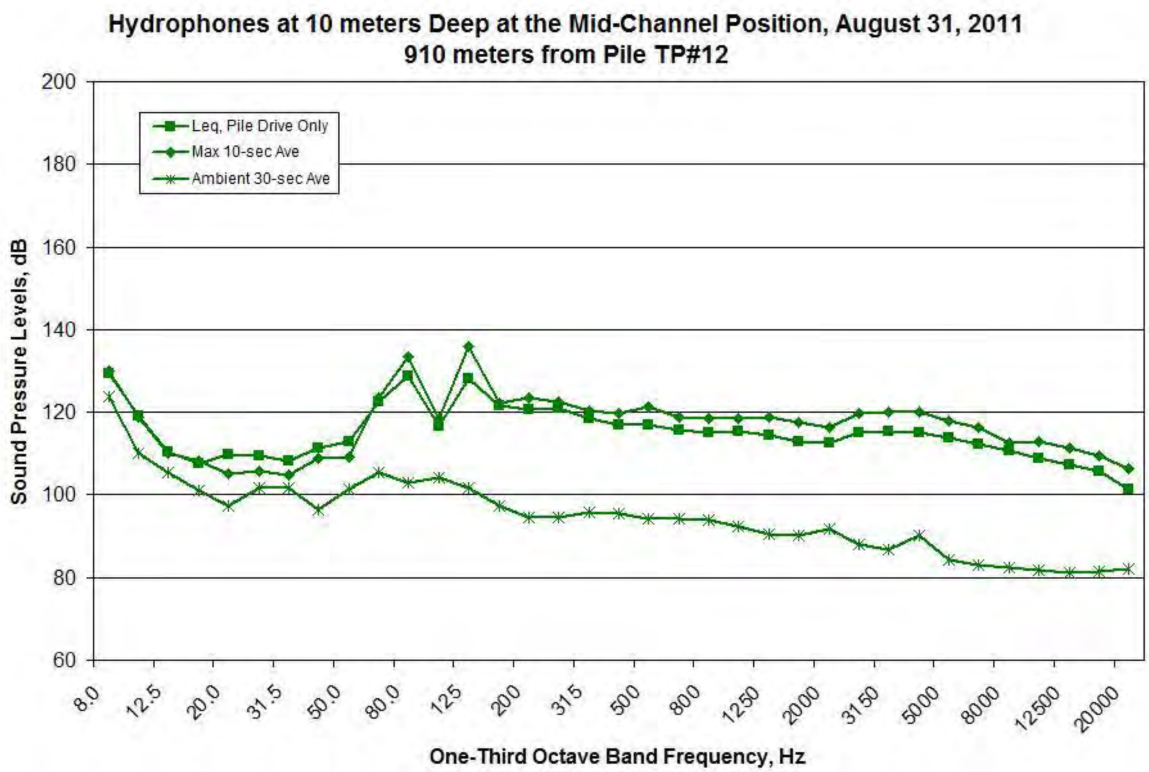

Figure A137. Spectral Data Measured at the MID Location during TP#12, 14:27-14:31, Measured at Depths of 10 meters on August 31, 2011

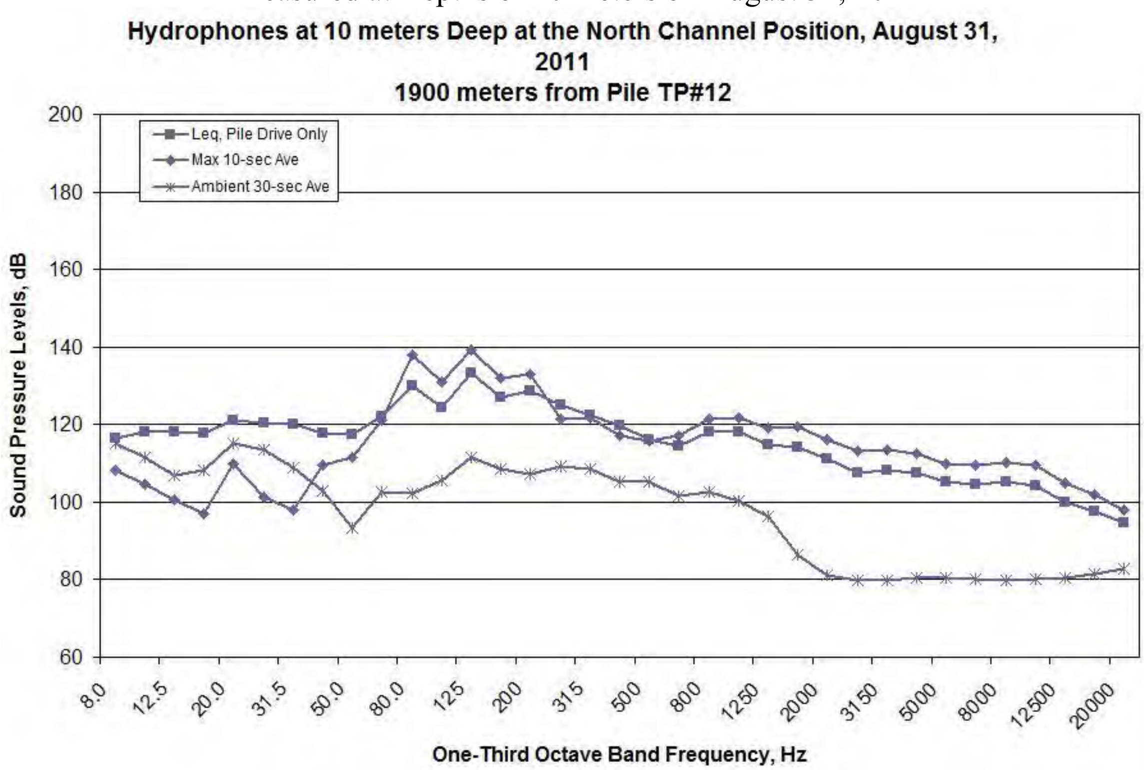

Figure A138. Spectral Data Measured at the NO Location during TP#12, 14:27-14:31, Measured at Depths of 10 meters on August 31, 2011

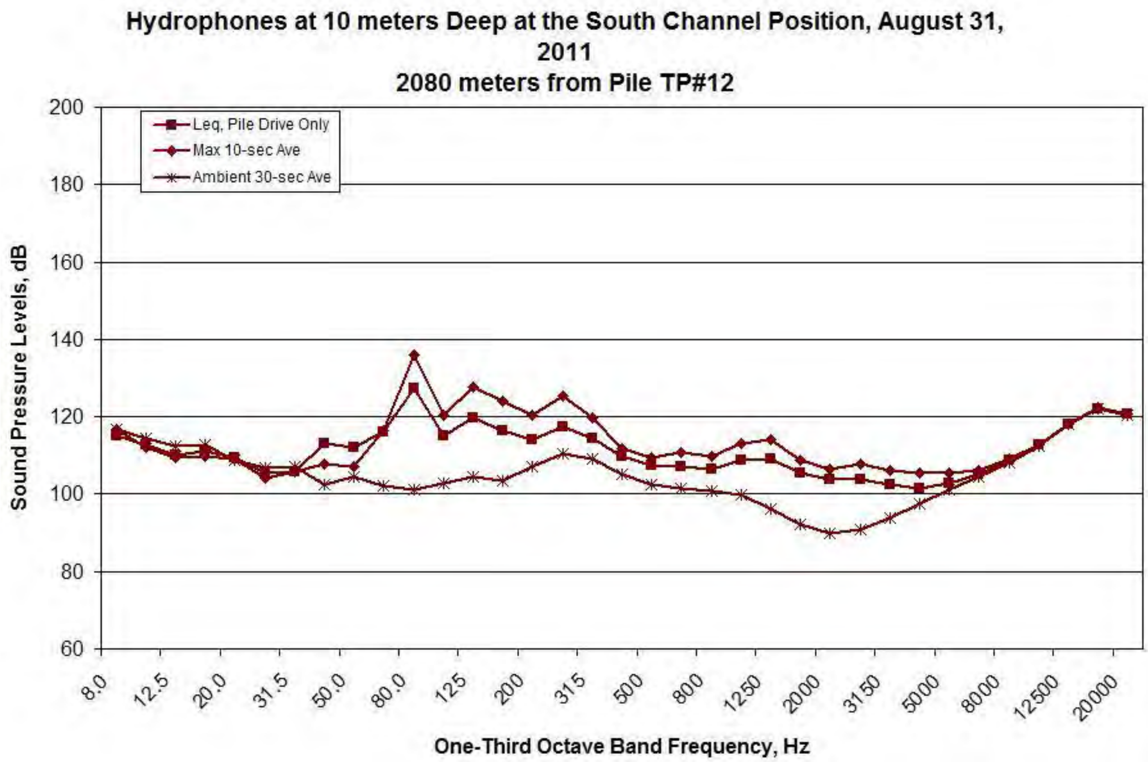

Figure A139. Spectral Data Measured at the SO Location during TP#12, 14:27-14:31, Measured at Depths of 10 meters on August 31, 2011

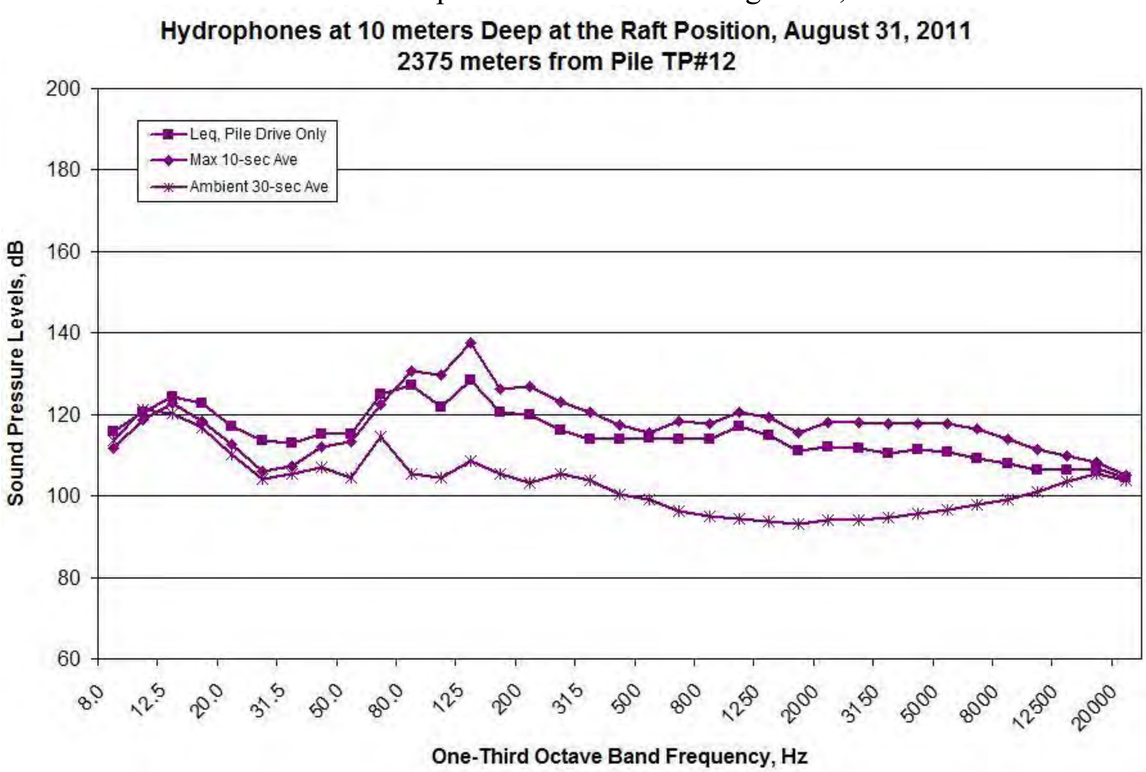

Figure A140. Spectral Data Measured at the RFT Location during TP#12, 14:27-14:31, Measured at Depths of 10 meters on August 31, 2011

9/8/2011 – TP#3 RP#3 (Vibratory Installation)

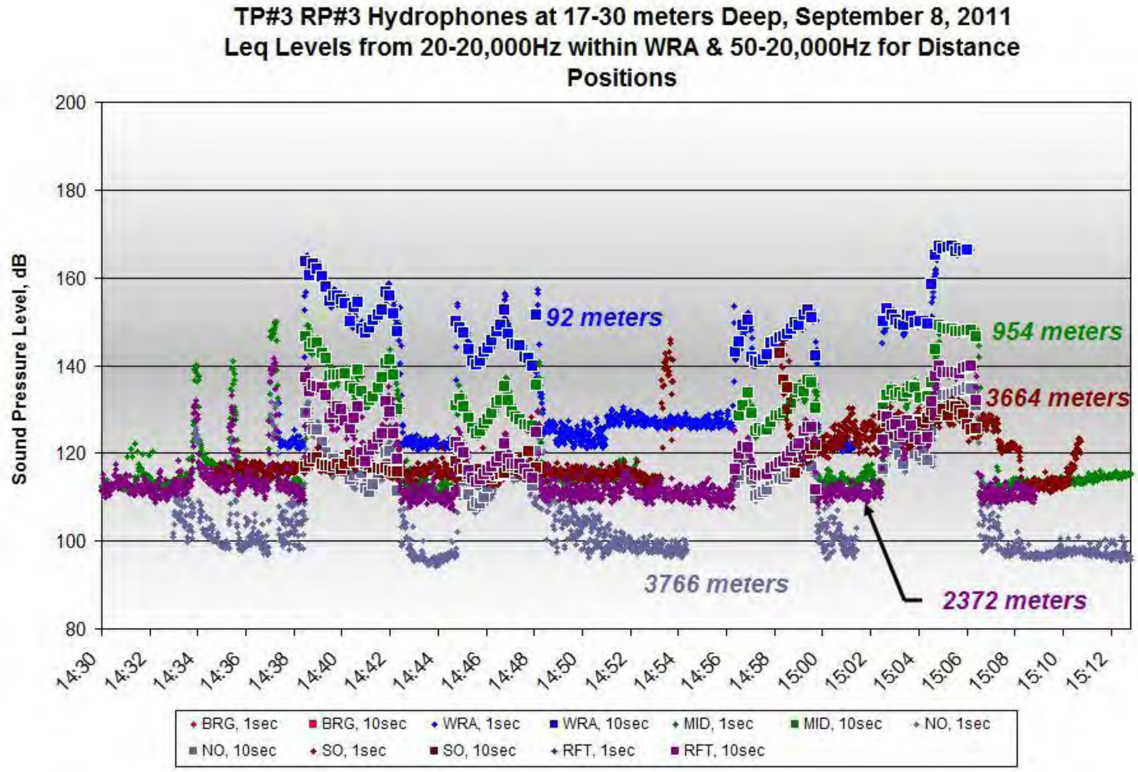

Figure A141. One-second and 10-second Average Data for TP#3 RP#3, 14:38-15:06, Measured at Depths of 17-30 meters on September 8, 2011

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Figure A142. Spectral Data Measured at the BRG Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 20 meters on September 8, 2011

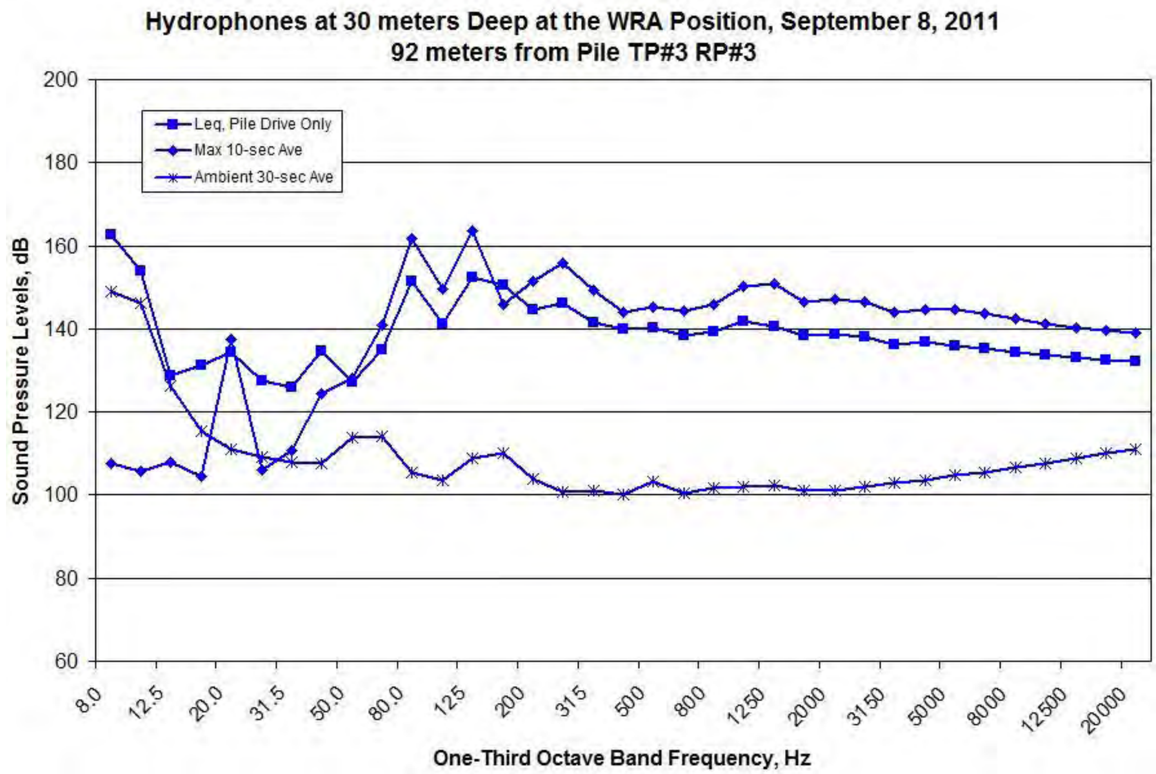

Figure A143. Spectral Data Measured at the WRA Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 30 meters on September 8, 2011

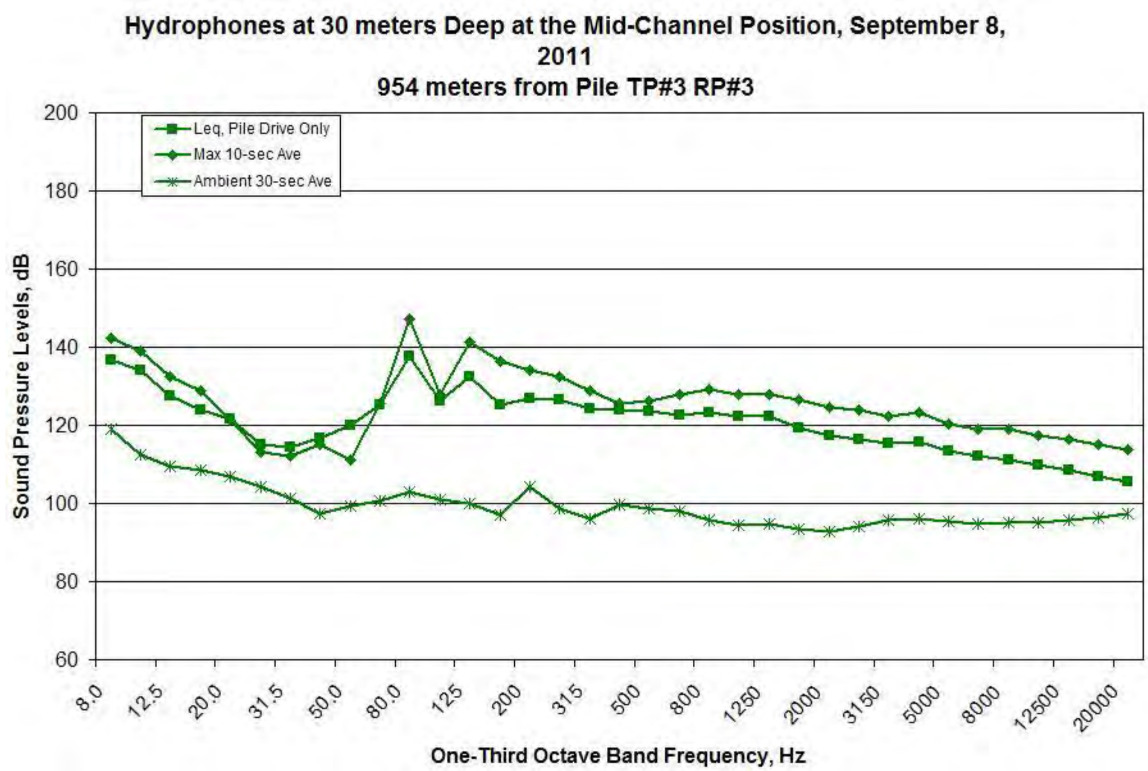

Figure A144. Spectral Data Measured at the MID Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 30 meters on September 8, 2011

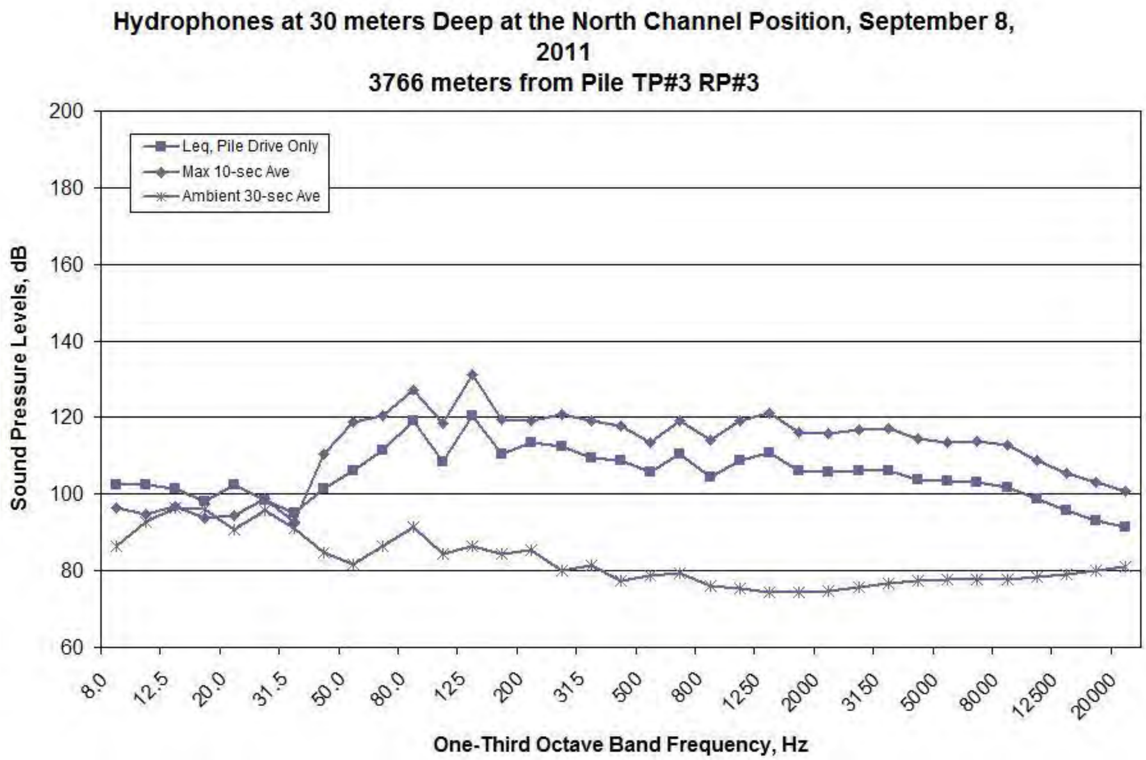

Figure A145. Spectral Data Measured at the NO Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 30 meters on September 8, 2011

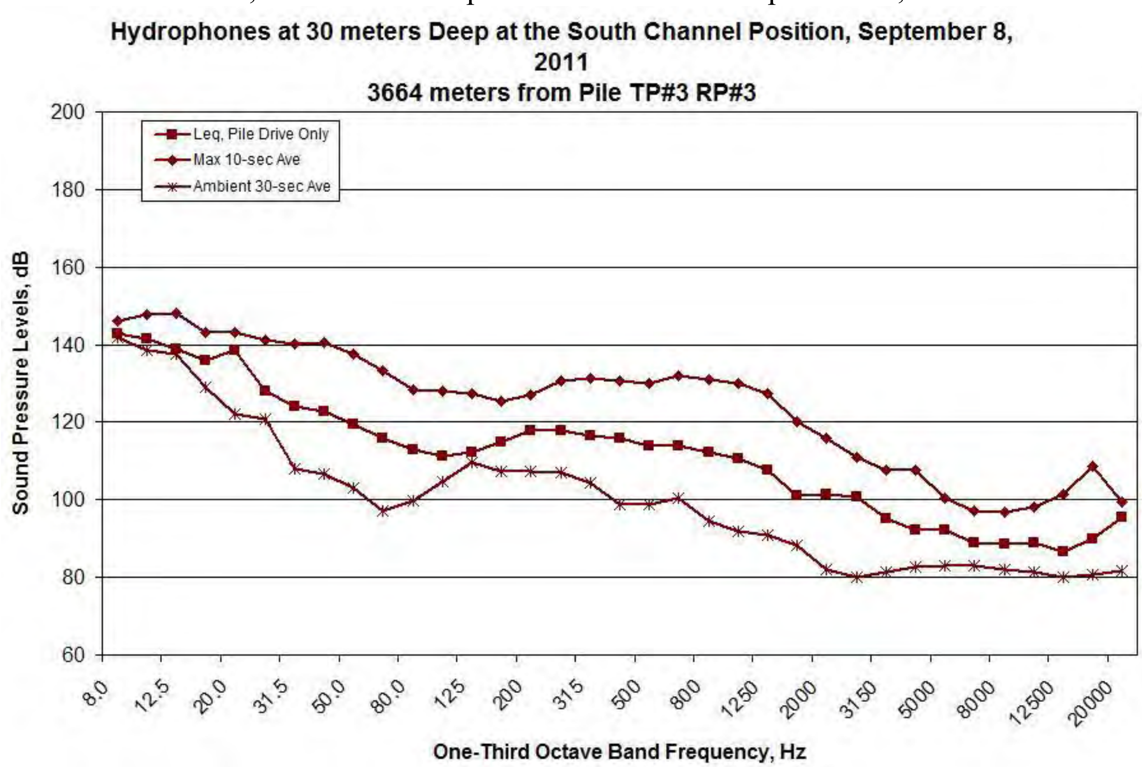

Figure A146. Spectral Data Measured at the SO Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 30 meters on September 8, 2011

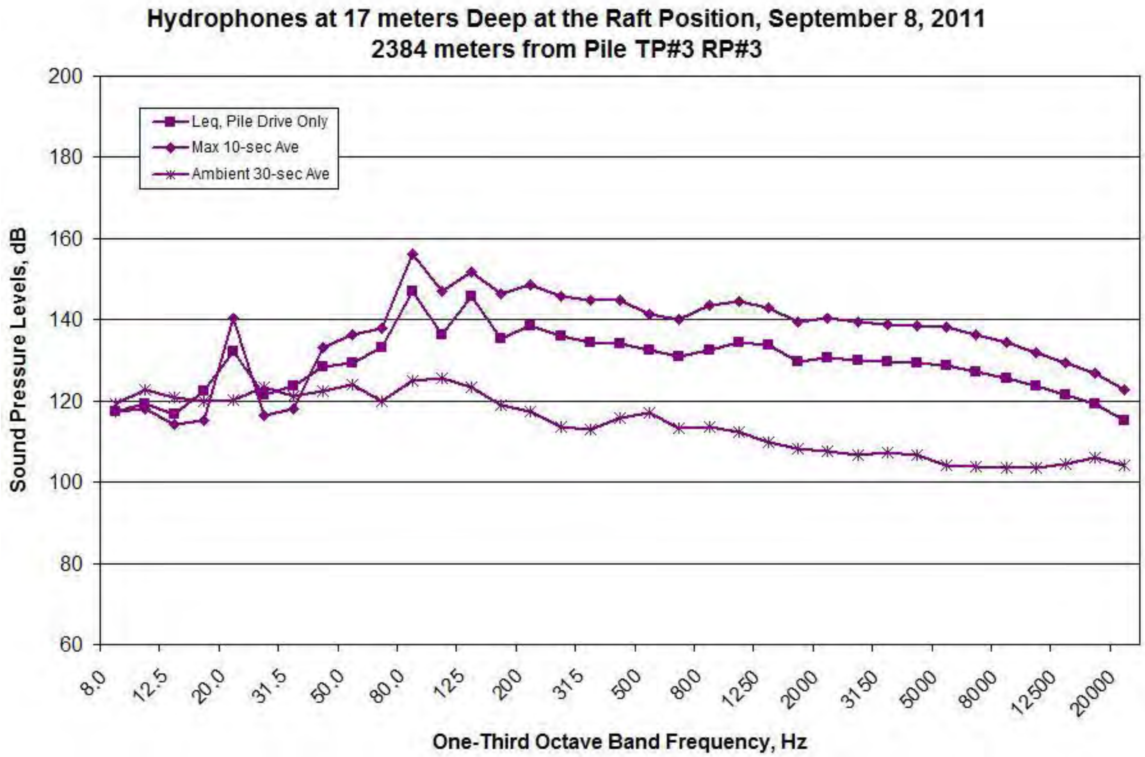

Figure A147. Spectral Data Measured at the RFT Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 17 meters on September 8, 2011

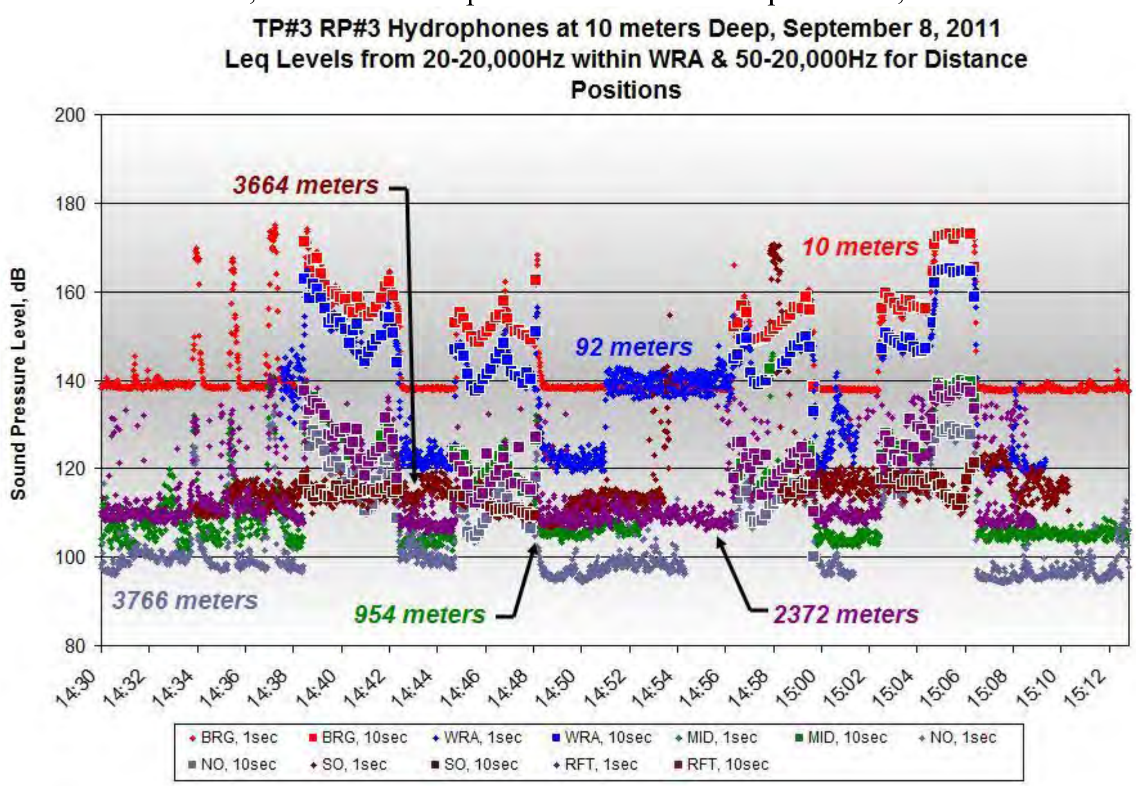

Figure A148. One-second and 10-second Average Data for TP#3 RP#3, 14:38-15:06, Measured at Depths of 10 meters on September 8, 2011

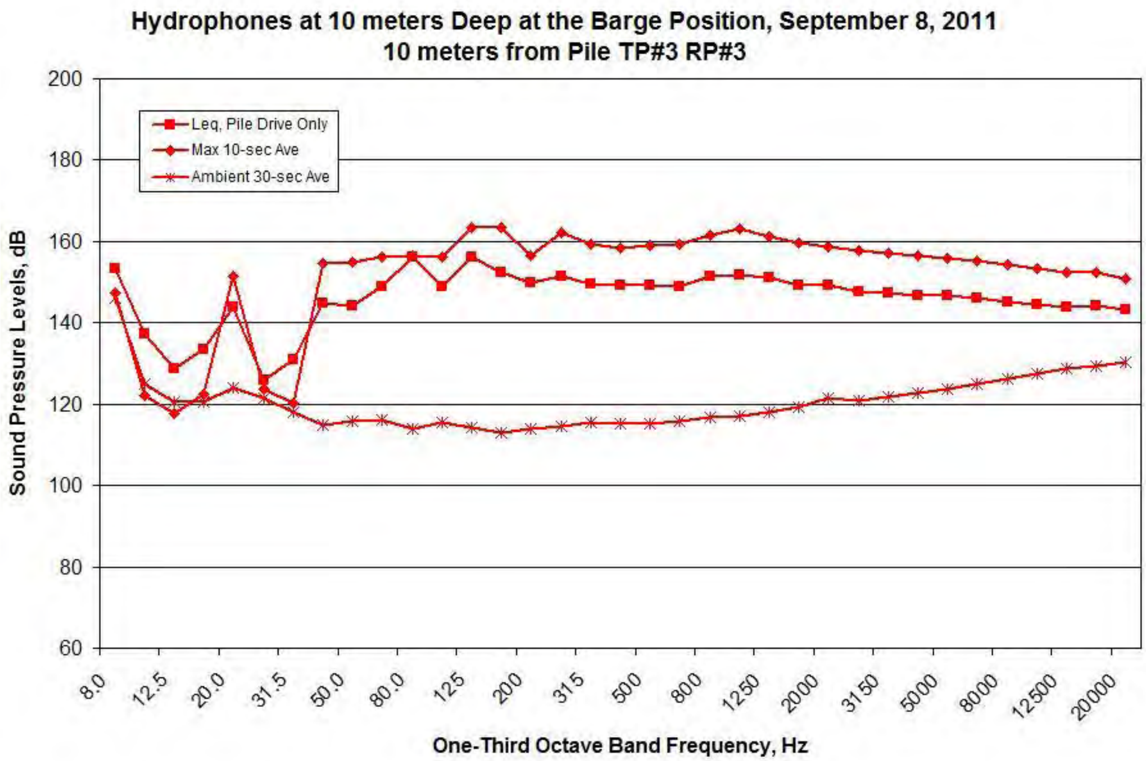

Figure A149. Spectral Data Measured at the BRG Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 10 meters on September 8, 2011

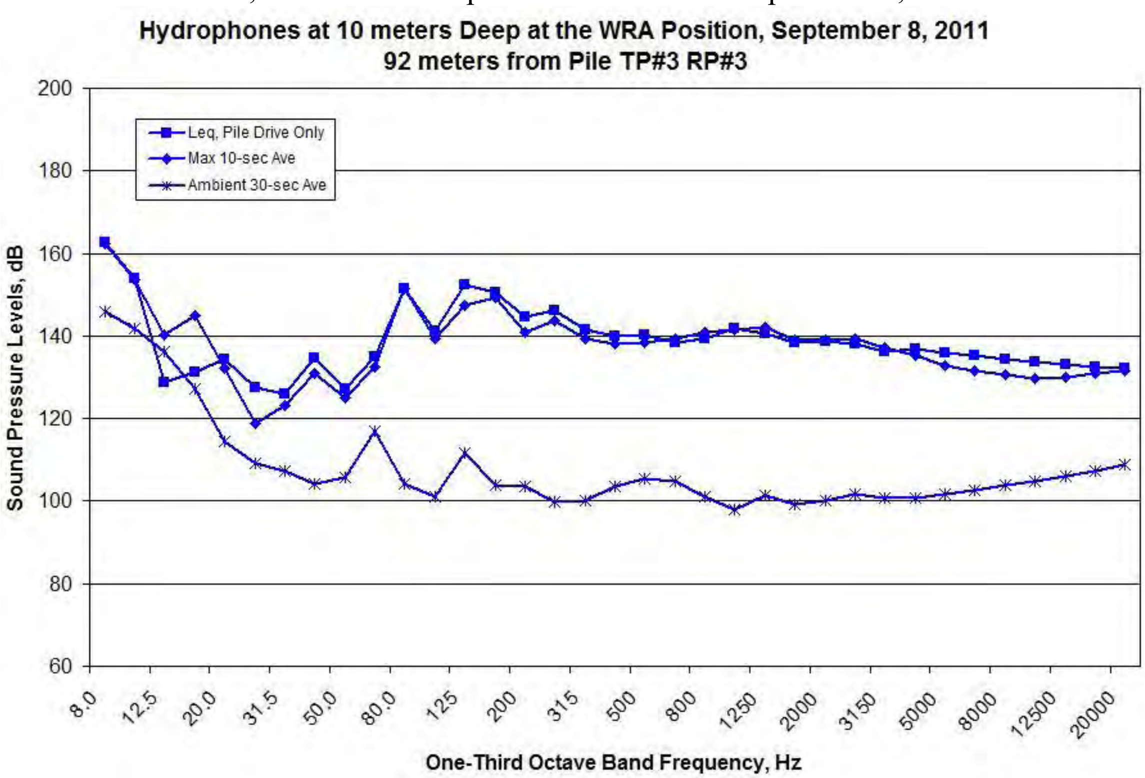

Figure A150. Spectral Data Measured at the WRA Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 10 meters on September 8, 2011

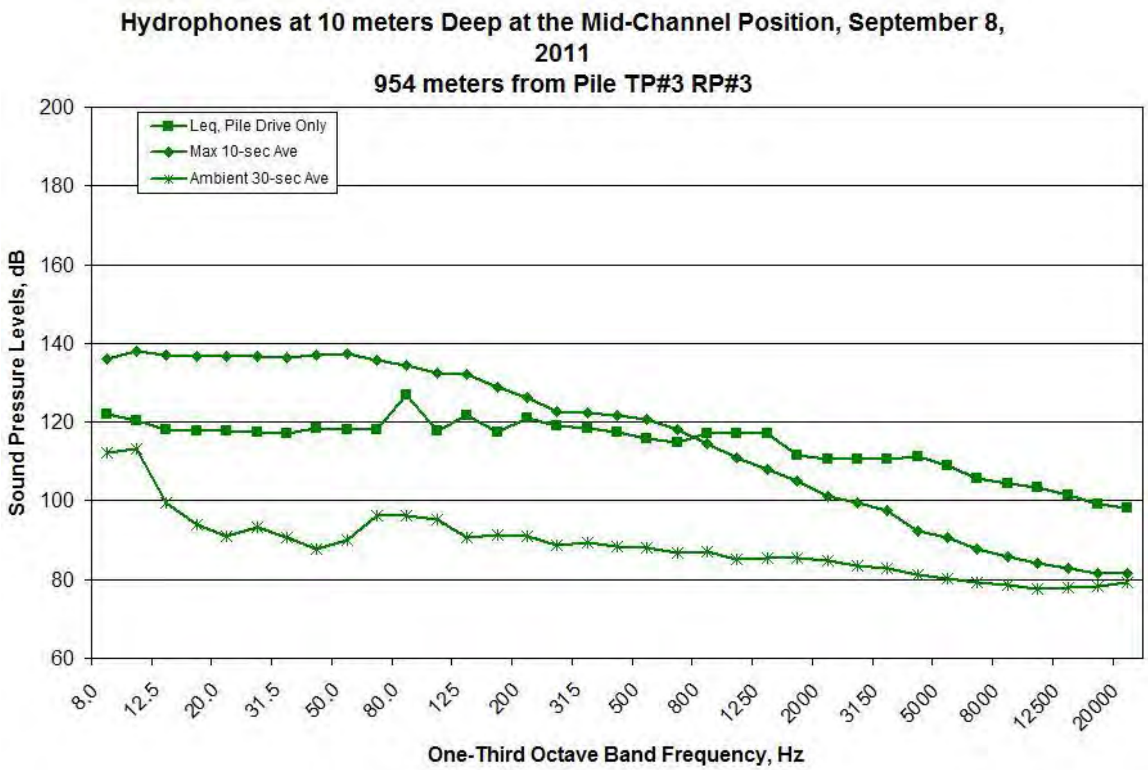

Figure A151. Spectral Data Measured at the MID Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 10 meters on September 8, 2011

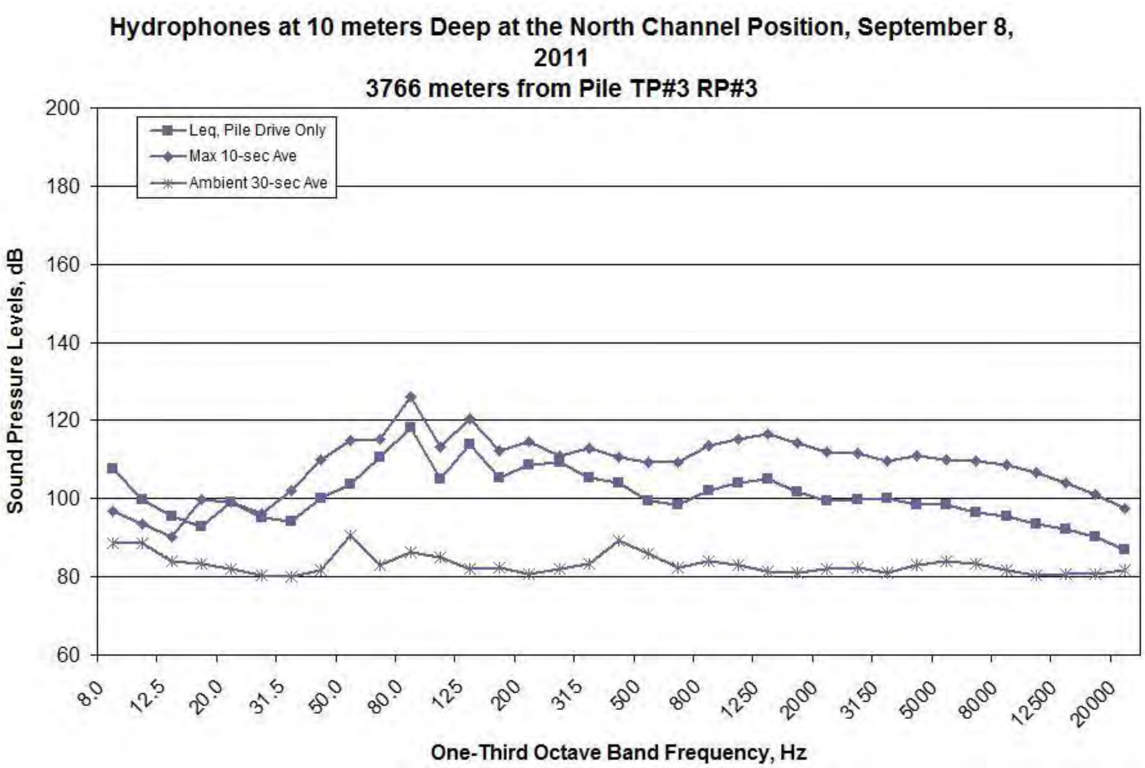

Figure A152. Spectral Data Measured at the NO Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 10 meters on September 8, 2011

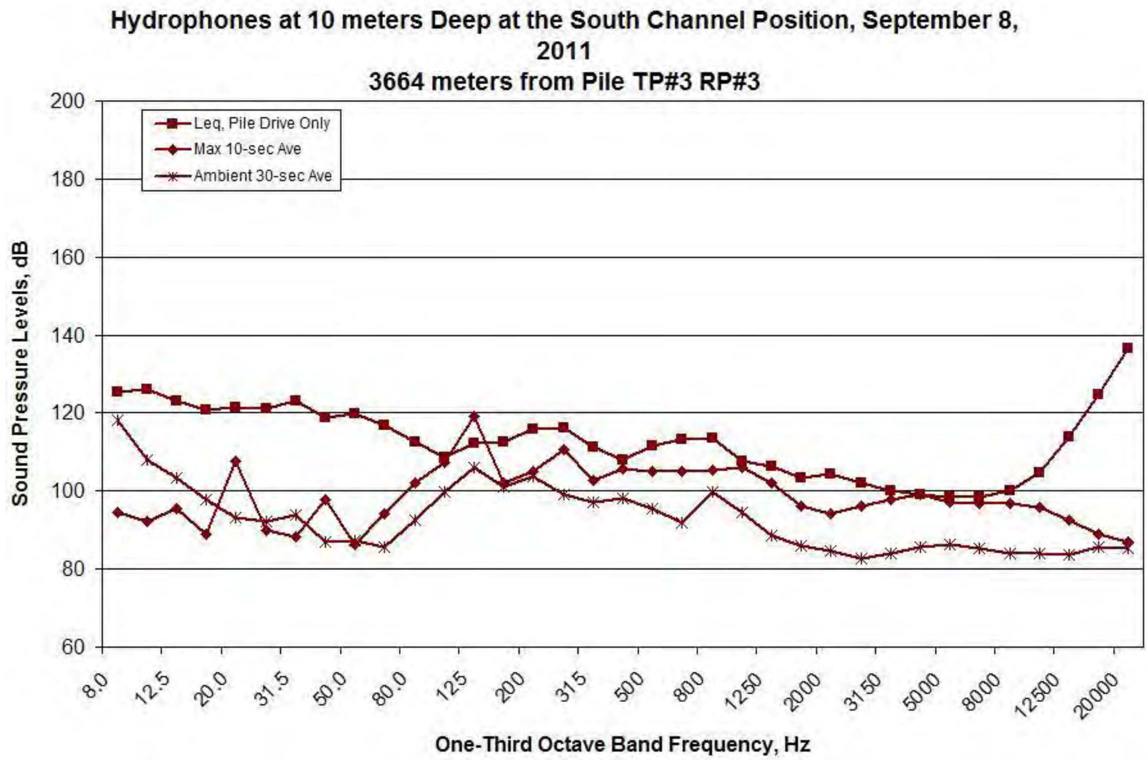

Figure A153. Spectral Data Measured at the SO Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 10 meters on September 8, 2011

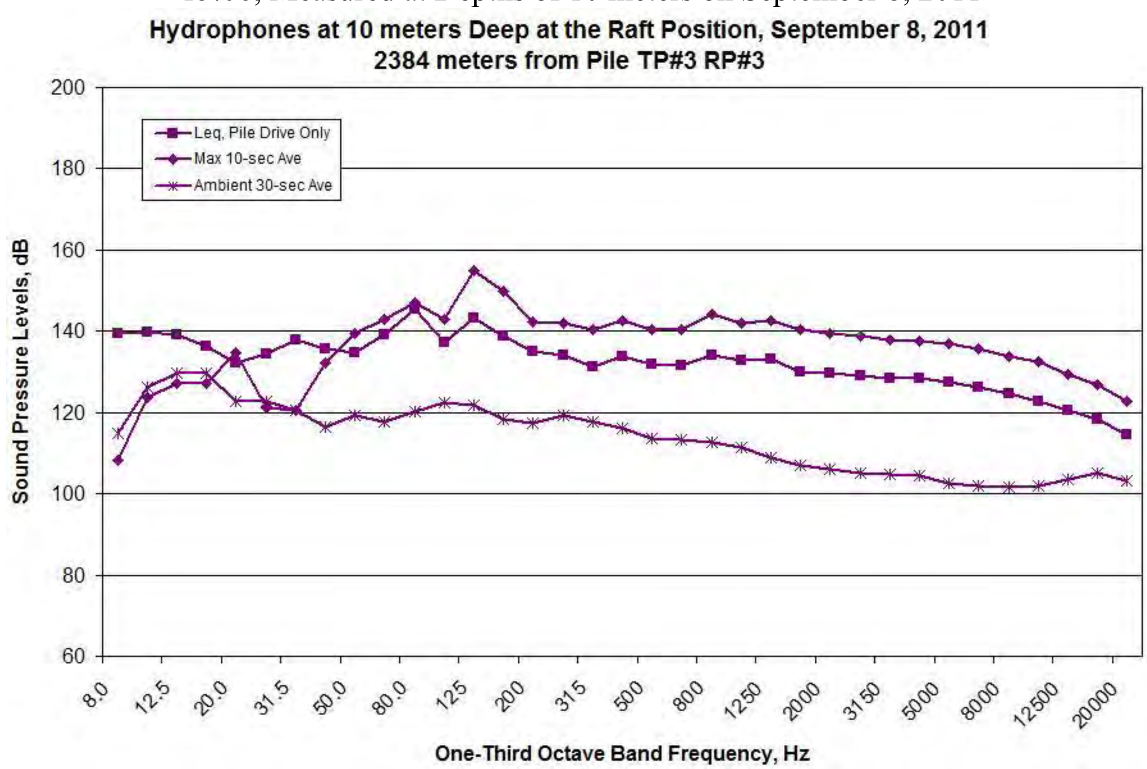

Figure A154. Spectral Data Measured at the RFT Location during TP#3 RP#3, 14:38-15:06, Measured at Depths of 10 meters on September 8, 2011

TP#3 RP#2, 16:21-16:32 (Vibratory Installation)

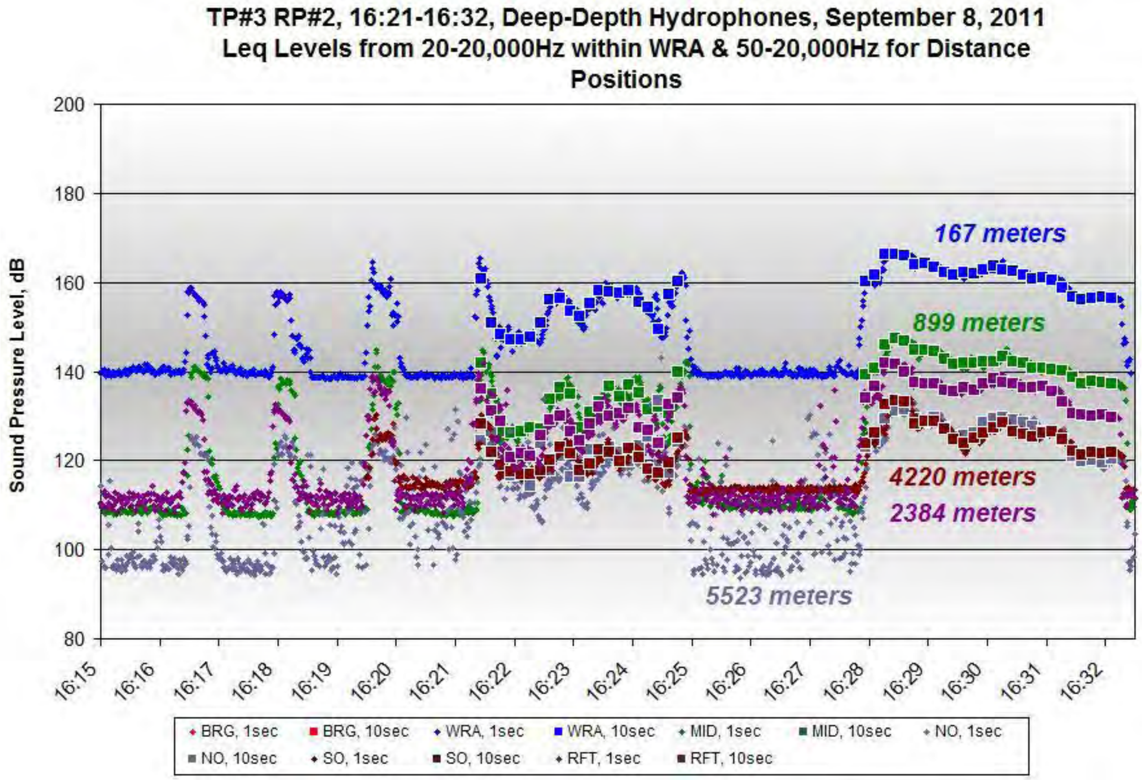

Figure A155. One-second and 10-second Average Data for TP#3 RP#2, 16:21-16:32, Measured at Depths of 17-30 meters on September 8, 2011

DATA NOT USABLE

Figure A56. Spectral Data Measured at the BRG Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 20 meters on September 8, 2011

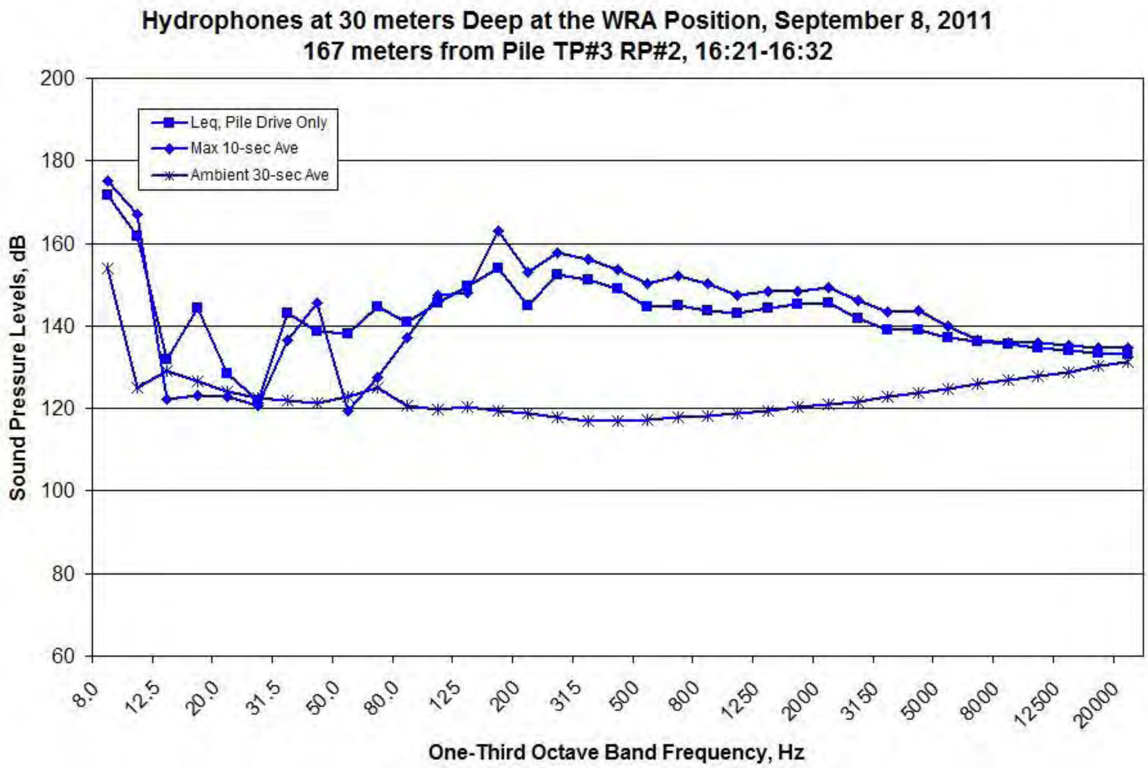

Figure A157. Spectral Data Measured at the WRA Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 30 meters on September 8, 2011

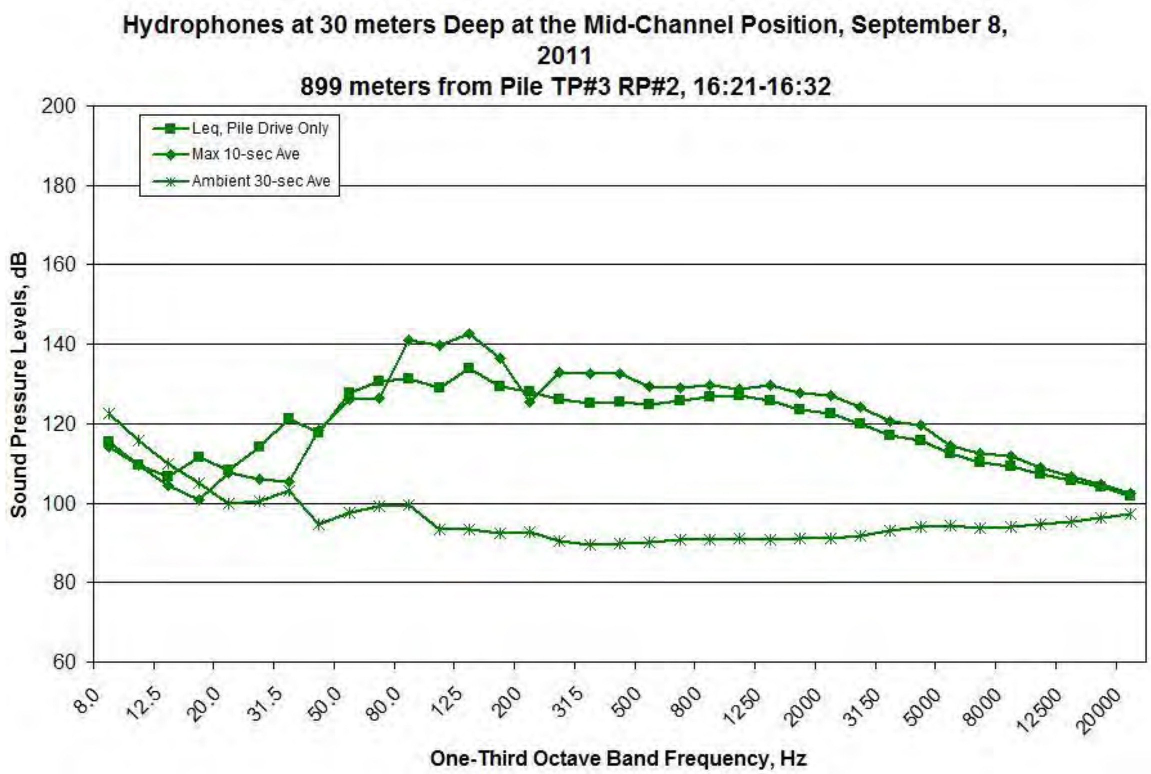

Figure A158. Spectral Data Measured at the MID Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 30 meters on September 8, 2011

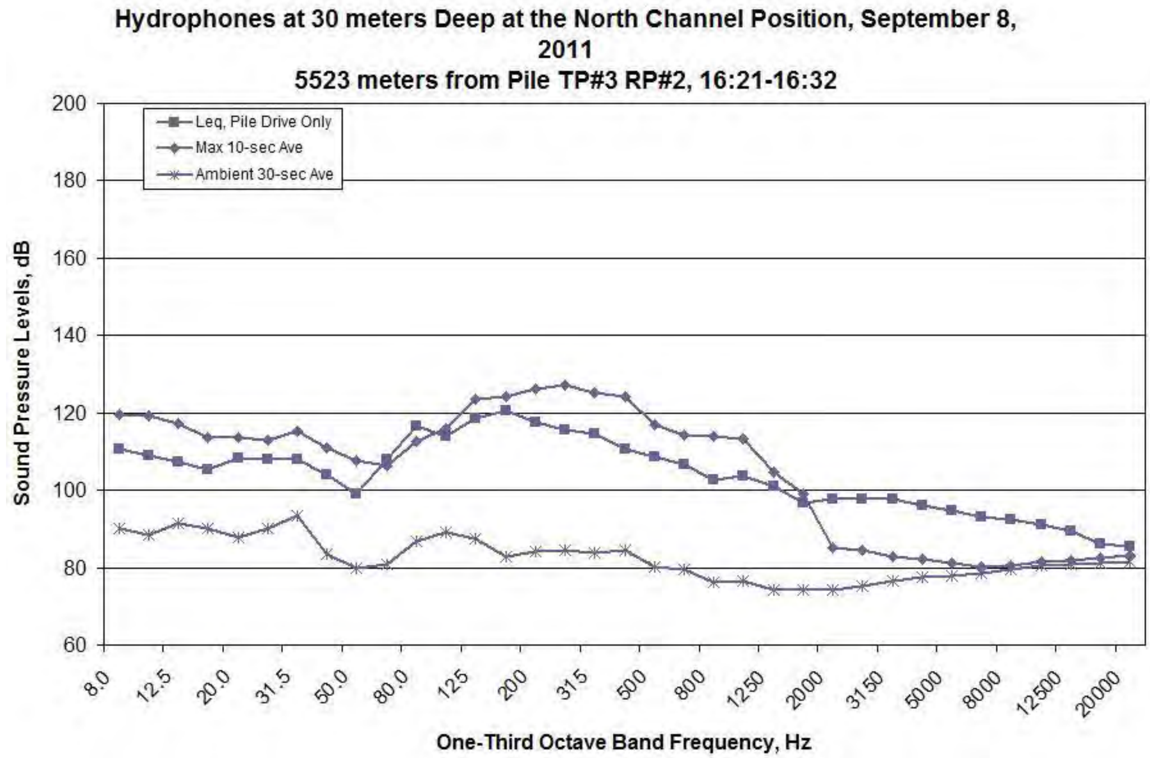

Figure A159. Spectral Data Measured at the NO Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 30 meters on September 8, 2011

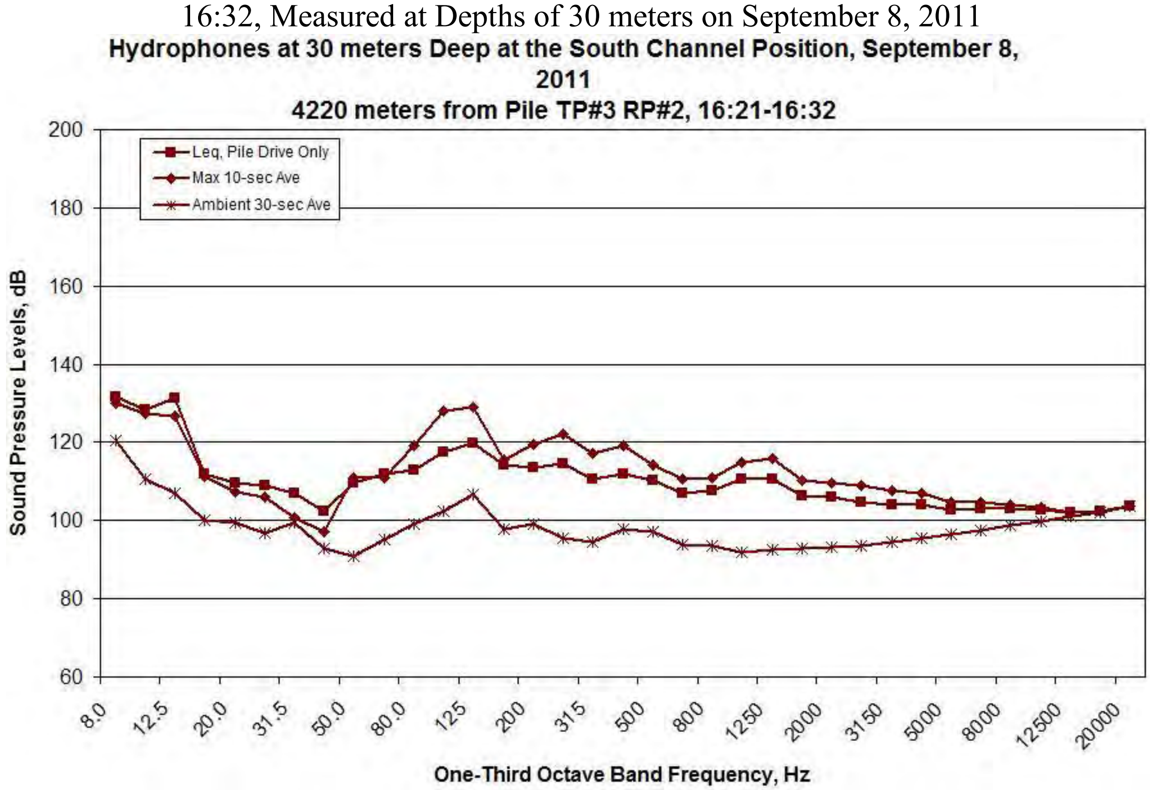

Figure A160. Spectral Data Measured at the SO Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 30 meters on September 8, 2011

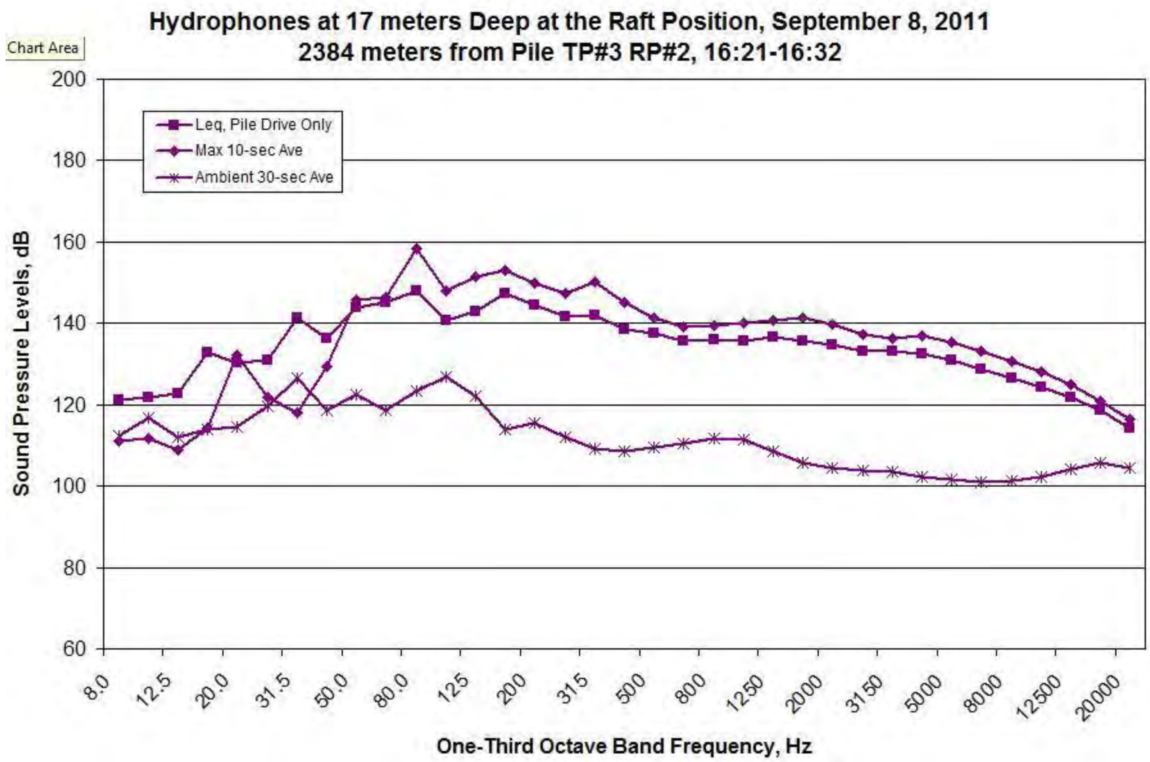

Figure A161. Spectral Data Measured at the RFT Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 17 meters on September 8, 2011

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Figure A162. One-second and 10-second Average Data for TP#3 RP#2, 16:21-16:32, Measured at Depths of 10 meters on September 8, 2011

SEE MAIN REPORT

Figure A163. Spectral Data Measured at the BRG Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 10 meters on September 8, 2011

SEE MAIN REPORT

Figure A164. Spectral Data Measured at the WRA Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 10 meters on September 8, 2011

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Figure A165. Spectral Data Measured at the MID Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 10 meters on September 8, 2011

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Figure A166. Spectral Data Measured at the NO Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 10 meters on September 8, 2011

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Figure A167. Spectral Data Measured at the SO Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 10 meters on September 8, 2011

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Figure A168. Spectral Data Measured at the RFT Location during TP#3 RP#2, 16:21-16:32, Measured at Depths of 10 meters on September 8, 2011

TP#3 RP#2, 16:45-16:57 (Vibratory Installation)

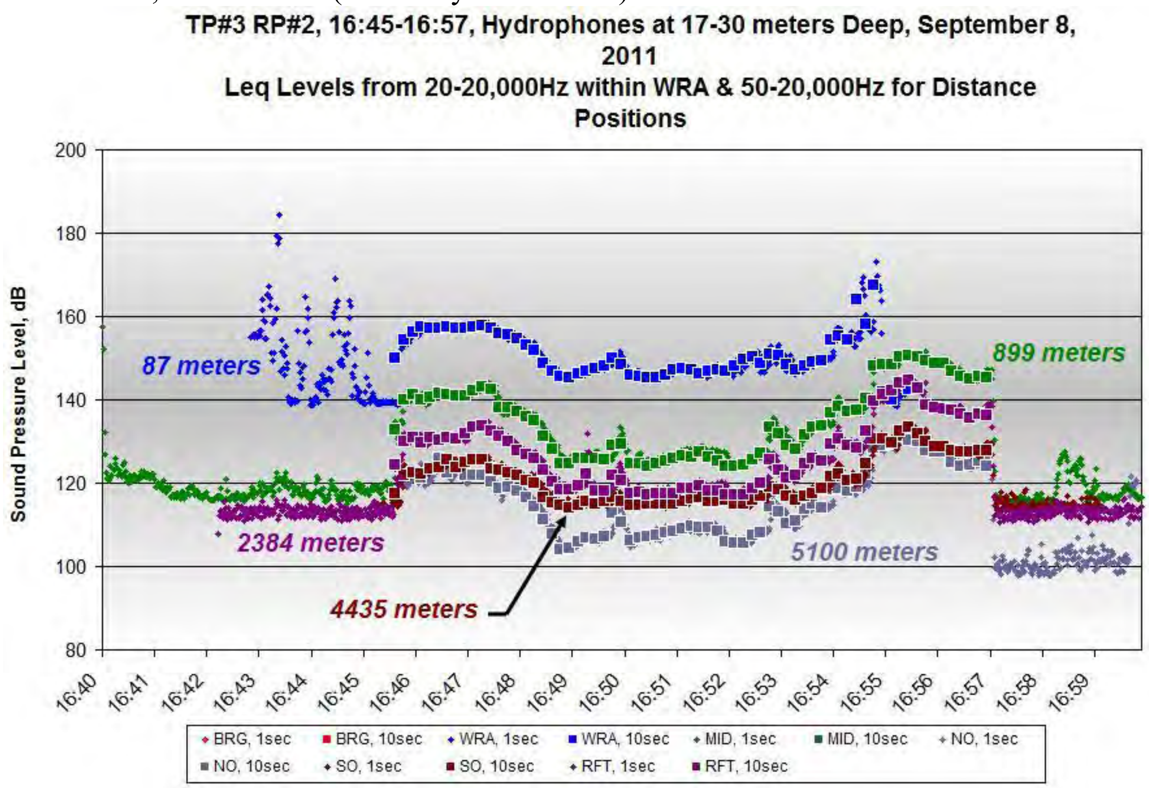

Figure A169. One-second and 10-second Average Data for TP#3 RP#2, 16:45-16:57, Measured at Depths of 17-30 meters on September 8, 2011

DATA NOT USABLE

Figure A170. Spectral Data Measured at the BRG Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 20 meters on September 8, 2011

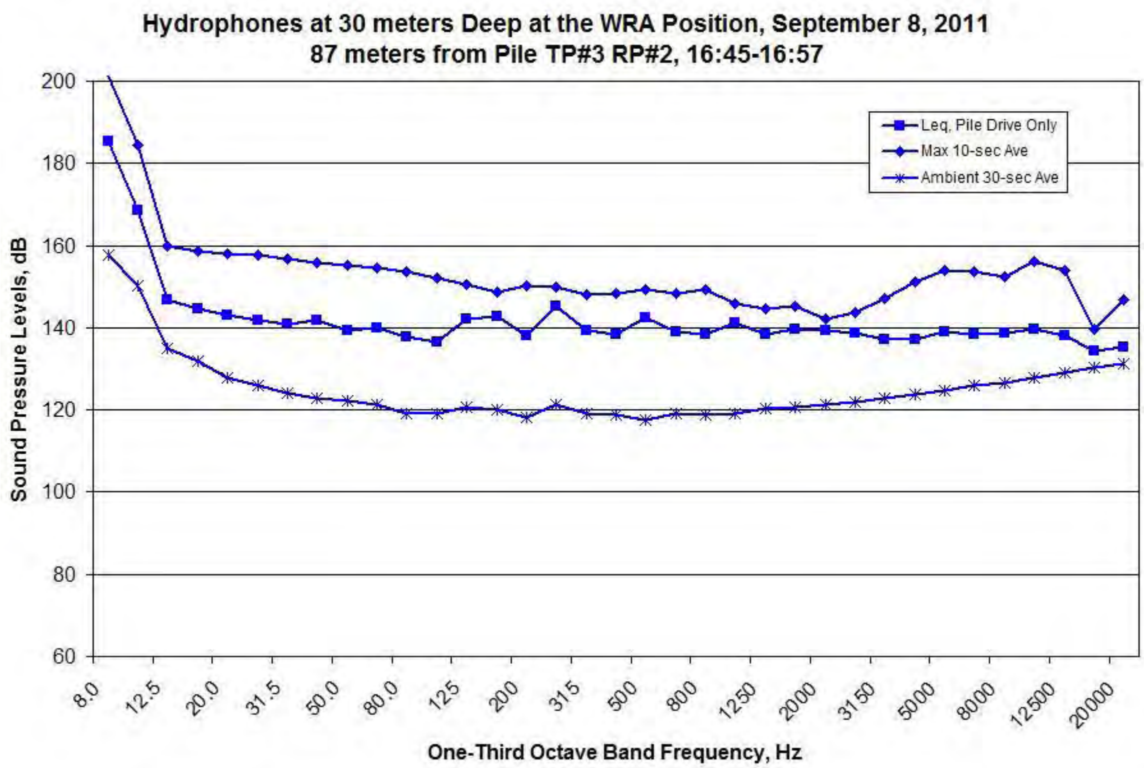

Figure A171. Spectral Data Measured at the WRA Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 30 meters on September 8, 2011

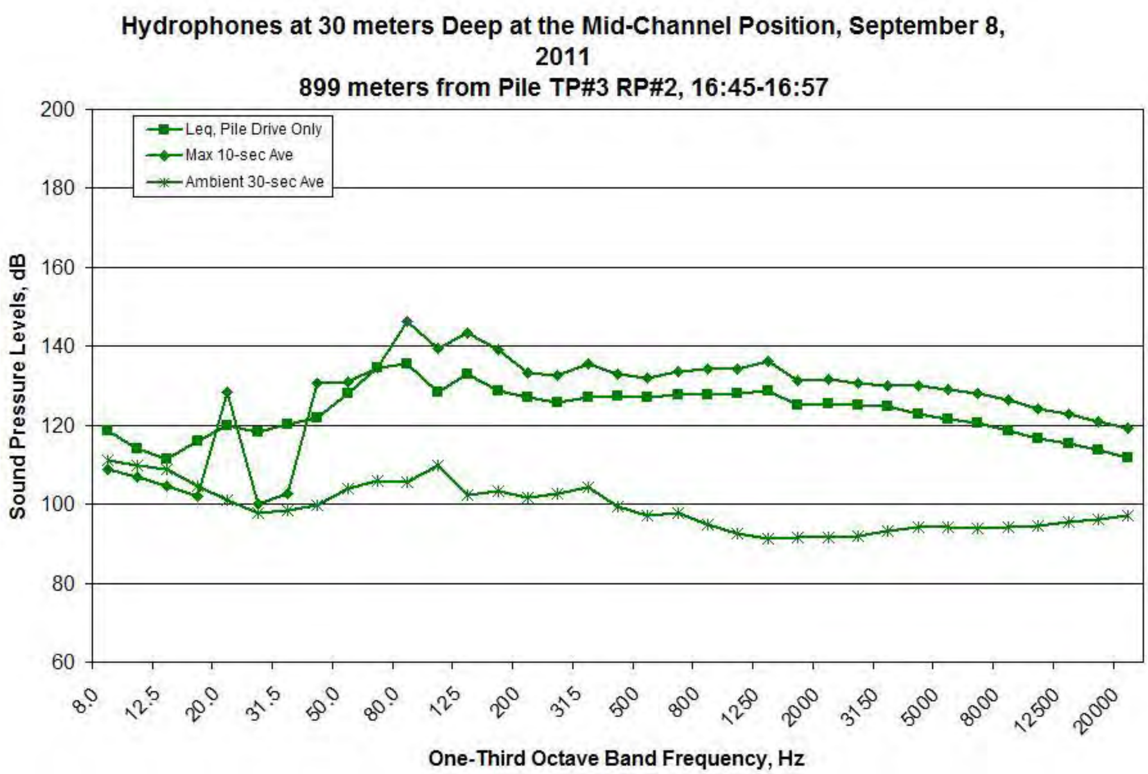

Figure A172. Spectral Data Measured at the MID Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 30 meters on September 8, 2011

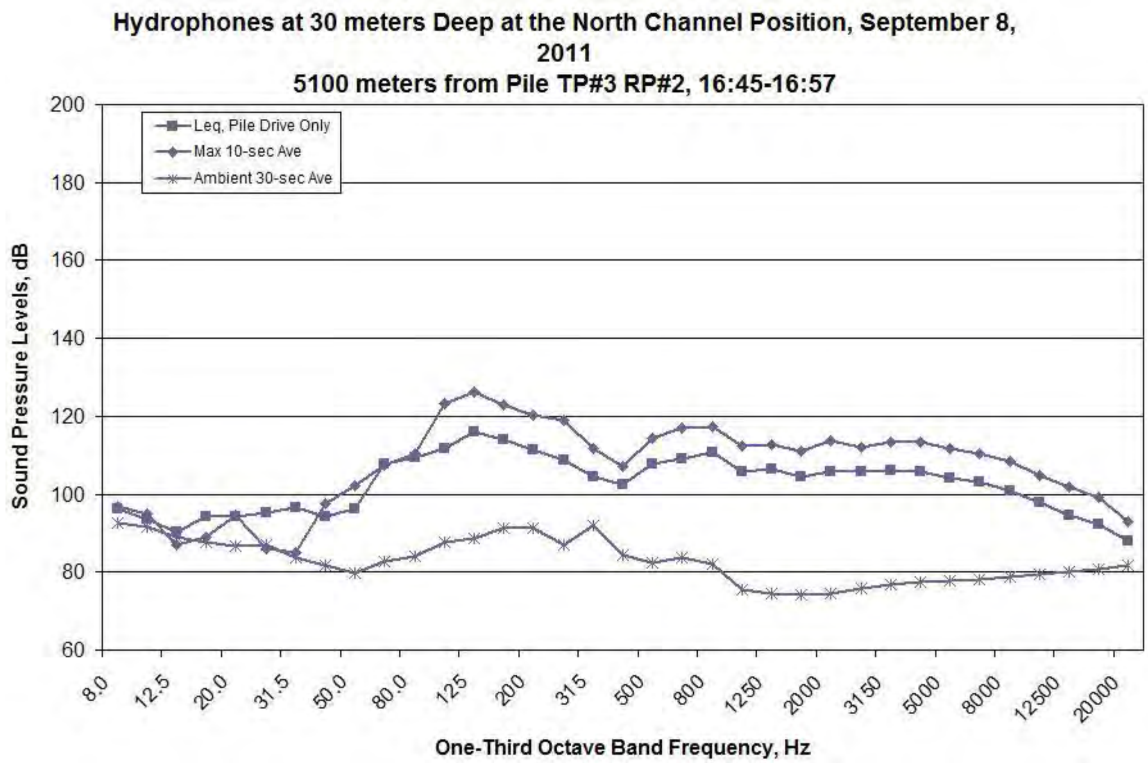

Figure A173. Spectral Data Measured at the NO Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 30 meters on September 8, 2011

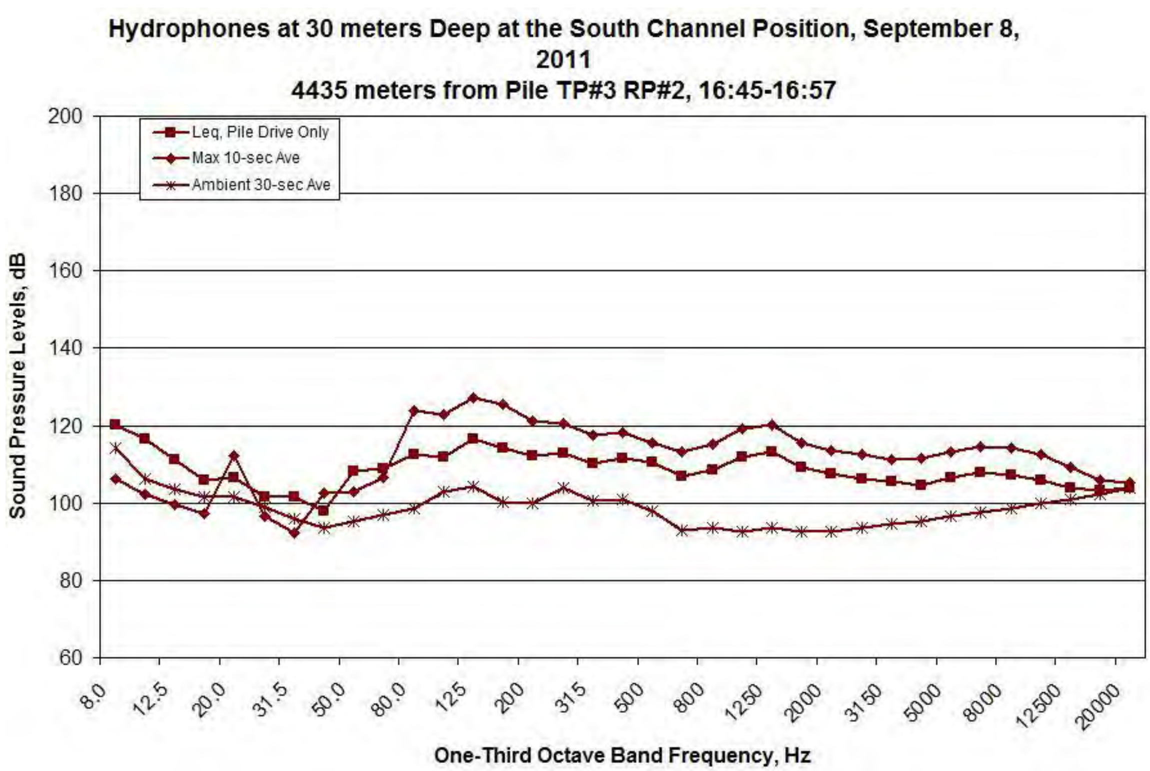

Figure A174. Spectral Data Measured at the SO Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 30 meters on September 8, 2011

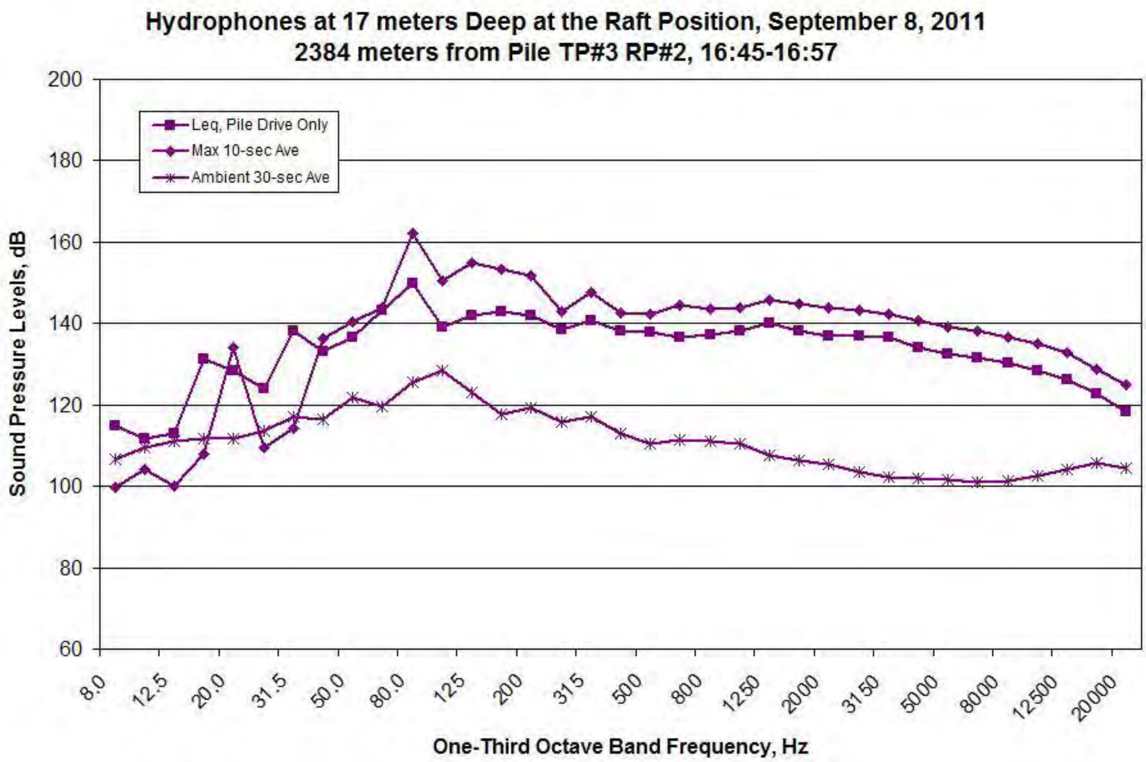

Figure A175. Spectral Data Measured at the RFT Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 17 meters on September 8, 2011

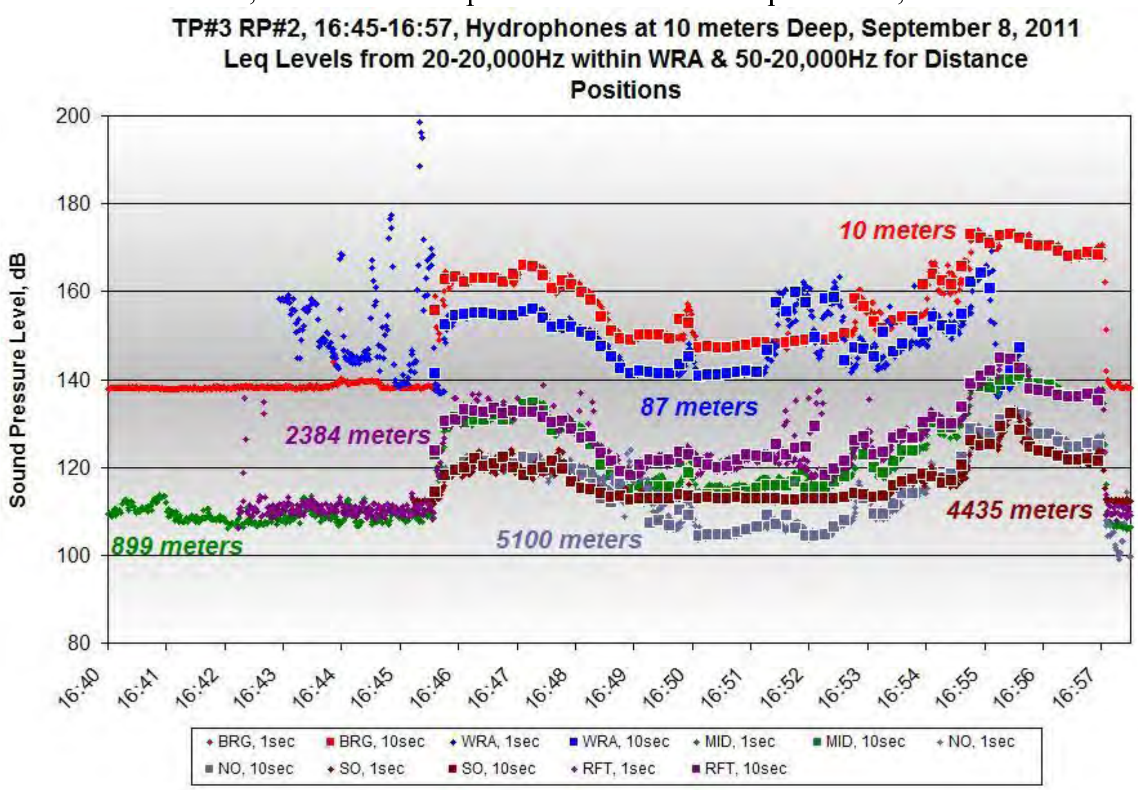

Figure A176. One-second and 10-second Average Data for TP#3 RP#2, 16:45-16:57, Measured at Depths of 10 meters on September 8, 2011

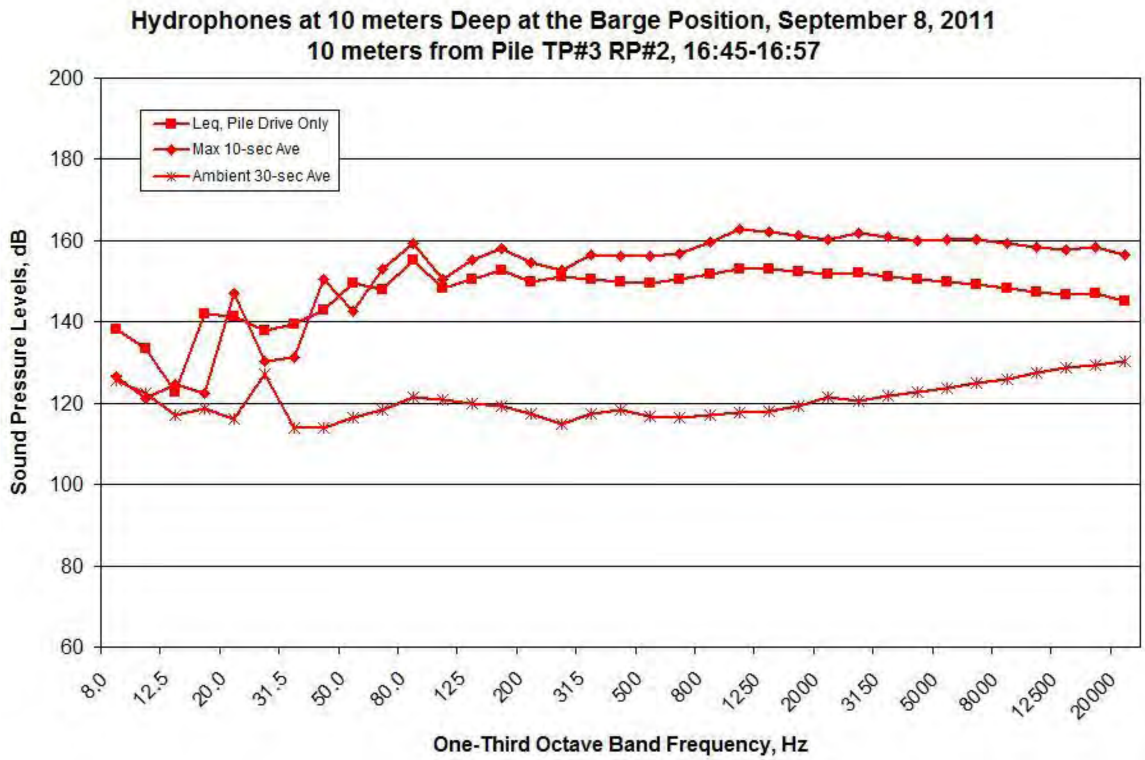

Figure A177. Spectral Data Measured at the BRG Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 10 meters on September 8, 2011

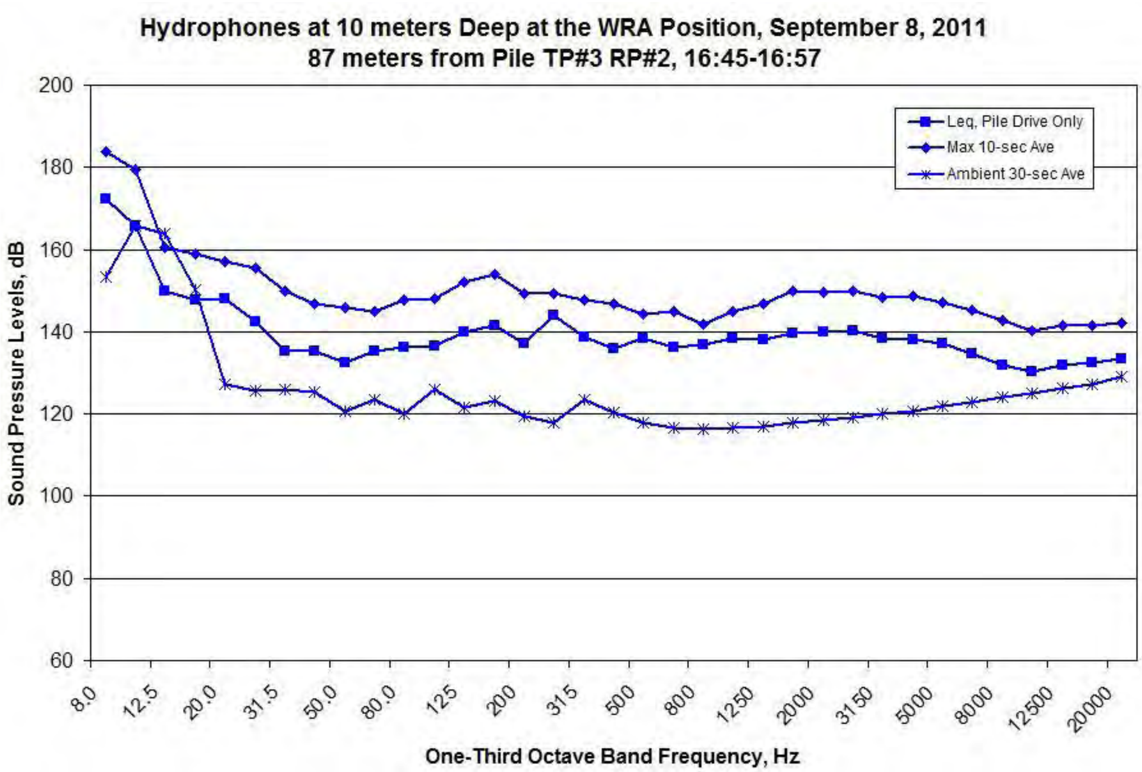

Figure A178. Spectral Data Measured at the WRA Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 10 meters on September 8, 2011

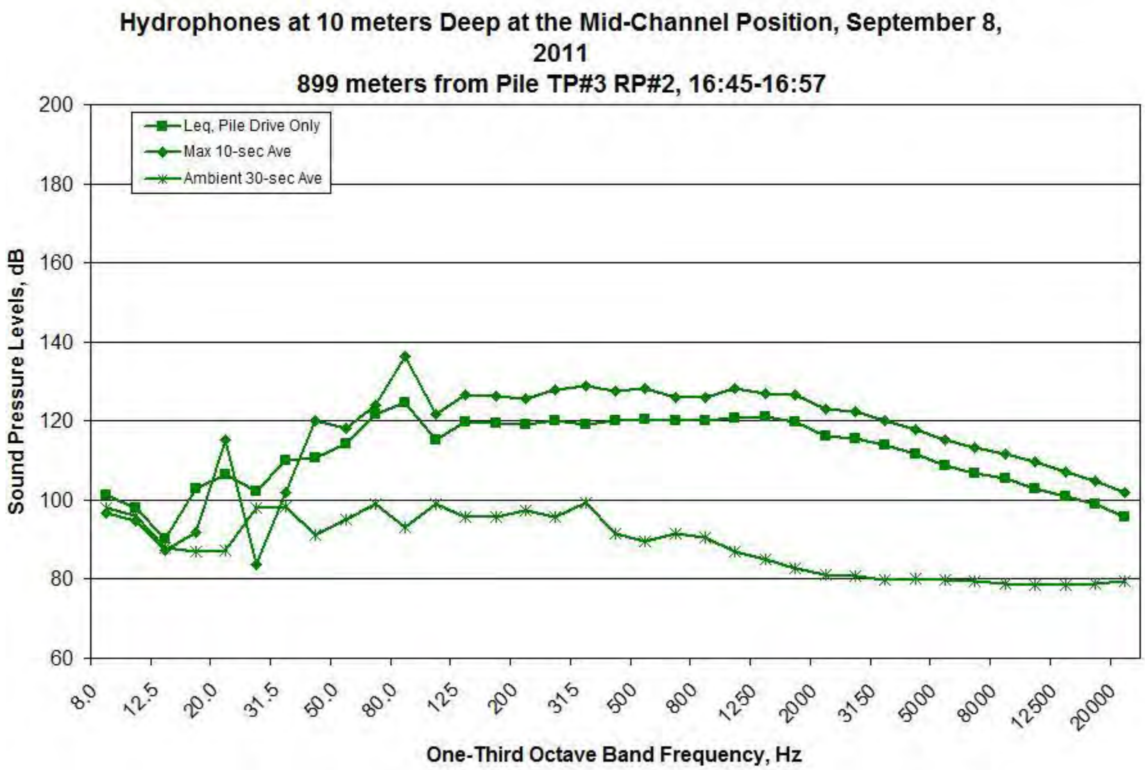

Figure A179. Spectral Data Measured at the MID Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 10 meters on September 8, 2011

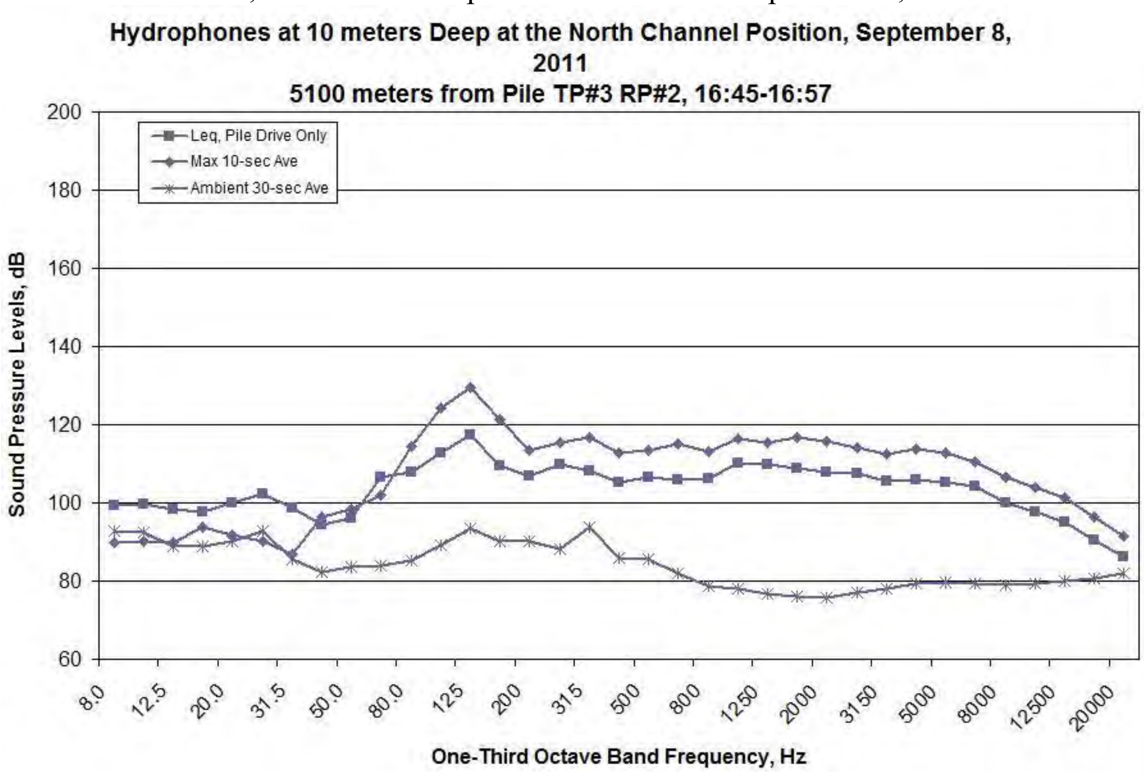

Figure A180. Spectral Data Measured at the NO Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 10 meters on September 8, 2011

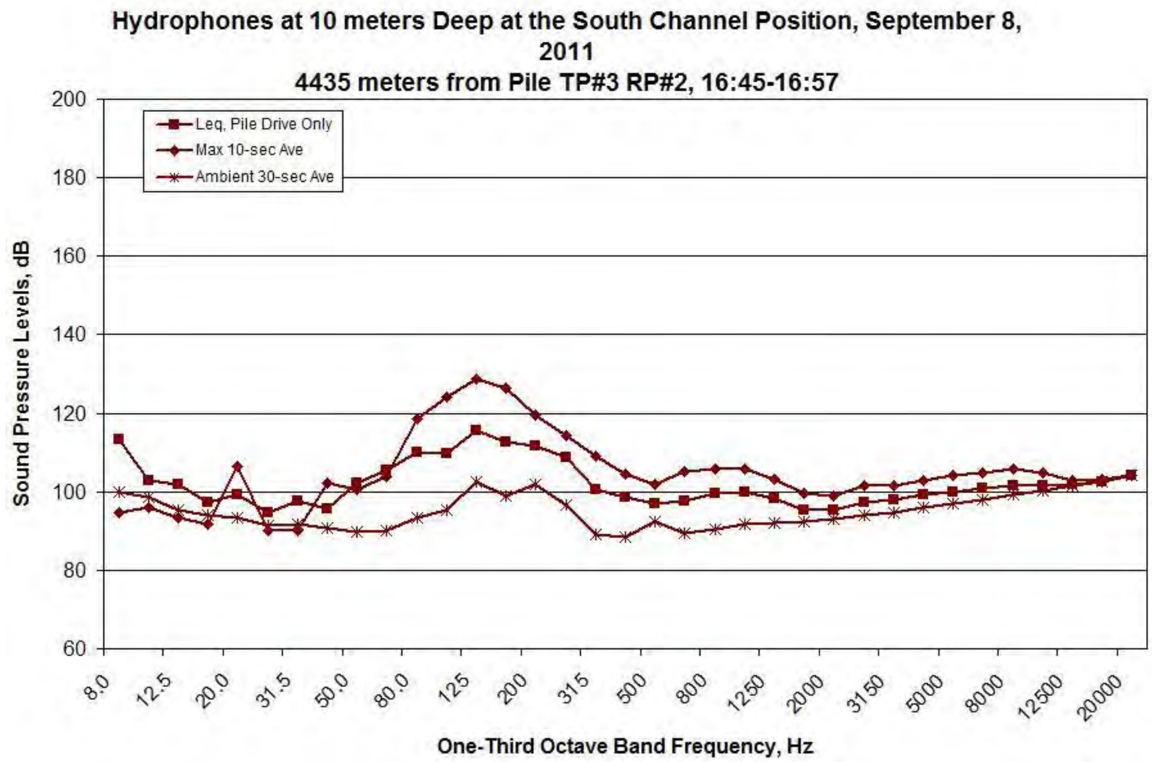

Figure A181. Spectral Data Measured at the SO Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 10 meters on September 8, 2011

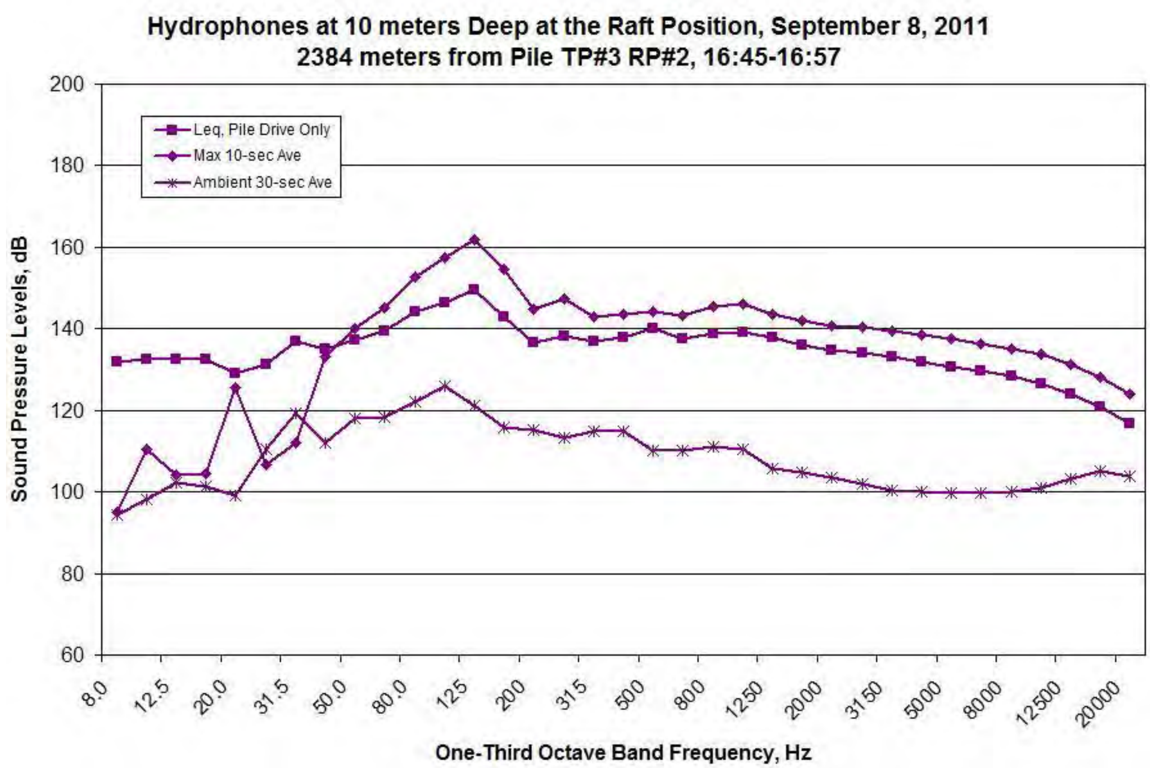

Figure A182. Spectral Data Measured at the RFT Location during TP#3 RP#2, 16:45-16:57, Measured at Depths of 10 meters on September 8, 2011

9/10/2011 – TP#3 RP#1 (Vibratory Installation)

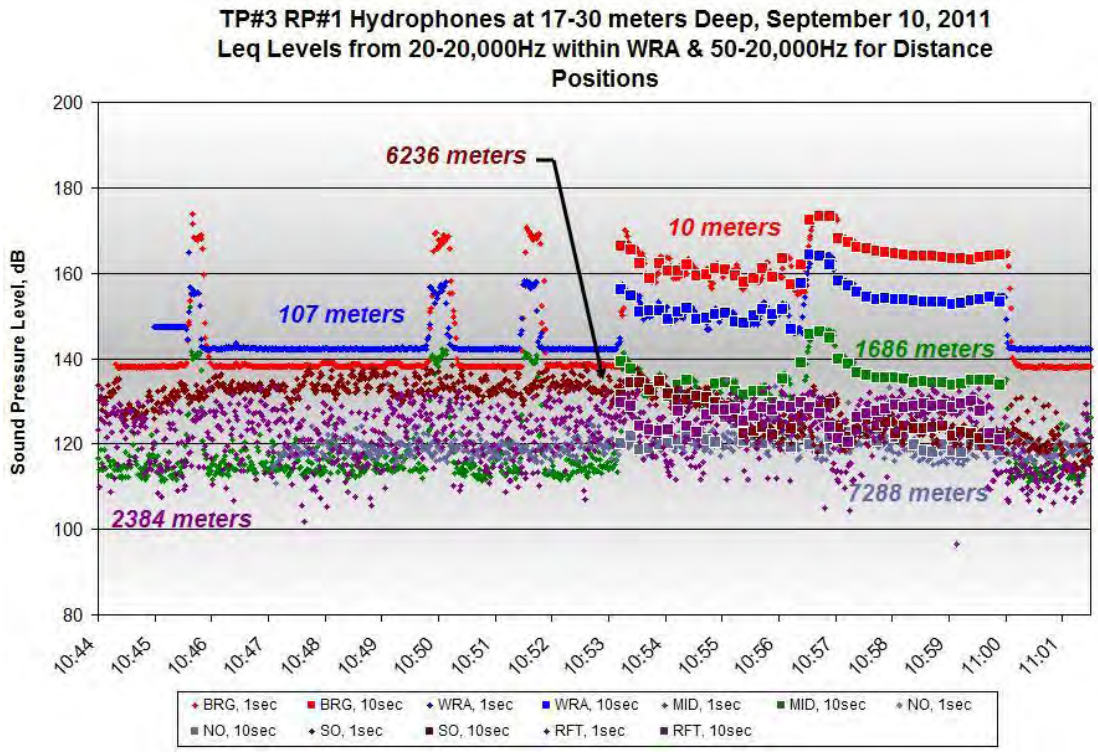

Figure A183. One-second and 10-second Average Data for TP#3 RP#1, 10:53-10:59, Measured at Depths of 17-30 meters on September 10, 2011

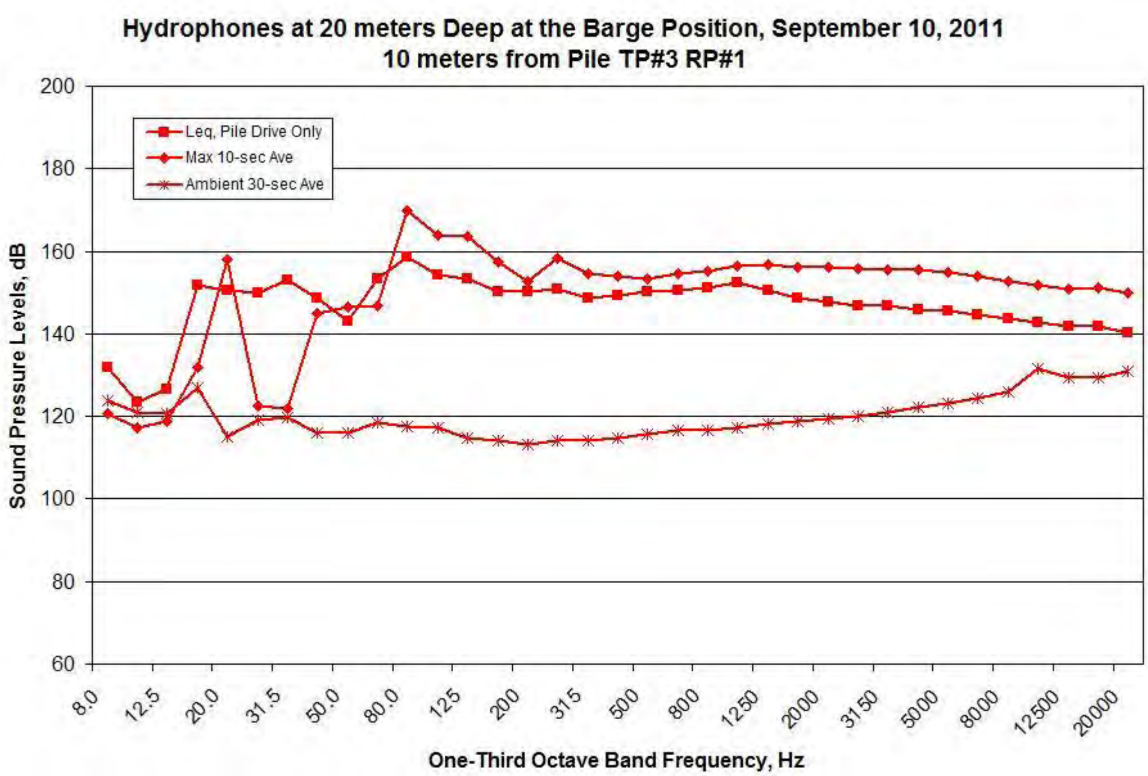

Figure A184. Spectral Data Measured at the BRG Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 20 meters on September 10, 2011

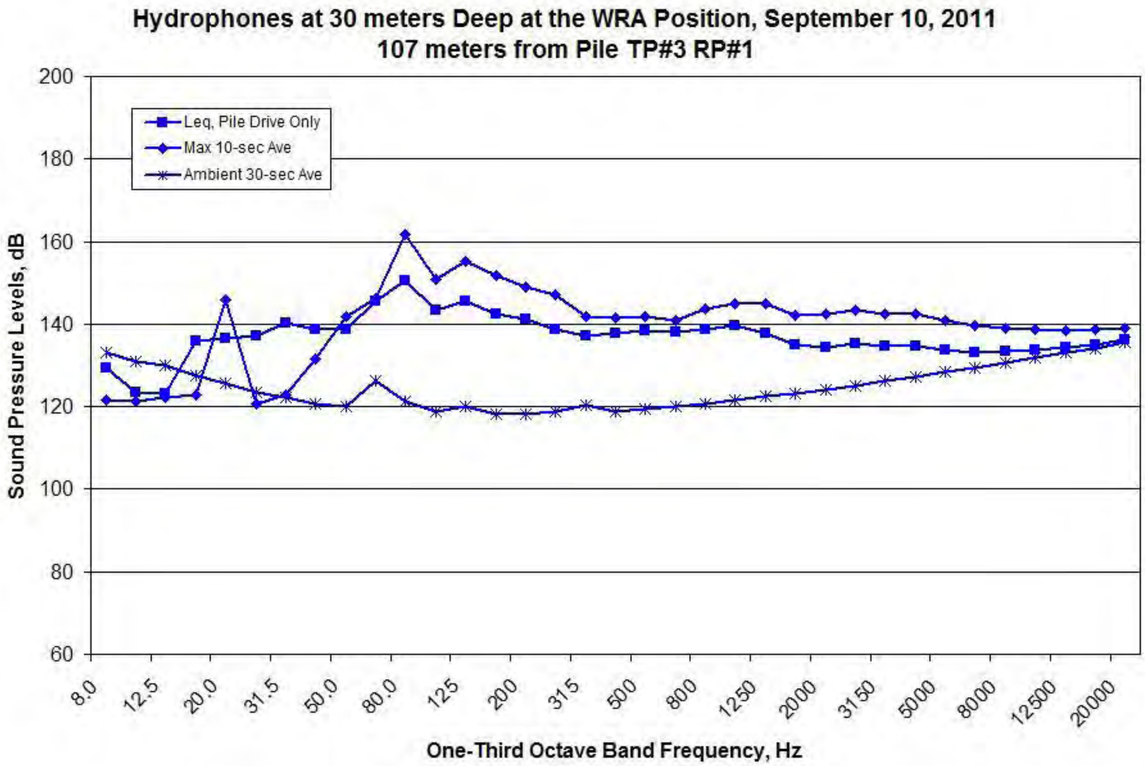

Figure A185. Spectral Data Measured at the WRA Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 30 meters on September 10, 2011

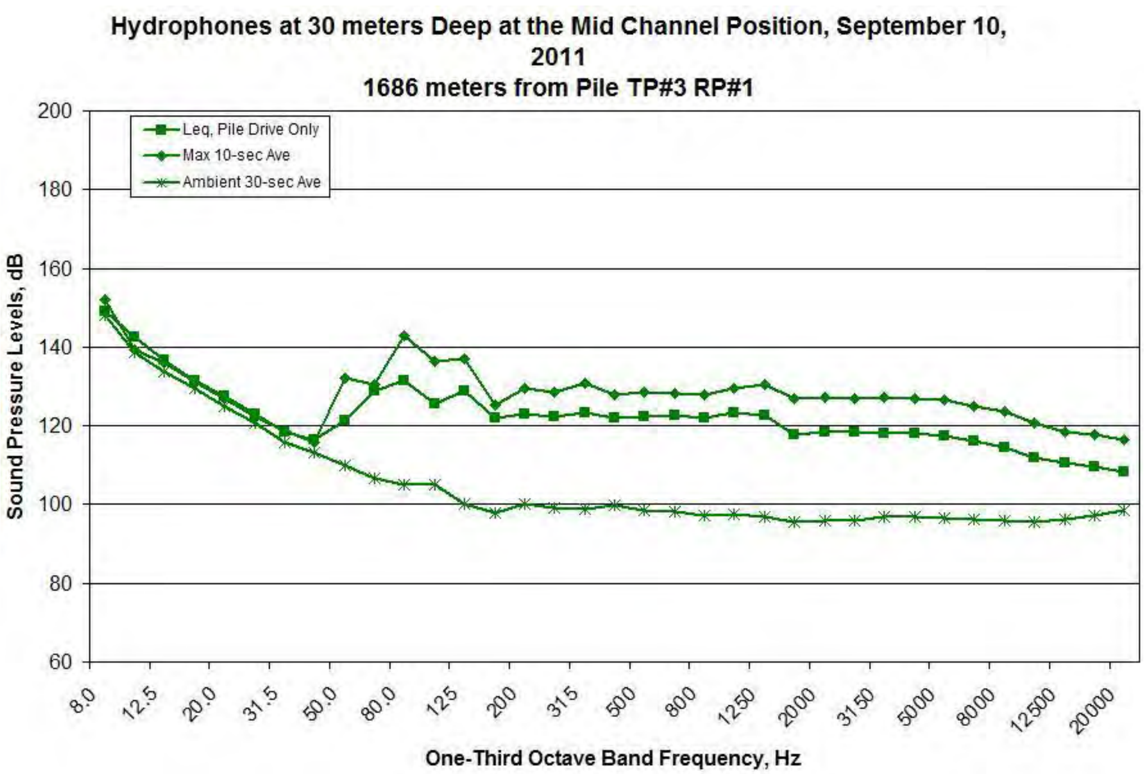

Figure A186. Spectral Data Measured at the MID Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 30 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A187. Spectral Data Measured at the NO Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 30 meters on September 10, 2011

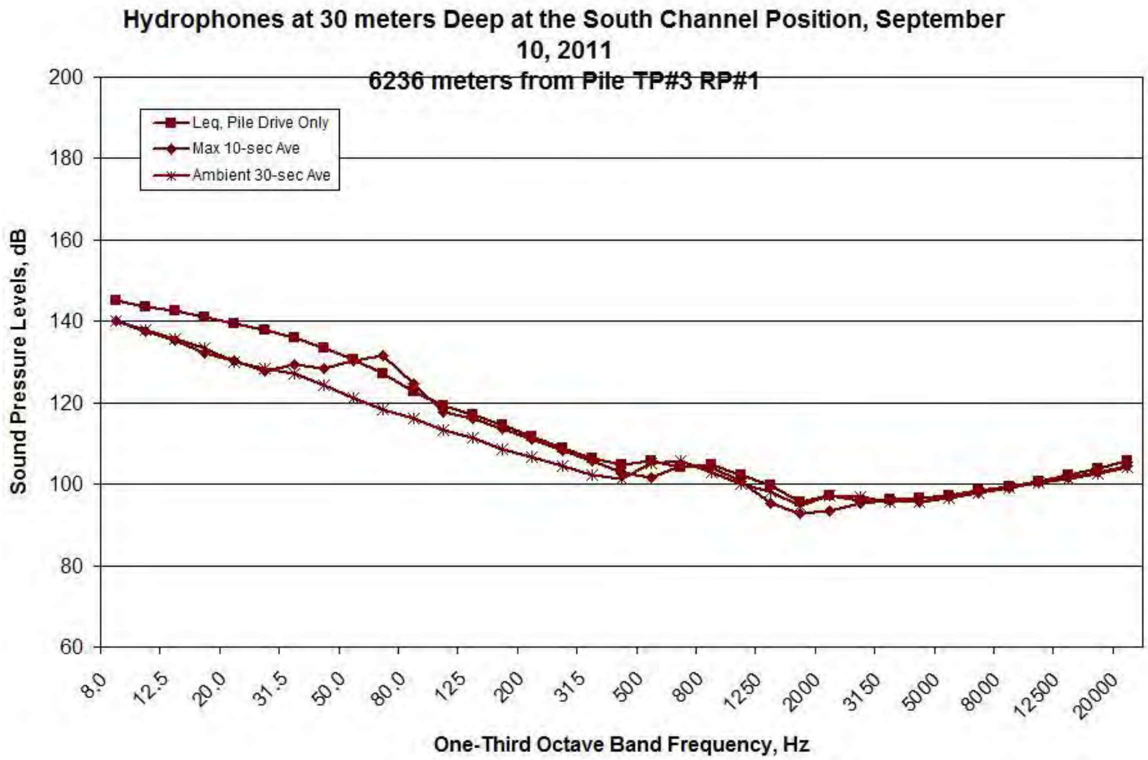

Figure A188. Spectral Data Measured at the SO Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 30 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A189. Spectral Data Measured at the RFT Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 17 meters on September 10, 2011

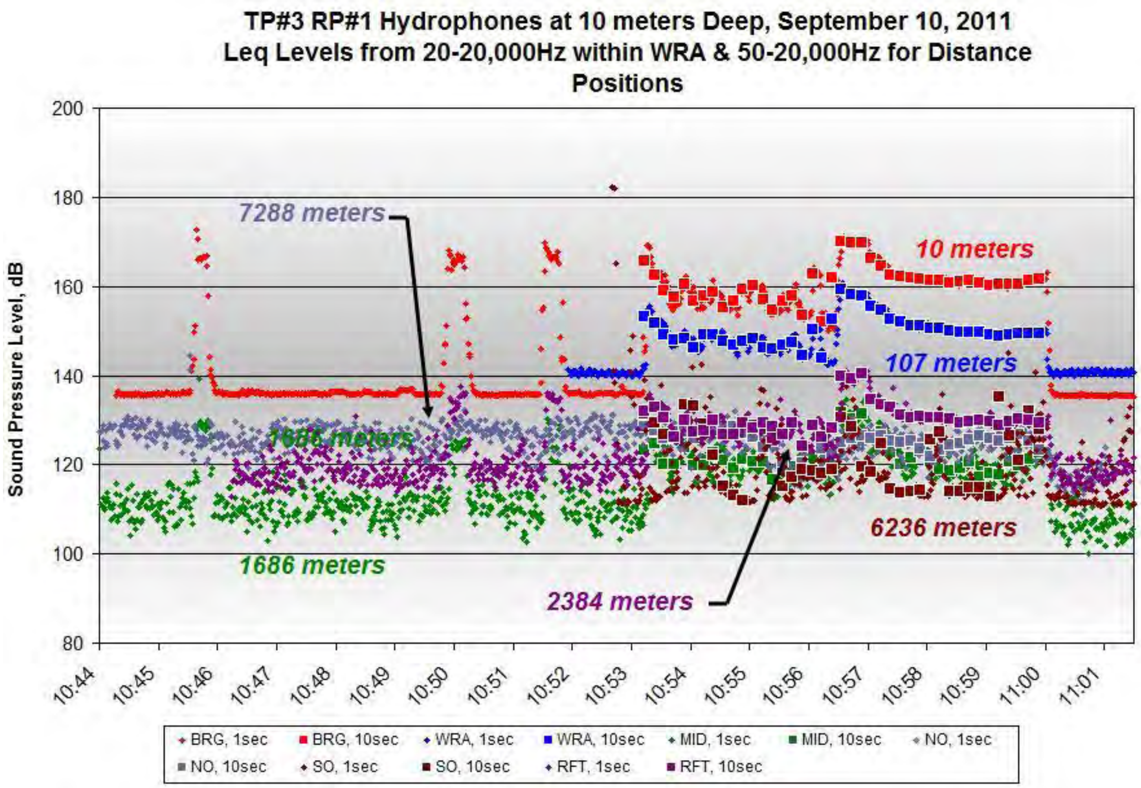

Figure A190. One-second and 10-second Average Data for TP#3 RP#1, 10:53-10:59, Measured at Depths of 10 meters on September 10, 2011

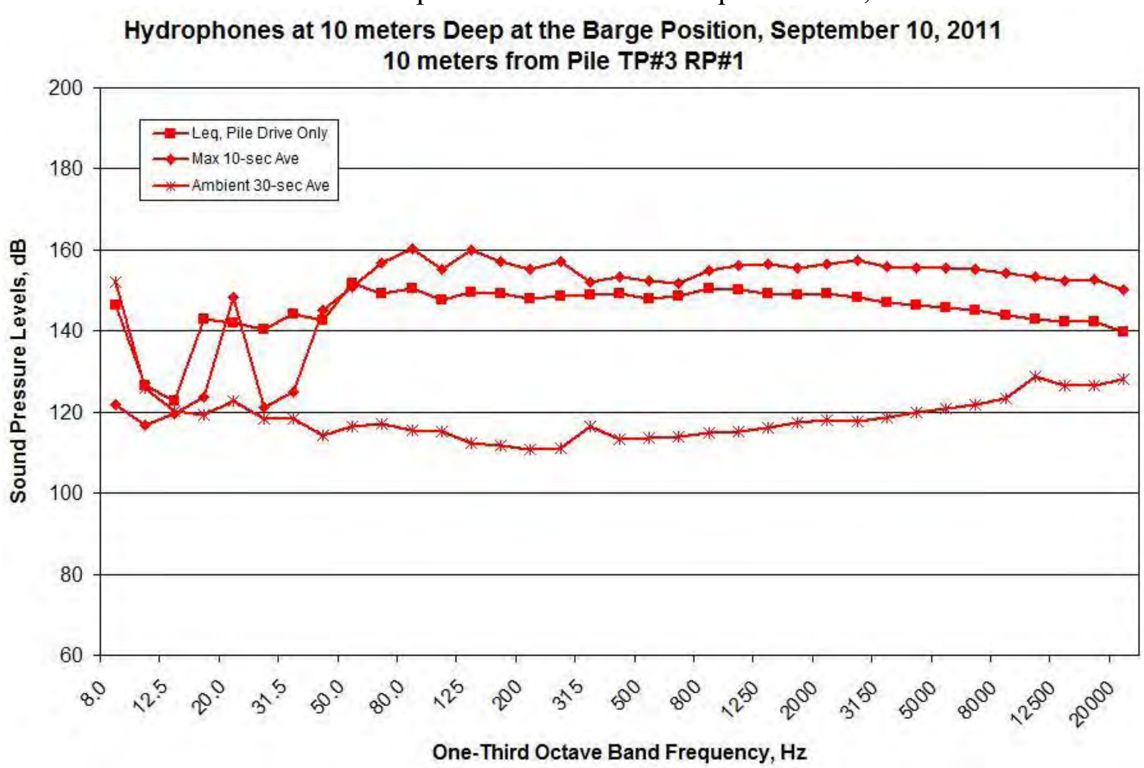

Figure A191. Spectral Data Measured at the BRG Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 10 meters on September 10, 2011

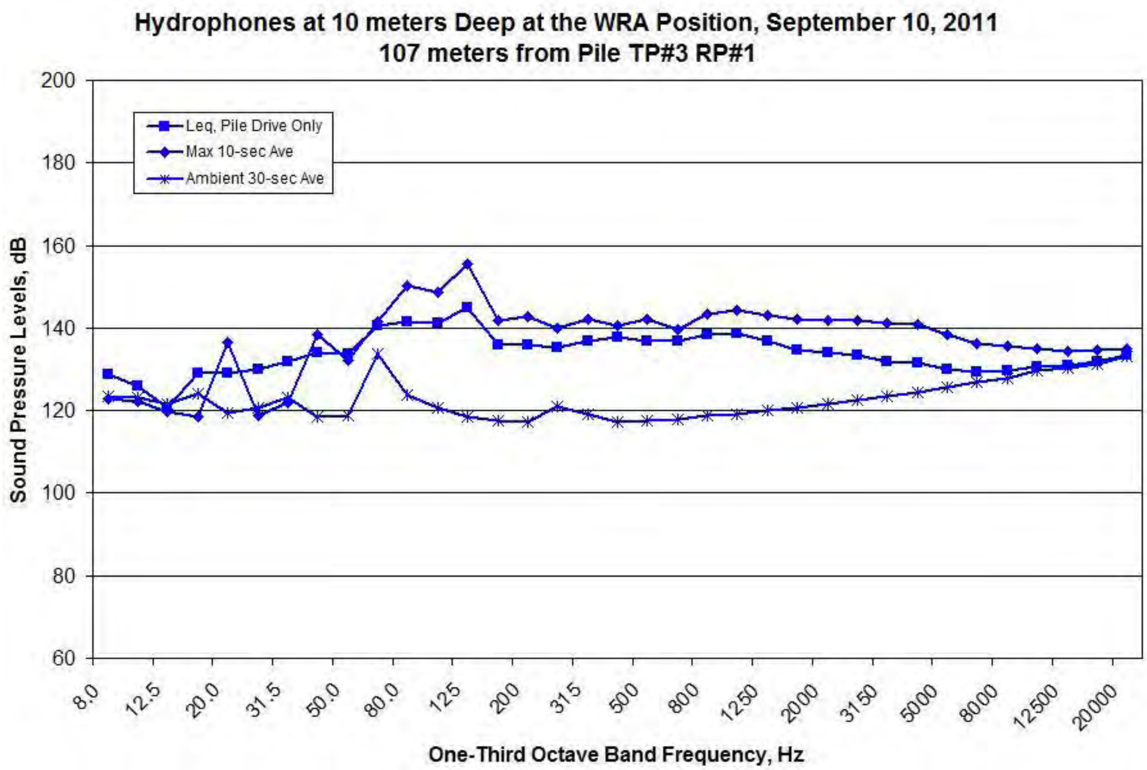

Figure A192. Spectral Data Measured at the WRA Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 10 meters on September 10, 2011

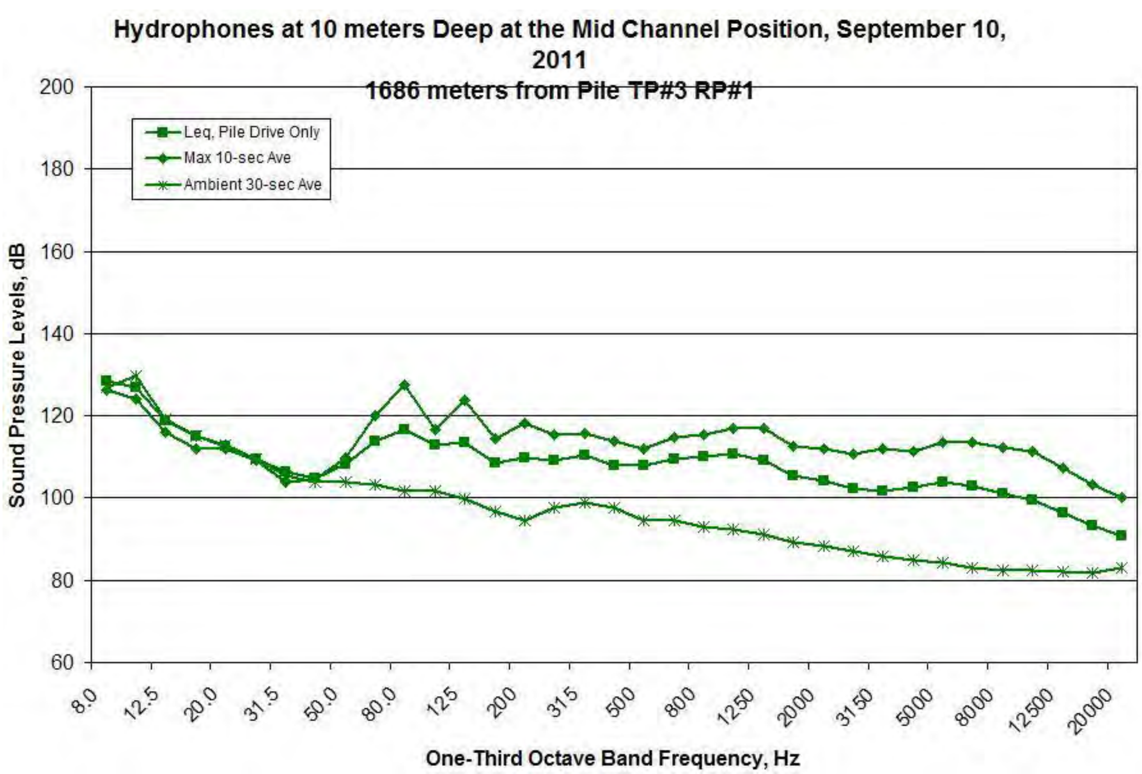

Figure A193. Spectral Data Measured at the MID Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 10 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A194. Spectral Data Measured at the NO Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 10 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A195. Spectral Data Measured at the SO Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 10 meters on September 10, 2011

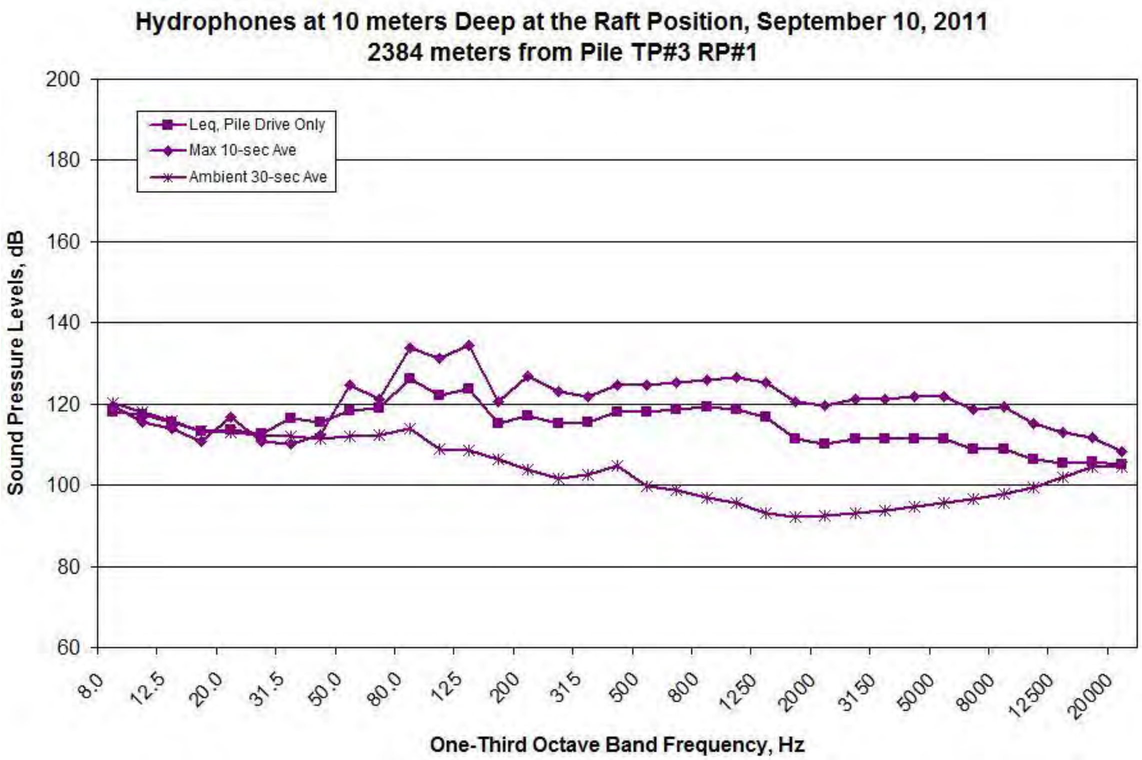

Figure A196. Spectral Data Measured at the RFT Location during TP#3 RP#1, 10:53-10:59, Measured at Depths of 10 meters on September 10, 2011

TP#2 (Vibratory Installation)

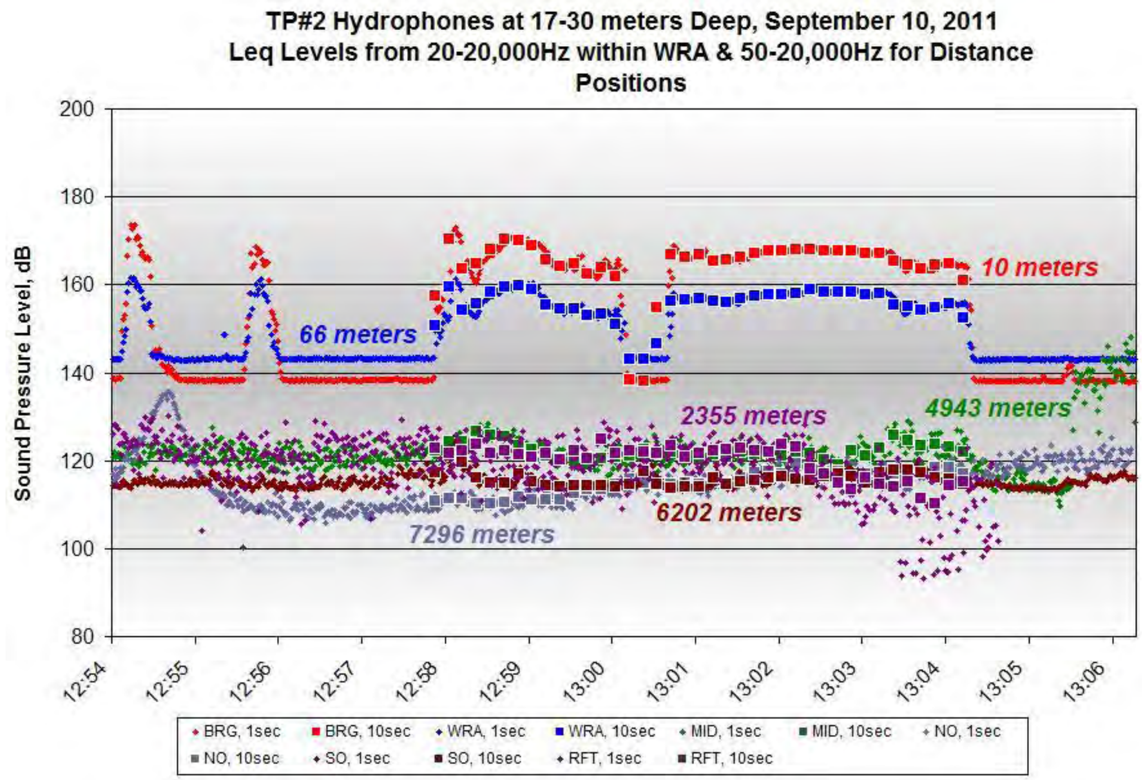

Figure A197. One-second and 10-second Average Data for TP#2, 12:58-13:05, Measured at Depths of 17-30 meters on September 10, 2011

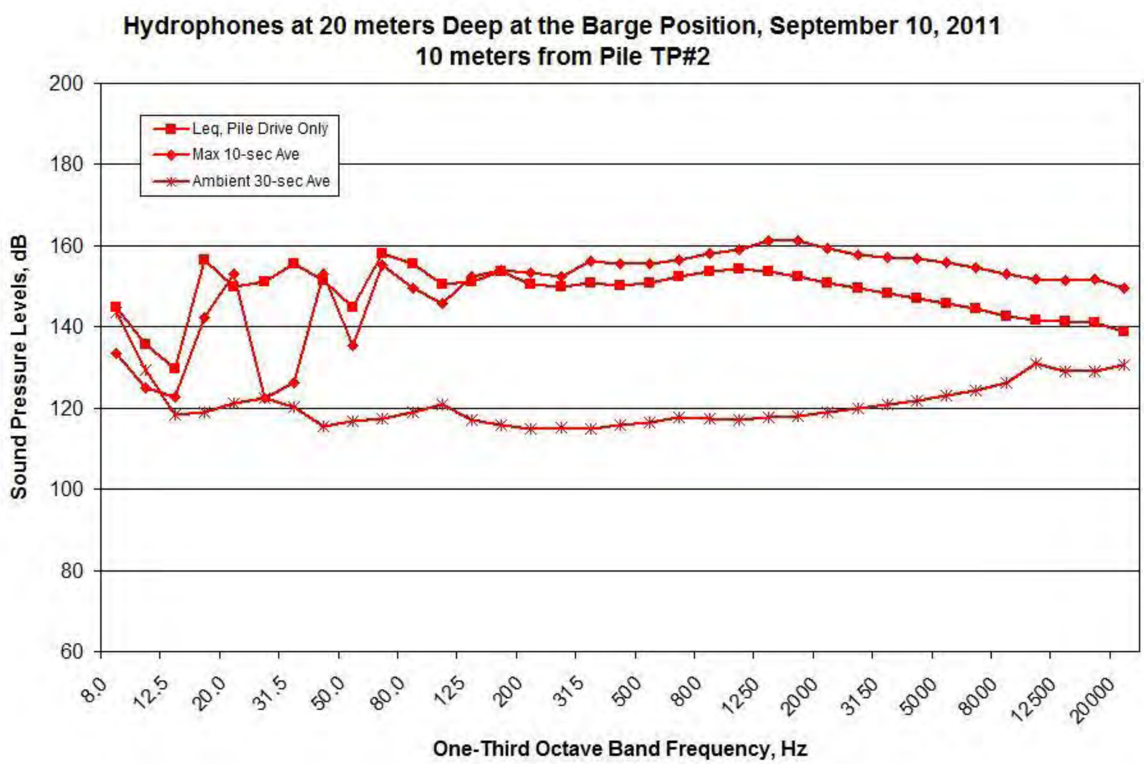

Figure A198. Spectral Data Measured at the BRG Location during TP#2, 12:58-13:05, Measured at Depths of 20 meters on September 10, 2011

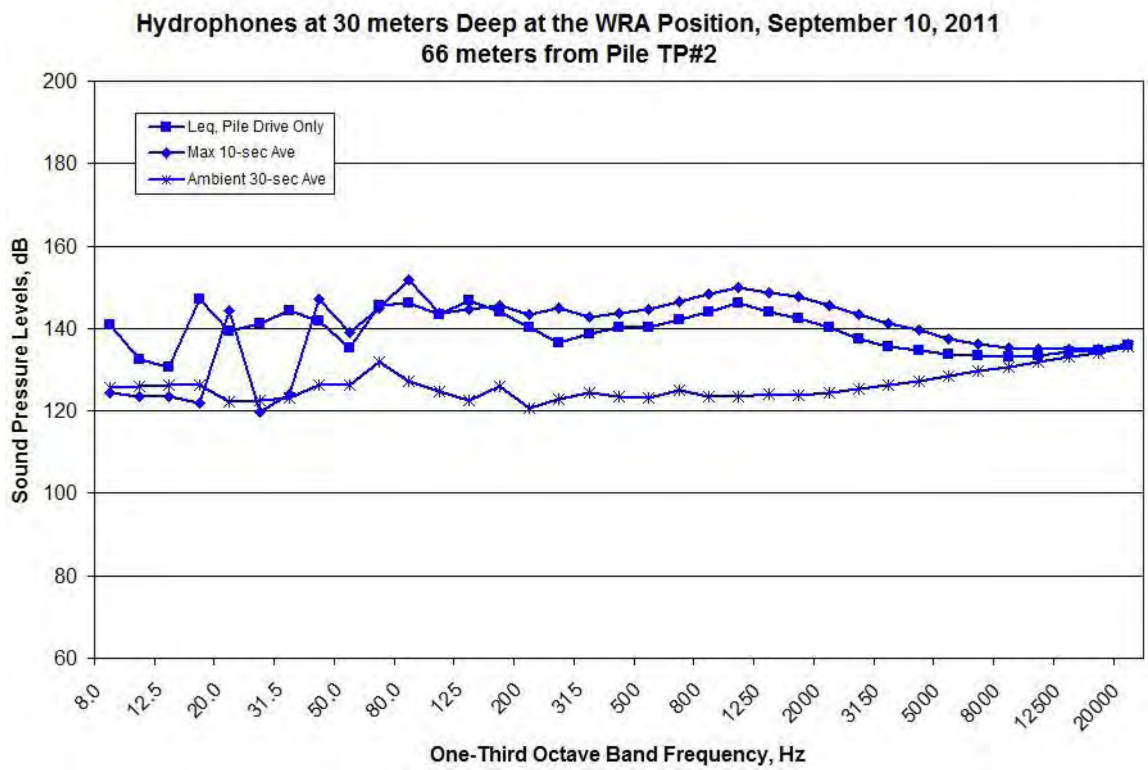

Figure A199. Spectral Data Measured at the WRA Location during TP#2, 12:58-13:05, Measured at Depths of 30 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A200. Spectral Data Measured at the MID Location during TP#2, 12:58-13:05, Measured at Depths of 30 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A201. Spectral Data Measured at the NO Location during TP#2, 12:58-13:05, Measured at Depths of 30 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A202. Spectral Data Measured at the SO Location during TP#2, 12:58-13:05, Measured at Depths of 30 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A203. Spectral Data Measured at the RFT Location during TP#2, 12:58-13:05, Measured at Depths of 17 meters on September 10, 2011

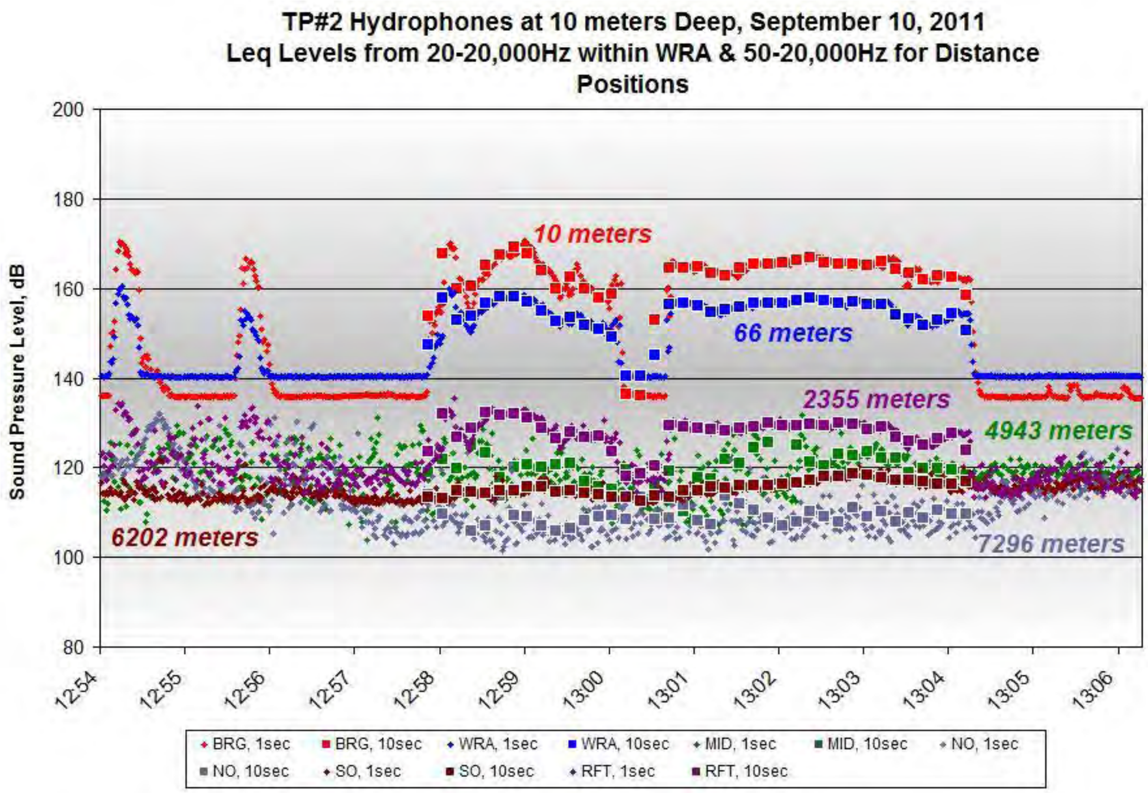

Figure A204. One-second and 10-second Average Data for TP#2, 12:58-13:05, Measured at Depths of 10 meters on September 10, 2011

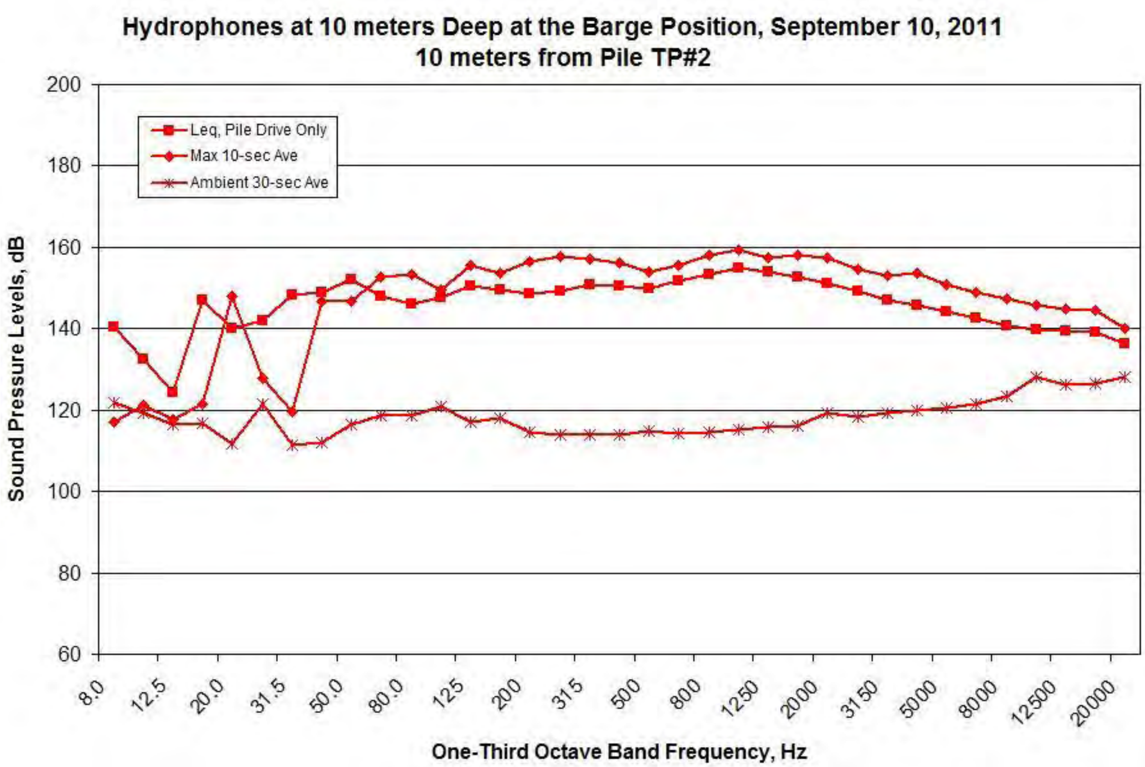

Figure A205. Spectral Data Measured at the BRG Location during TP#2, 12:58-13:05, Measured at Depths of 10 meters on September 10, 2011

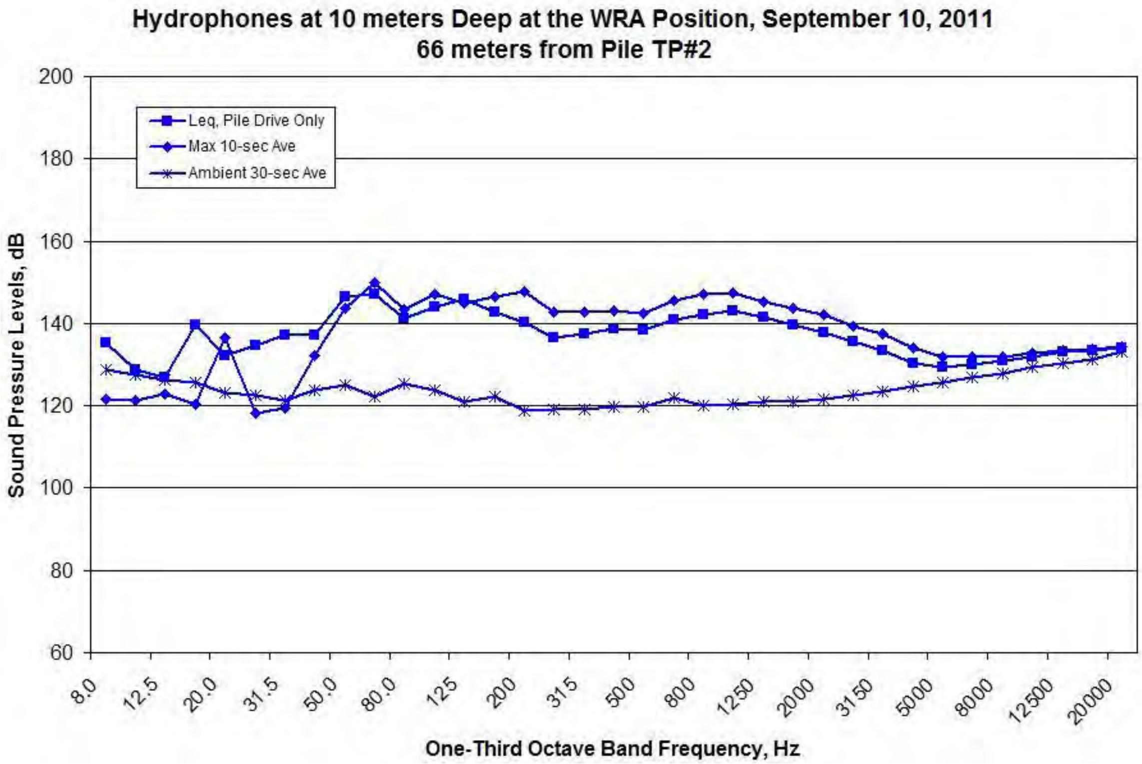

Figure A206. Spectral Data Measured at the WRA Location during TP#2, 12:58-13:05, Measured at Depths of 10 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A207. Spectral Data Measured at the MID Location during TP#2, 12:58-13:05, Measured at Depths of 10 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A208. Spectral Data Measured at the NO Location during TP#2, 12:58-13:05, Measured at Depths of 10 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A209. Spectral Data Measured at the SO Location during TP#2, 12:58-13:05, Measured at Depths of 10 meters on September 10, 2011

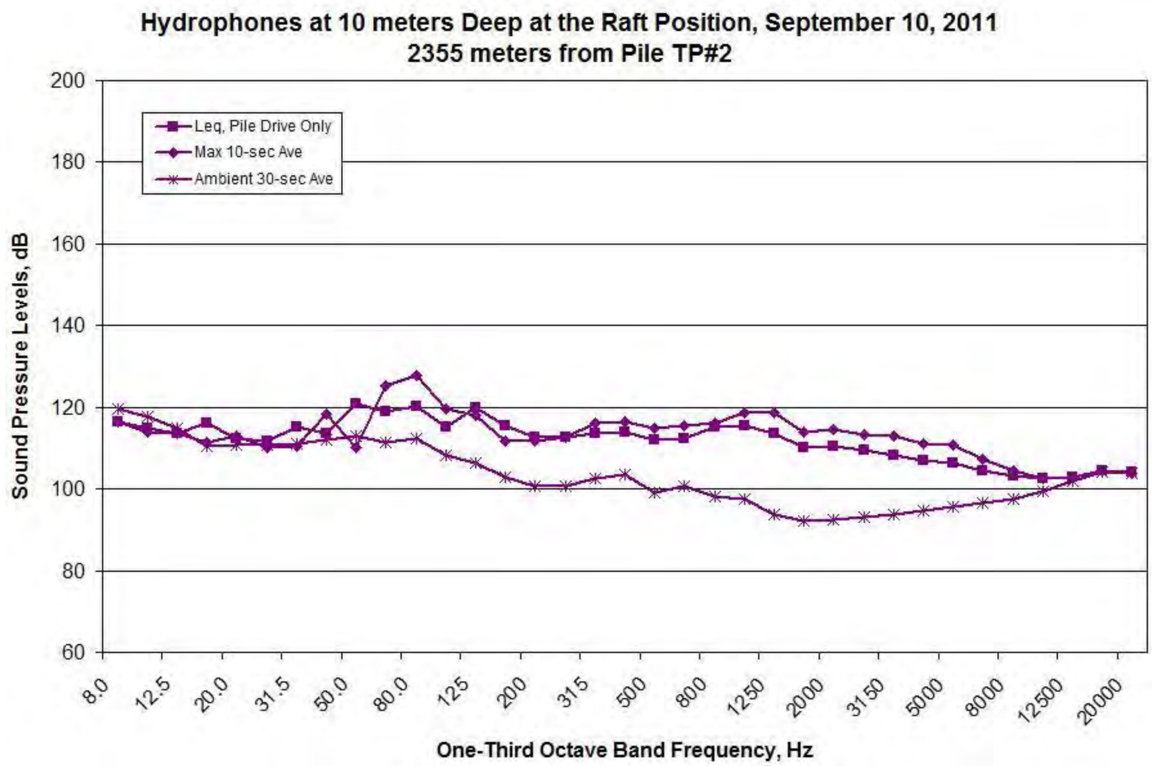

Figure A210. Spectral Data Measured at the RFT Location during TP#2, 12:58-13:05, Measured at Depths of 10 meters on September 10, 2011

9/17/2011 – TP#2 (Vibratory Removal)

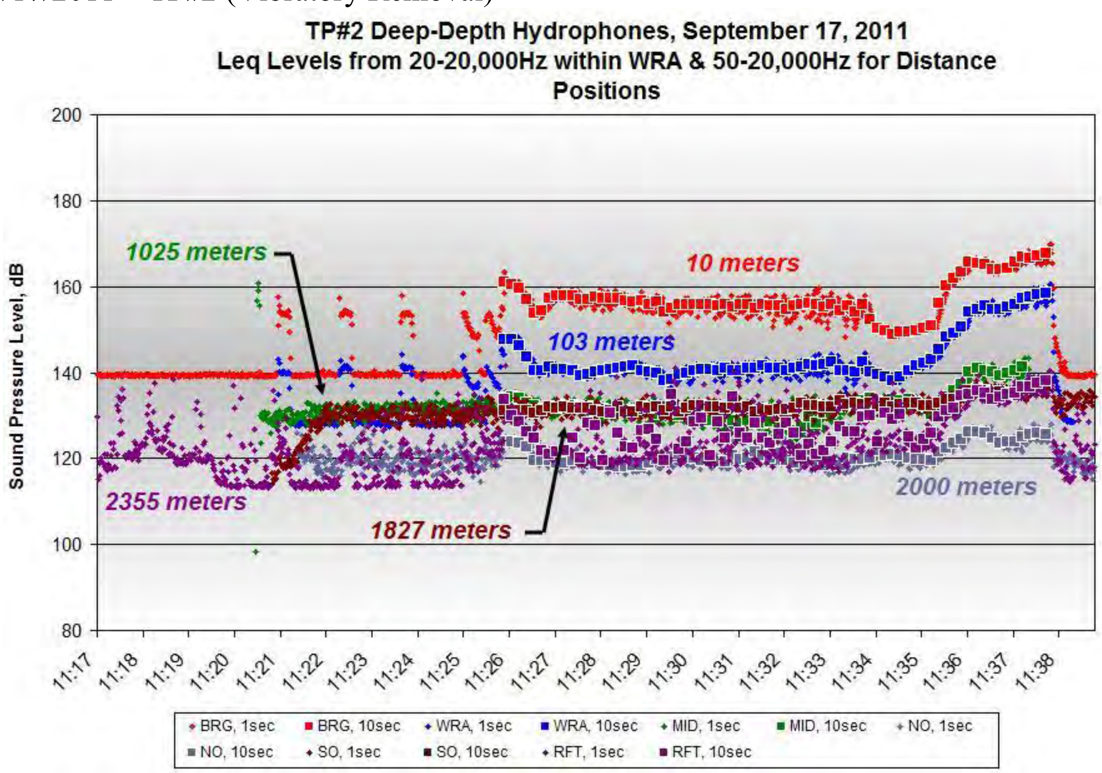

Figure A211. One-second and 10-second Average Data for TP#2, 11:26-11:38, Measured at Depths of 17-30 meters on September 17, 2011

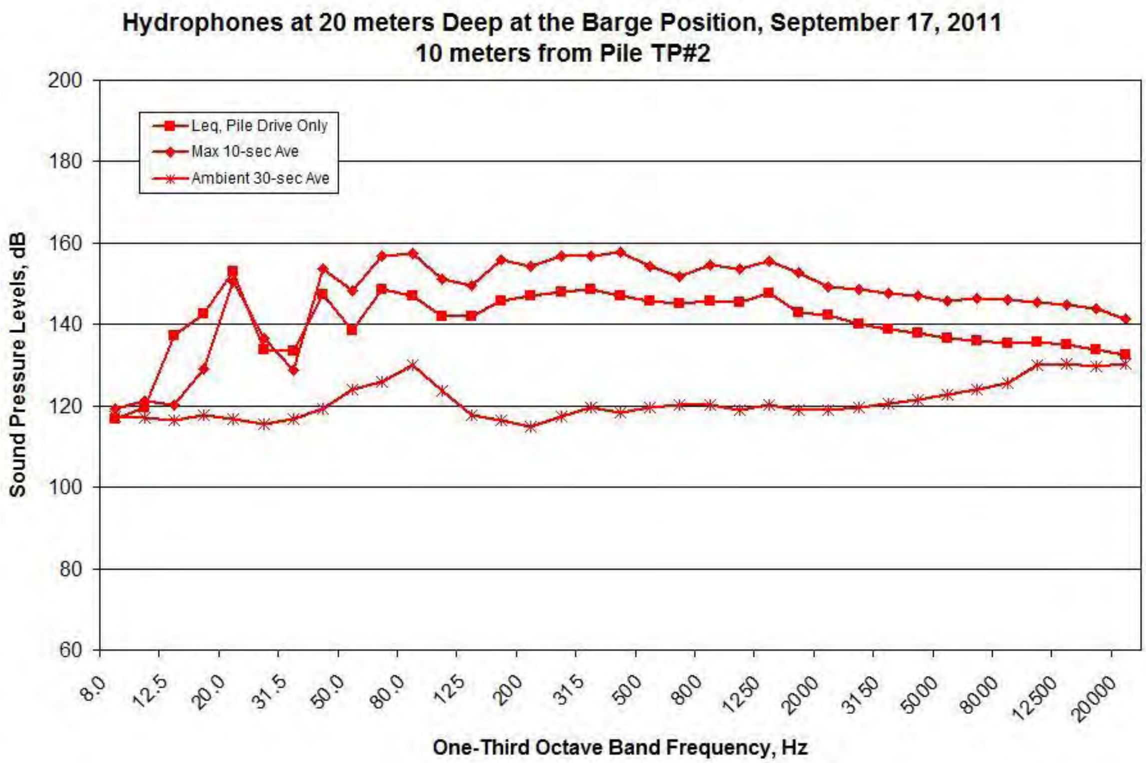

Figure A212. Spectral Data Measured at the BRG Location during TP#2, 11:26-11:38, Measured at Depths of 20 meters on September 17, 2011

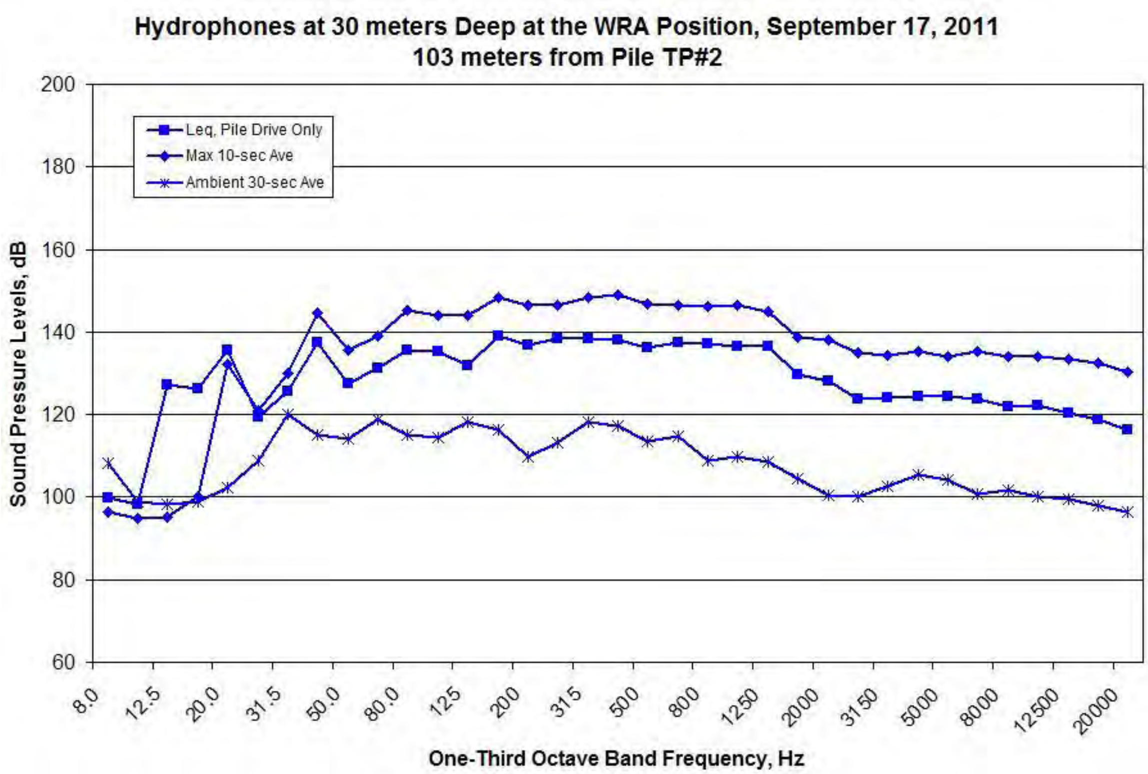

Figure A213. Spectral Data Measured at the WRA Location during TP#2, 11:26-11:38, Measured at Depths of 30 meters on September 17, 2011

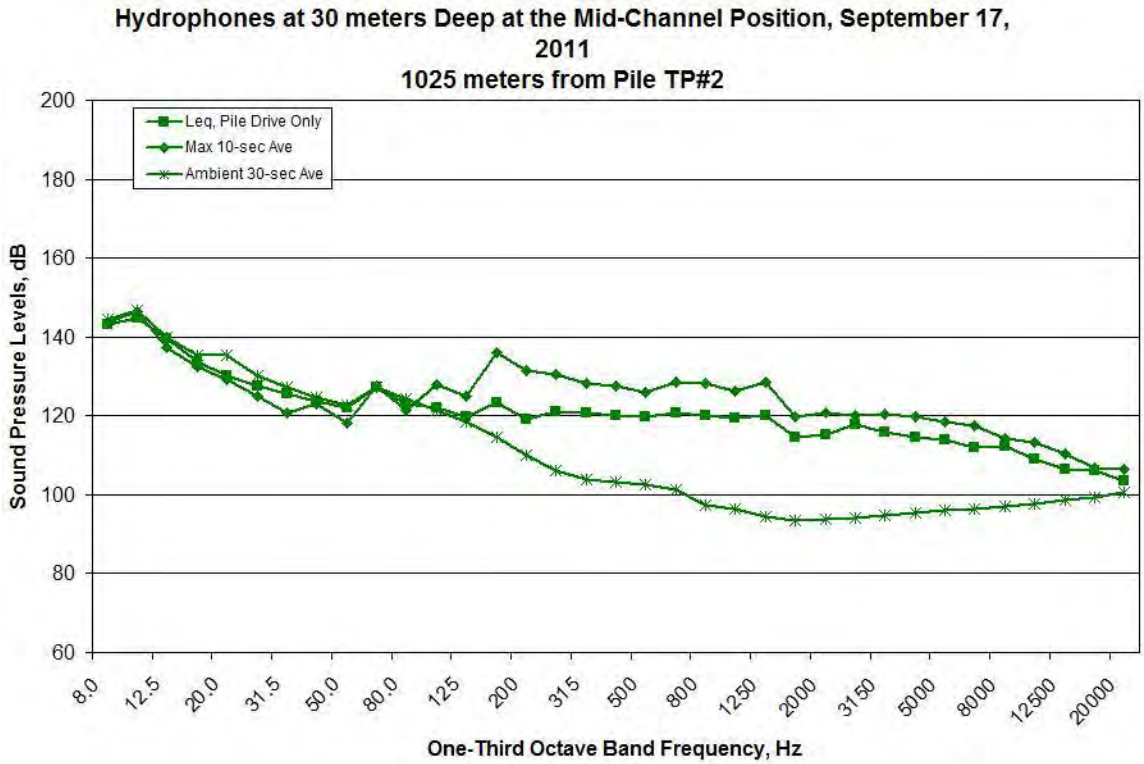

Figure A214. Spectral Data Measured at the MID Location during TP#2, 11:26-11:38, Measured at Depths of 30 meters on September 17, 2011

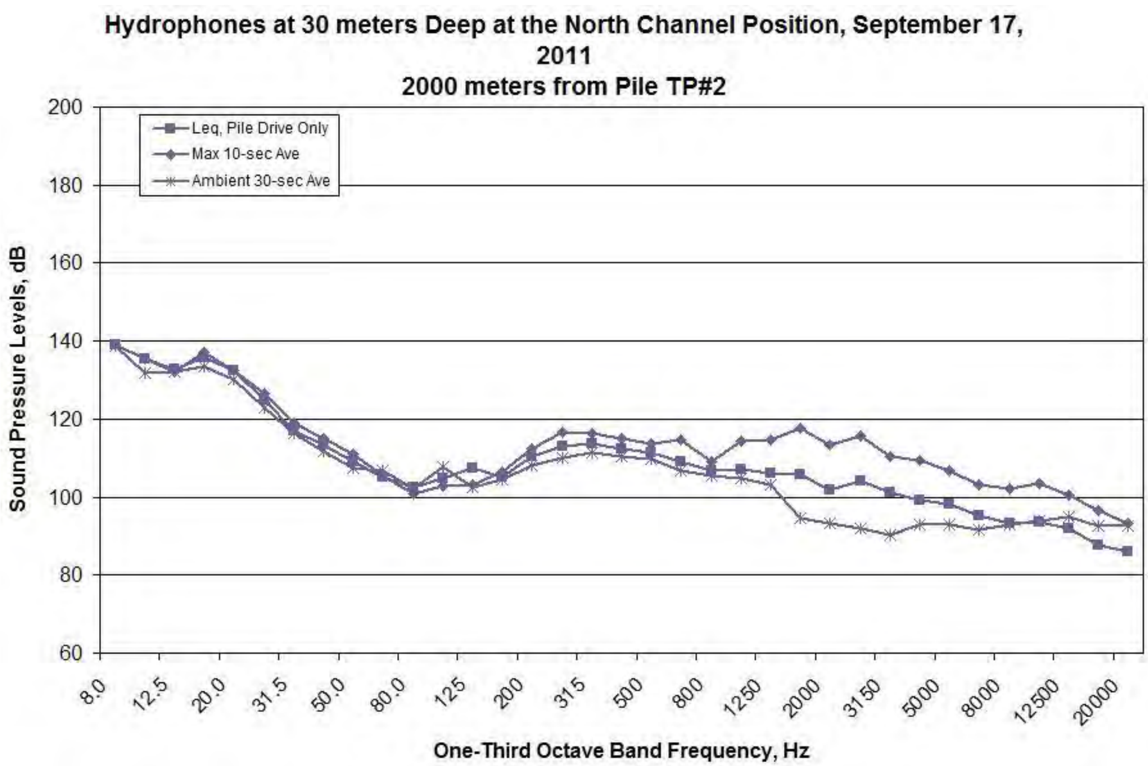

Figure A215. Spectral Data Measured at the NO Location during TP#2, 11:26-11:38, Measured at Depths of 30 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A216. Spectral Data Measured at the SO Location during TP#2, 11:26-11:38, Measured at Depths of 30 meters on September 17, 2011

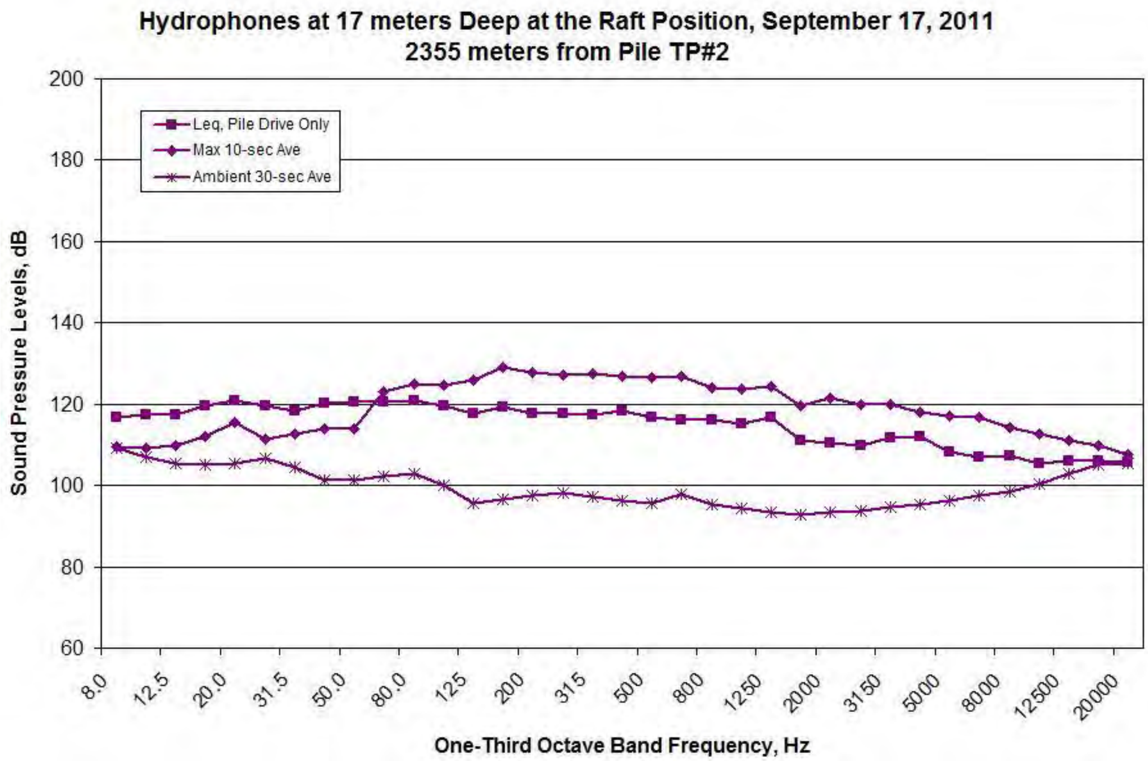

Figure A217. Spectral Data Measured at the RFT Location during TP#2, 11:26-11:38, Measured at Depths of 17 meters on September 17, 2011

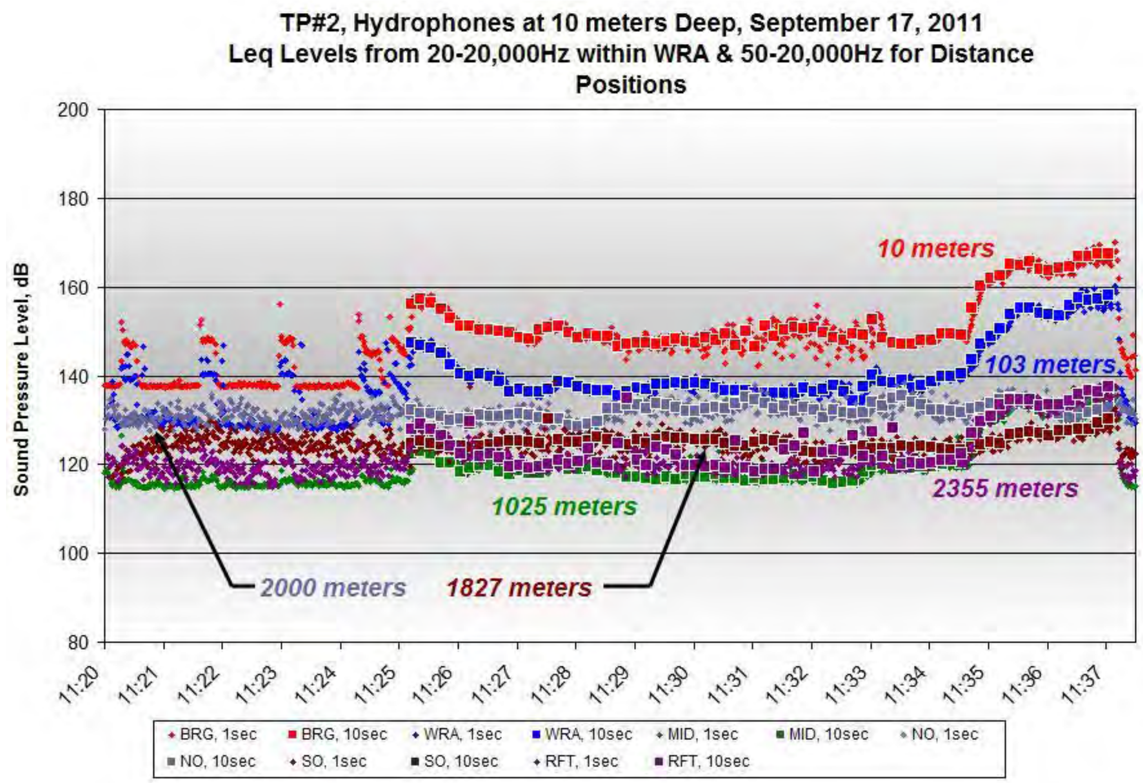

Figure A218. One-second and 10-second Average Data for TP#2, 11:26-11:38, Measured at Depths of 10 meters on September 17, 2011

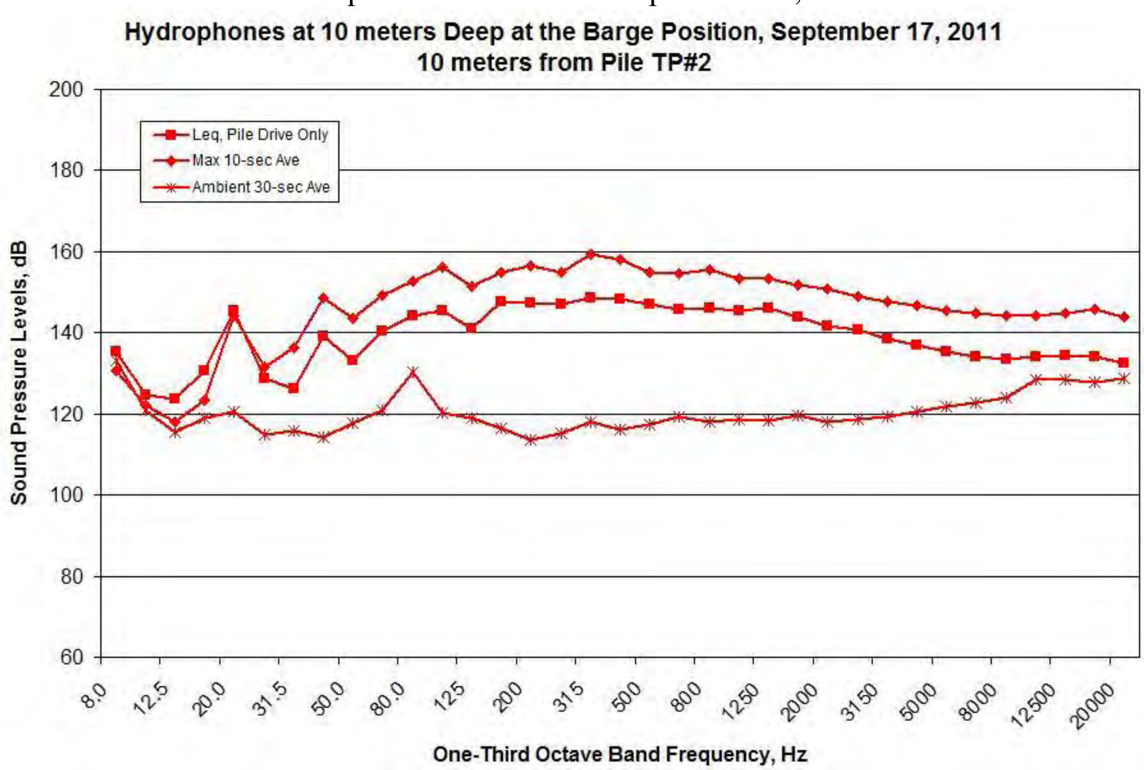

Figure A219. Spectral Data Measured at the BRG Location during TP#2, 11:26-11:38, Measured at Depths of 10 meters on September 17, 2011

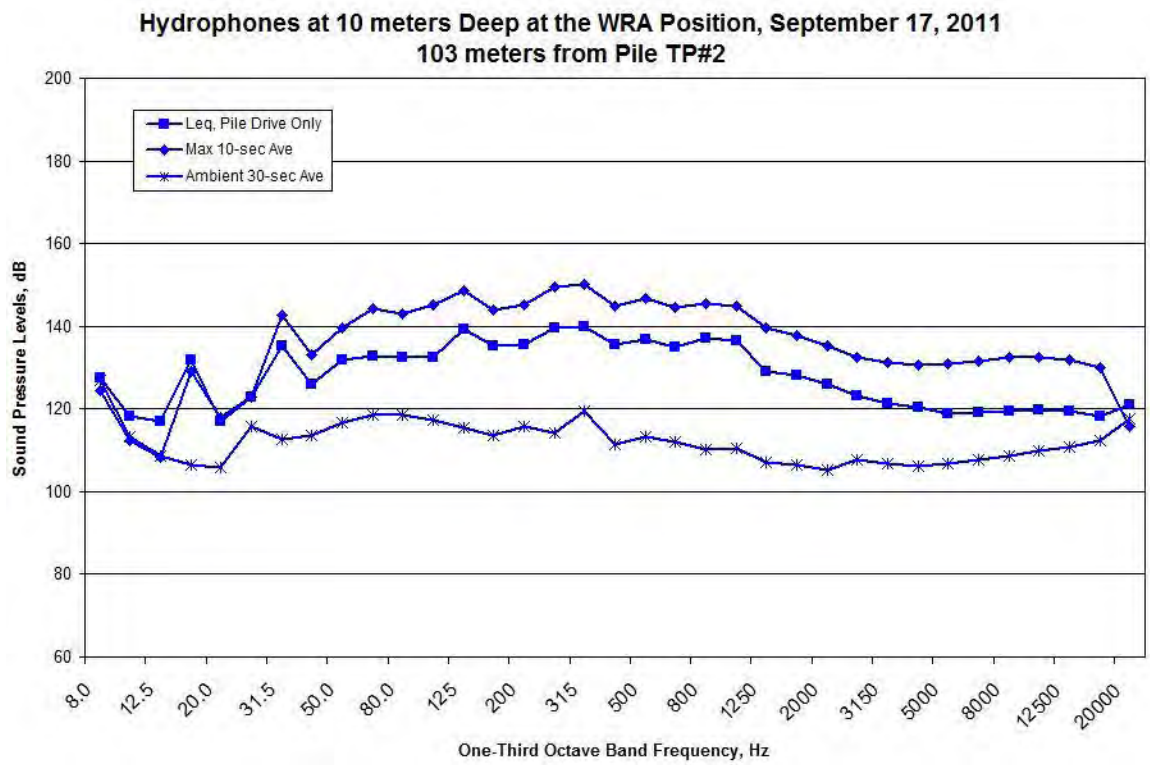

Figure A220. Spectral Data Measured at the WRA Location during TP#2, 11:26-11:38, Measured at Depths of 10 meters on September 17, 2011

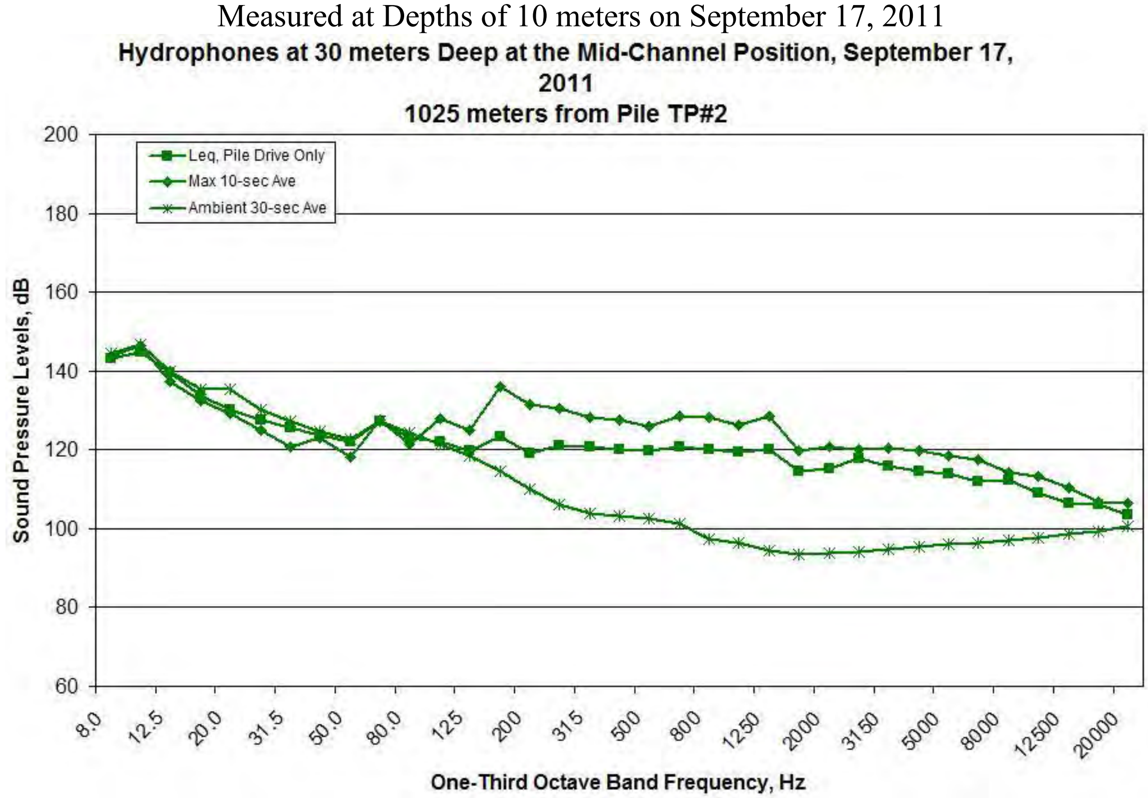

Figure A221. Spectral Data Measured at the MID Location during TP#2, 11:26-11:38, Measured at Depths of 10 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A222. Spectral Data Measured at the NO Location during TP#2, 11:26-11:38, Measured at Depths of 10 meters on September 17, 2011

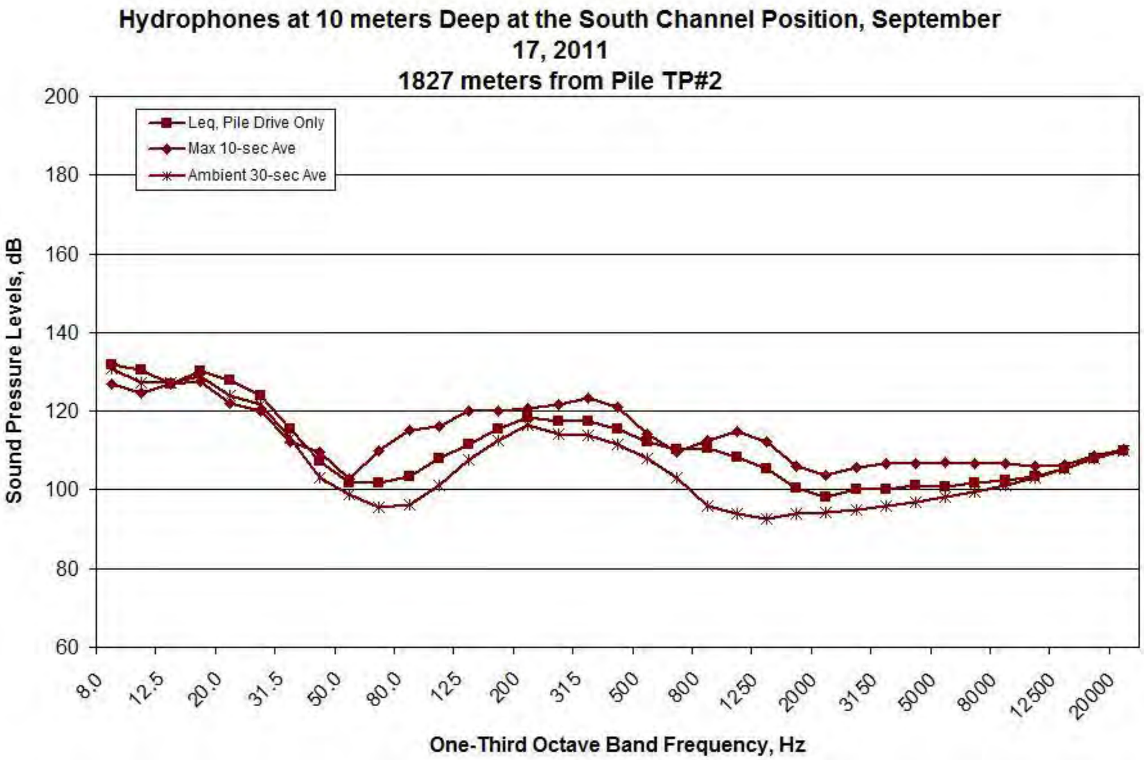

Figure A223. Spectral Data Measured at the SO Location during TP#2, 11:26-11:38, Measured at Depths of 10 meters on September 17, 2011

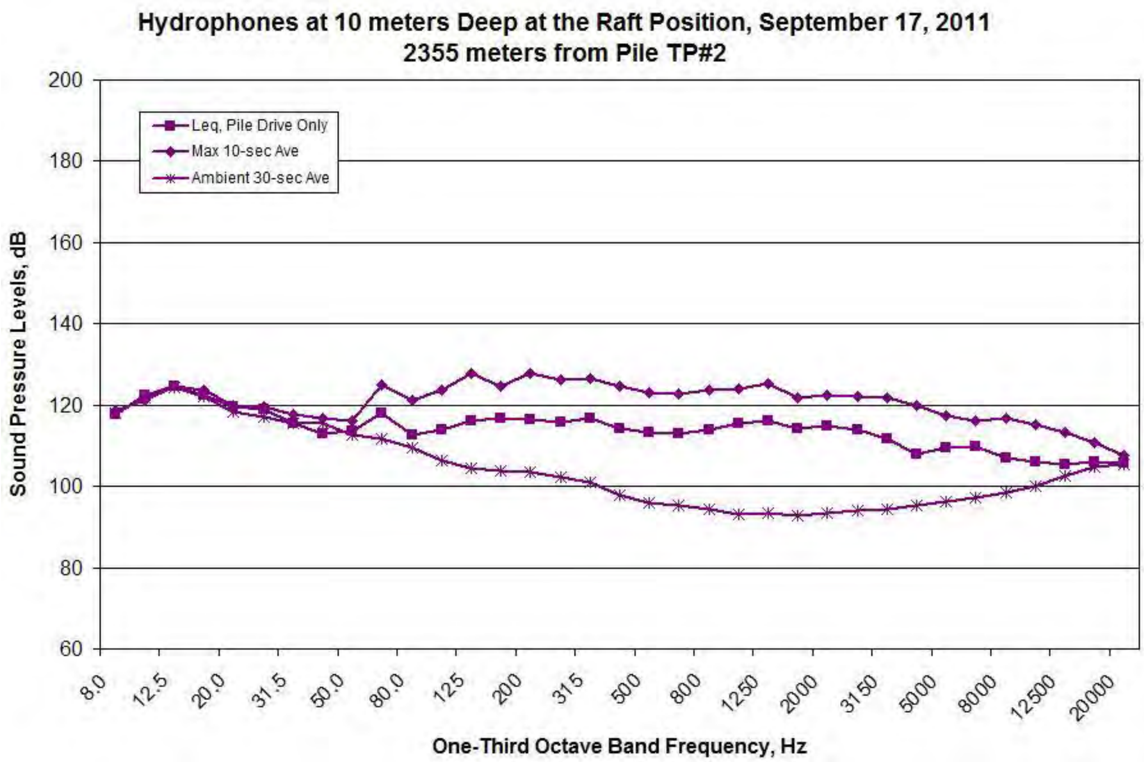

Figure A224. Spectral Data Measured at the RFT Location during TP#2, 11:26-11:38, Measured at Depths of 10 meters on September 17, 2011

TP#3 MP#1 (Vibratory Installation)

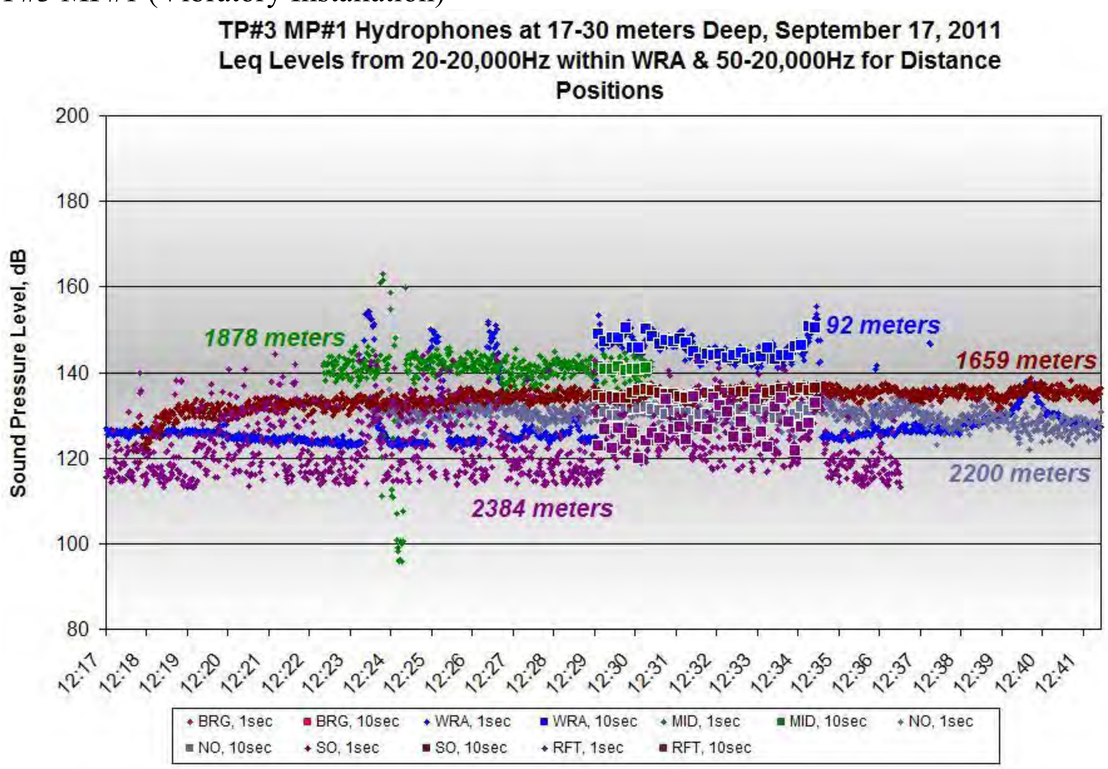

Figure A225. One-second and 10-second Average Data for TP#3 MP#1, 12:30-12:36, Measured at Depths of 17-30 meters on September 17, 2011

DATA NOT USABLE

Figure A226. Spectral Data Measured at the BRG Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 20 meters on September 17, 2011

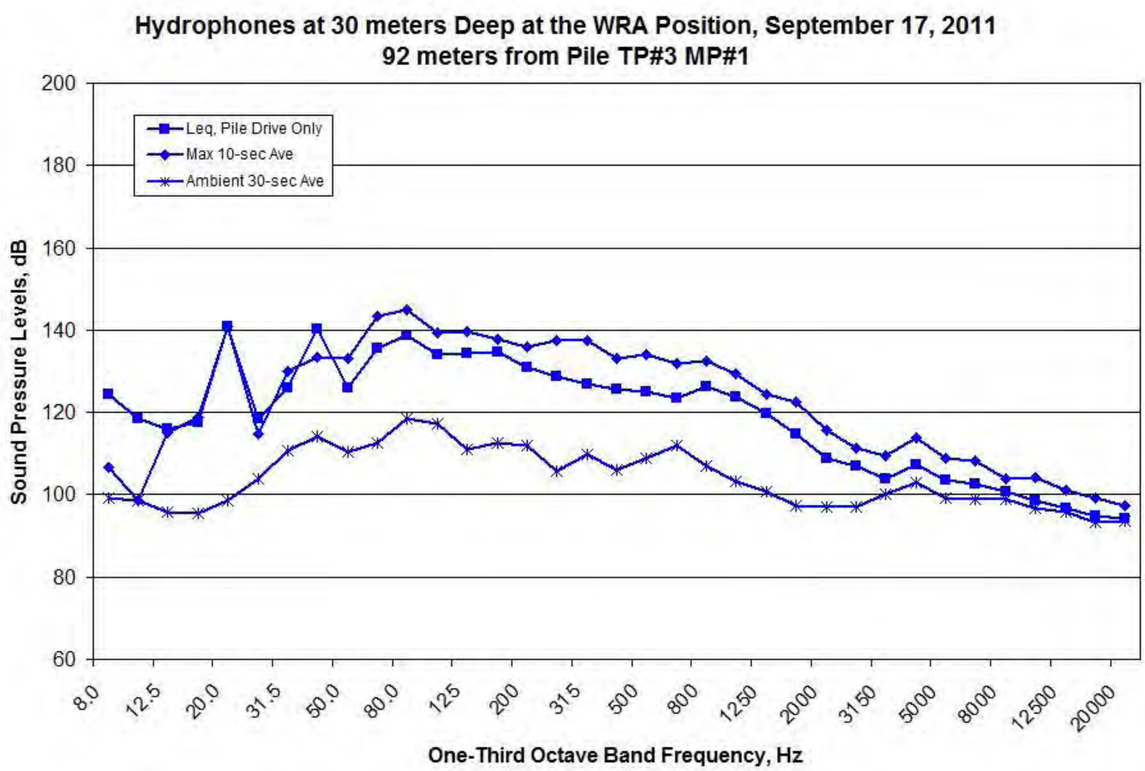

Figure A227. Spectral Data Measured at the WRA Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 30 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A228. Spectral Data Measured at the MID Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 30 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A229. Spectral Data Measured at the NO Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 30 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A230. Spectral Data Measured at the SO Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 30 meters on September 17, 2011

TOO MUCH NOISE

Figure A231. Spectral Data Measured at the RFT Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 17 meters on September 17, 2011

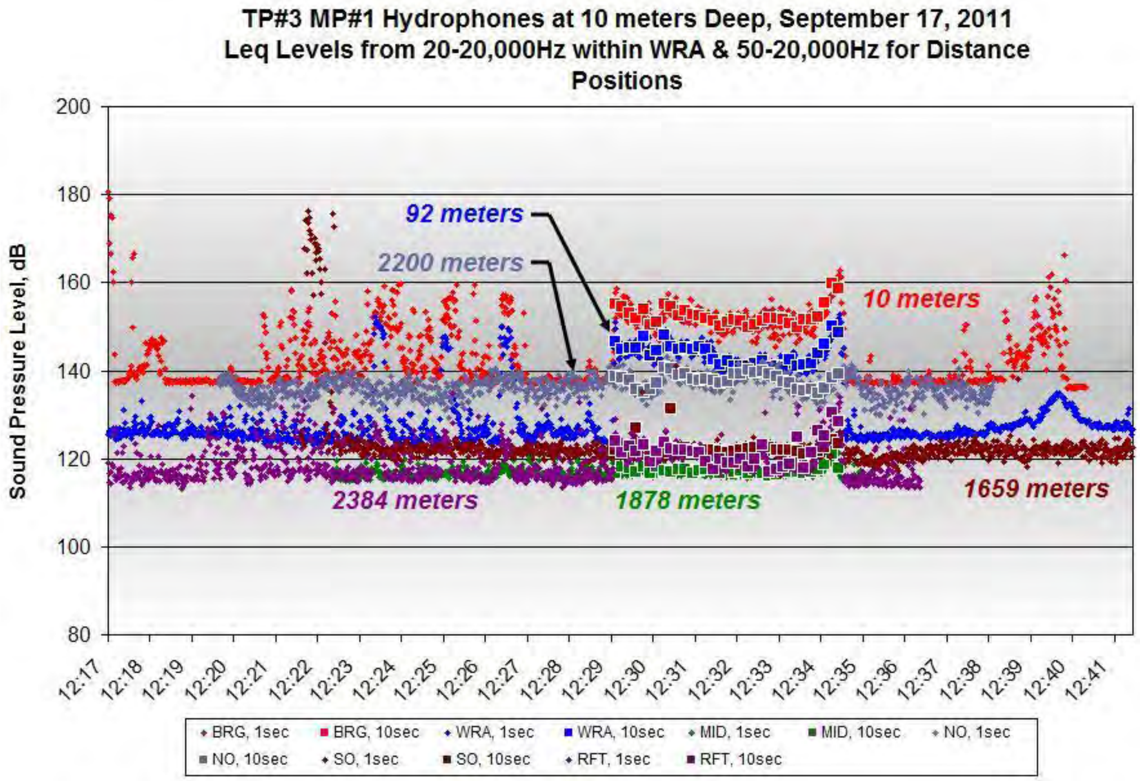

Figure A232. One-second and 10-second Average Data for TP#3 MP#1, 12:30-12:36, Measured at Depths of 10 meters on September 17, 2011

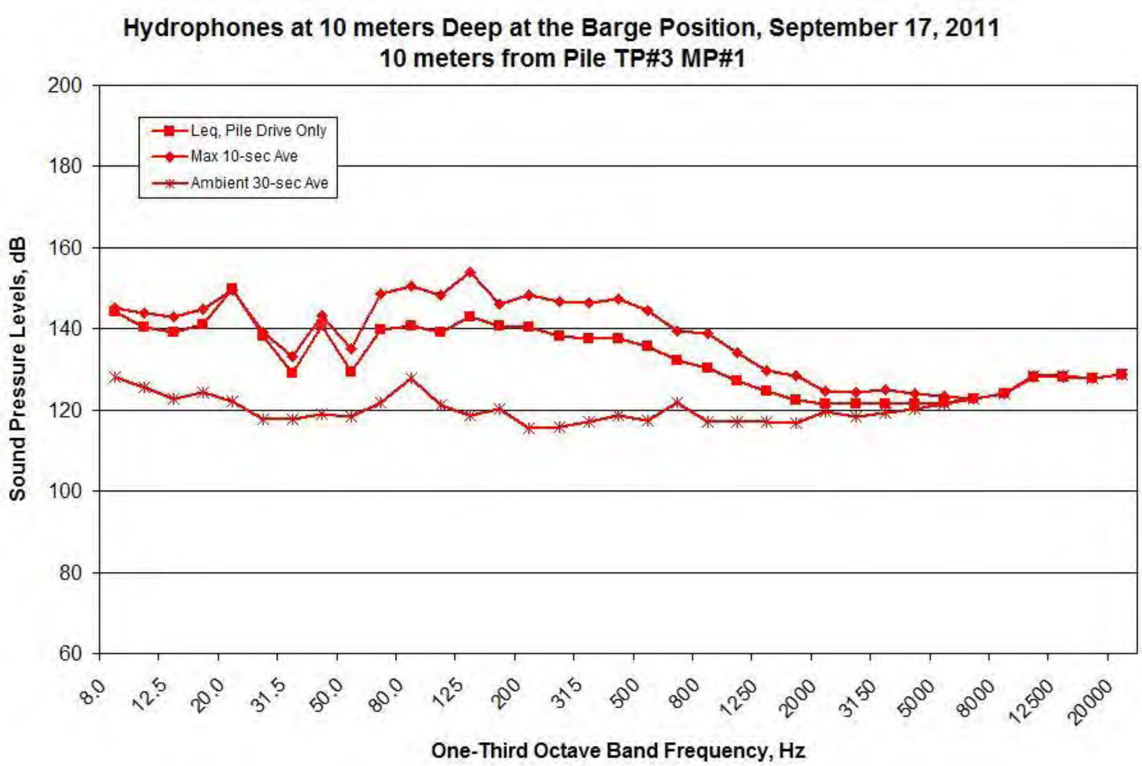

Figure A233. Spectral Data Measured at the BRG Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 10 meters on September 17, 2011

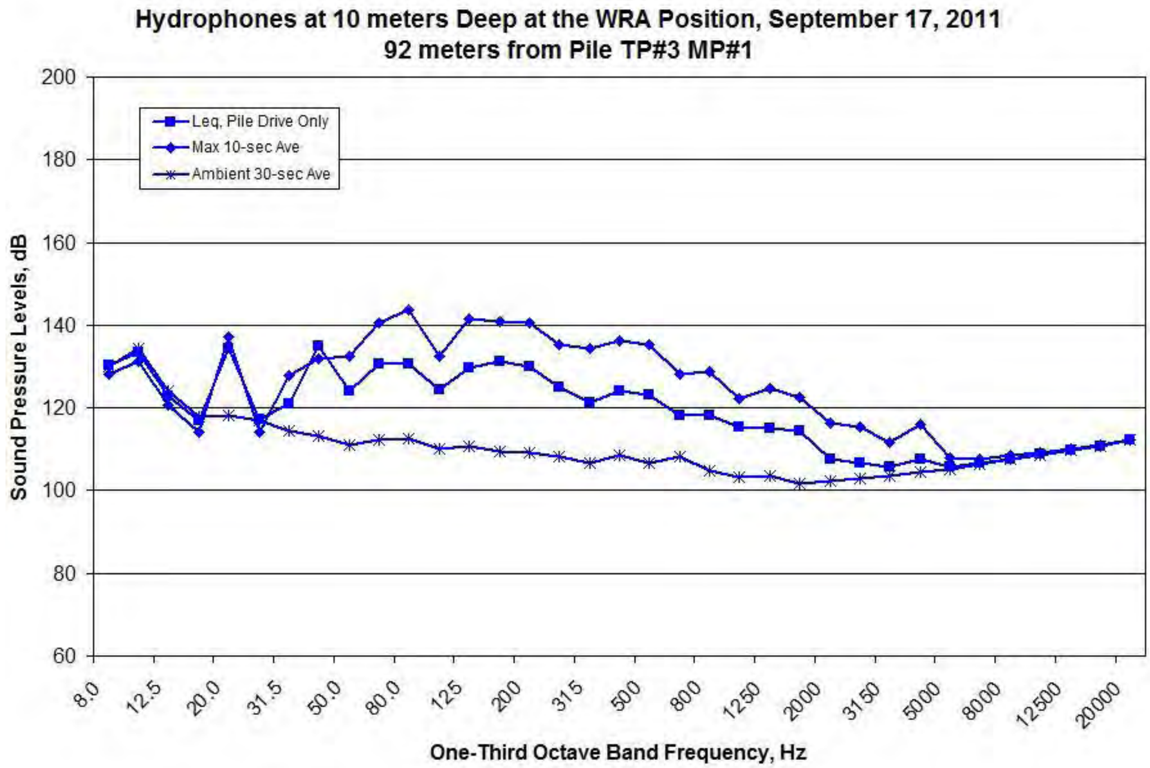

Figure A234. Spectral Data Measured at the WRA Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 10 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A235. Spectral Data Measured at the MID Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 10 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A236. Spectral Data Measured at the NO Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 10 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A237. Spectral Data Measured at the SO Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 10 meters on September 17, 2011

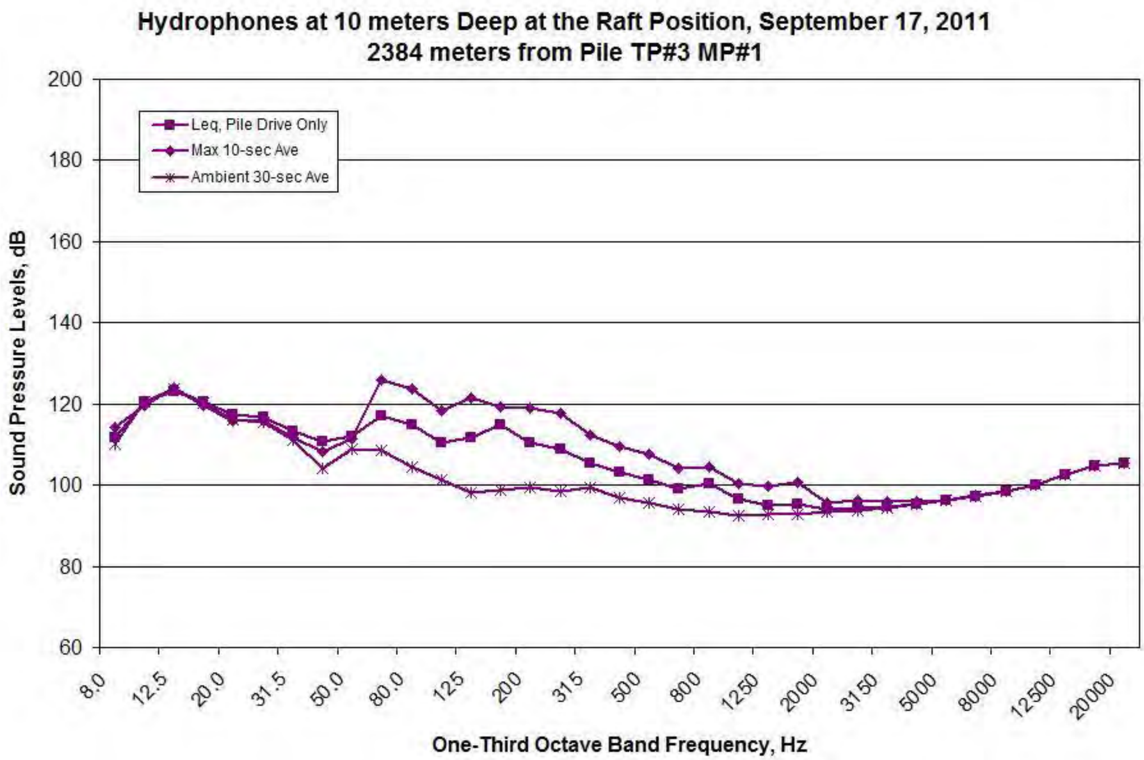

Figure A238. Spectral Data Measured at the RFT Location during TP#3 MP#1, 12:30-12:36, Measured at Depths of 10 meters on September 17, 2011

TTP#2 (Vibratory Removal)

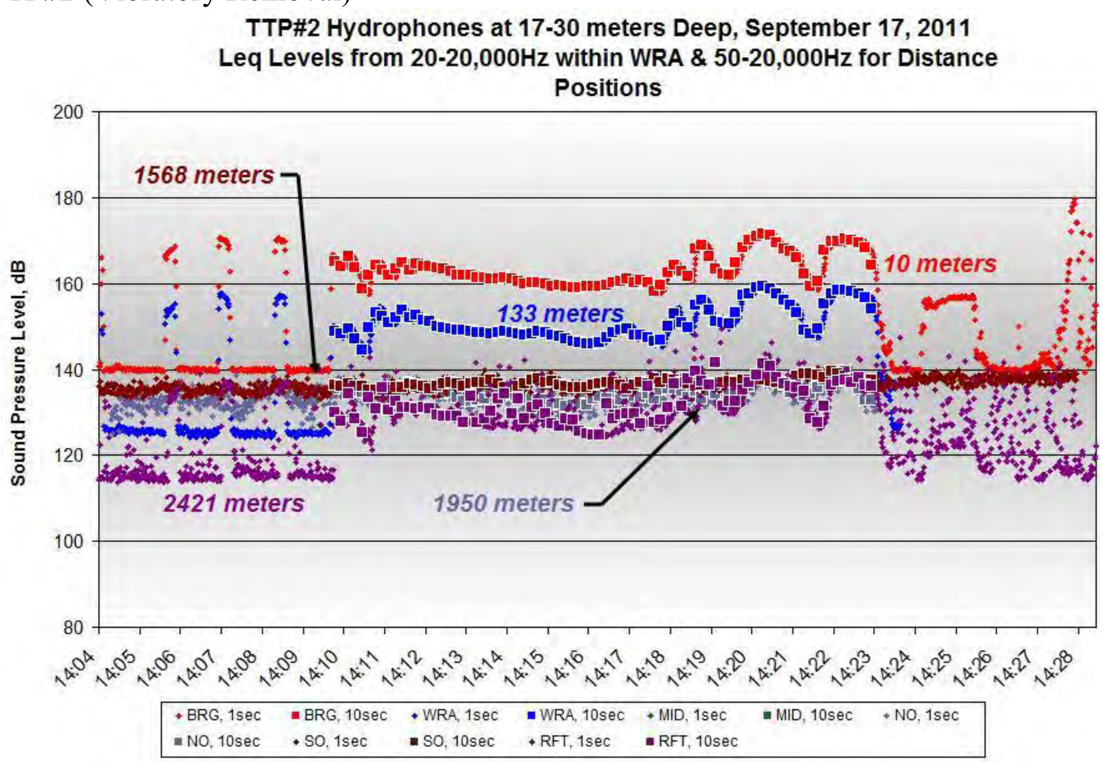

Figure A239. One-second and 10-second Average Data for TTP#2, 14:09-14:24, Measured at Depths of 17-30 meters on September 17, 2011

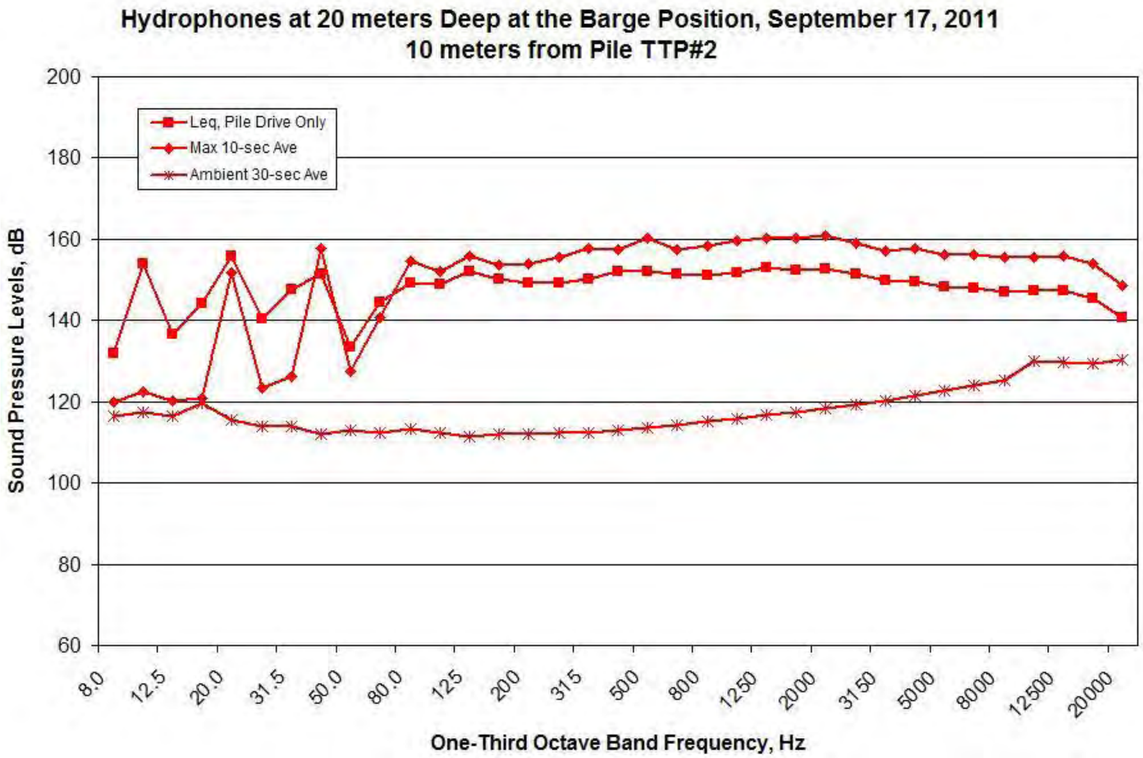

Figure A240. Spectral Data Measured at the BRG Location during TTP#2, 14:09-14:24, Measured at Depths of 20 meters on September 17, 2011

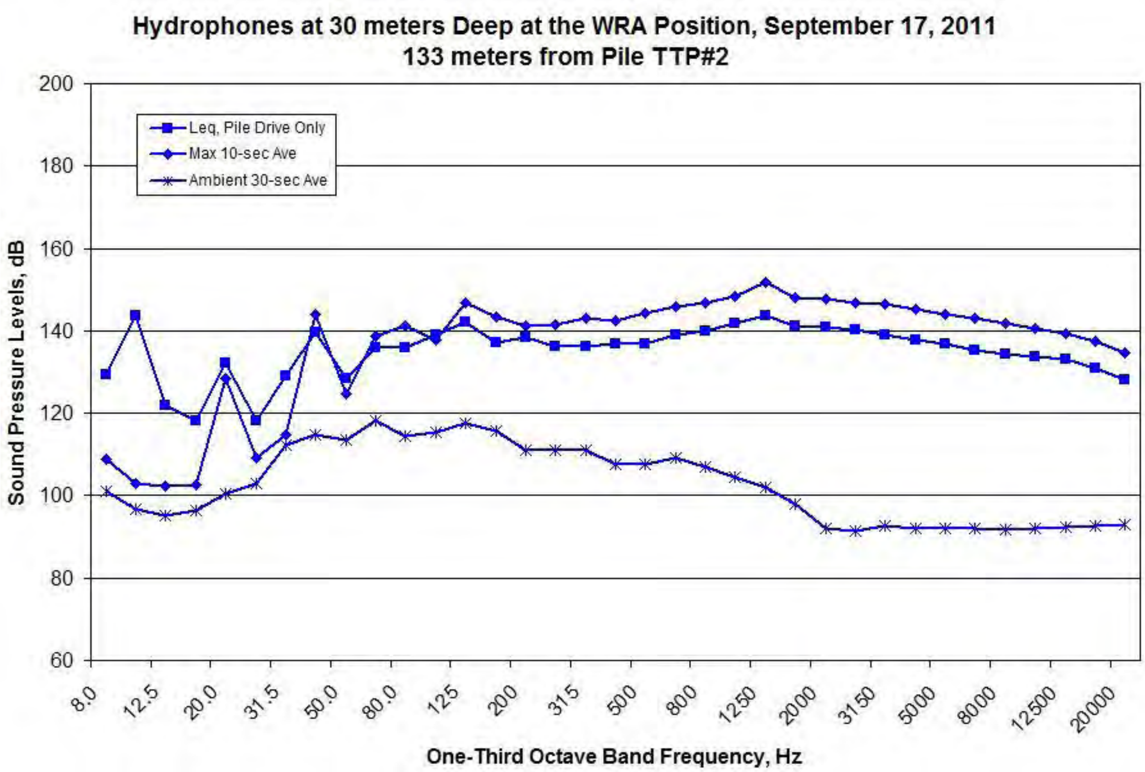

Figure A241. Spectral Data Measured at the WRA Location during TTP#2, 14:09-14:24, Measured at Depths of 30 meters on September 17, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A242. Spectral Data Measured at the MID Location during TTP#2, 14:09-14:24, Measured at Depths of 30 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A243. Spectral Data Measured at the NO Location during TTP#2, 14:09-14:24, Measured at Depths of 30 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A244. Spectral Data Measured at the SO Location during TTP#2, 14:09-14:24, Measured at Depths of 30 meters on September 17, 2011

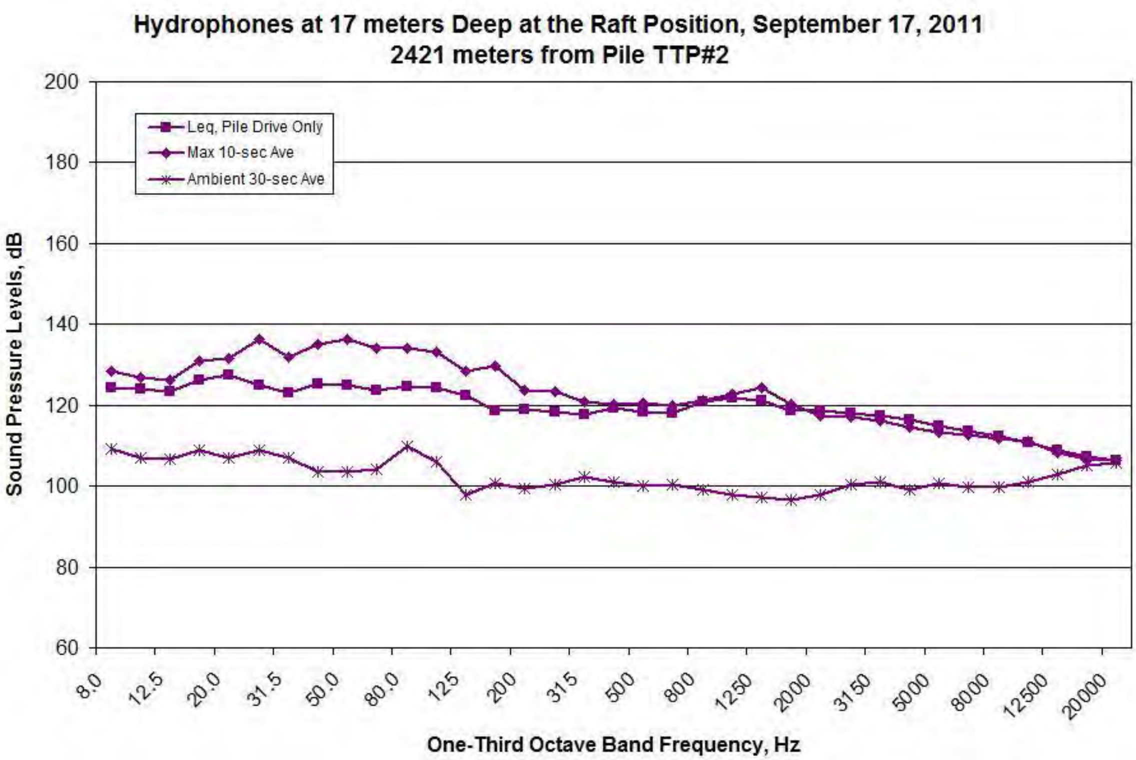

Figure A245. Spectral Data Measured at the RFT Location during TTP#2, 14:09-14:24, Measured at Depths of 17 meters on September 17, 2011

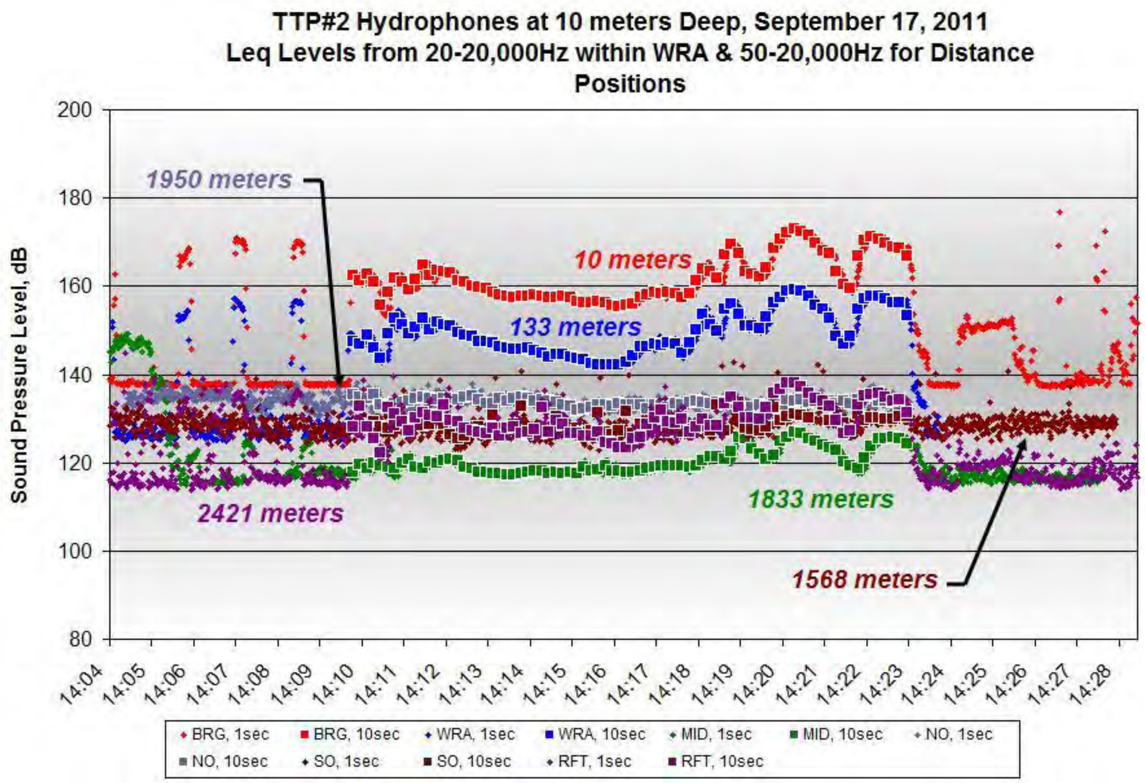

Figure A246. One-second and 10-second Average Data for TTP#2, 14:09-14:24, Measured at Depths of 10 meters on September 17, 2011

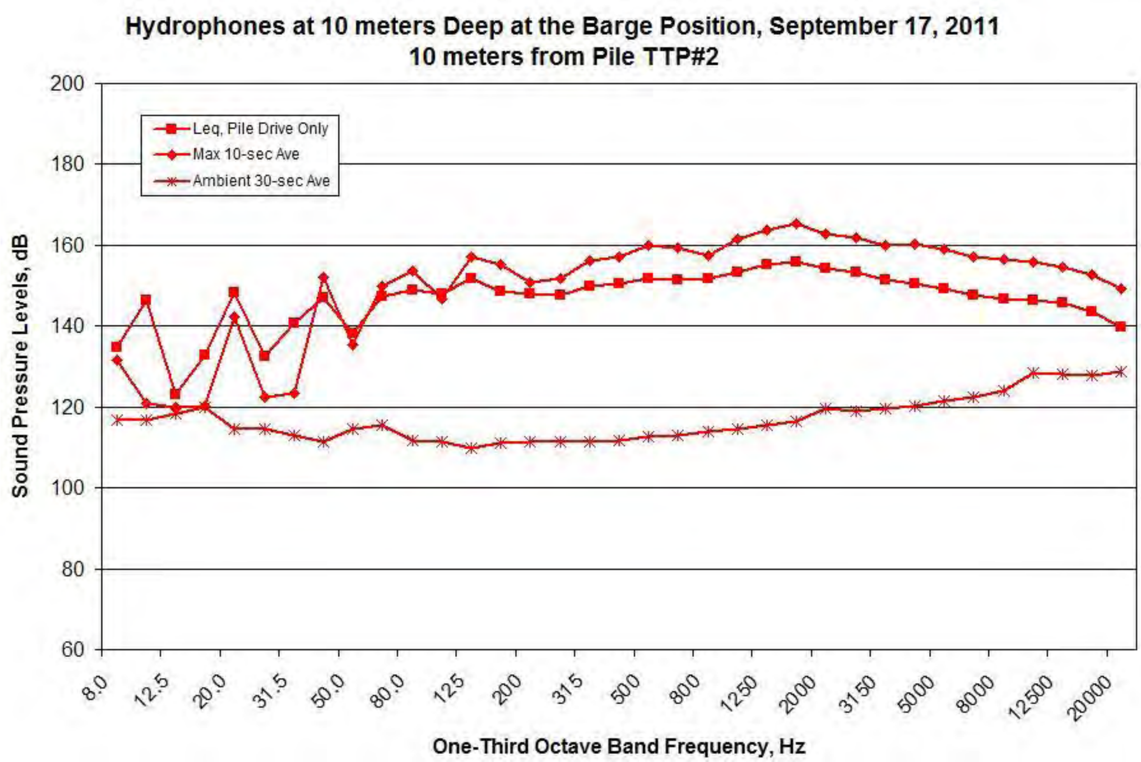

Figure A247. Spectral Data Measured at the BRG Location during TTP#2, 14:09-14:24, Measured at Depths of 10 meters on September 17, 2011

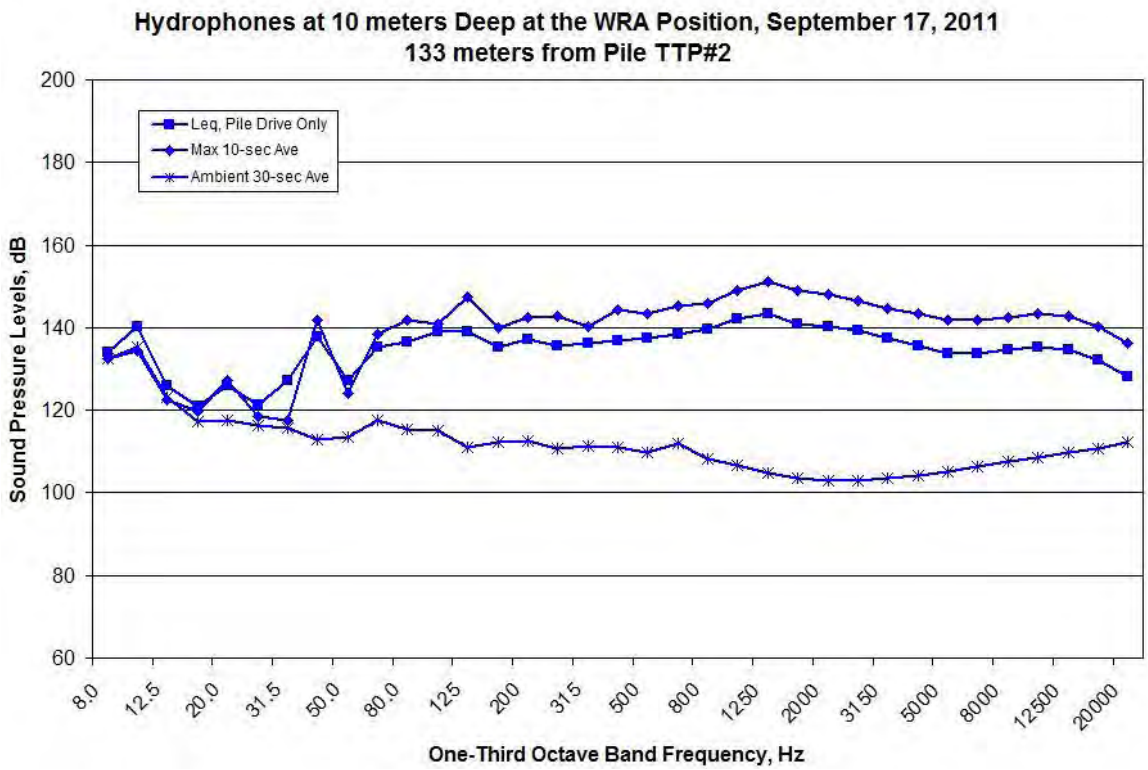

Figure A248. Spectral Data Measured at the WRA Location during TTP#2, 14:09-14:24, Measured at Depths of 10 meters on September 17, 2011

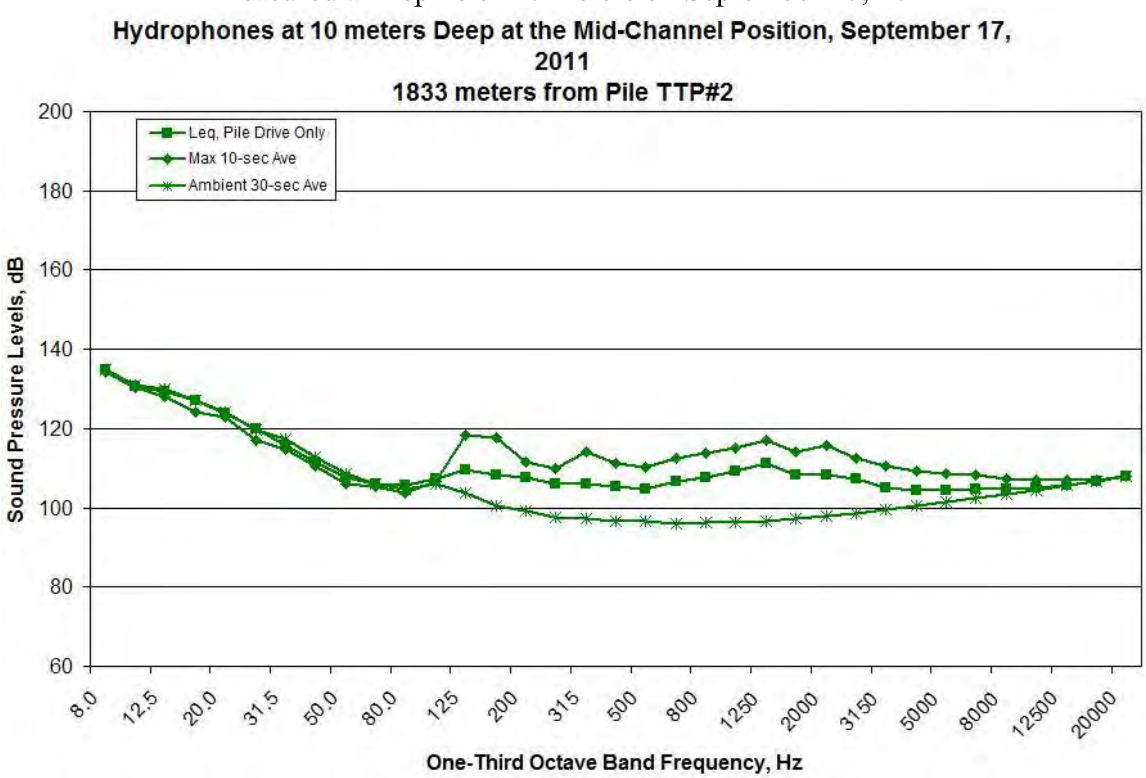

Figure A249. Spectral Data Measured at the MID Location during TTP#2, 14:09-14:24, Measured at Depths of 10 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A250. Spectral Data Measured at the NO Location during TTP#2, 14:09-14:24, Measured at Depths of 10 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A251. Spectral Data Measured at the SO Location during TTP#2, 14:09-14:24, Measured at Depths of 10 meters on September 17, 2011

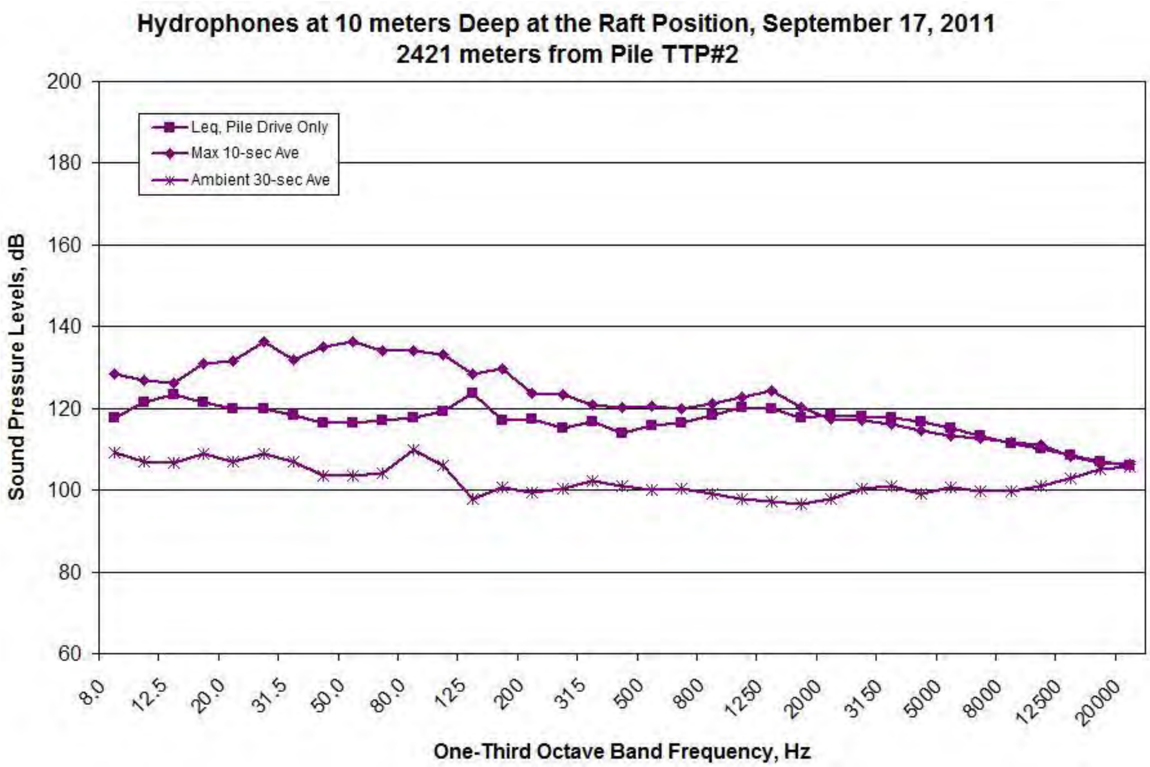

Figure A252. Spectral Data Measured at the RFT Location during TTP#2, 14:09-14:24, Measured at Depths of 10 meters on September 17, 2011

TP#3 MP#3 (Vibratory Installation)

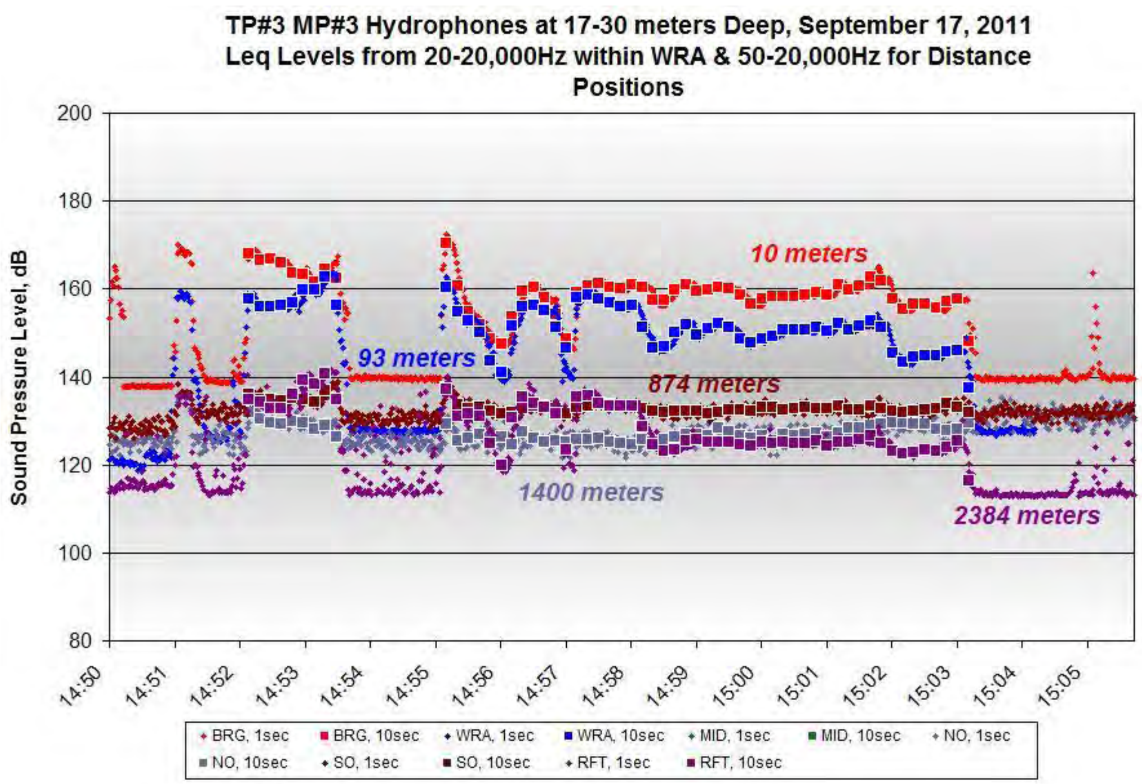

Figure A253. One-second and 10-second Average Data for TP#3 MP#3, 14:52-15:02, Measured at Depths of 17-30 meters on September 17, 2011

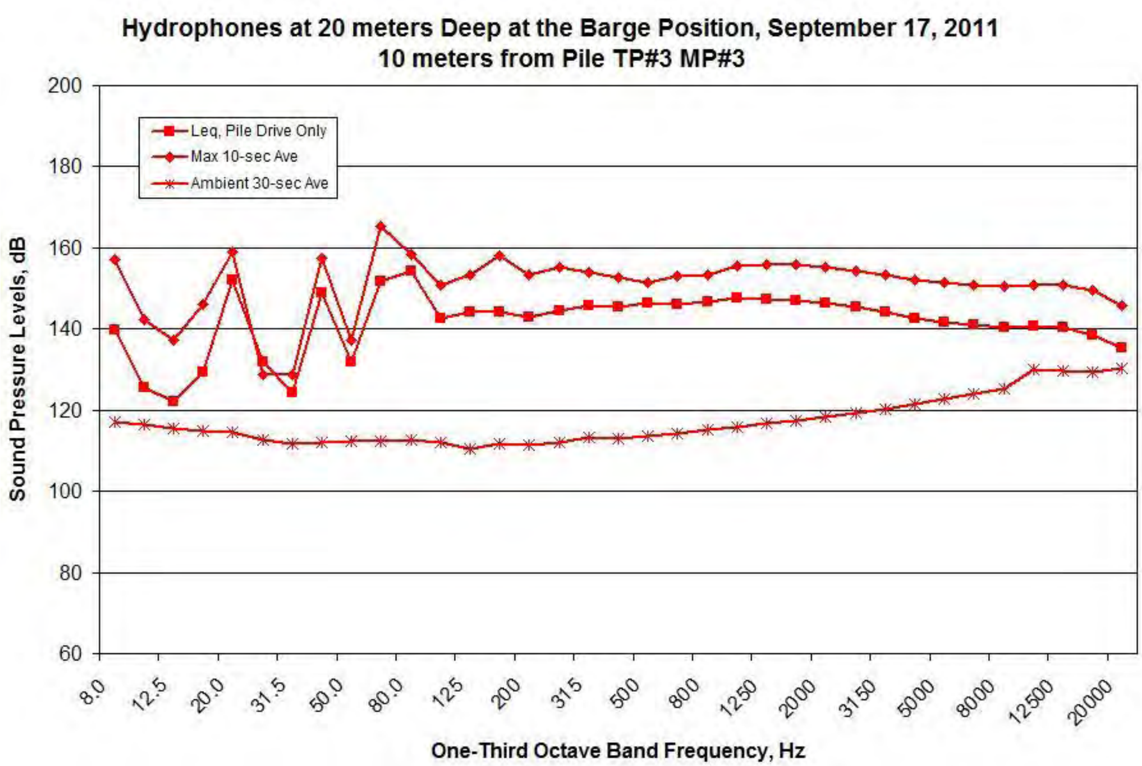

Figure A254. Spectral Data Measured at the BRG Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 20 meters on September 17, 2011

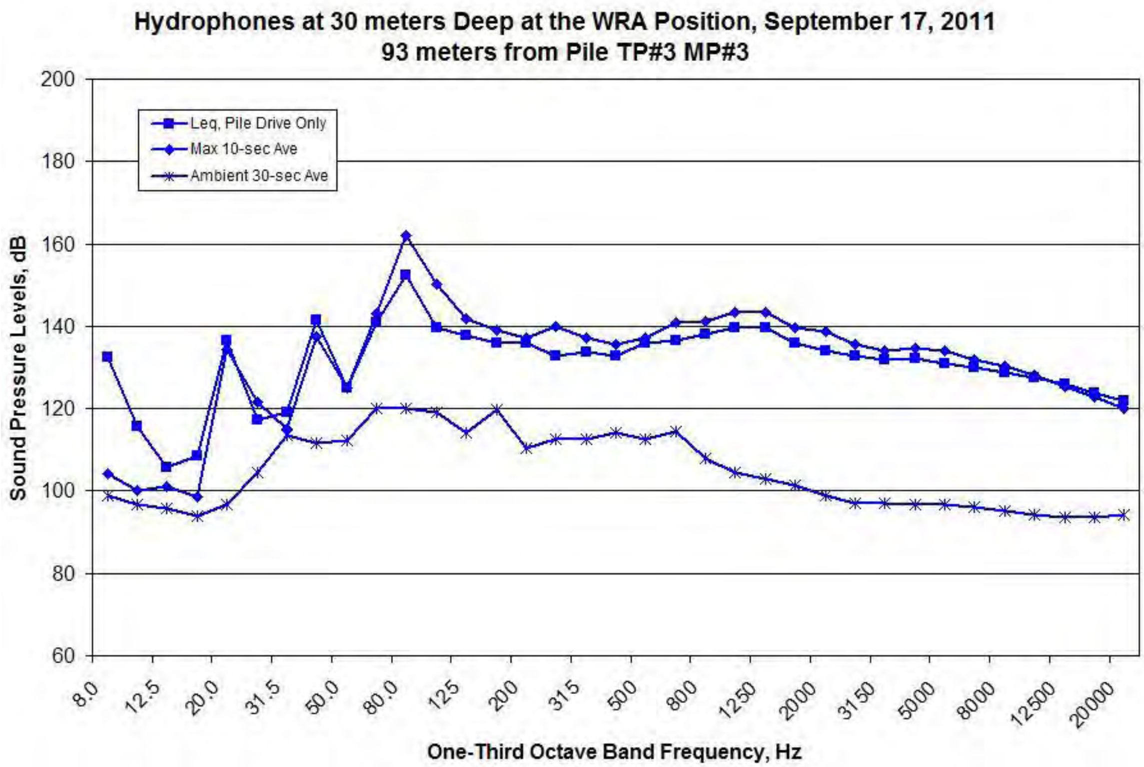

Figure A255. Spectral Data Measured at the WRA Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 30 meters on September 17, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A256. Spectral Data Measured at the MID Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 30 meters on September 17, 2011

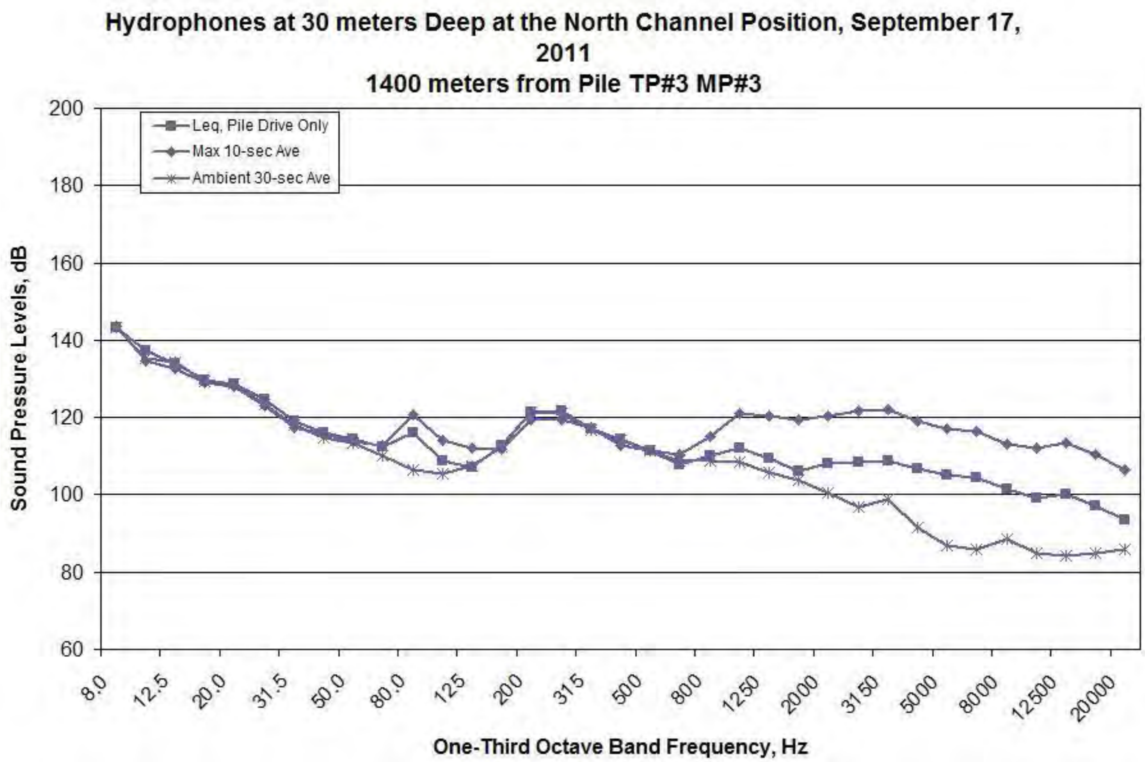

Figure A257. Spectral Data Measured at the NO Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 30 meters on September 17, 2011

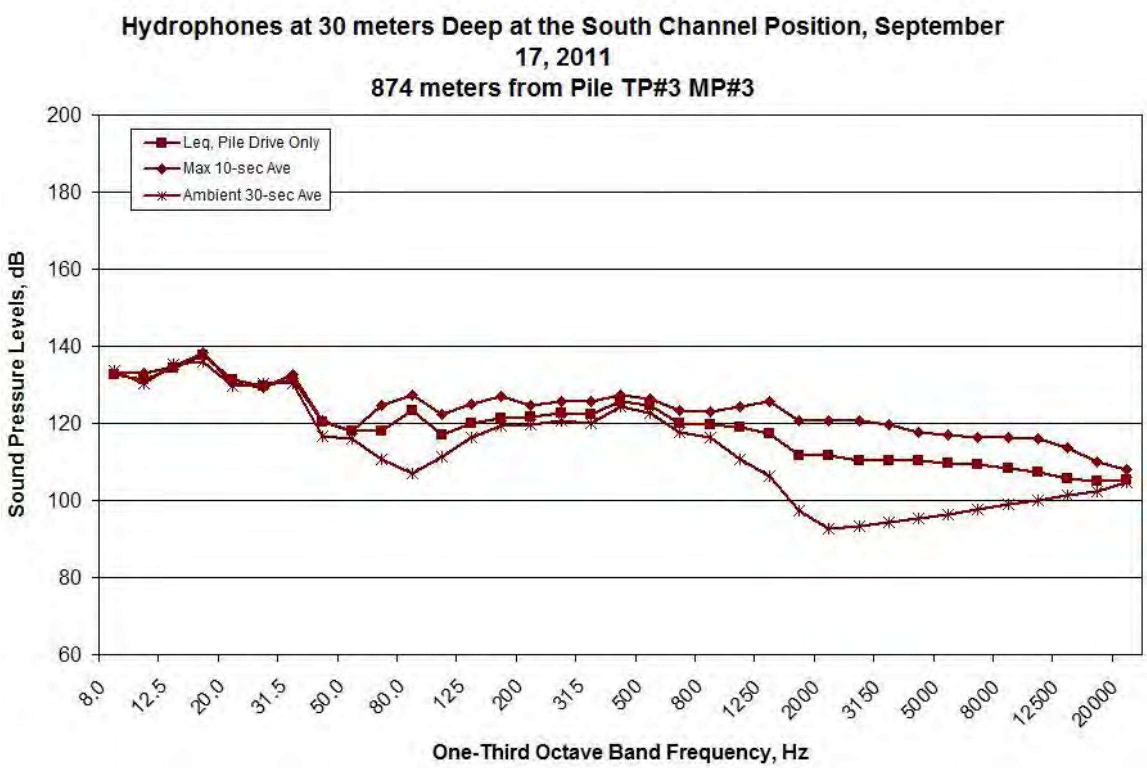

Figure A258. Spectral Data Measured at the SO Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 30 meters on September 17, 2011

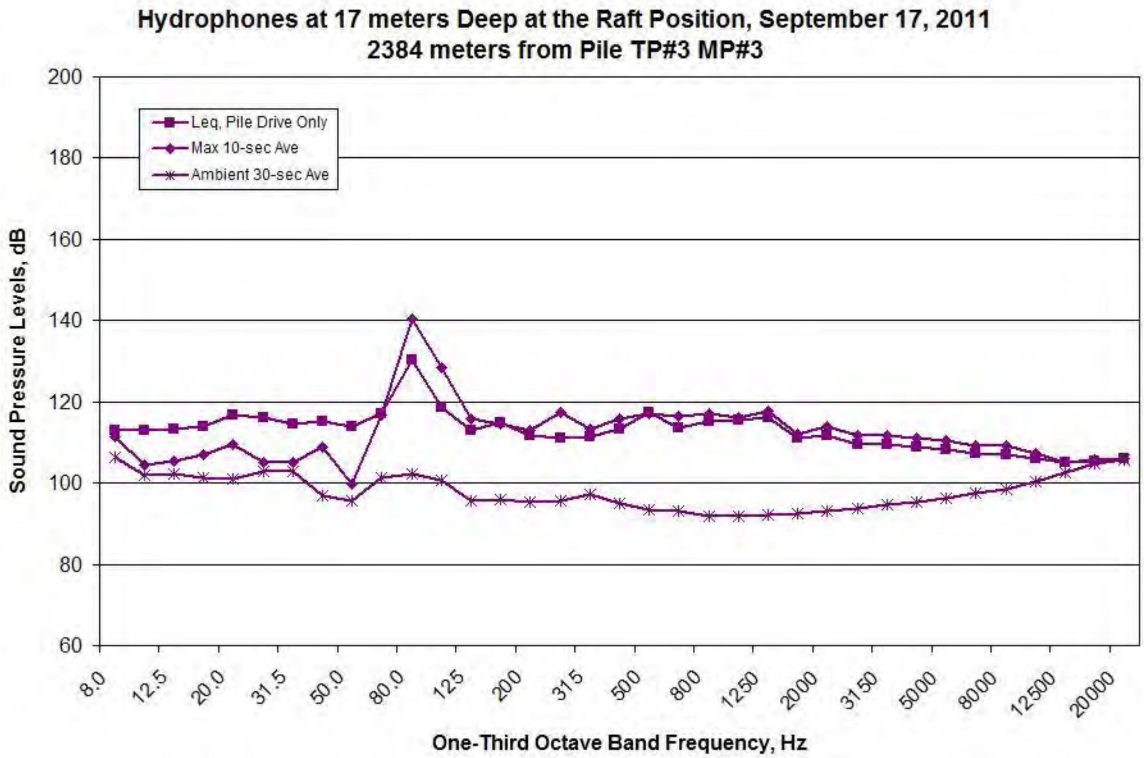

Figure A259. Spectral Data Measured at the RFT Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 17 meters on September 17, 2011

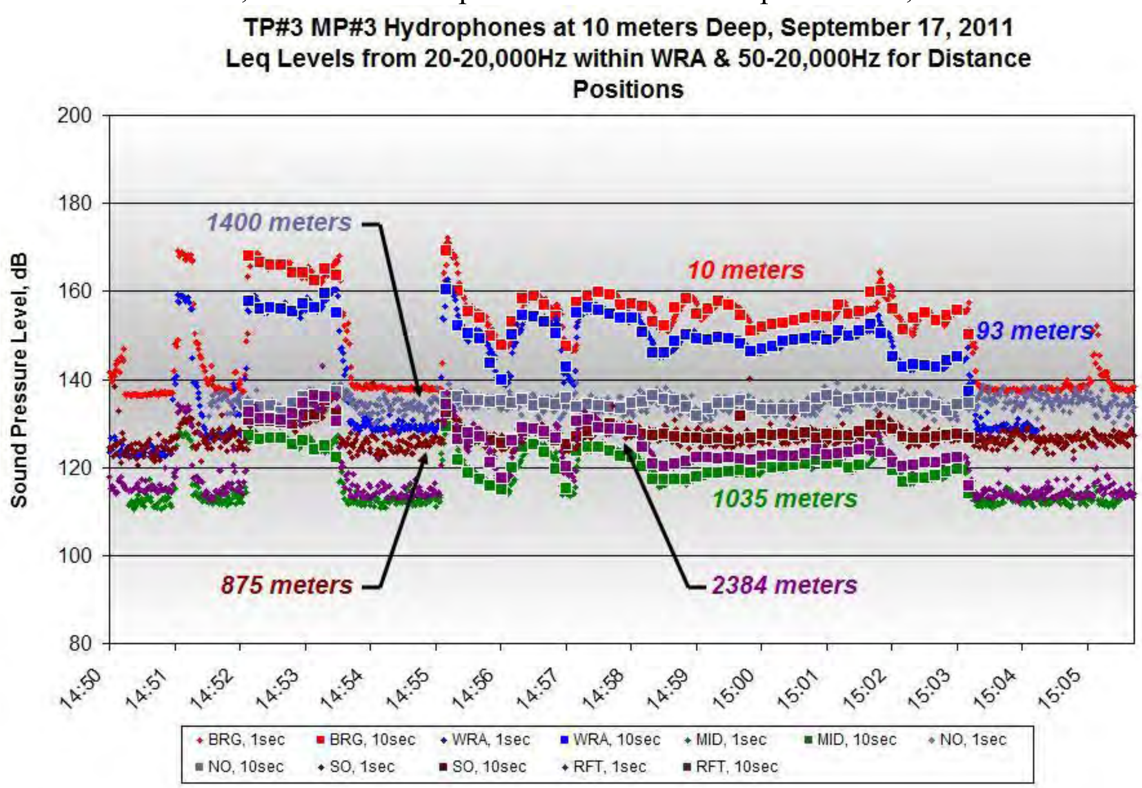

Figure A260. One-second and 10-second Average Data for TP#3 MP#3, 14:52-15:02, Measured at Depths of 10 meters on September 17, 2011

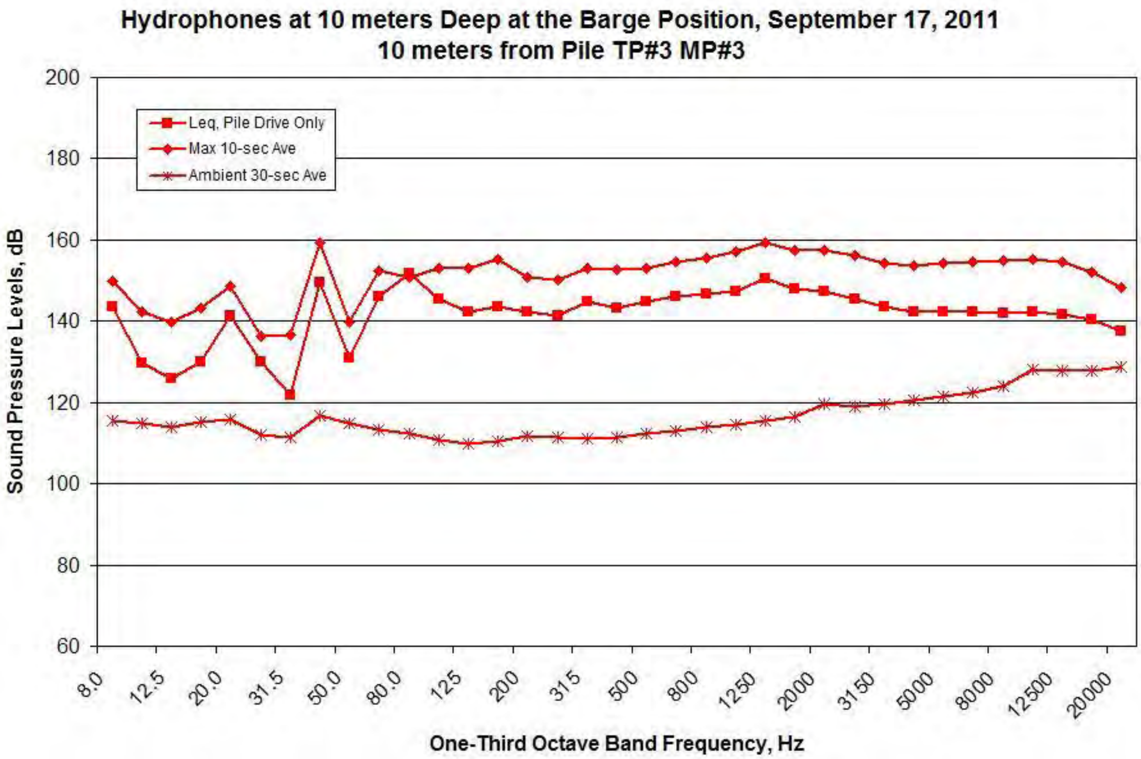

Figure A261. Spectral Data Measured at the BRG Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 10 meters on September 17, 2011

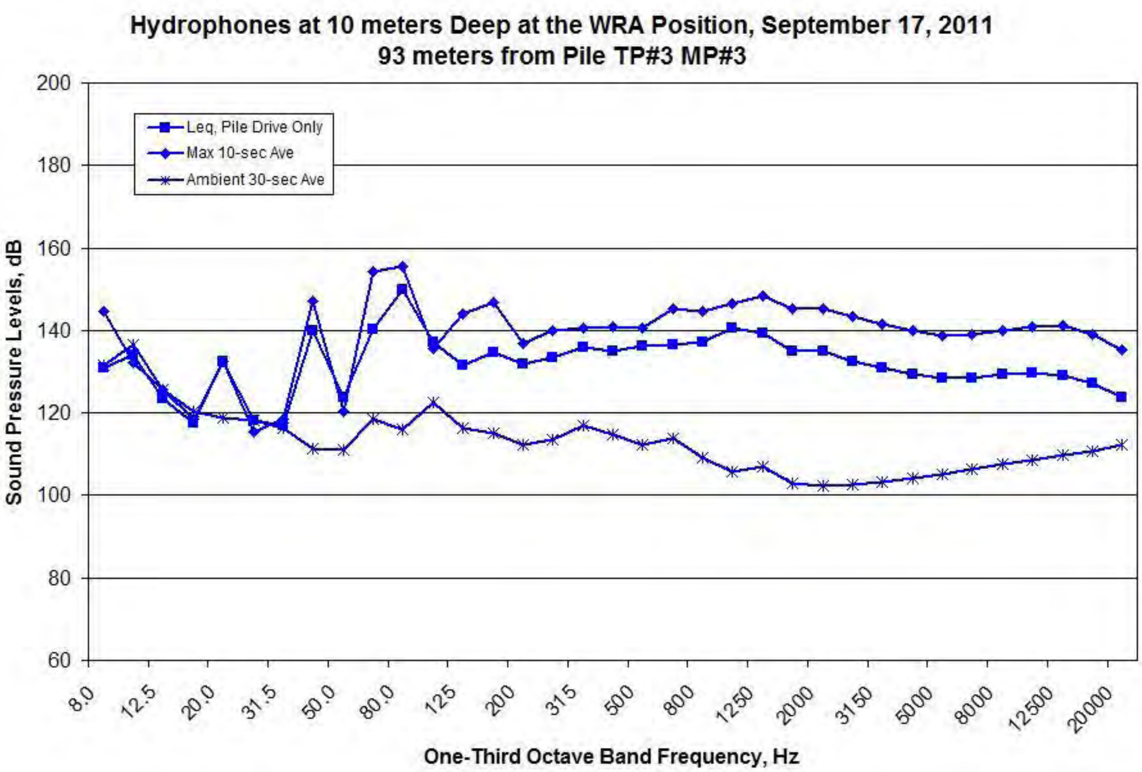

Figure A262. Spectral Data Measured at the WRA Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 10 meters on September 17, 2011

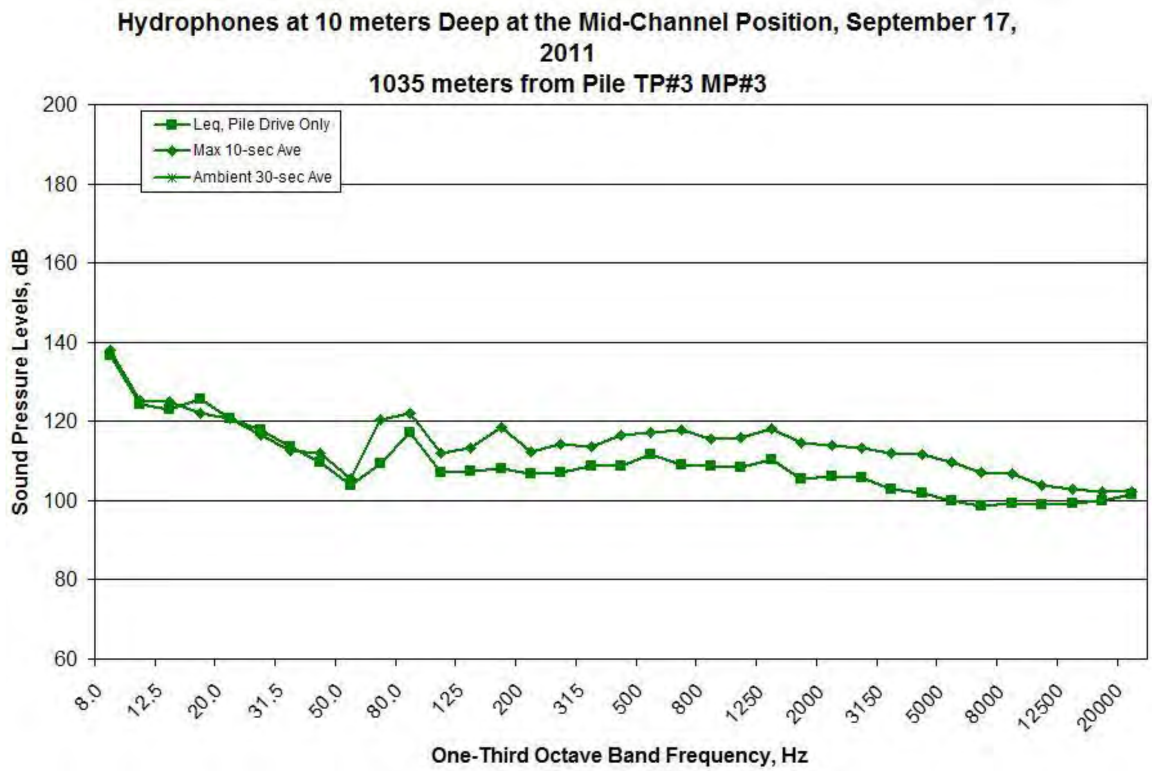

Figure A263. Spectral Data Measured at the MID Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 10 meters on September 17, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A264. Spectral Data Measured at the NO Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 10 meters on September 17, 2011

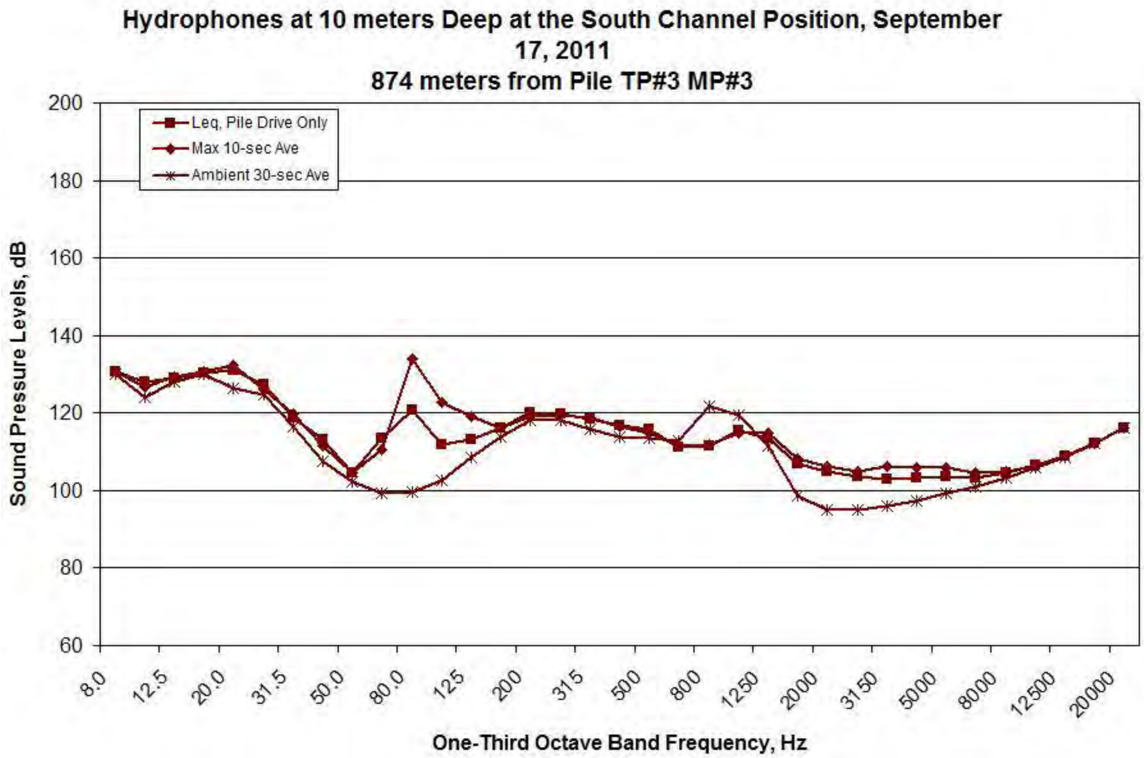

Figure A265. Spectral Data Measured at the SO Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 10 meters on September 17, 2011

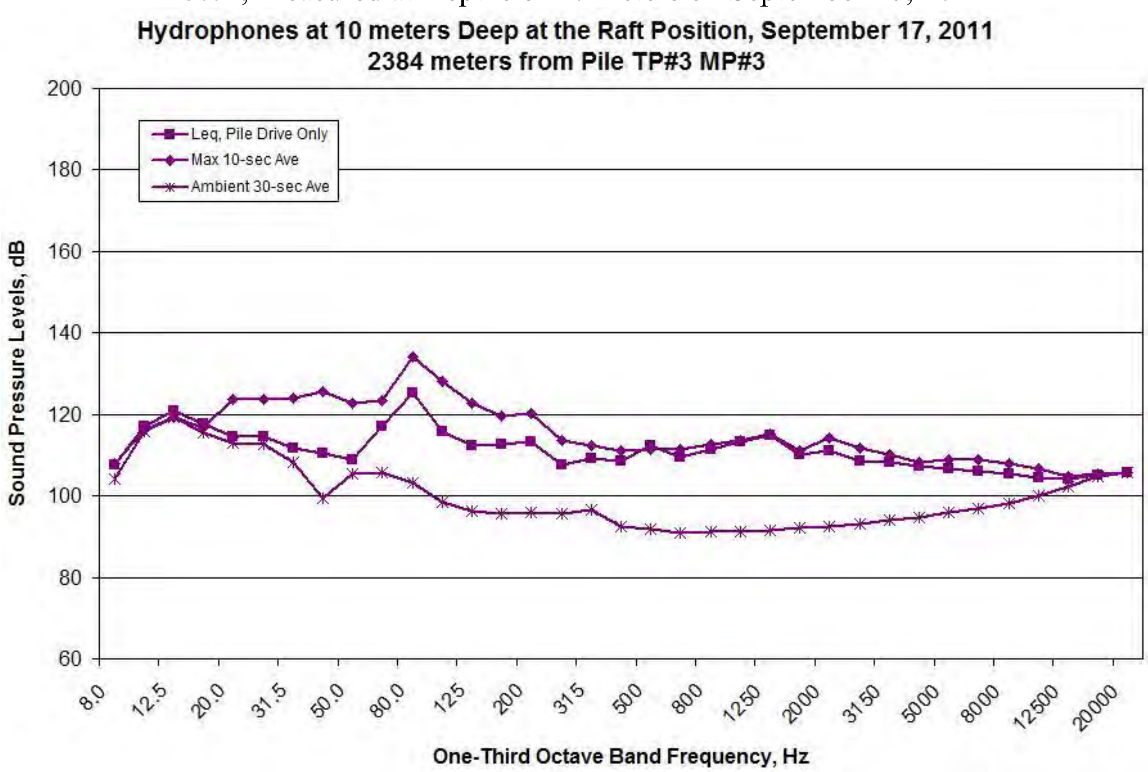

Figure A266. Spectral Data Measured at the RFT Location during TP#3 MP#3, 14:52-15:02, Measured at Depths of 10 meters on September 17, 2011

TP#7 (Vibratory Removal)

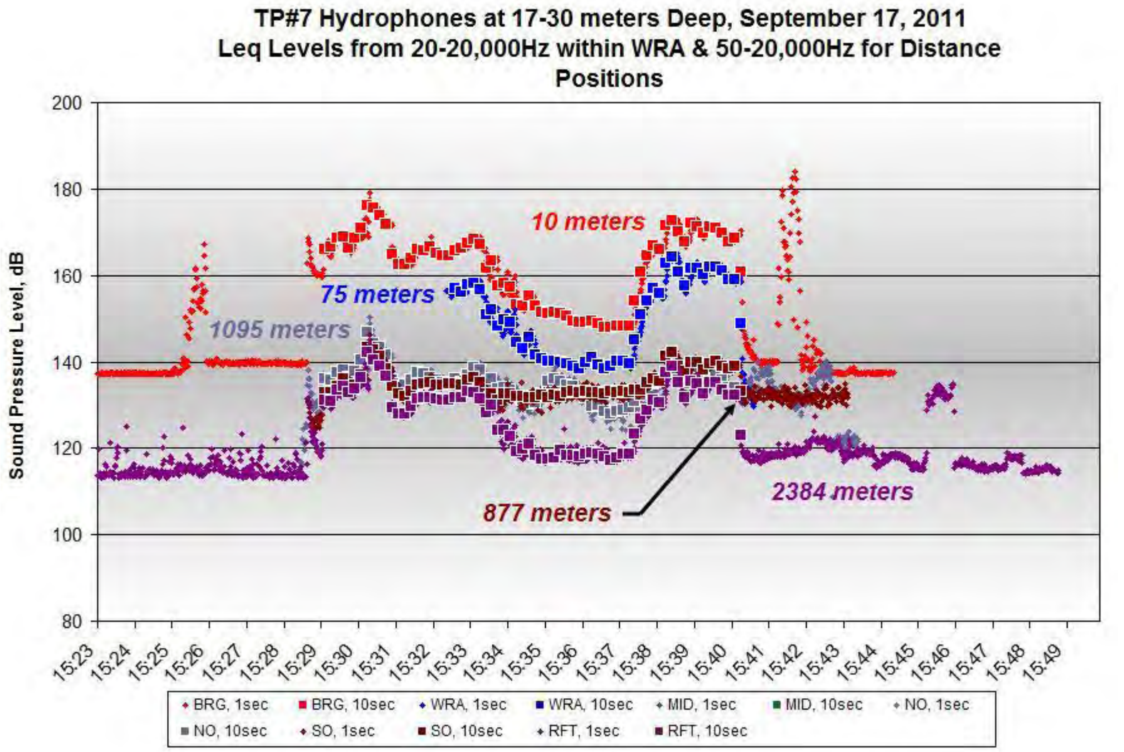

Figure A267. One-second and 10-second Average Data for TP#7, 15:28-15:40, Measured at Depths of 17-30 meters on September 17, 2011

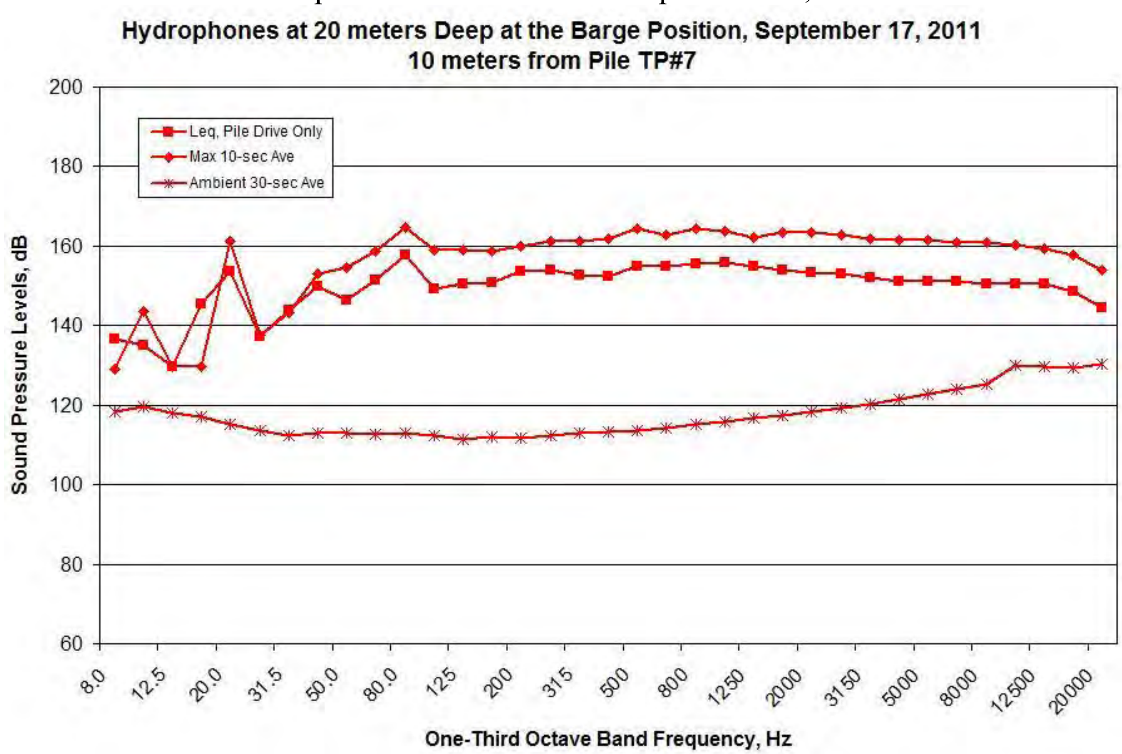

Figure A268. Spectral Data Measured at the BRG Location during TP#7, 15:28-15:40, Measured at Depths of 20 meters on September 17, 2011

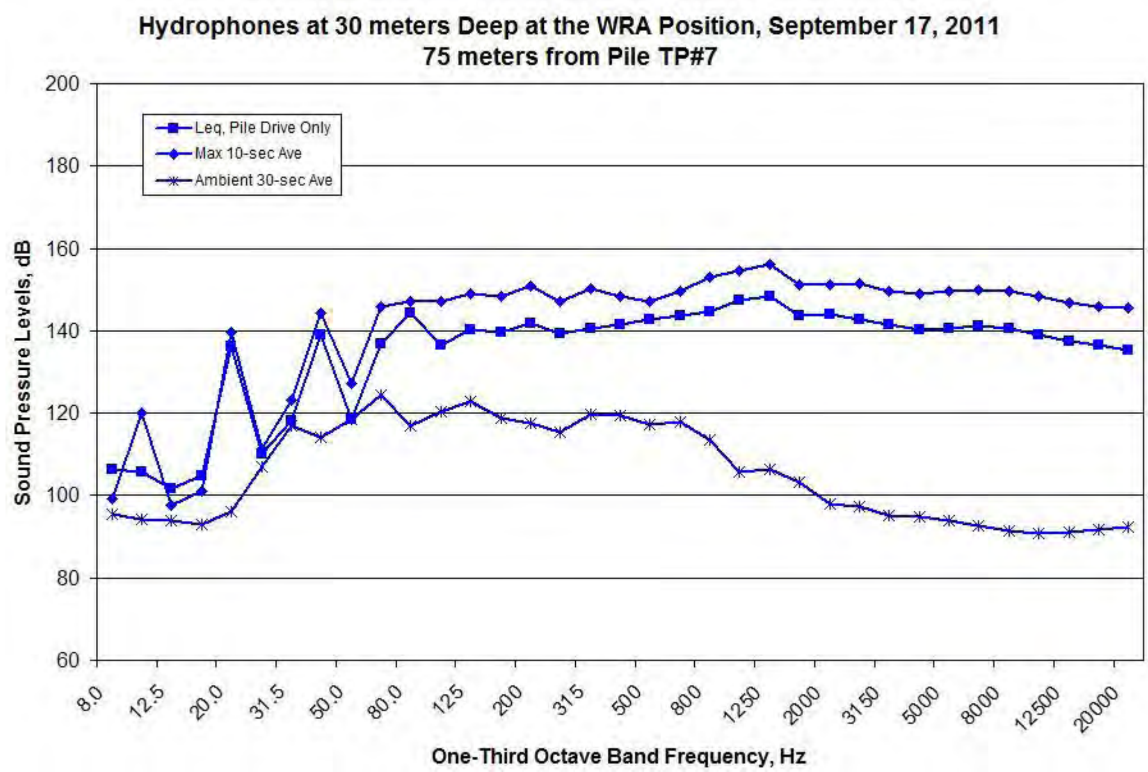

Figure A269. Spectral Data Measured at the WRA Location during TP#7, 15:28-15:40, Measured at Depths of 30 meters on September 17, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A270. Spectral Data Measured at the MID Location during TP#7, 15:28-15:40, Measured at Depths of 30 meters on September 17, 2011

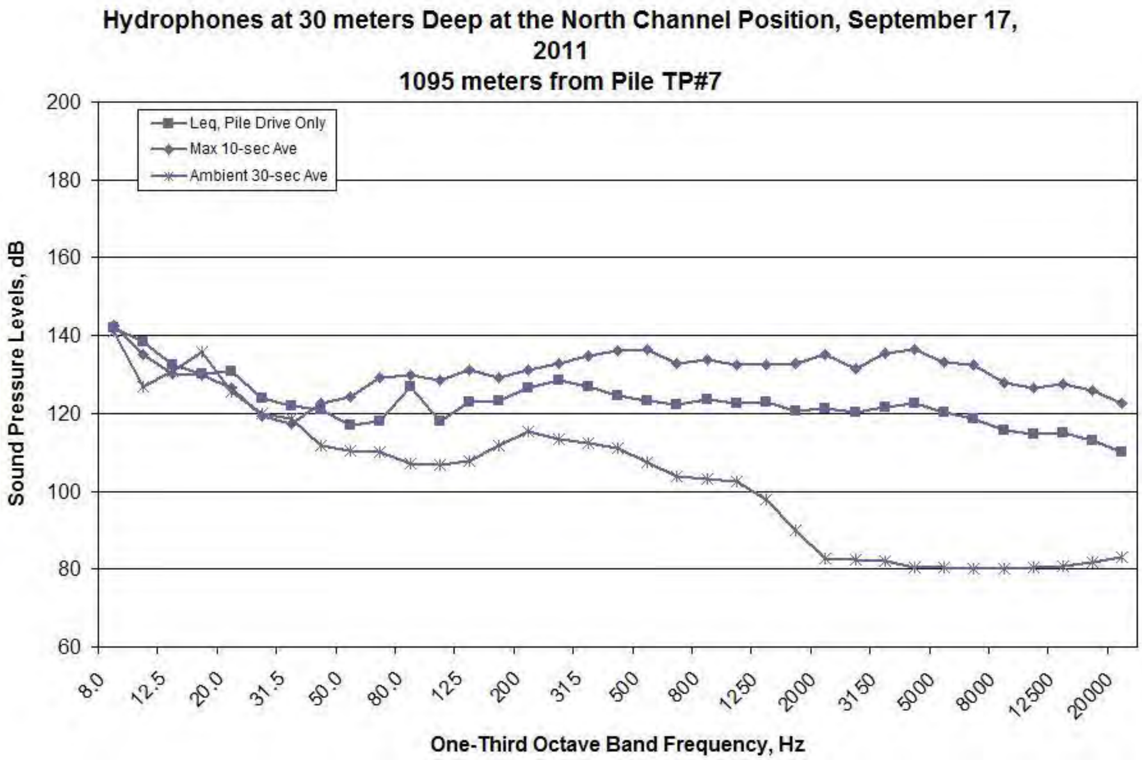

Figure A271. Spectral Data Measured at the NO Location during TP#7, 15:28-15:40, Measured at Depths of 30 meters on September 17, 2011

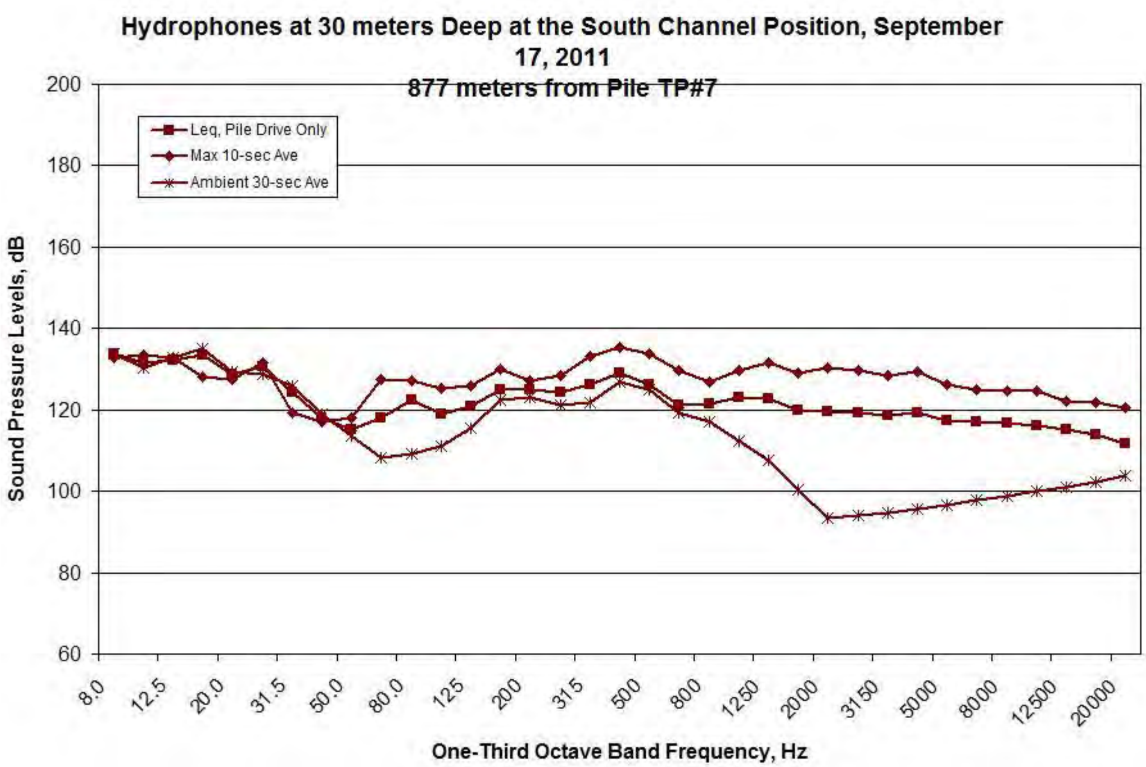

Figure A272. Spectral Data Measured at the SO Location during TP#7, 15:28-15:40, Measured at Depths of 30 meters on September 17, 2011

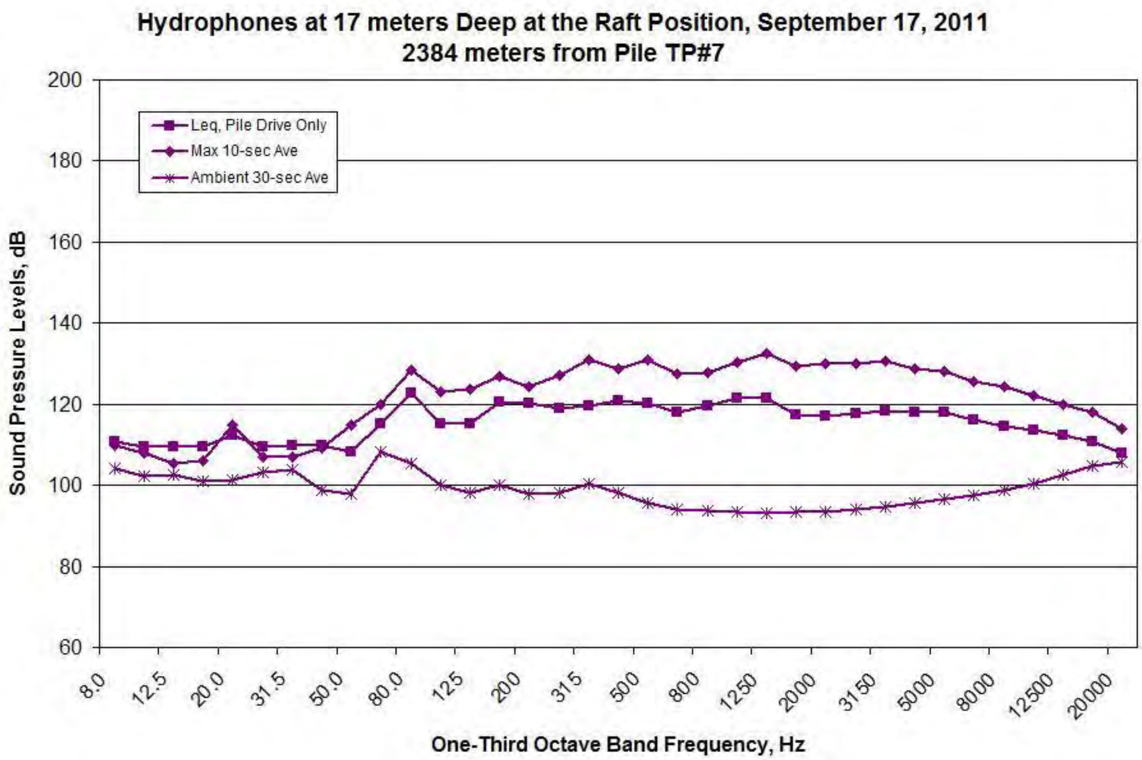

Figure A273. Spectral Data Measured at the RFT Location during TP#7, 15:28-15:40, Measured at Depths of 17 meters on September 17, 2011

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Figure A274. One-second and 10-second Average Data for TP#7, 15:28-15:40, Measured at Depths of 10 meters on September 17, 2011

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Figure A275. Spectral Data Measured at the BRG Location during TP#7, 15:28-15:40, Measured at Depths of 10 meters on September 17, 2011

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Figure A276. Spectral Data Measured at the WRA Location during TP#7, 15:28-15:40, Measured at Depths of 10 meters on September 17, 2011

SEE MAIN REPORT

Figure A277. Spectral Data Measured at the MID Location during TP#7, 15:28-15:40, Measured at Depths of 10 meters on September 17, 2011

SEE MAIN REPORT

Figure A278. Spectral Data Measured at the NO Location during TP#7, 15:28-15:40, Measured at Depths of 10 meters on September 17, 2011

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Figure A279. Spectral Data Measured at the SO Location during TP#7, 15:28-15:40, Measured at Depths of 10 meters on September 17, 2011

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Figure A280. Spectral Data Measured at the RFT Location during TP#7, 15:28-15:40, Measured at Depths of 10 meters on September 17, 2011

TP#3 MP#2 (Vibratory Installation)

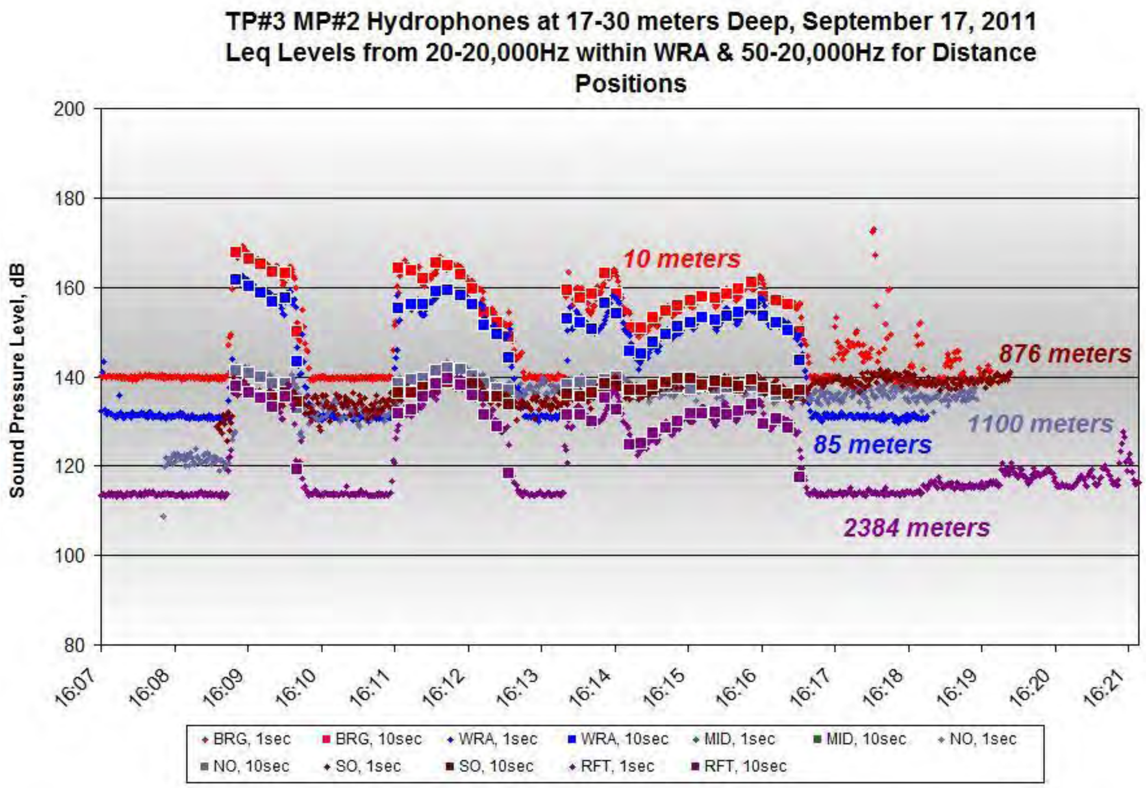

Figure A281. One-second and 10-second Average Data for TP#3 MP#2, 16:09-16:17, Measured at Depths of 17-30 meters on September 17, 2011

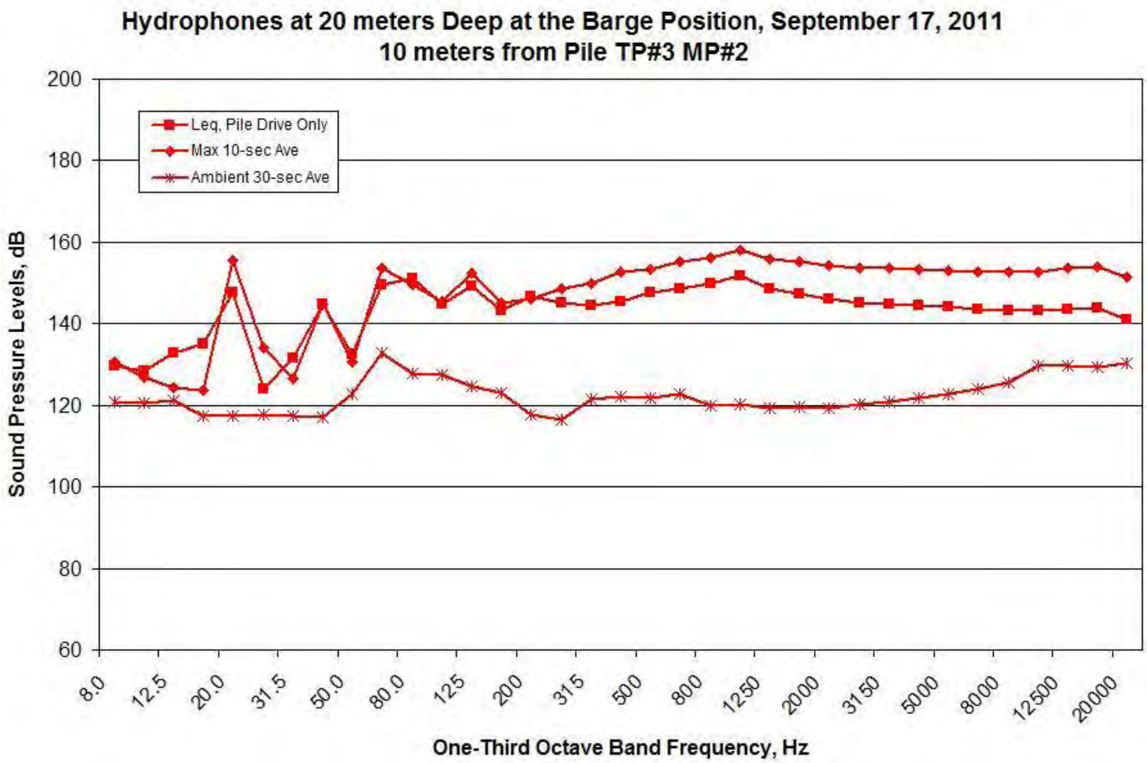

Figure A282. Spectral Data Measured at the BRG Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 20 meters on September 17, 2011

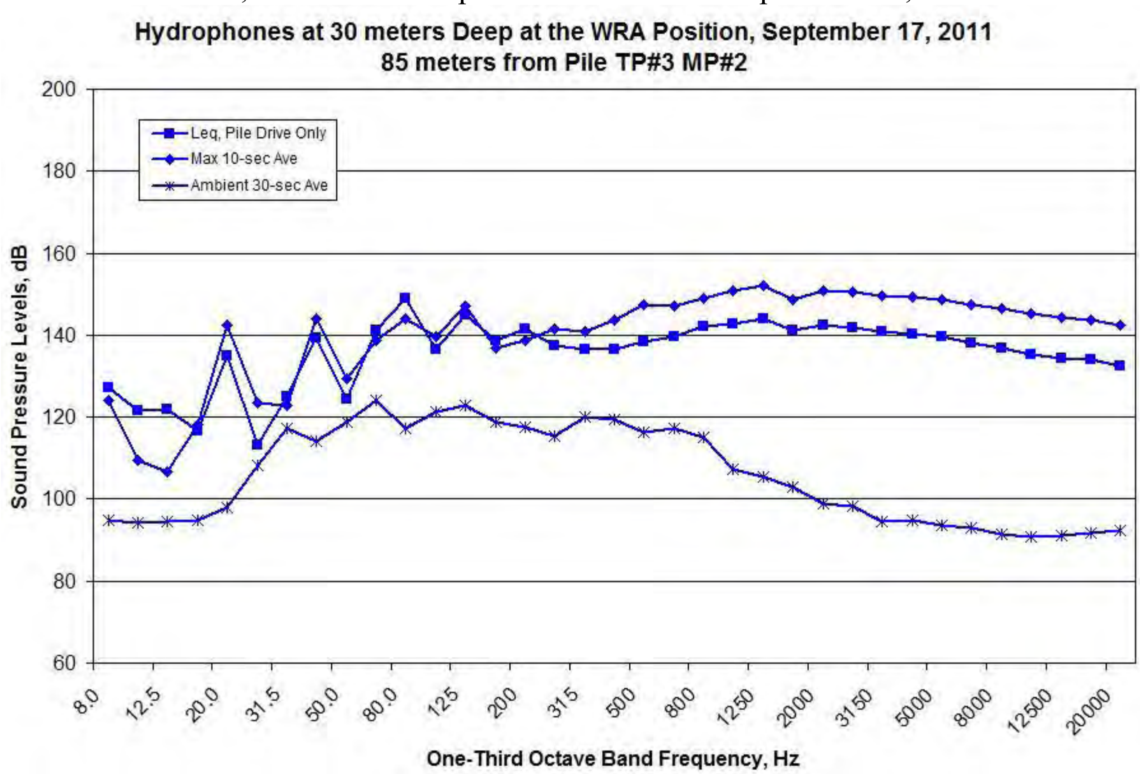

Figure A283. Spectral Data Measured at the WRA Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 30 meters on September 17, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A284. Spectral Data Measured at the MID Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 30 meters on September 17, 2011

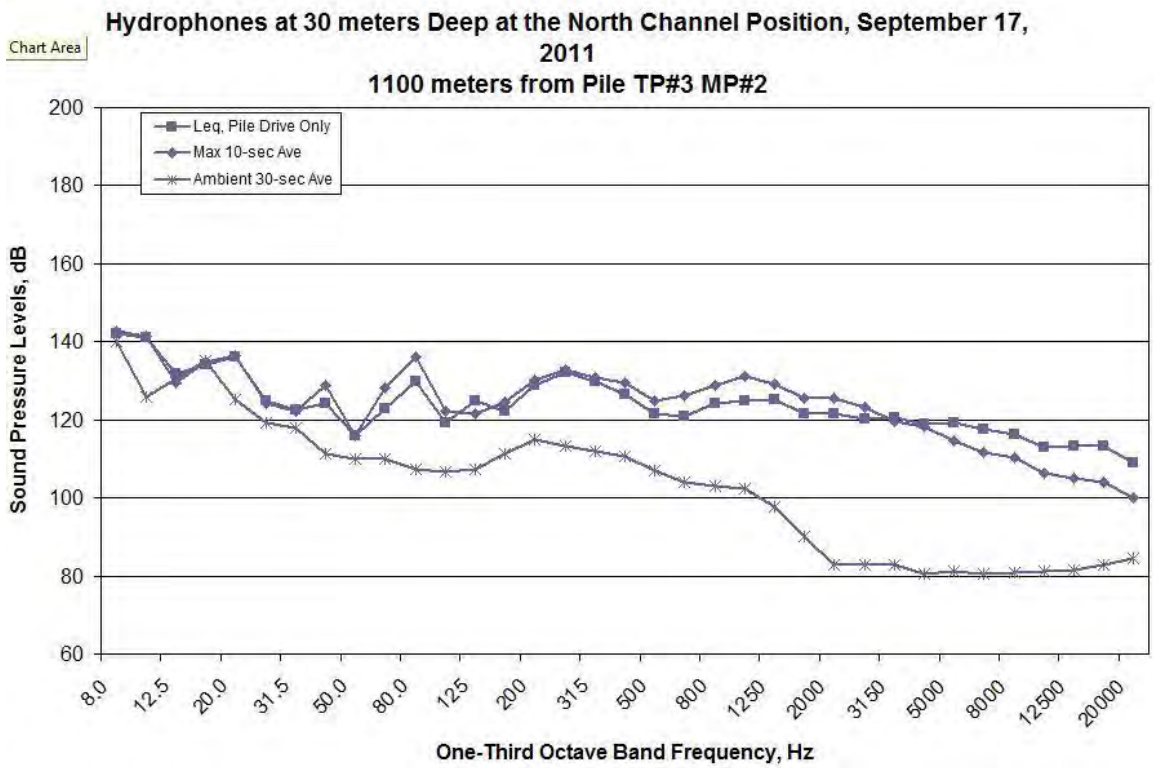

Figure A285. Spectral Data Measured at the NO Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 30 meters on September 17, 2011

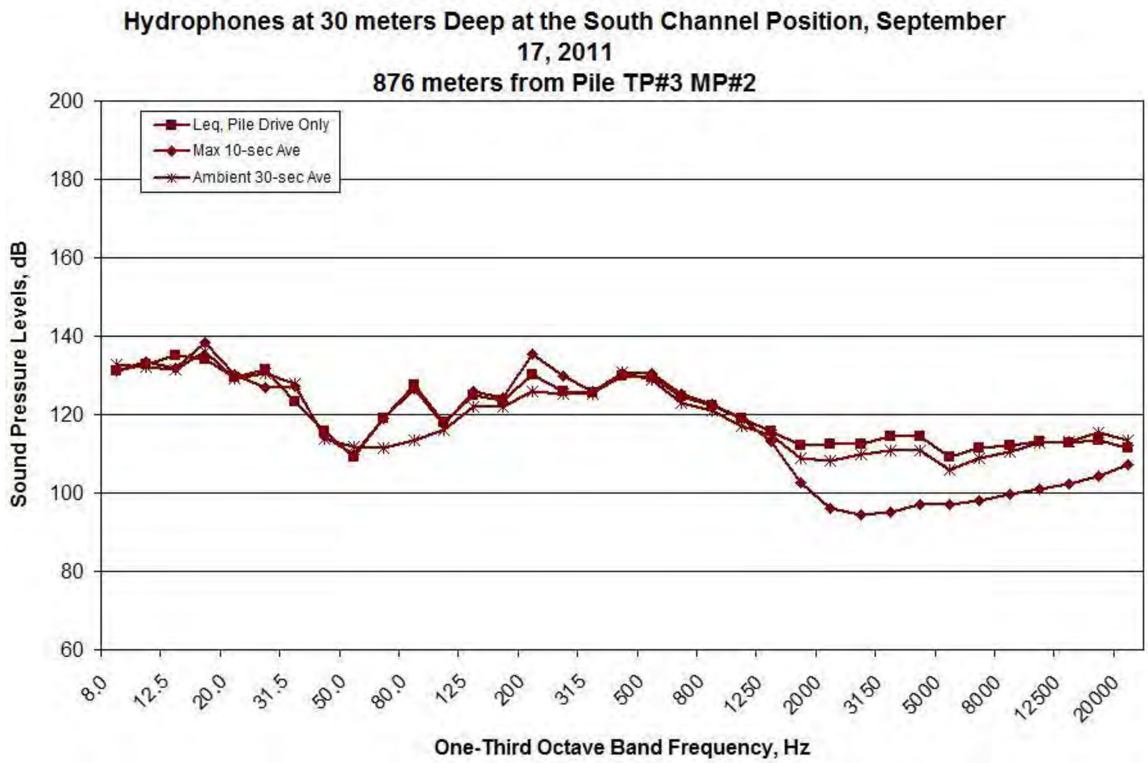

Figure A286. Spectral Data Measured at the SO Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 30 meters on September 17, 2011

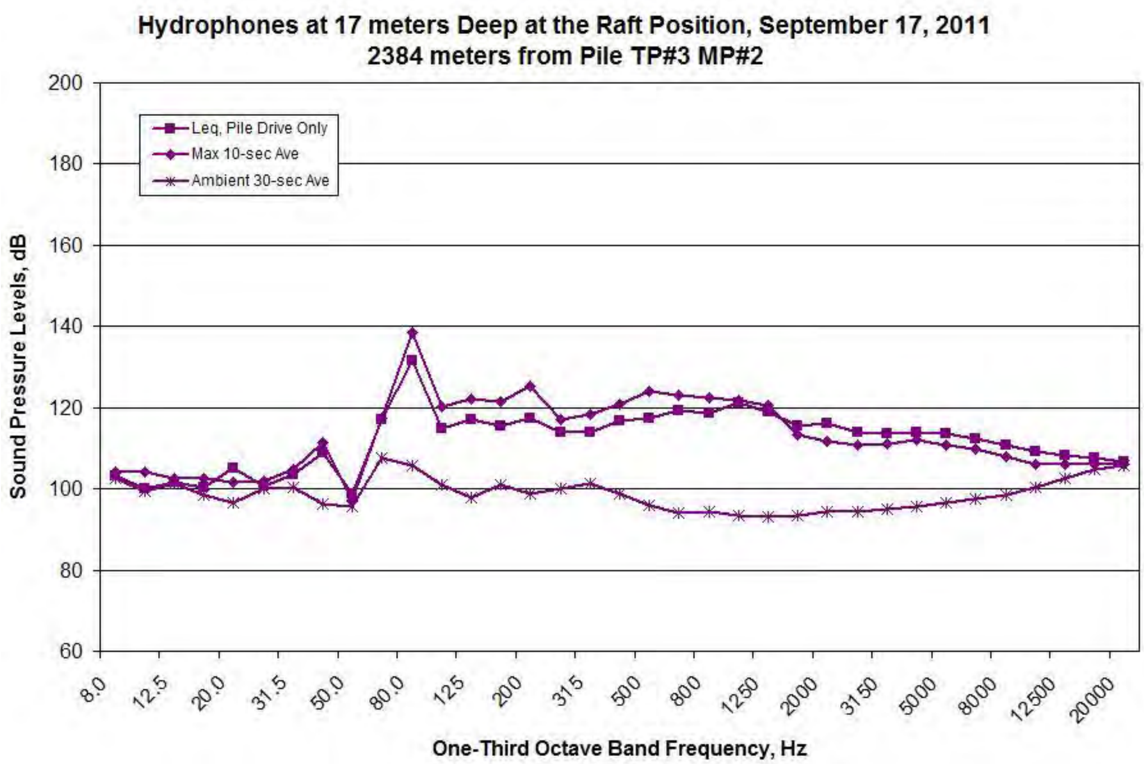

Figure A287. Spectral Data Measured at the RFT Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 17 meters on September 17, 2011

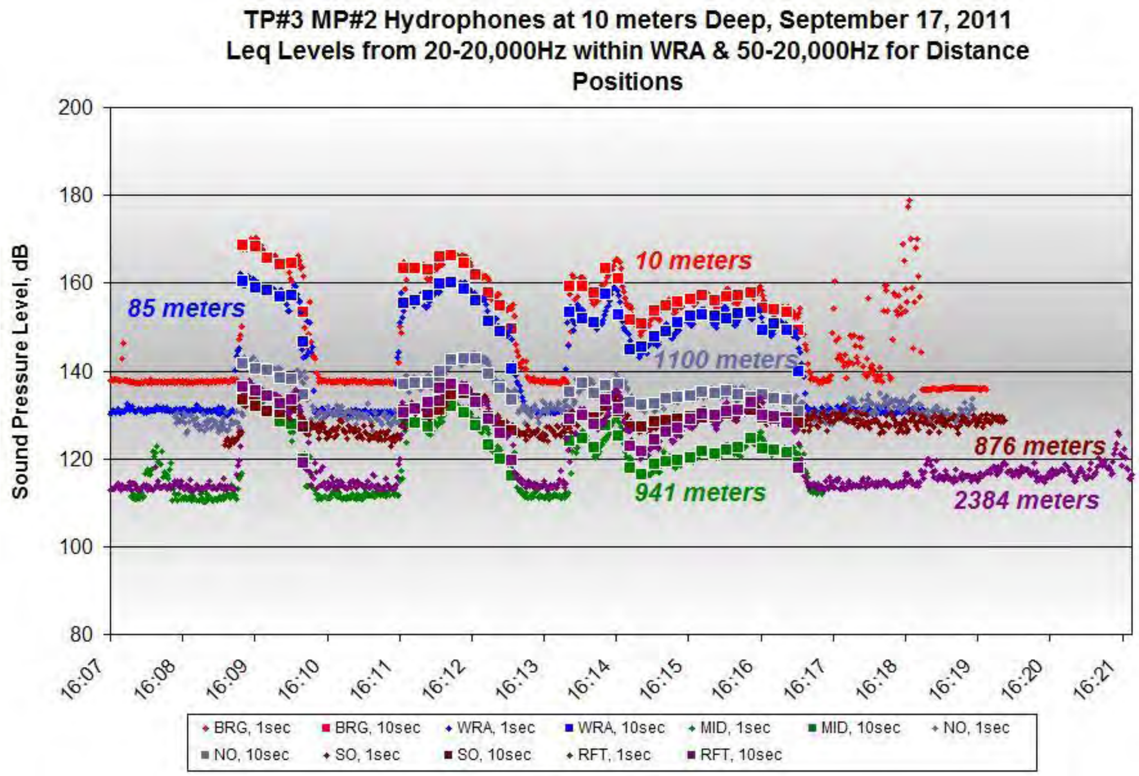

Figure A288. One-second and 10-second Average Data for TP#3 MP#2, 16:09-16:17, Measured at Depths of 10 meters on September 17, 2011

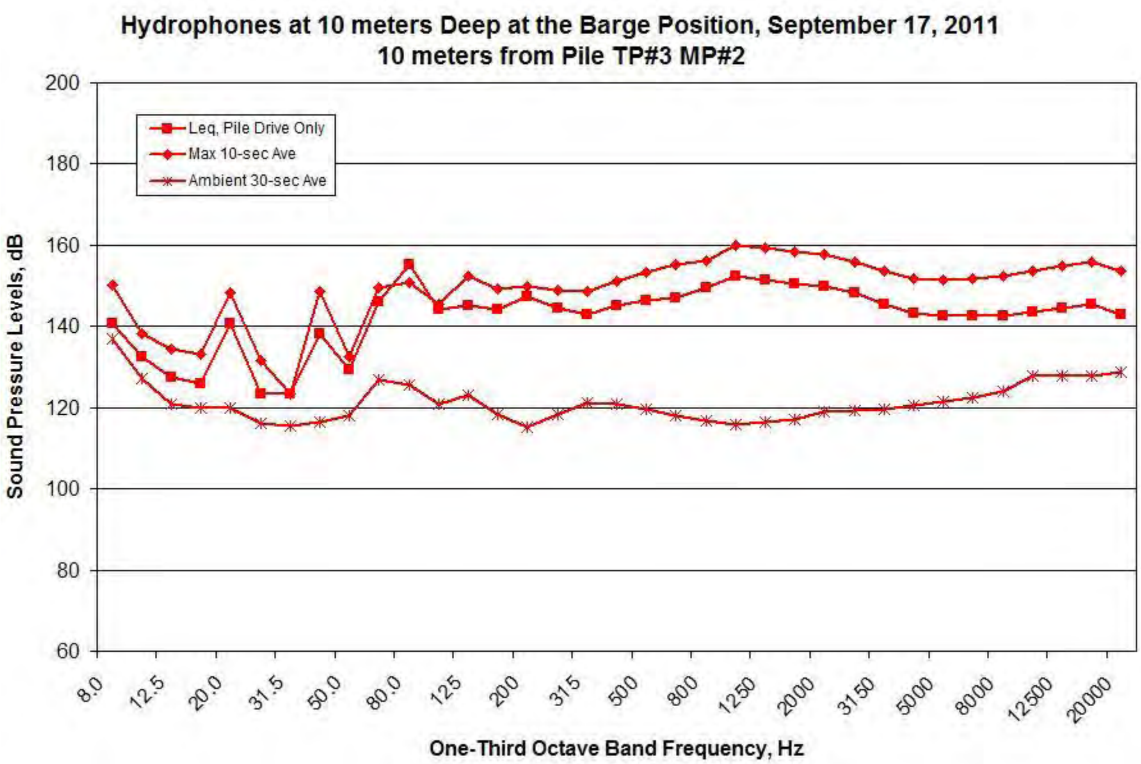

Figure A289. Spectral Data Measured at the BRG Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 10 meters on September 17, 2011

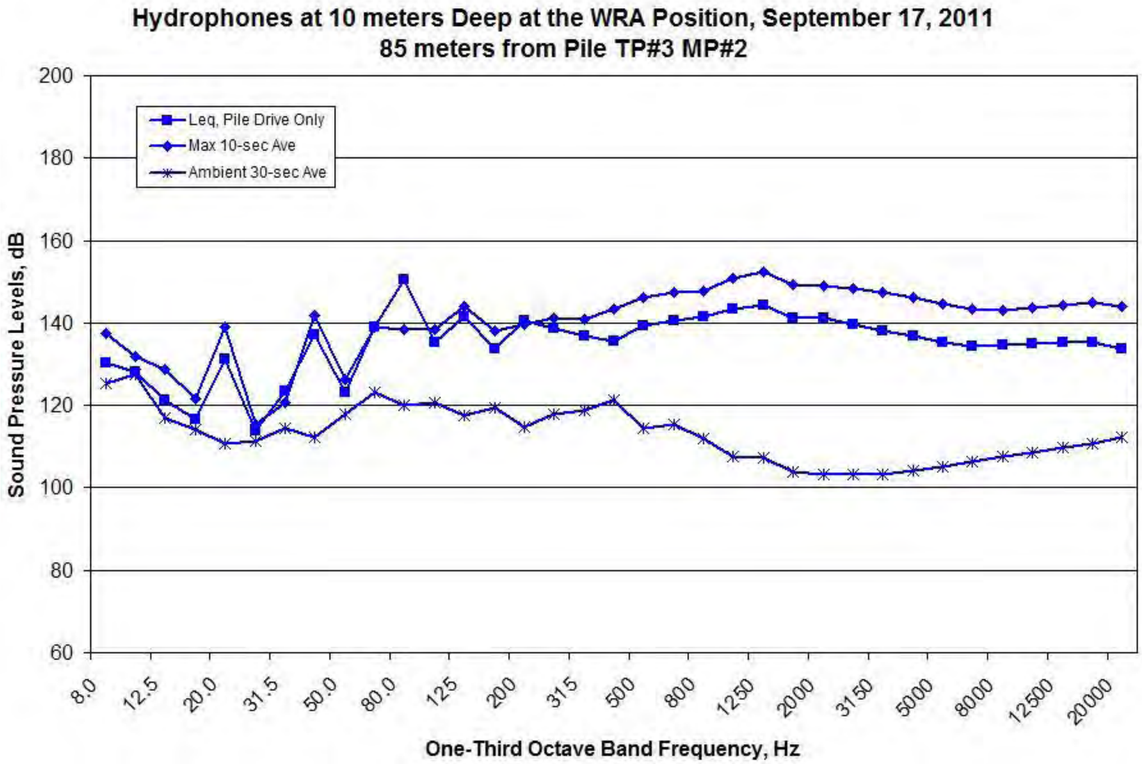

Figure A290. Spectral Data Measured at the WRA Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 10 meters on September 17, 2011

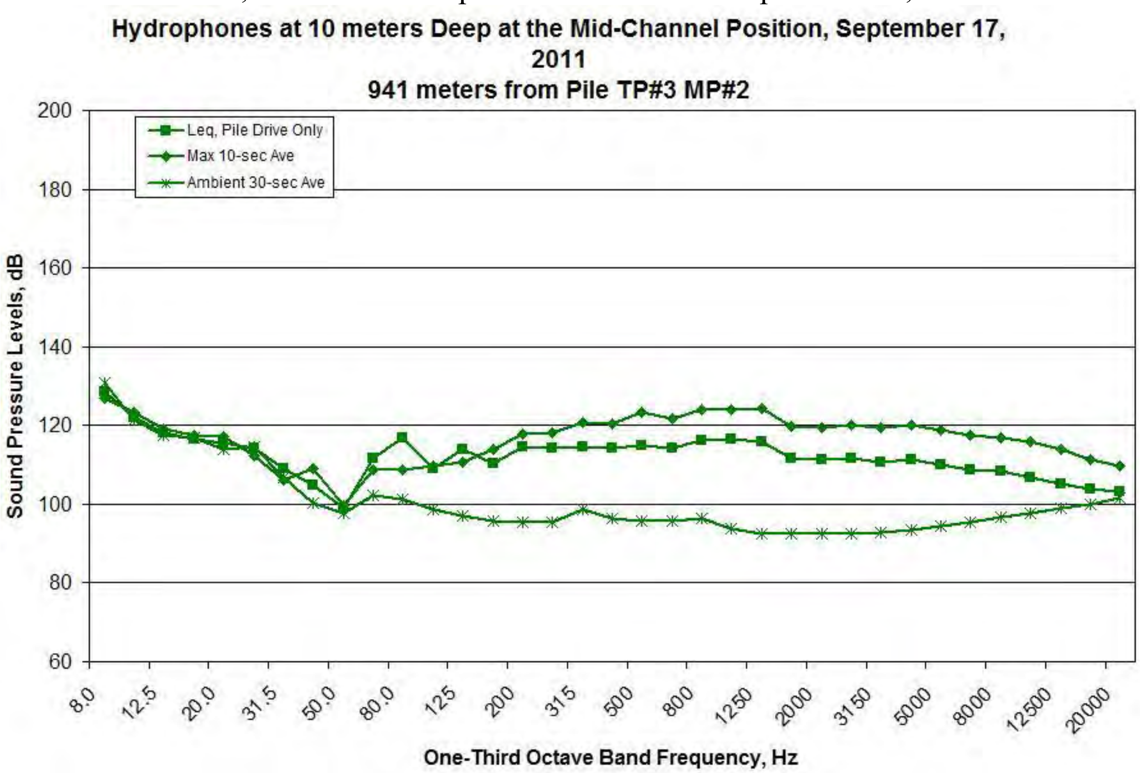

Figure A291. Spectral Data Measured at the MID Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 10 meters on September 17, 2011

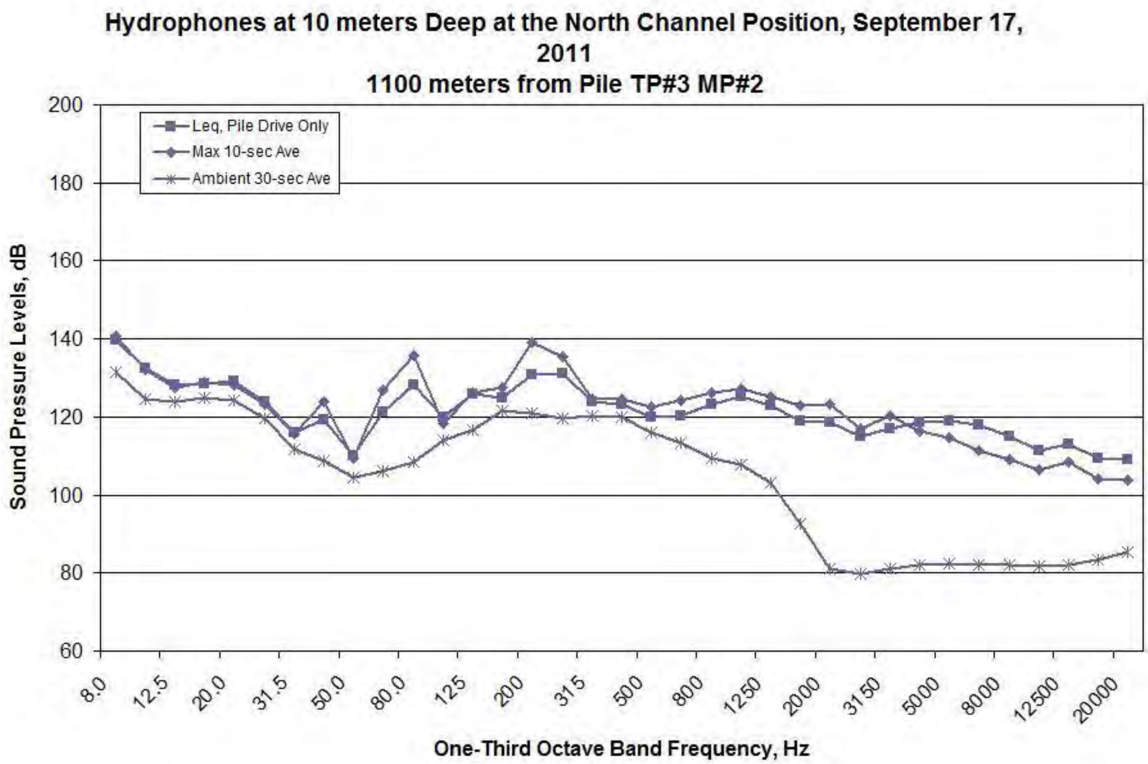

Figure A292. Spectral Data Measured at the NO Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 10 meters on September 17, 2011

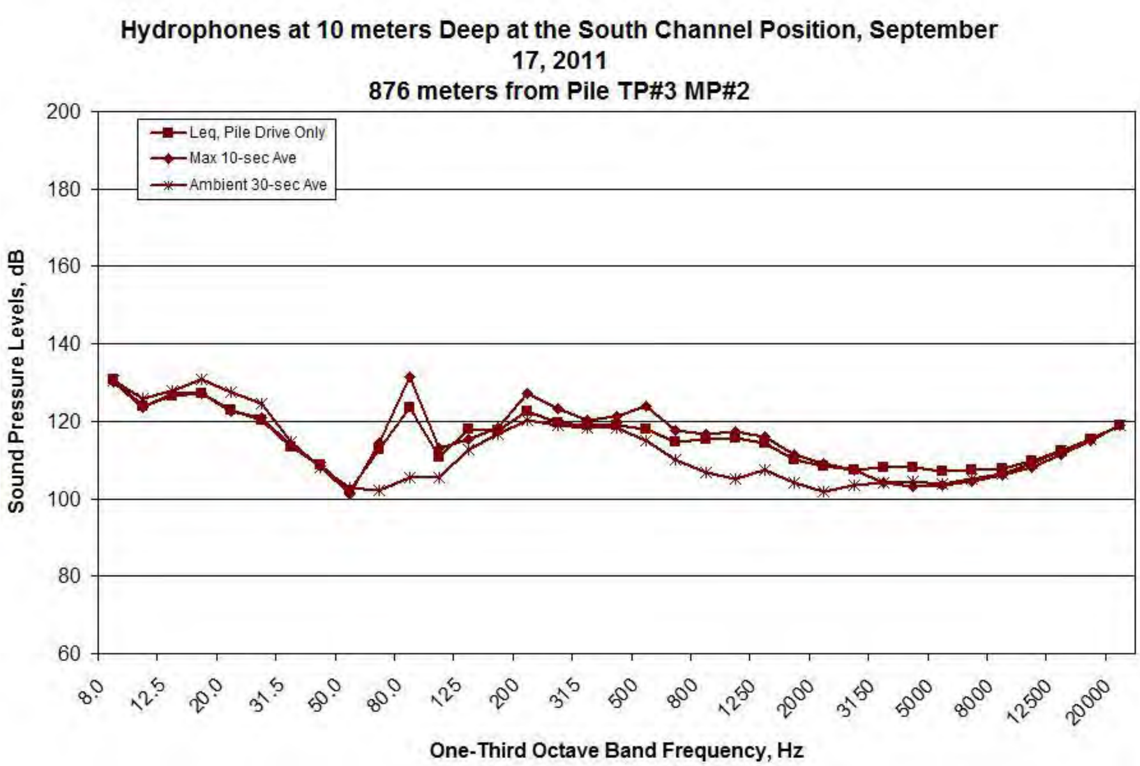

Figure A293. Spectral Data Measured at the SO Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 10 meters on September 17, 2011

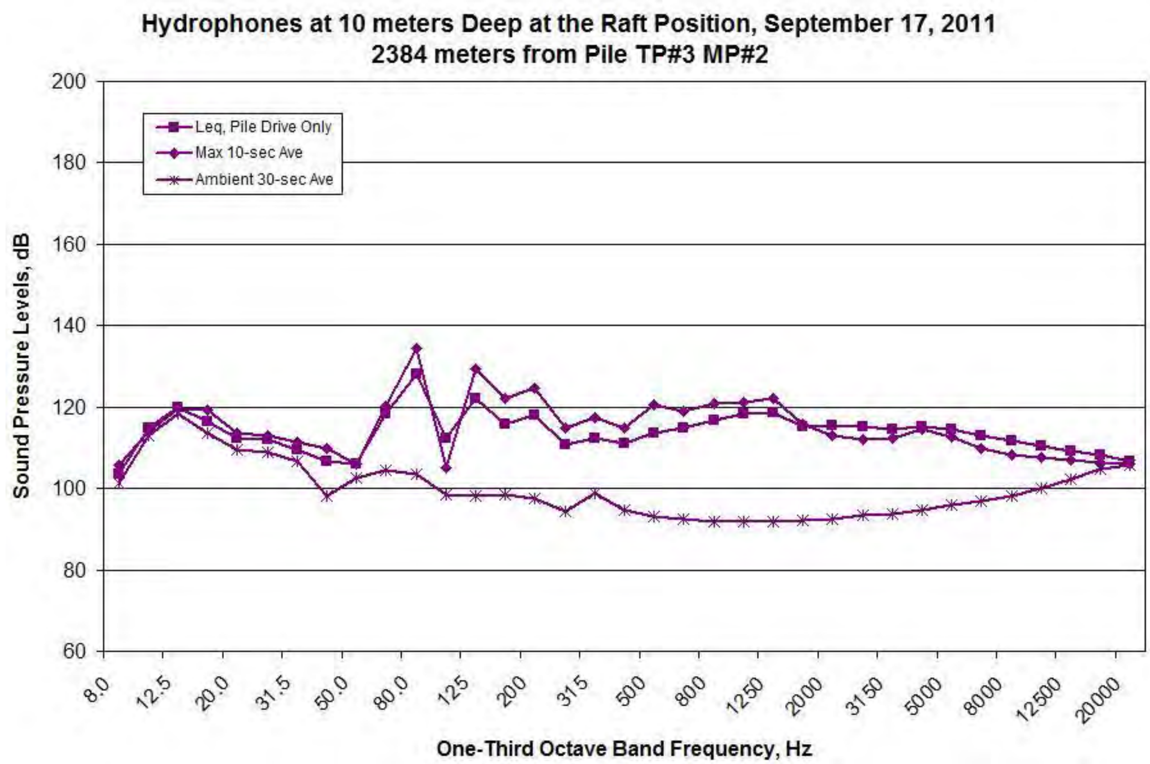

Figure A294. Spectral Data Measured at the RFT Location during TP#3 MP#2, 16:09-16:17, Measured at Depths of 10 meters on September 17, 2011

9/21/2011 – TP#10, 13:42-13:48 (Vibratory Installation)

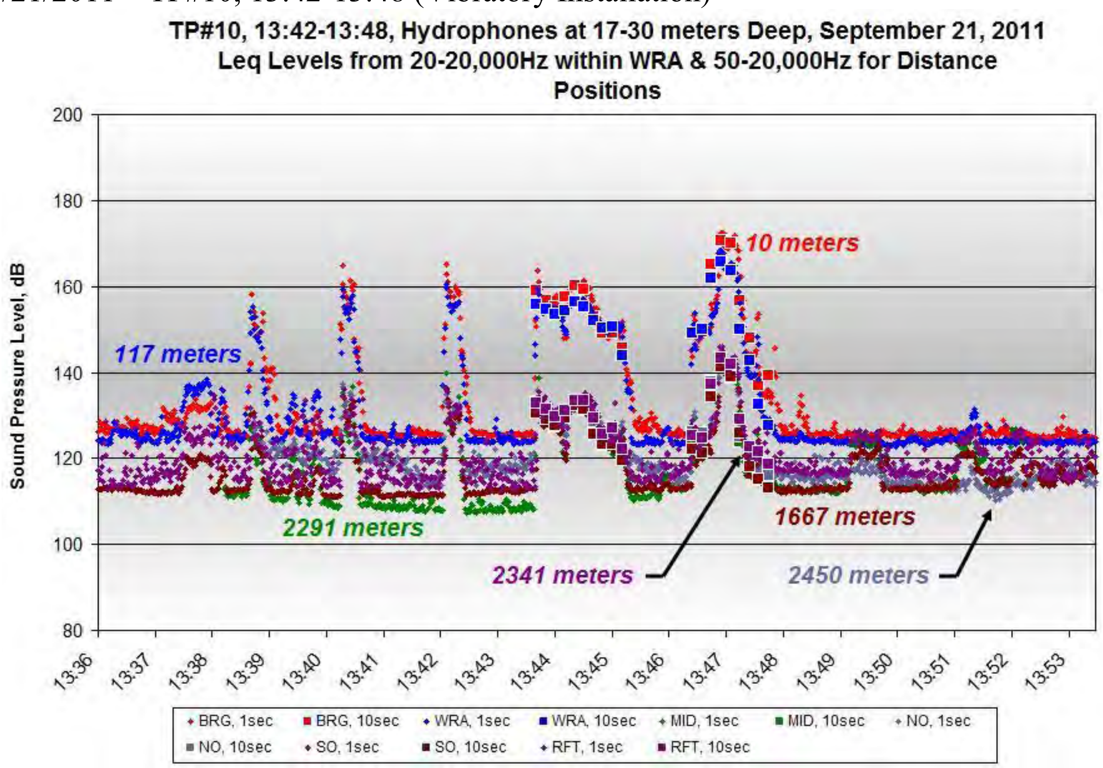

Figure A295. One-second and 10-second Average Data for TP#10, 13:42-13:48, Measured at Depths of 17-30 meters on September 21, 2011

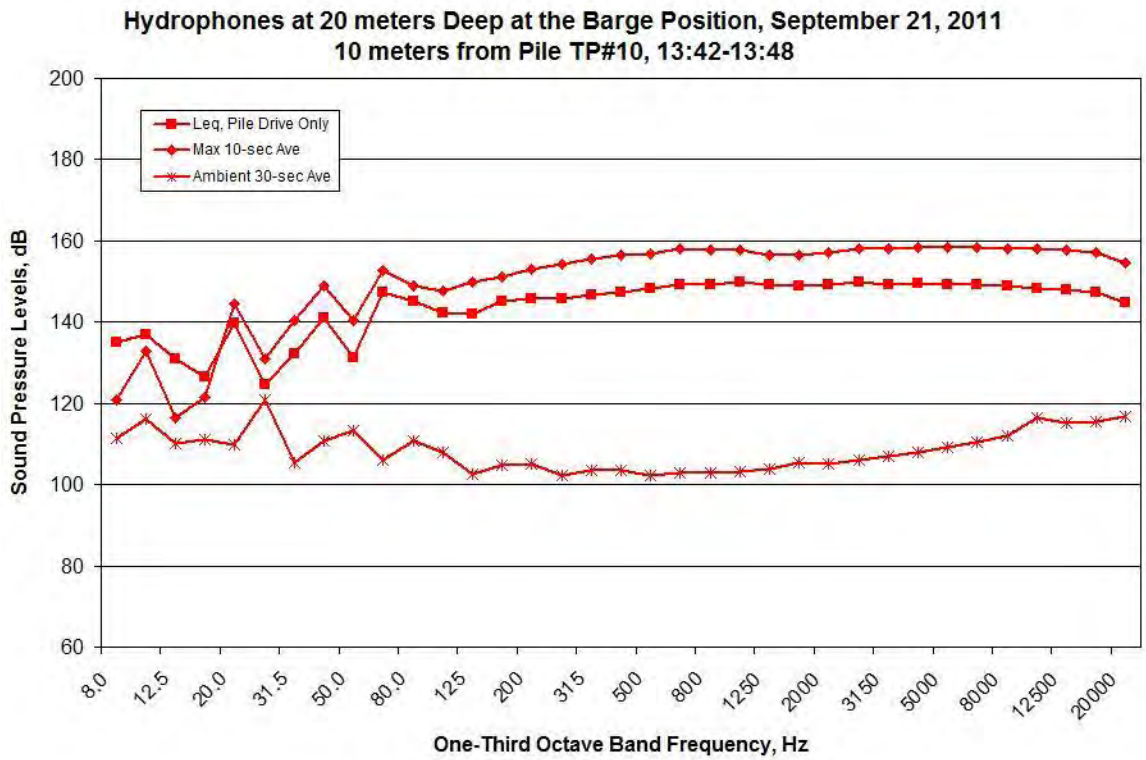

Figure A296. Spectral Data Measured at the BRG Location during TP#10, 13:42-13:48, Measured at Depths of 20 meters on September 21, 2011

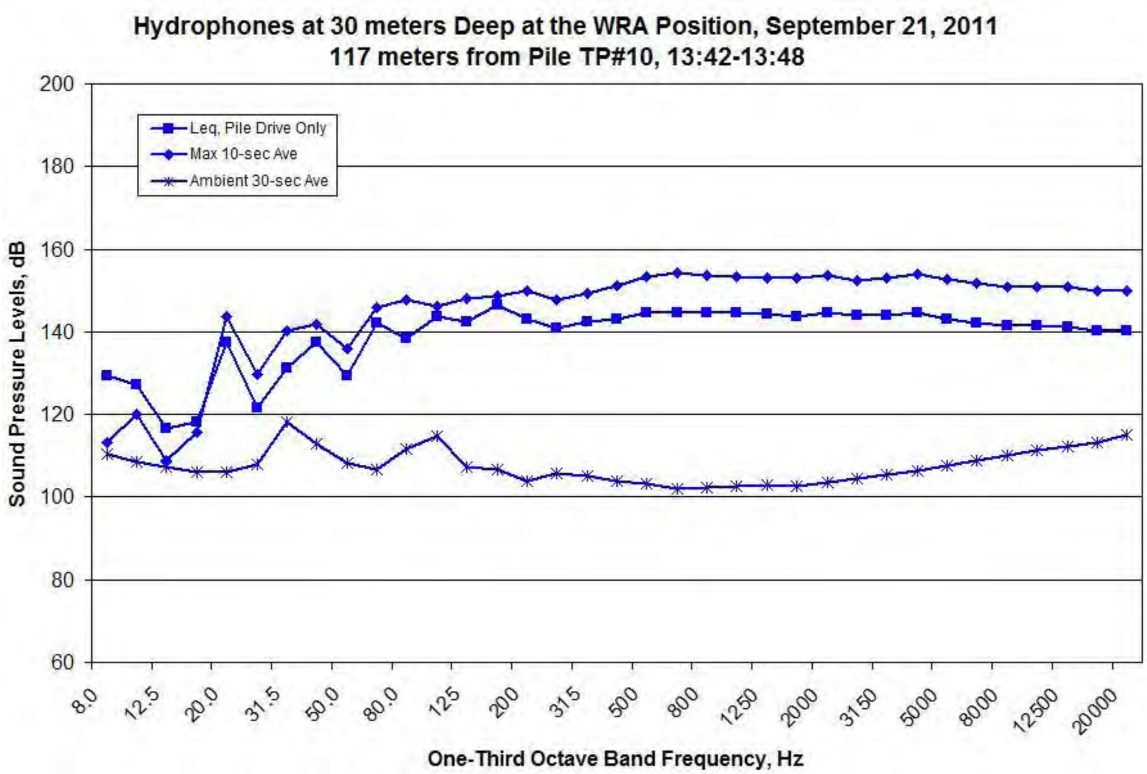

Figure A297. Spectral Data Measured at the WRA Location during TP#10, 13:42-13:48, Measured at Depths of 30 meters on September 21, 2011

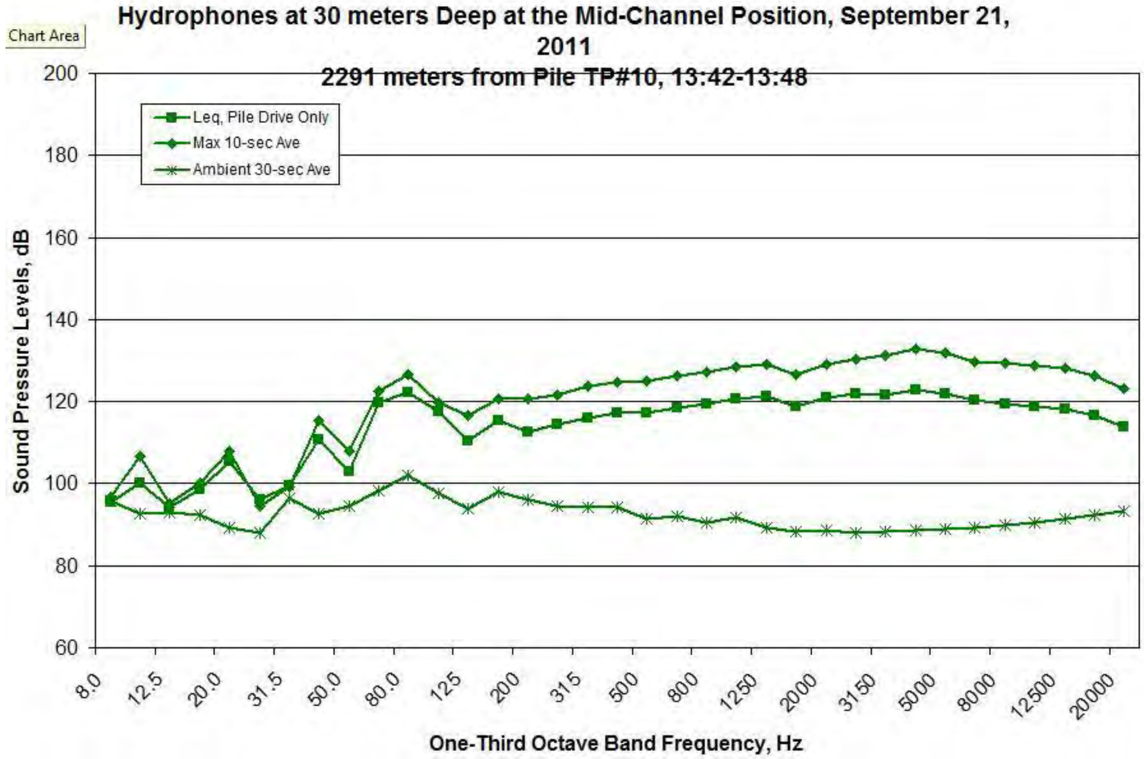

Figure A298. Spectral Data Measured at the MID Location during TP#10, 13:42-13:48, Measured at Depths of 30 meters on September 21, 2011

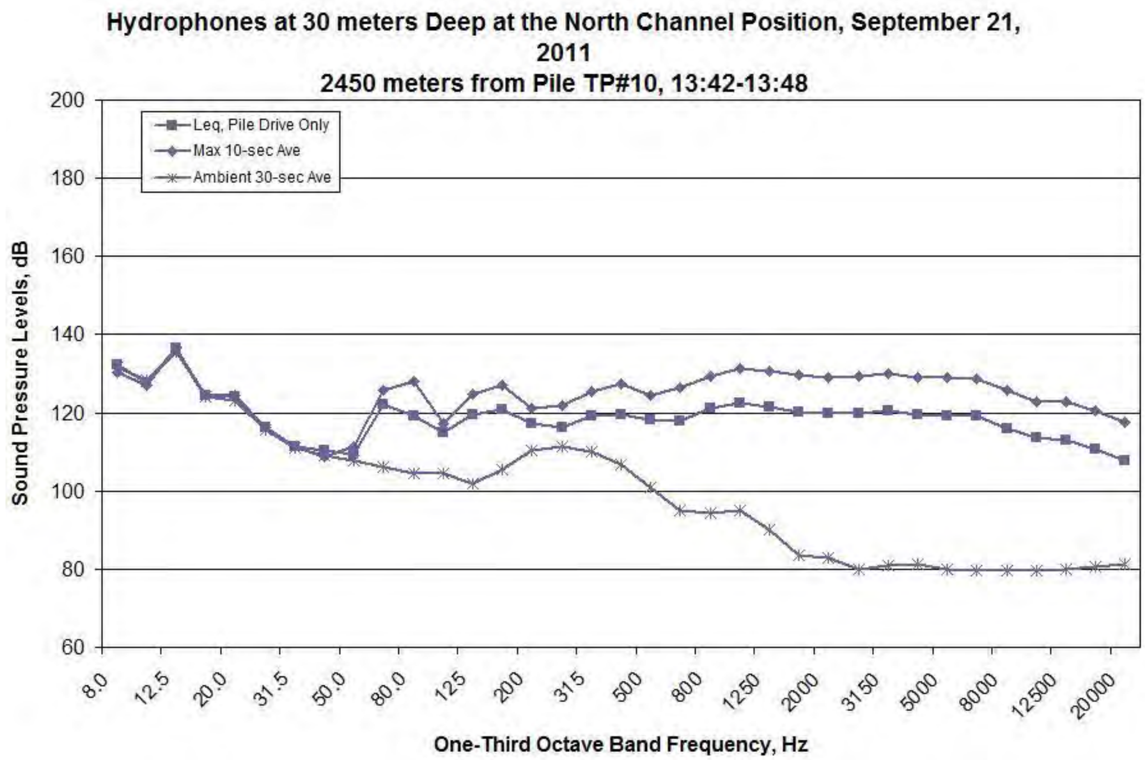

Figure A299. Spectral Data Measured at the NO Location during TP#10, 13:42-13:48, Measured at Depths of 30 meters on September 21, 2011

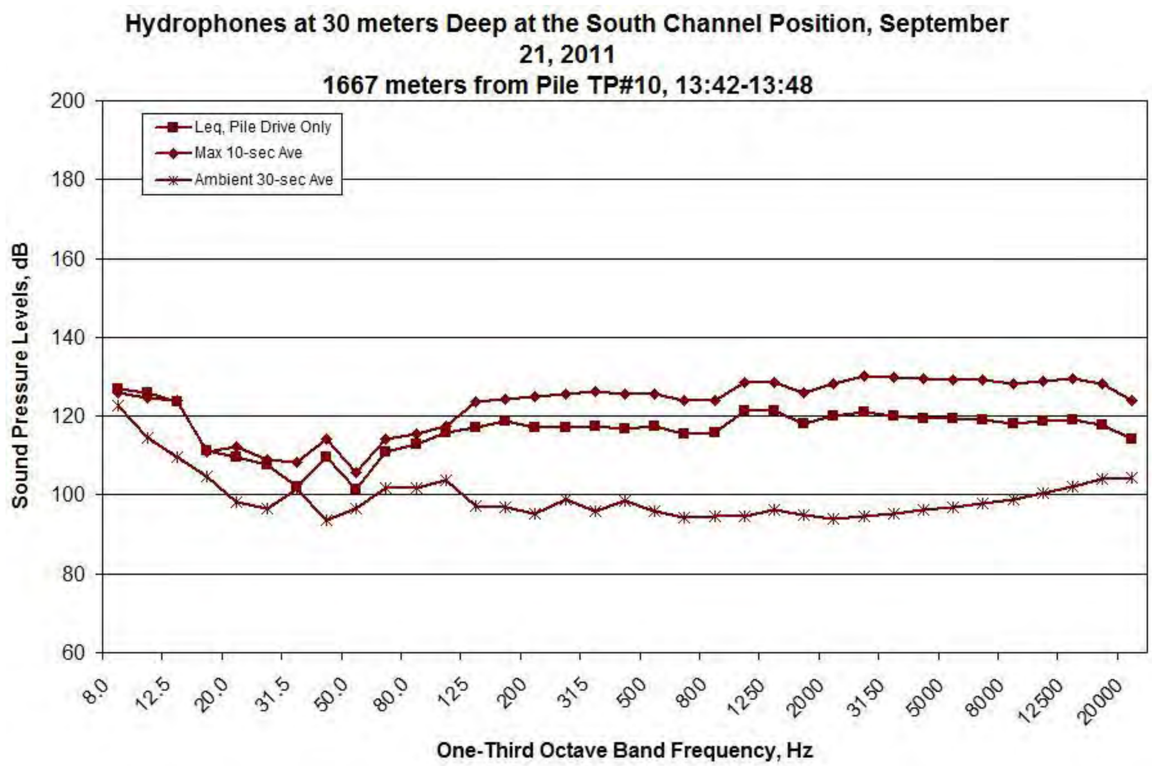

Figure A300. Spectral Data Measured at the SO Location during TP#10, 13:42-13:48, Measured at Depths of 30 meters on September 21, 2011

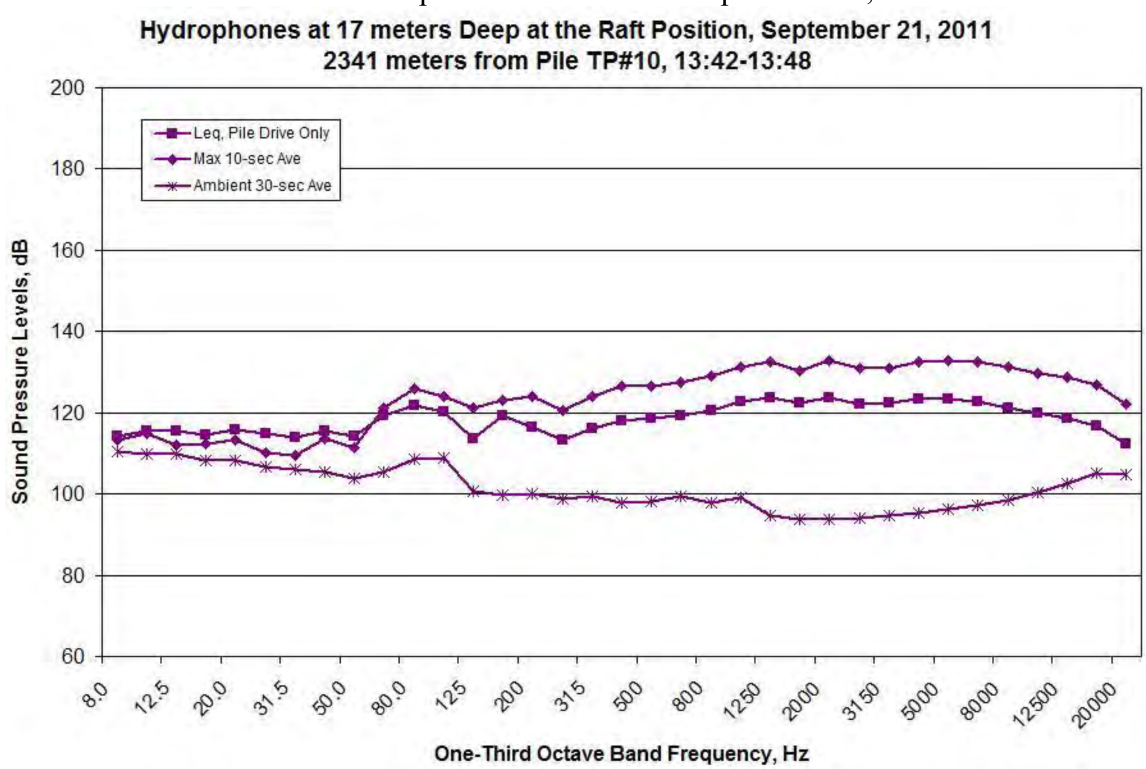

Figure A301. Spectral Data Measured at the RFT Location during TP#10, 13:42-13:48, Measured at Depths of 17 meters on September 21, 2011

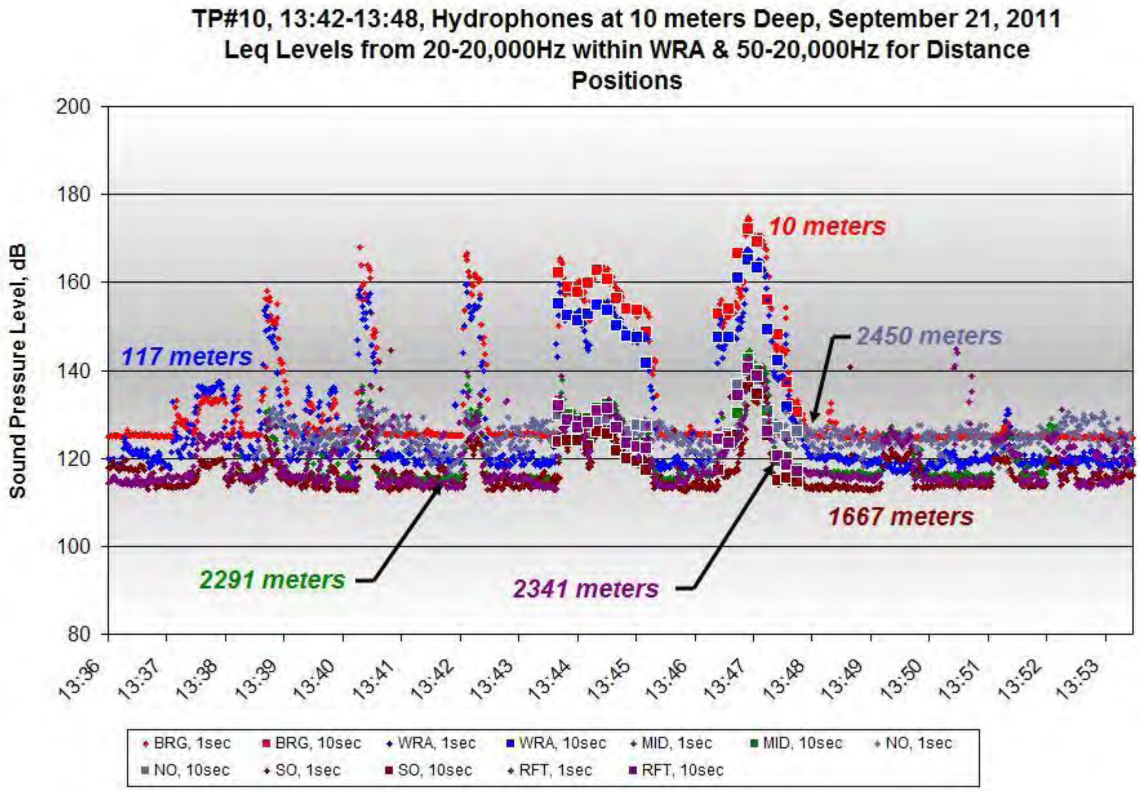

Figure A302. One-second and 10-second Average Data for TP#10, 13:42-13:48, Measured at Depths of 10 meters on September 21, 2011

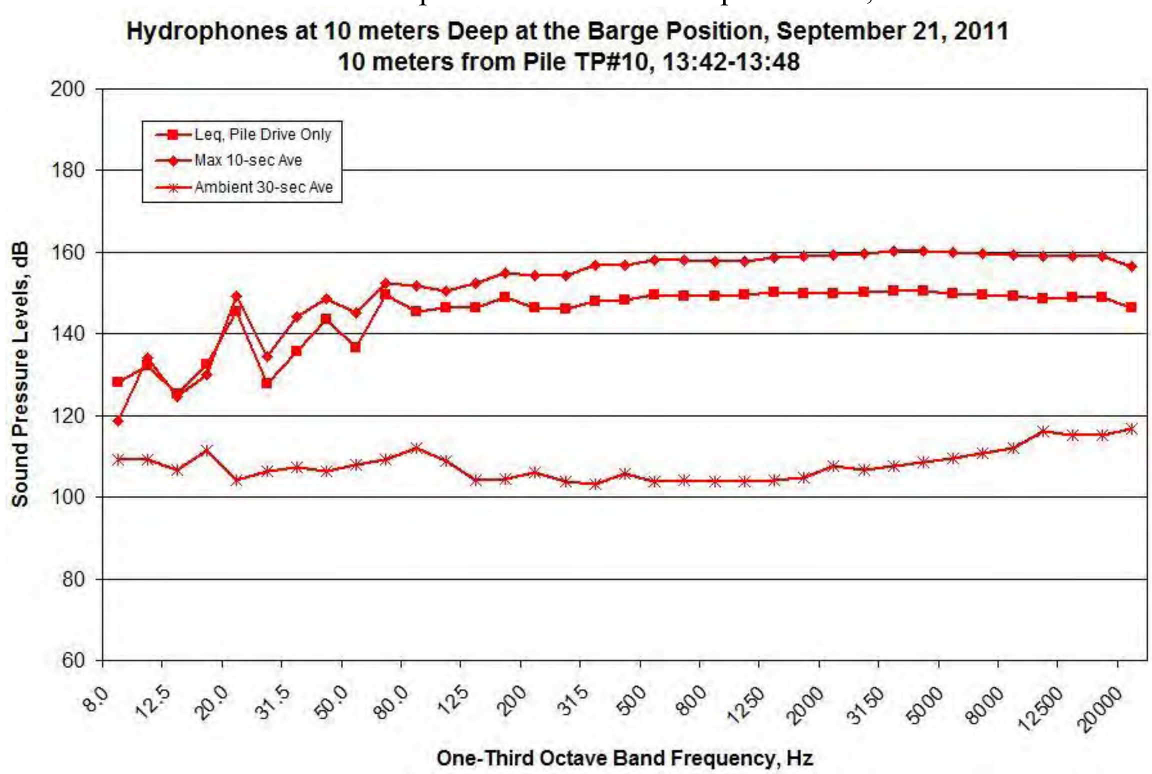

Figure A303. Spectral Data Measured at the BRG Location during TP#10, 13:42-13:48, Measured at Depths of 10 meters on September 21, 2011

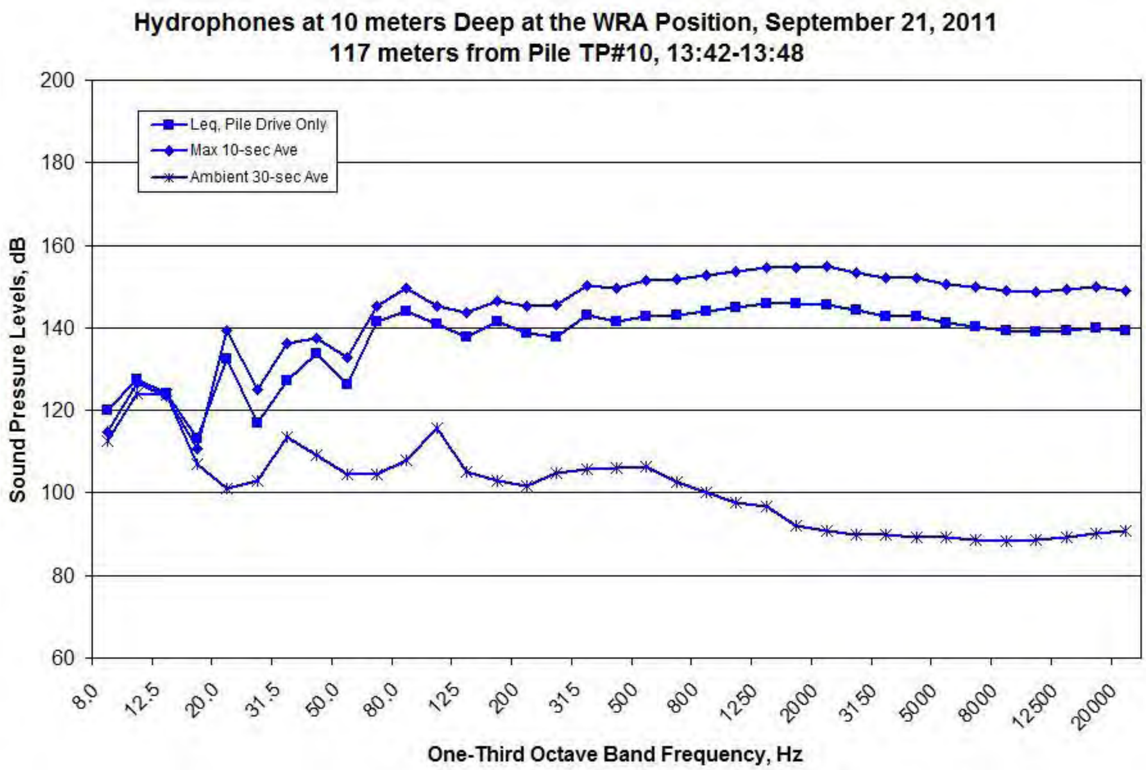

Figure A304. Spectral Data Measured at the WRA Location during TP#10, 13:42-13:48, Measured at Depths of 10 meters on September 21, 2011

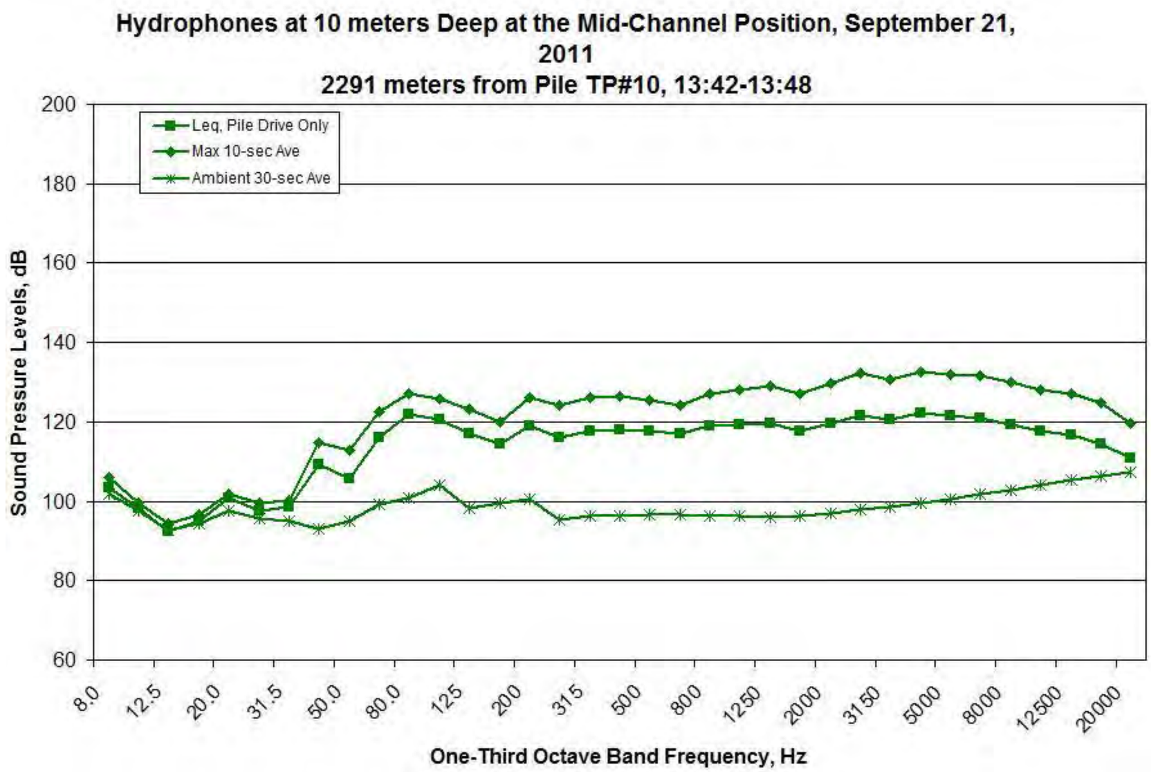

Figure A305. Spectral Data Measured at the MID Location during TP#10, 13:42-13:48, Measured at Depths of 10 meters on September 21, 2011

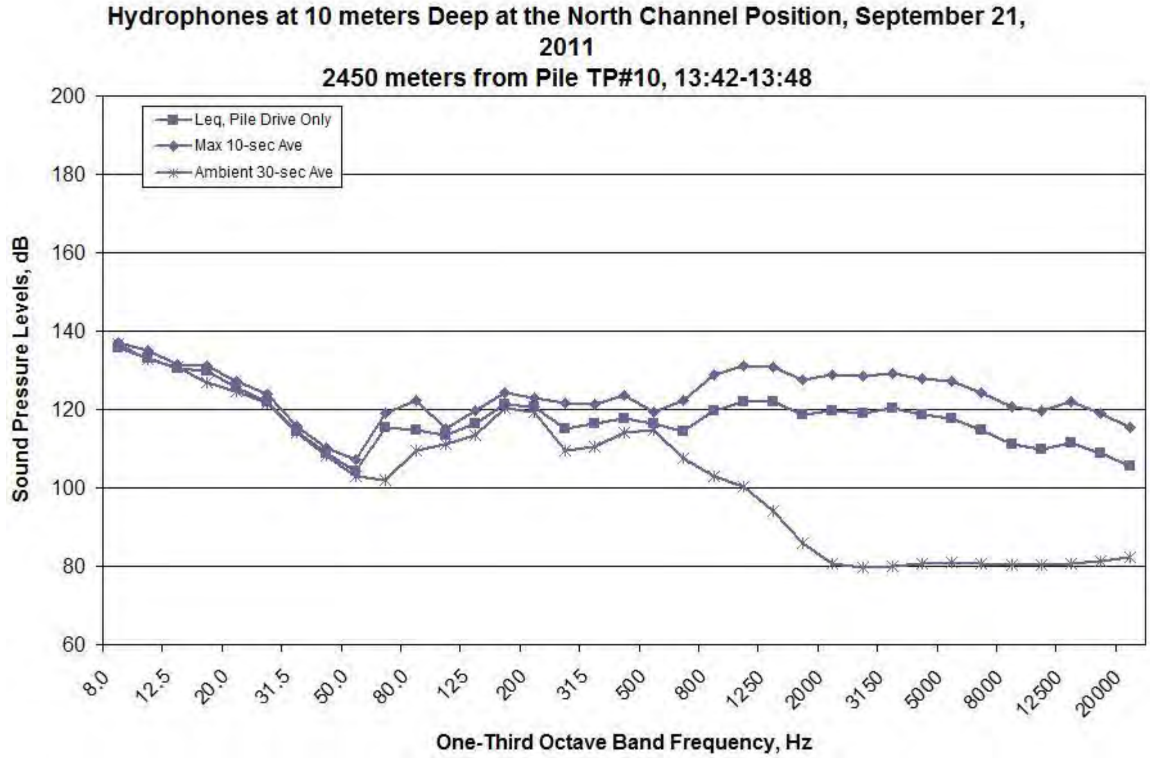

Figure A306. Spectral Data Measured at the NO Location during TP#10, 13:42-13:48, Measured at Depths of 10 meters on September 21, 2011

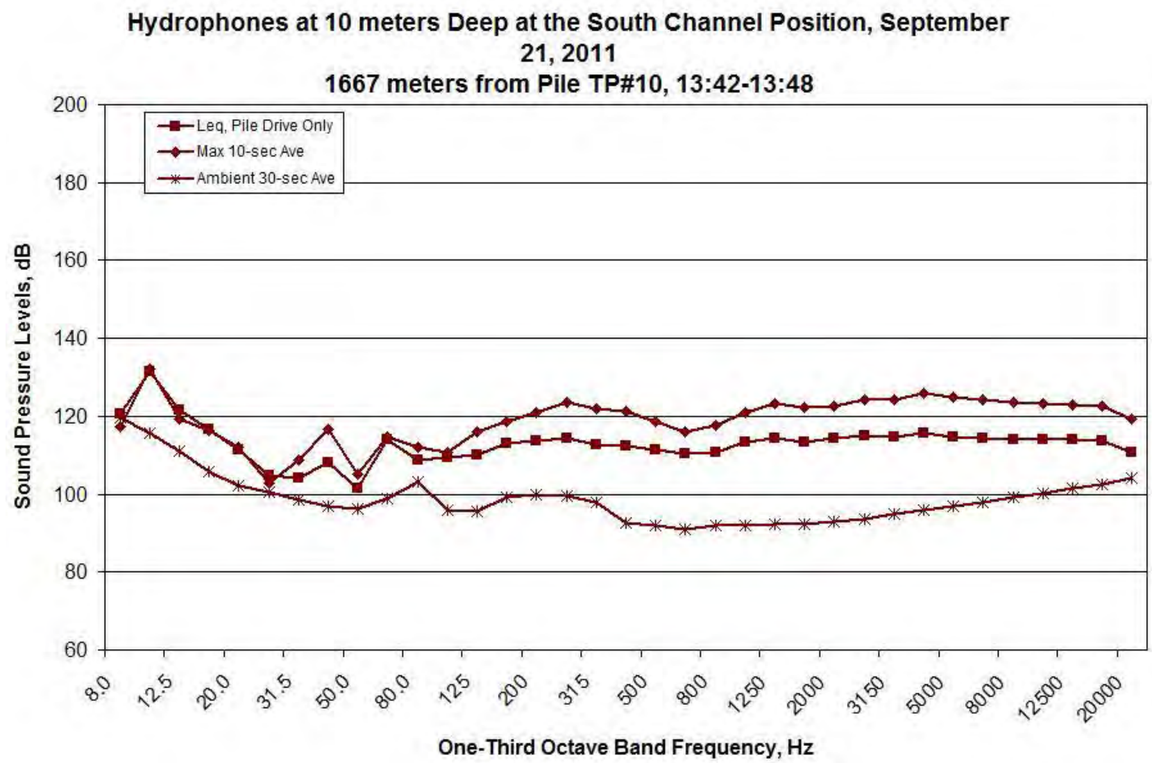

Figure A307. Spectral Data Measured at the SO Location during TP#10, 13:42-13:48, Measured at Depths of 10 meters on September 21, 2011

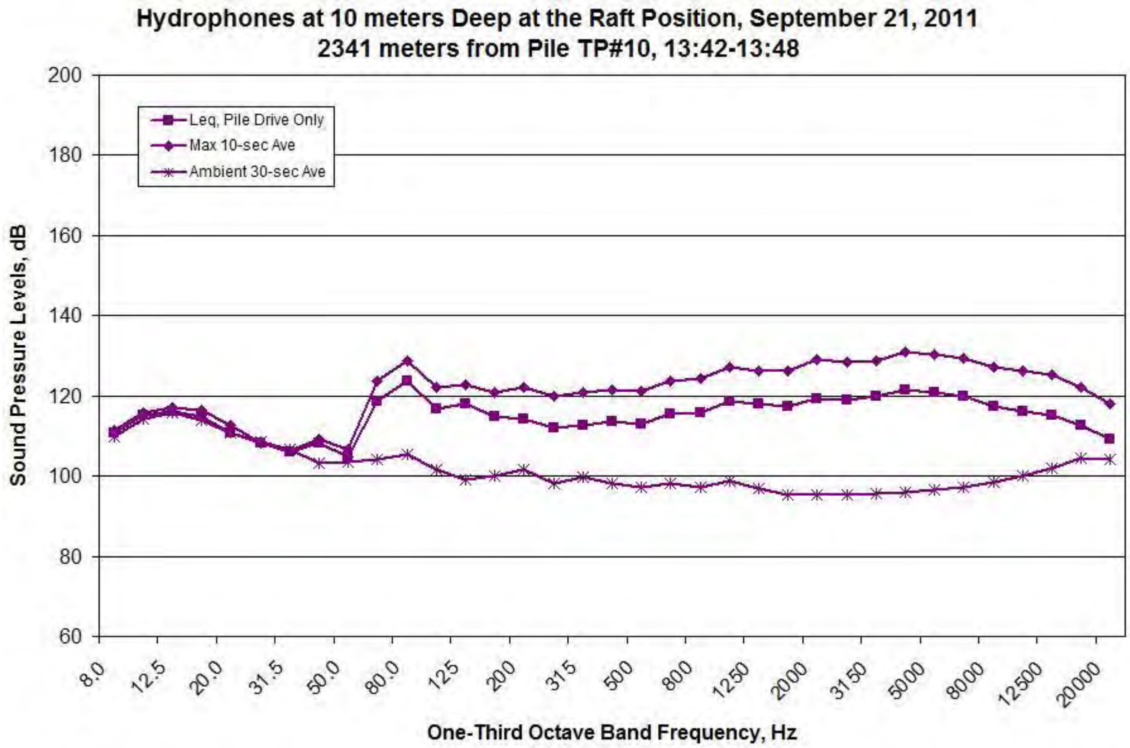

Figure A308. Spectral Data Measured at the RFT Location during TP#10, 13:42-13:48, Measured at Depths of 10 meters on September 21, 2011

TP#10, 15:03-15:14 (Vibratory Installation)

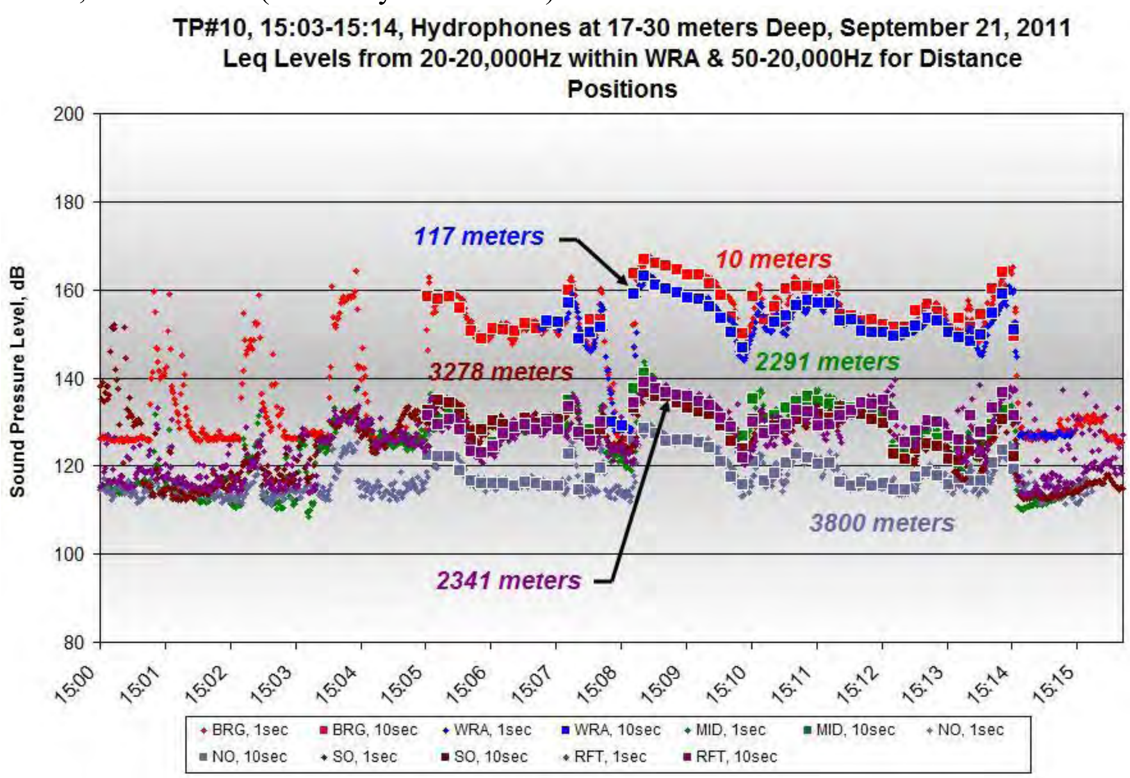

Figure A309. One-second and 10-second Average Data for TP#10, 15:03-15:14, Measured at Depths of 17-30 meters on September 21, 2011

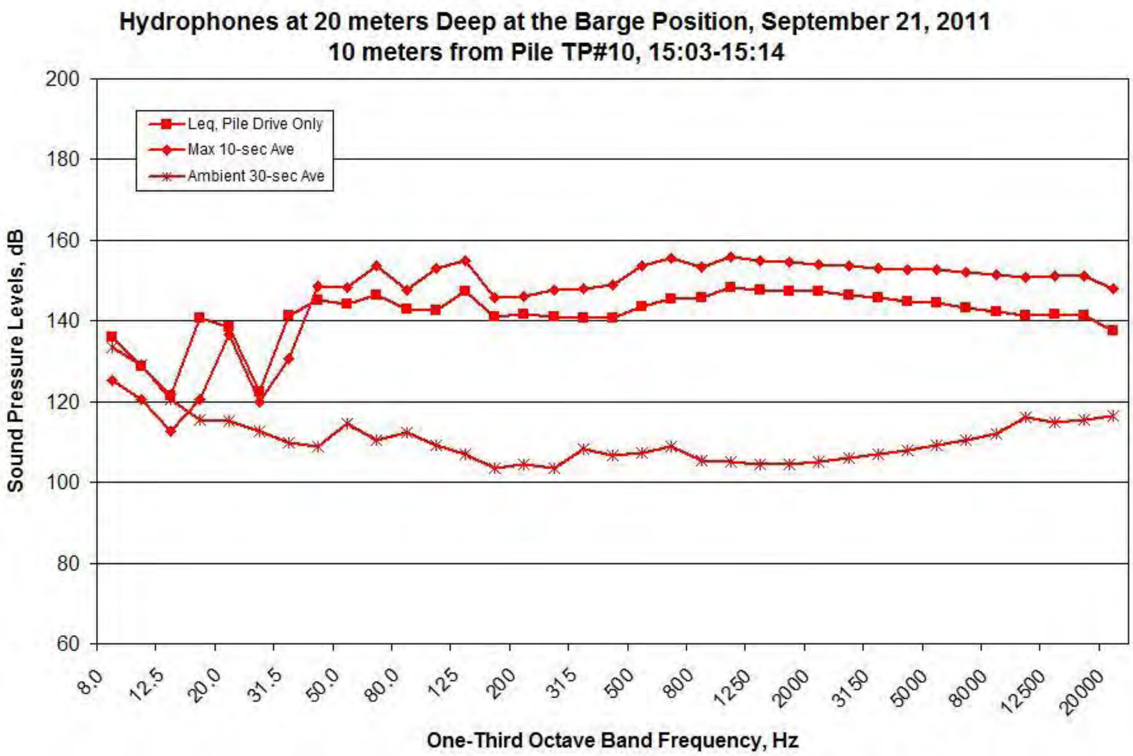

Figure A310. Spectral Data Measured at the BRG Location during TP#10, 15:03-15:14, Measured at Depths of 20 meters on September 21, 2011

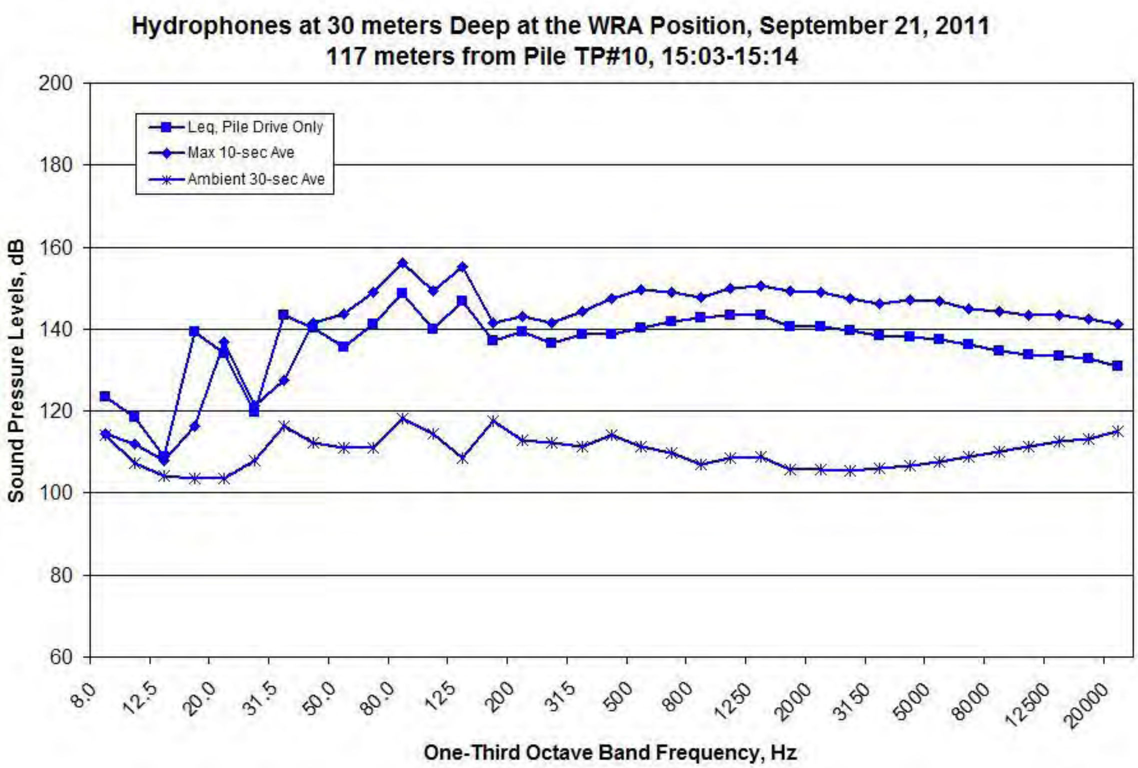

Figure A311. Spectral Data Measured at the WRA Location during TP#10, 15:03-15:14, Measured at Depths of 30 meters on September 21, 2011

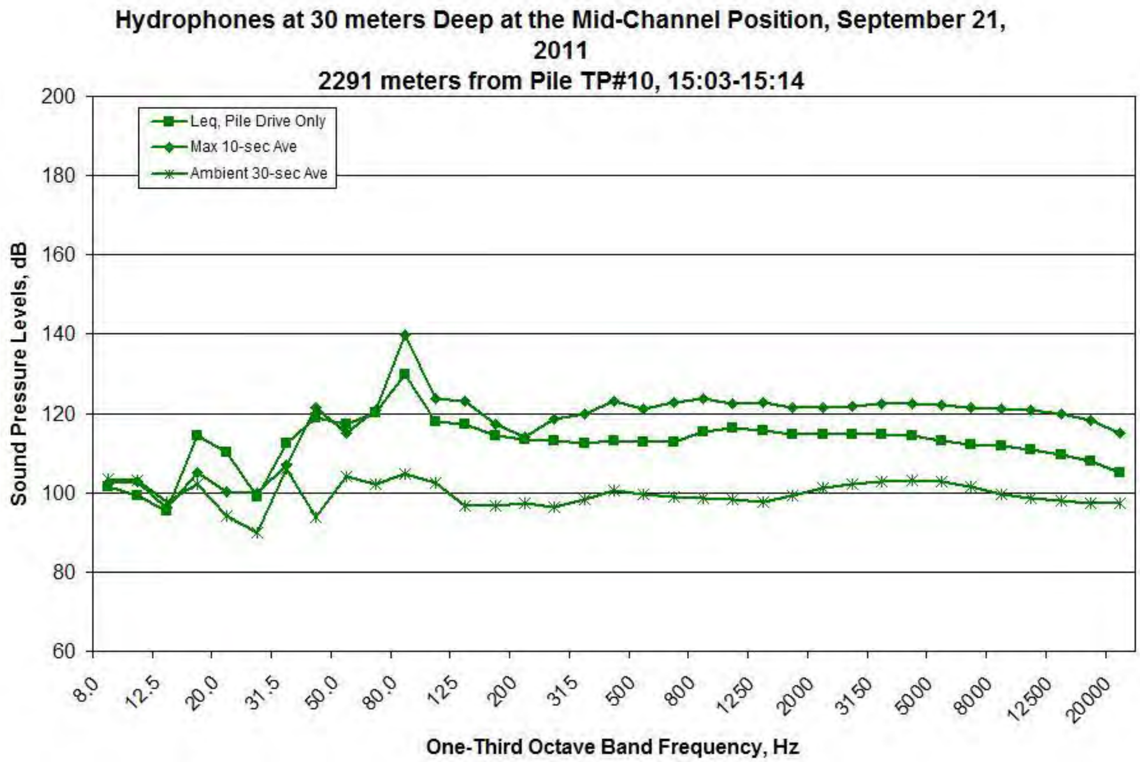

Figure A312. Spectral Data Measured at the MID Location during TP#10, 15:03-15:14, Measured at Depths of 30 meters on September 21, 2011

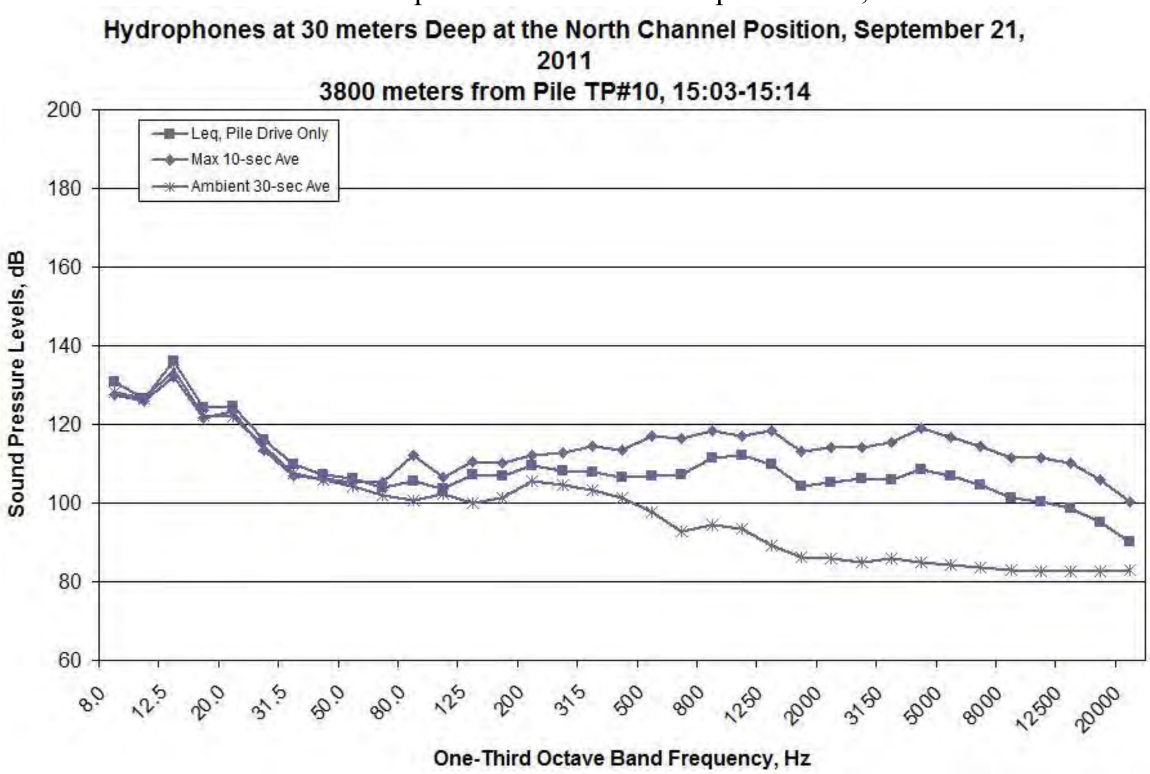

Figure A313. Spectral Data Measured at the NO Location during TP#10, 15:03-15:14, Measured at Depths of 30 meters on September 21, 2011

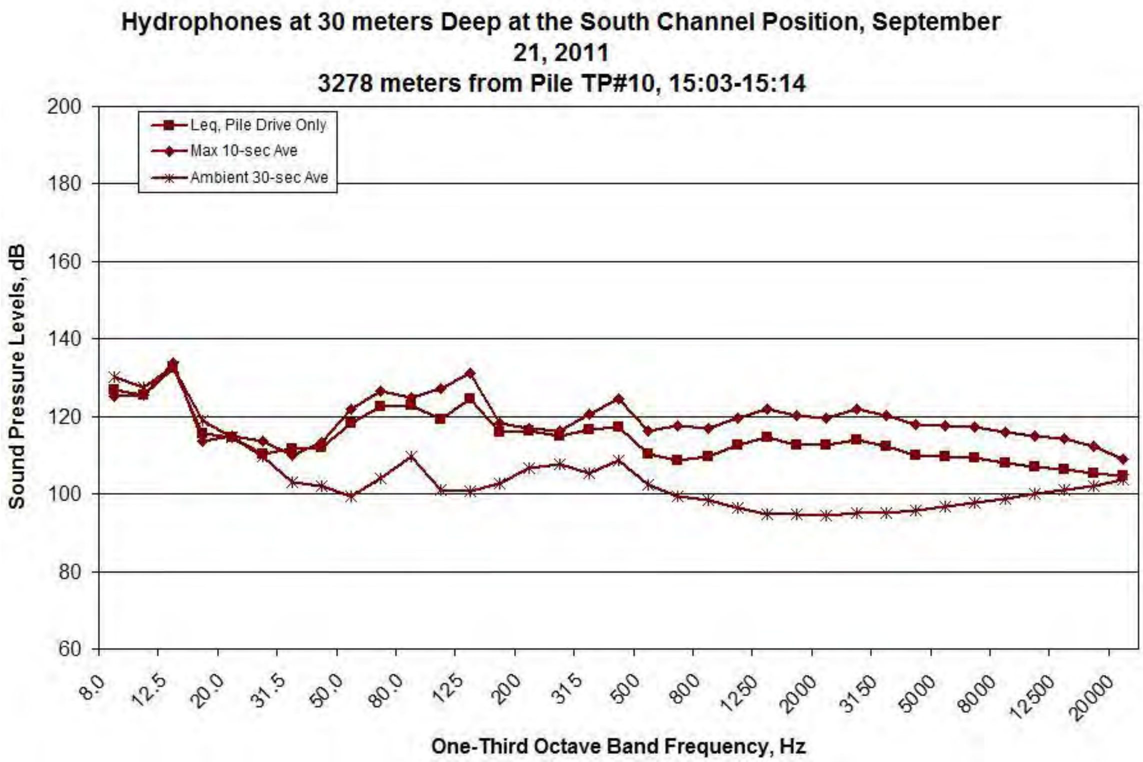

Figure A314. Spectral Data Measured at the SO Location during TP#10, 15:03-15:14, Measured at Depths of 30 meters on September 21, 2011

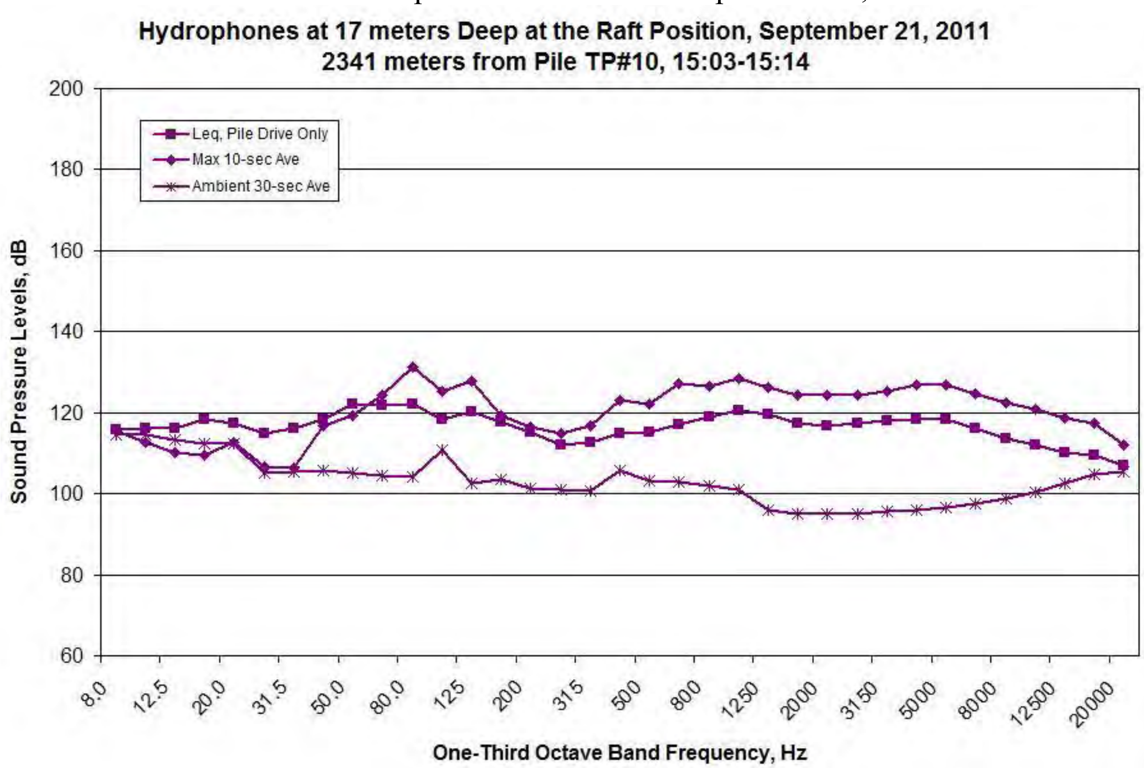

Figure A315. Spectral Data Measured at the RFT Location during TP#10, 15:03-15:14, Measured at Depths of 17 meters on September 21, 2011

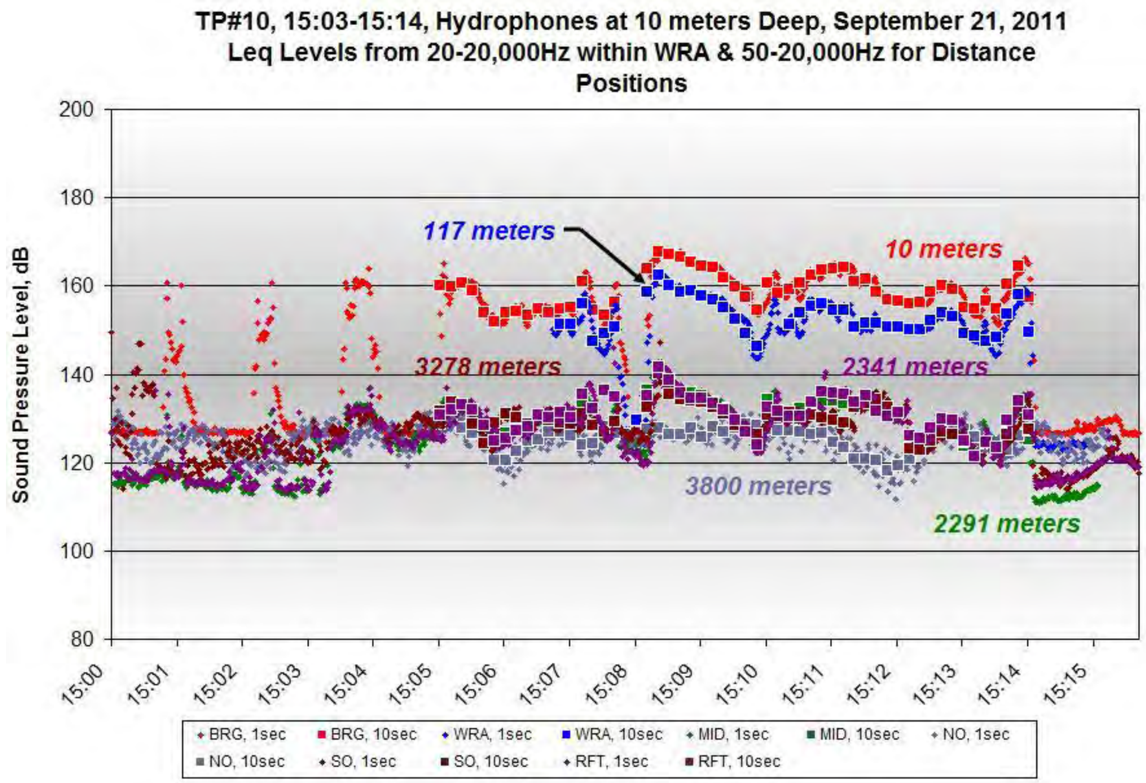

Figure A316. One-second and 10-second Average Data for TP#10, 15:03-15:14, Measured at Depths of 10 meters on September 21, 2011

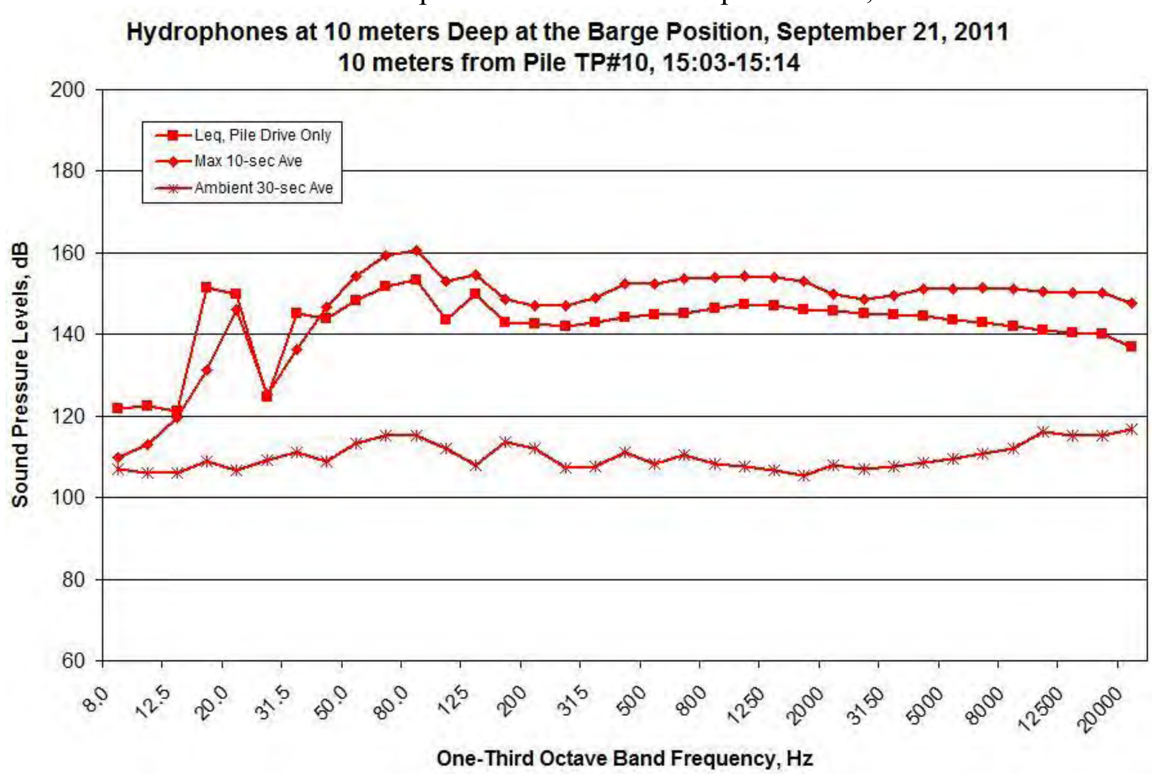

Figure A317. Spectral Data Measured at the BRG Location during TP#10, 15:03-15:14, Measured at Depths of 10 meters on September 21, 2011

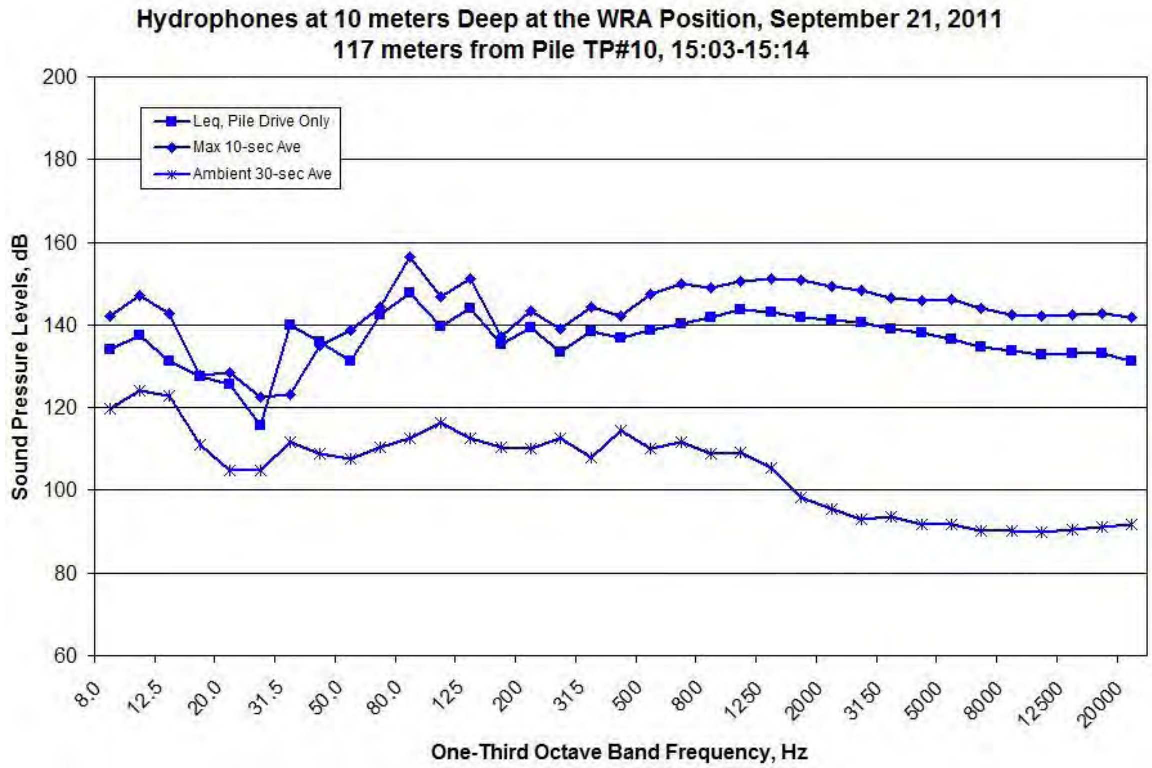

Figure A318. Spectral Data Measured at the WRA Location during TP#10, 15:03-15:14, Measured at Depths of 10 meters on September 21, 2011

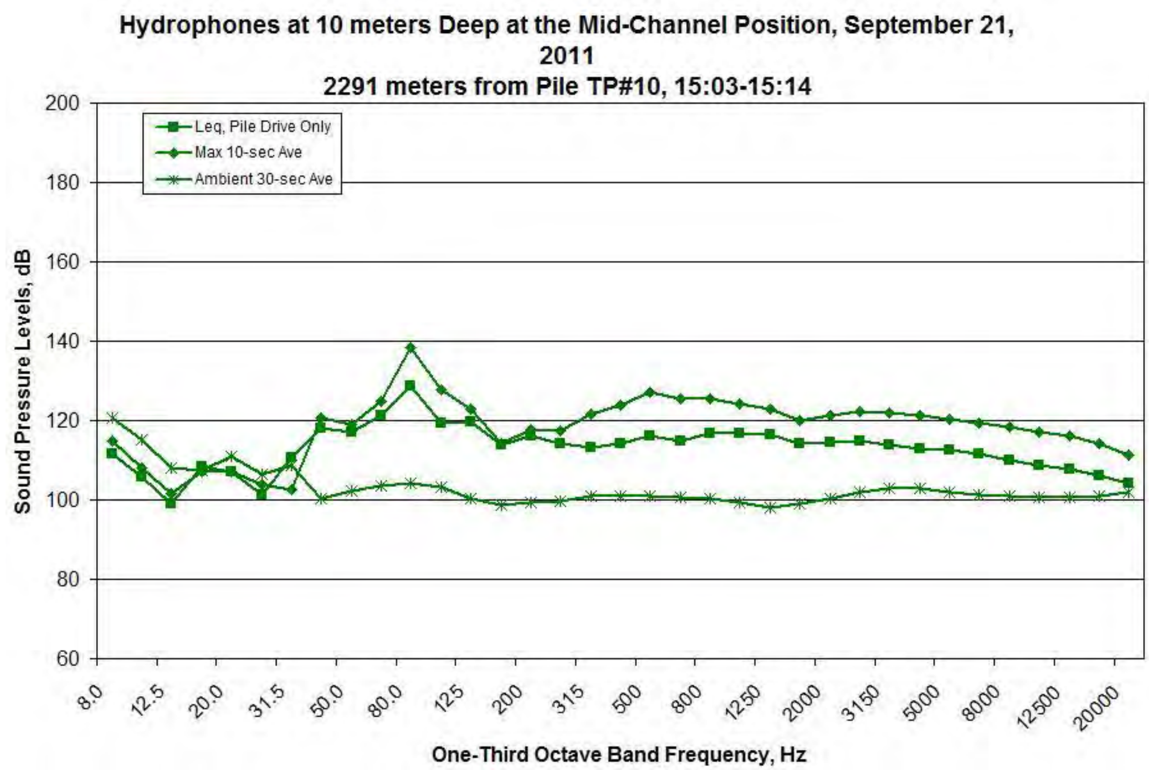

Figure A319. Spectral Data Measured at the MID Location during TP#10, 15:03-15:14, Measured at Depths of 10 meters on September 21, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A320. Spectral Data Measured at the NO Location during TP#10, 15:03-15:14, Measured at Depths of 10 meters on September 21, 2011

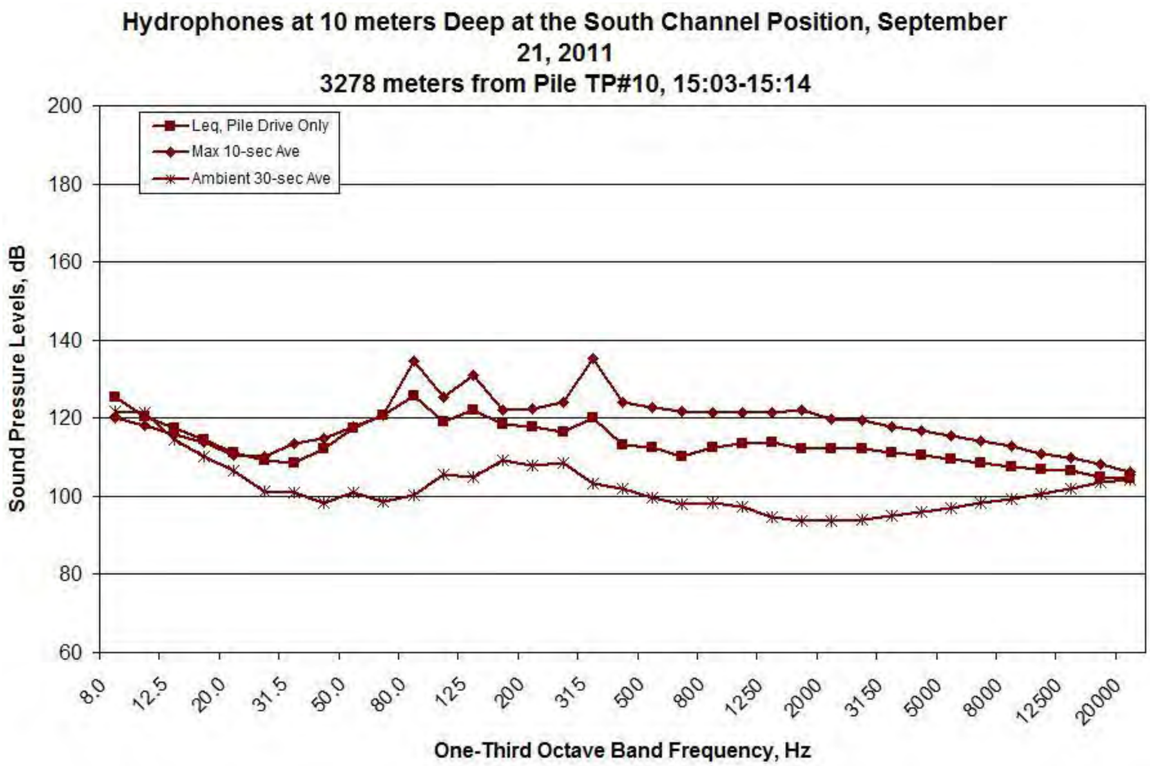

Figure A321. Spectral Data Measured at the SO Location during TP#10, 15:03-15:14, Measured at Depths of 10 meters on September 21, 2011

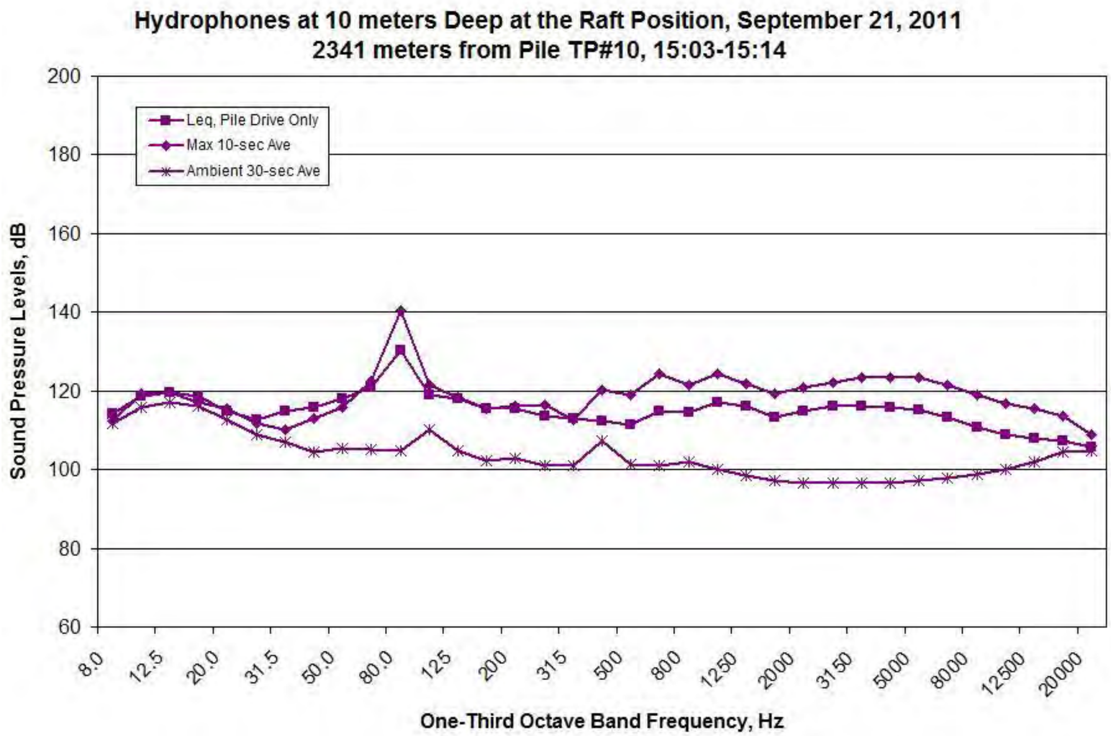

Figure A322. Spectral Data Measured at the RFT Location during TP#10, 15:03-15:14, Measured at Depths of 10 meters on September 21, 2011

TP#9 (Vibratory Installation)

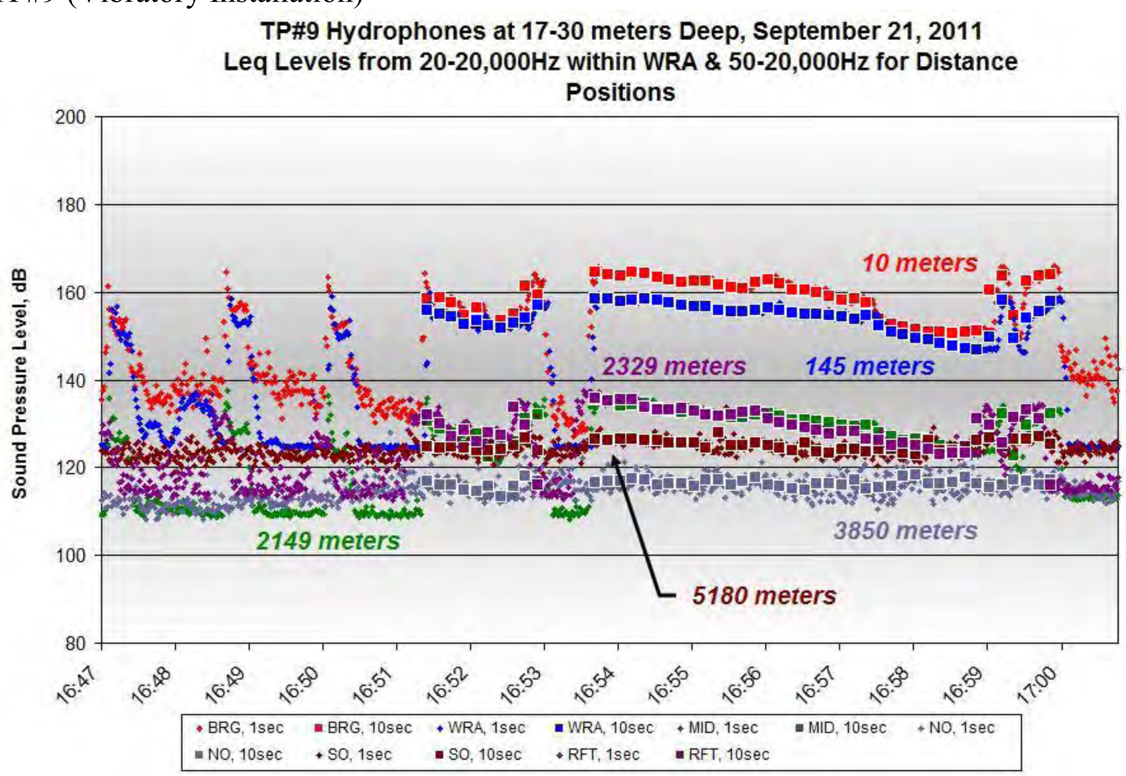

Figure A323. One-second and 10-second Average Data for TP#9, 16:49-17:00, Measured at Depths of 17-30 meters on September 21, 2011

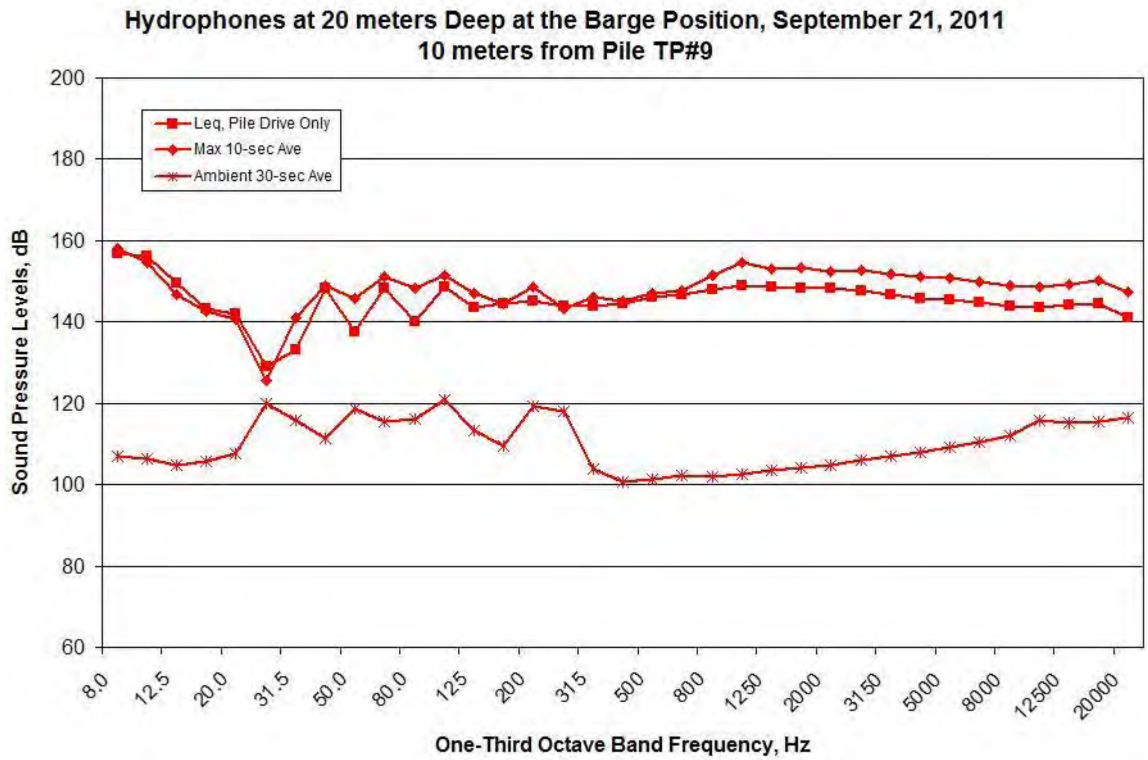

Figure A324. Spectral Data Measured at the BRG Location during TP#9, 16:49-17:00, Measured at Depths of 20 meters on September 21, 2011

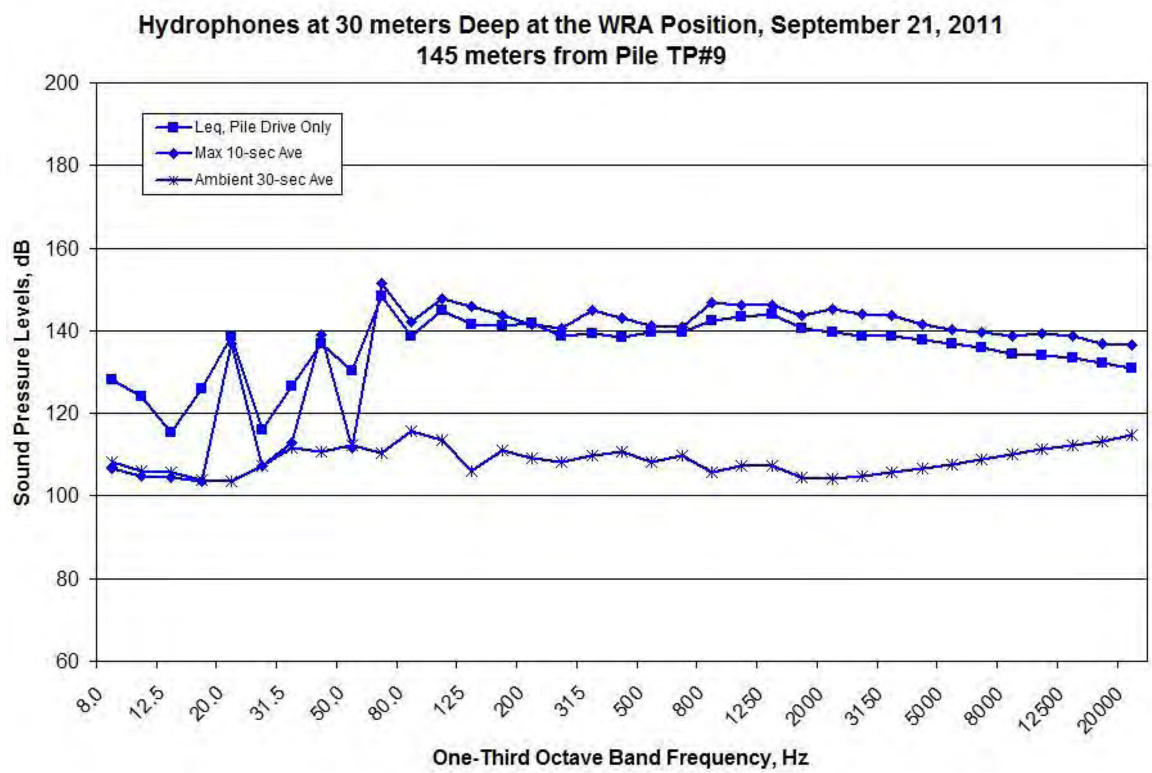

Figure A325. Spectral Data Measured at the WRA Location during TP#9, 16:49-17:00, Measured at Depths of 30 meters on September 21, 2011

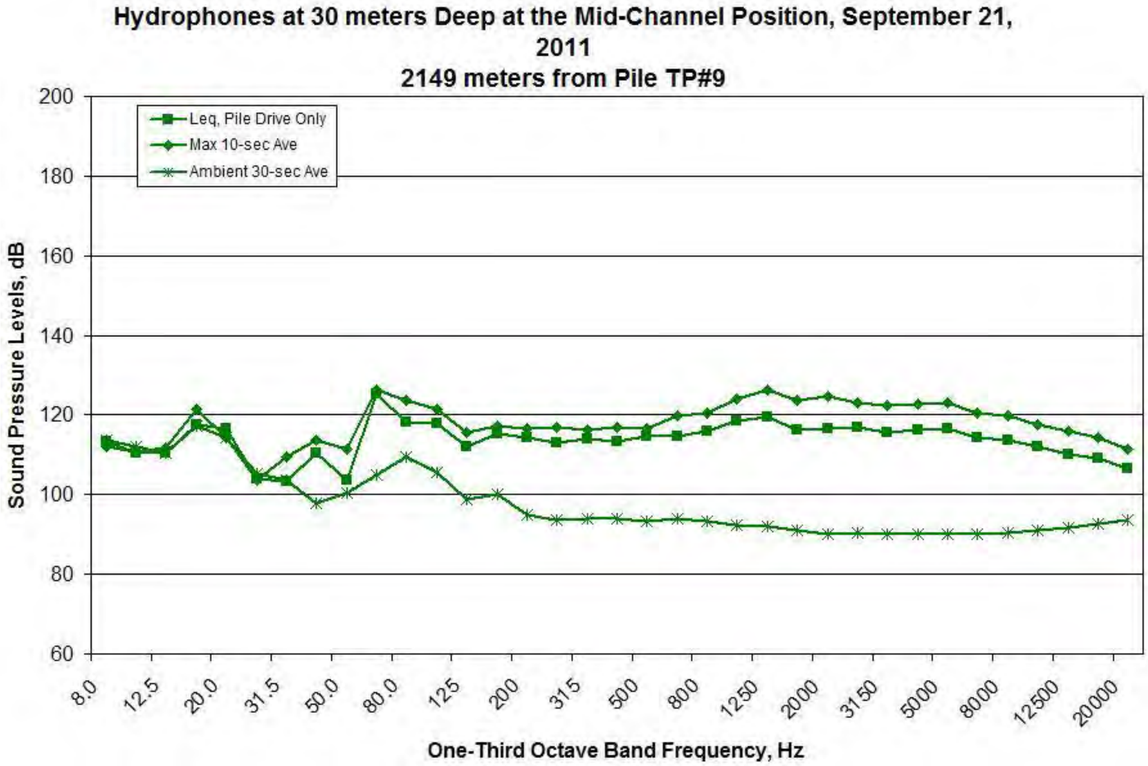

Figure A326. Spectral Data Measured at the MID Location during TP#9, 16:49-17:00, Measured at Depths of 30 meters on September 21, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A327. Spectral Data Measured at the NO Location during TP#9, 16:49-17:00, Measured at Depths of 30 meters on September 21, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A328. Spectral Data Measured at the SO Location during TP#9, 16:49-17:00, Measured at Depths of 30 meters on September 21, 2011

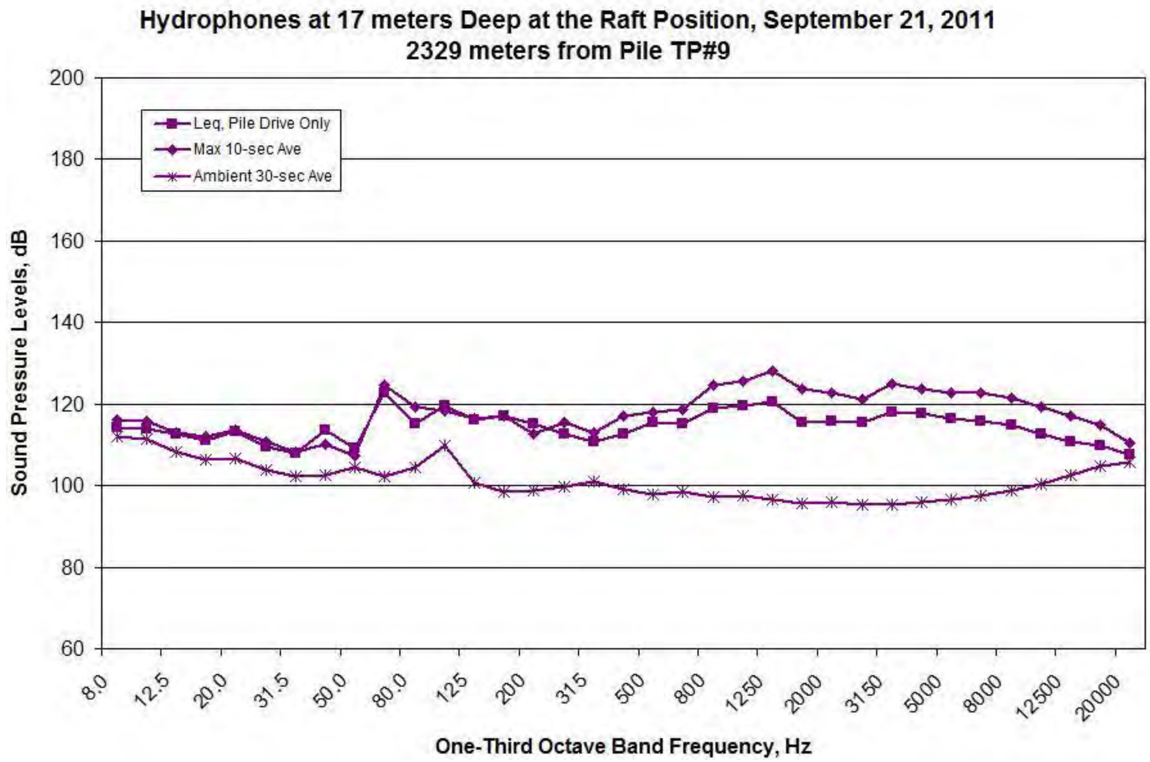

Figure A329. Spectral Data Measured at the RFT Location during TP#9, 16:49-17:00, Measured at Depths of 17 meters on September 21, 2011

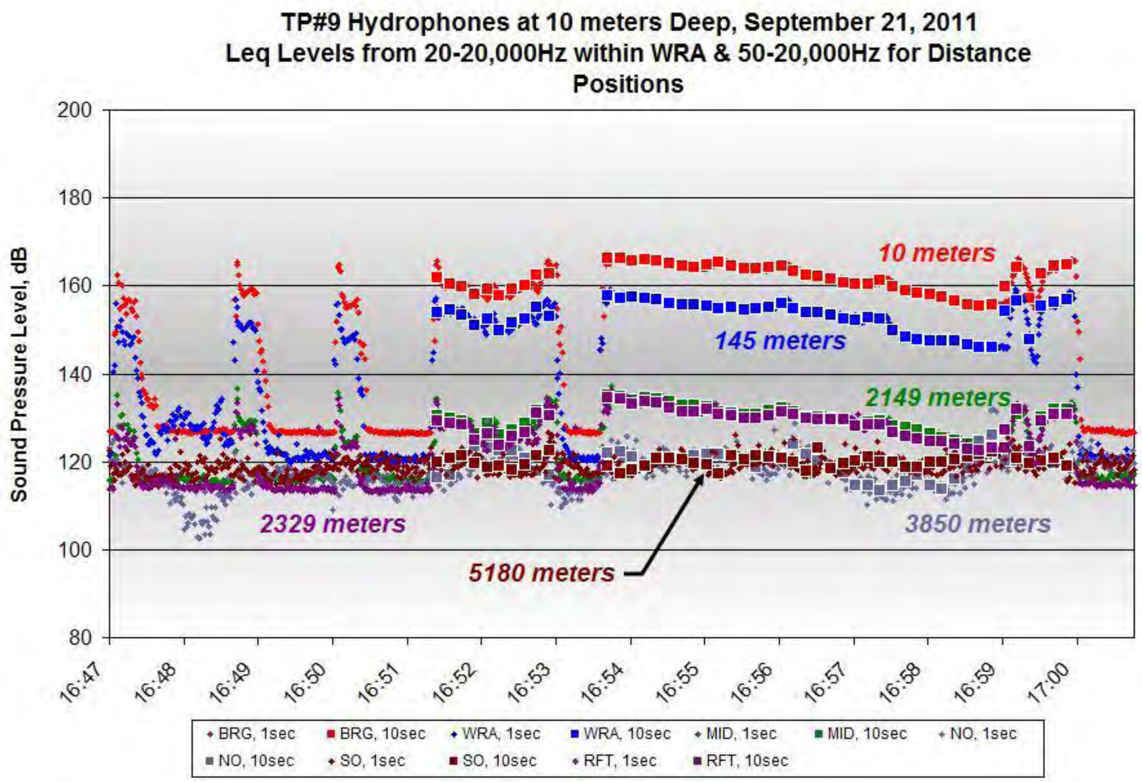

Figure A330. One-second and 10-second Average Data for TP#9, 16:49-17:00, Measured at Depths of 10 meters on September 21, 2011

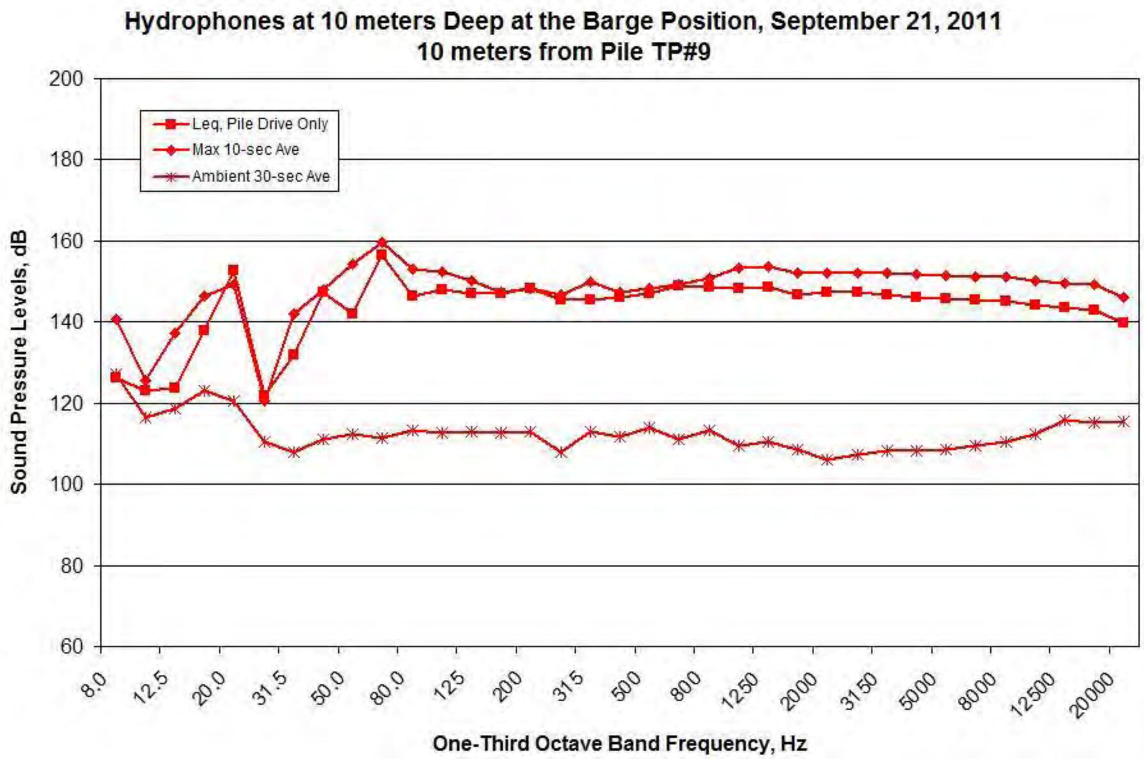

Figure A331. Spectral Data Measured at the BRG Location during TP#9, 16:49-17:00, Measured at Depths of 10 meters on September 21, 2011

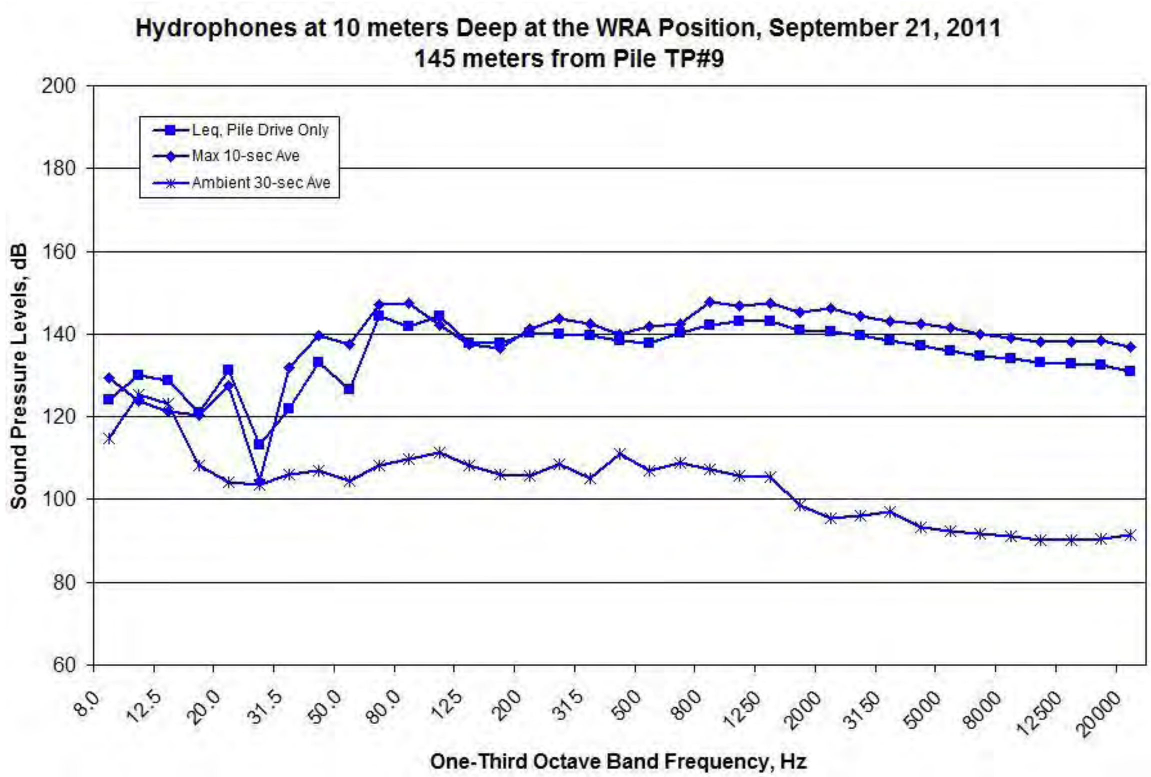

Figure A332. Spectral Data Measured at the WRA Location during TP#9, 16:49-17:00, Measured at Depths of 10 meters on September 21, 2011

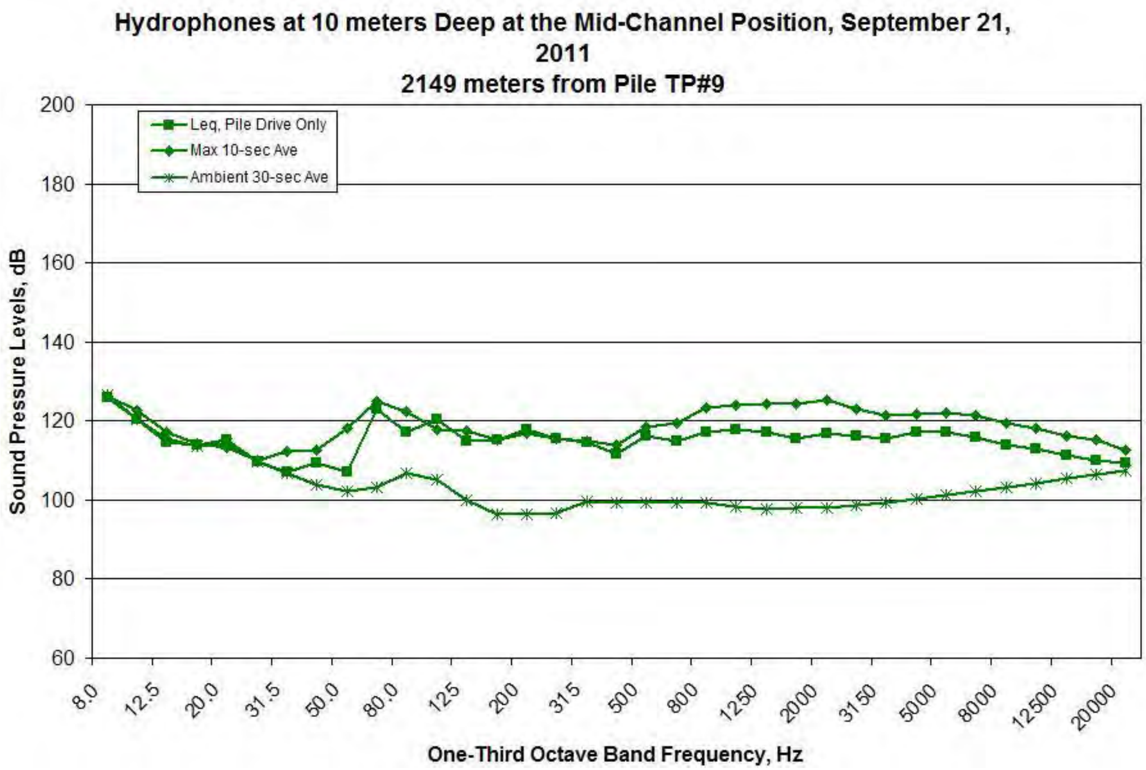

Figure A333. Spectral Data Measured at the MID Location during TP#9, 16:49-17:00, Measured at Depths of 10 meters on September 21, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A334. Spectral Data Measured at the NO Location during TP#9, 16:49-17:00, Measured at Depths of 10 meters on September 21, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A335. Spectral Data Measured at the SO Location during TP#9, 16:49-17:00, Measured at Depths of 10 meters on September 21, 2011

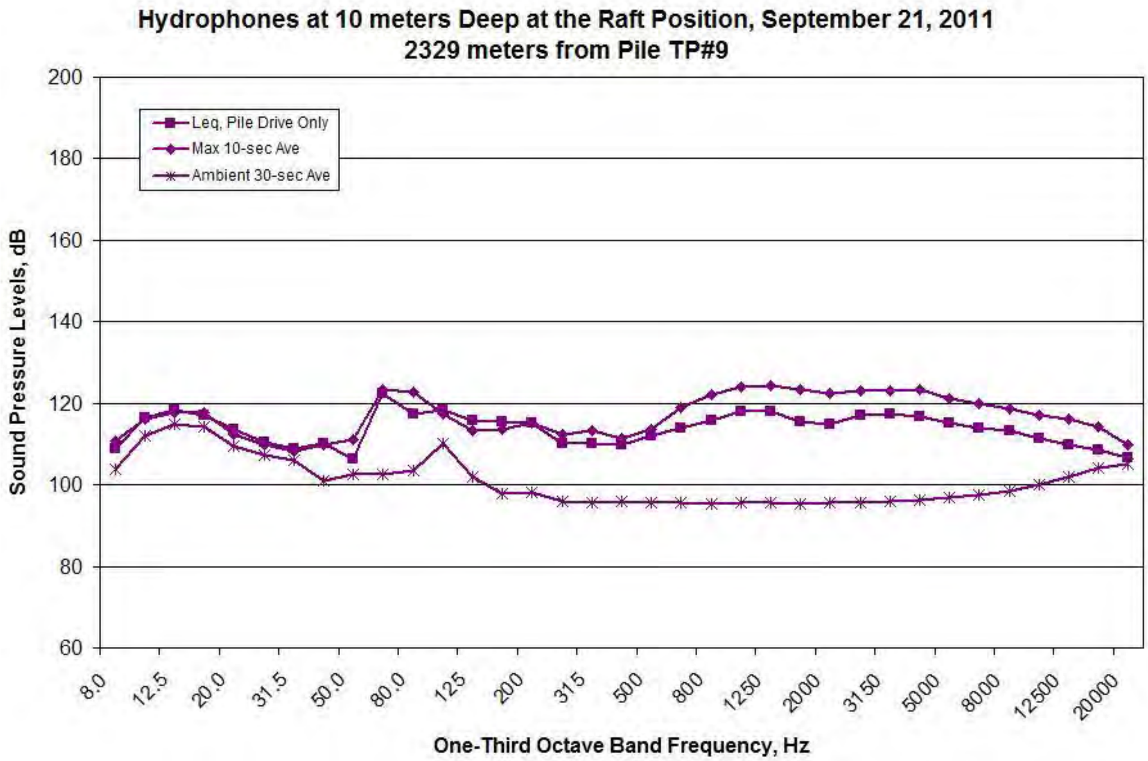

Figure A336. Spectral Data Measured at the RFT Location during TP#9, 16:49-17:00, Measured at Depths of 10 meters on September 21, 2011

9/22/2011 – TP#8 (Vibratory Installation)

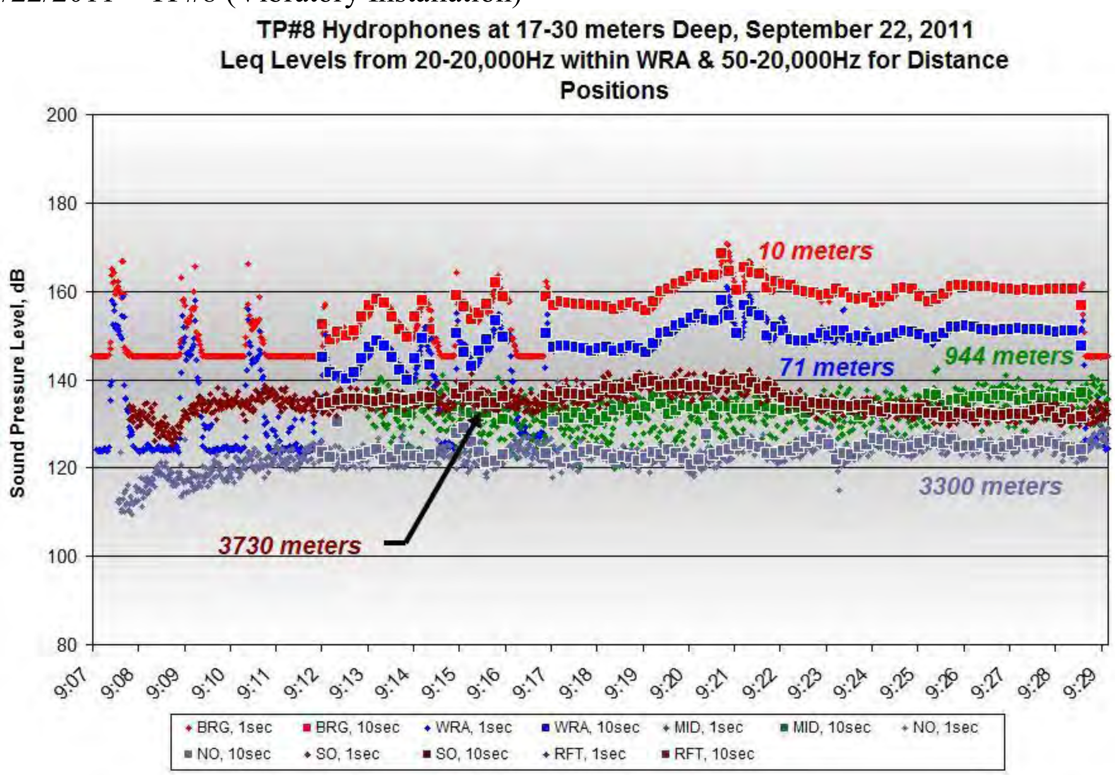

Figure A337. One-second and 10-second Average Data for TP#8, 9:13-9:29, Measured at Depths of 17-30 meters on September 22, 2011

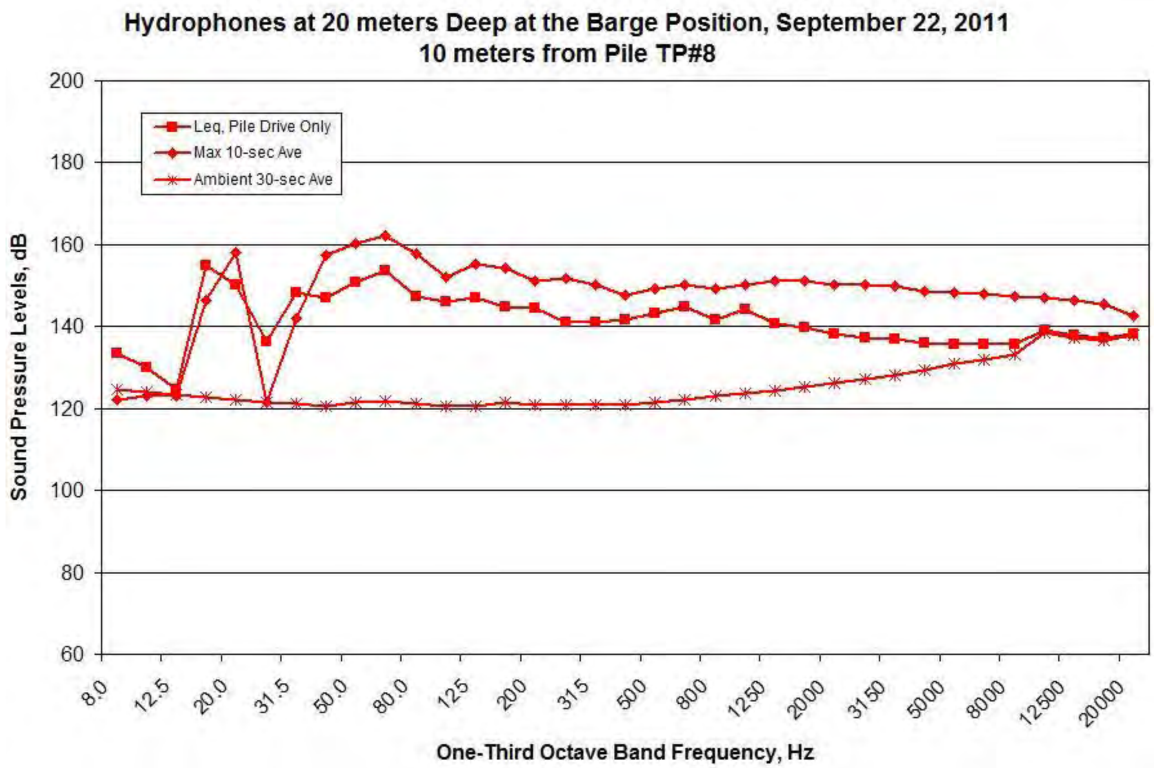

Figure A338. Spectral Data Measured at the BRG Location during TP#8, 9:13-9:29, Measured at Depths of 20 meters on September 22, 2011

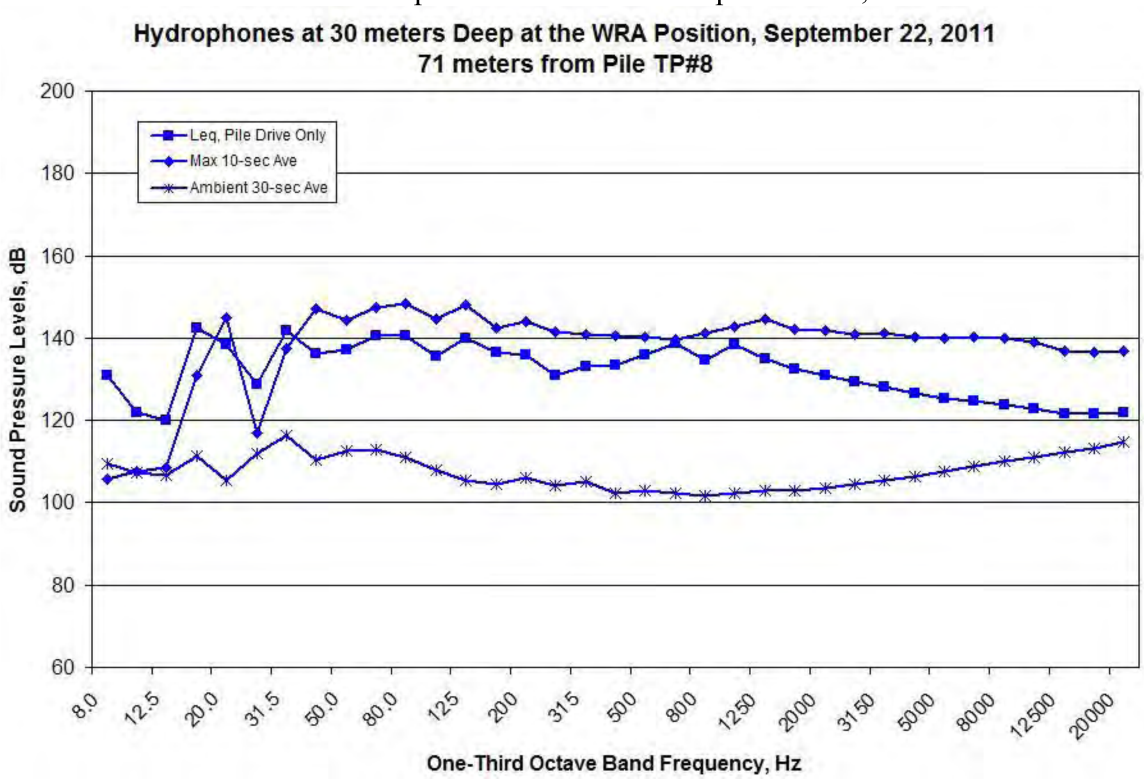

Figure A339. Spectral Data Measured at the WRA Location during TP#8, 9:13-9:29, Measured at Depths of 30 meters on September 22, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A340. Spectral Data Measured at the MID Location during TP#8, 9:13-9:29, Measured at Depths of 30 meters on September 22, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A341. Spectral Data Measured at the NO Location during TP#8, 9:13-9:29, Measured at Depths of 30 meters on September 22, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A342. Spectral Data Measured at the SO Location during TP#8, 9:13-9:29, Measured at Depths of 30 meters on September 22, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A343. Spectral Data Measured at the RFT Location during TP#8, 9:13-9:29, Measured at Depths of 17 meters on September 22, 2011

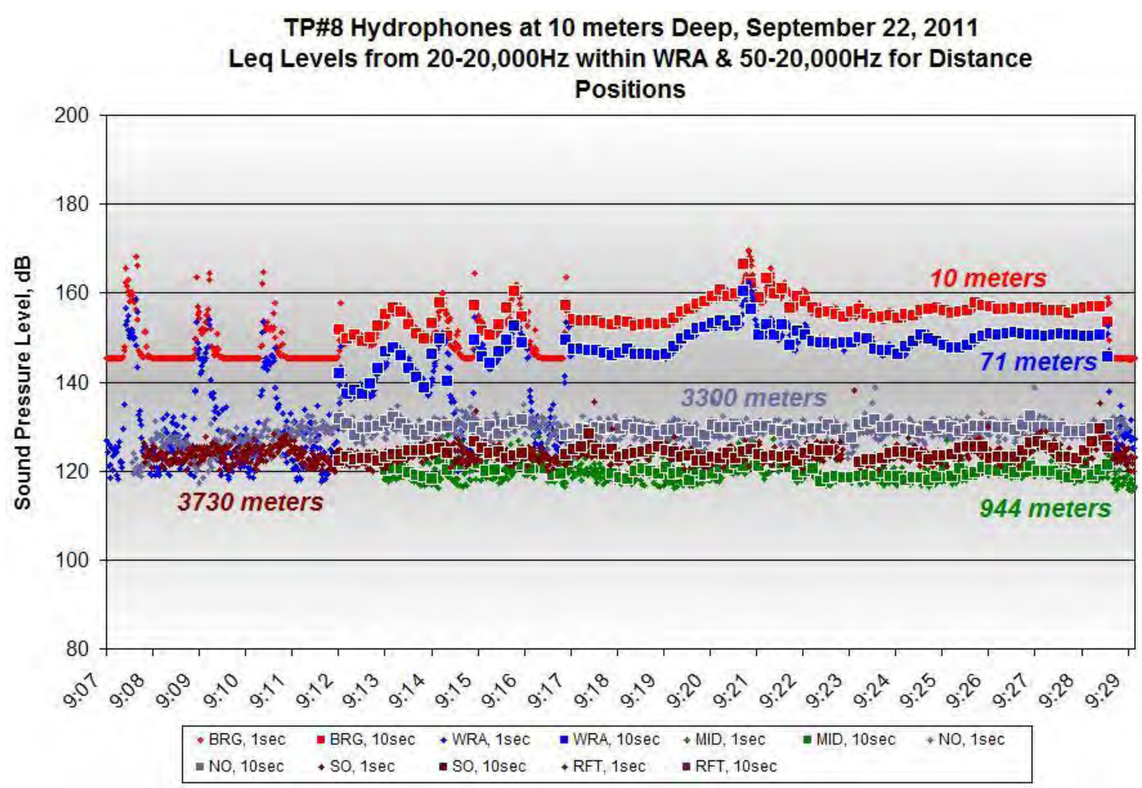

Figure A344. One-second and 10-second Average Data for TP#8, 9:13-9:29, Measured at Depths of 10 meters on September 22, 2011

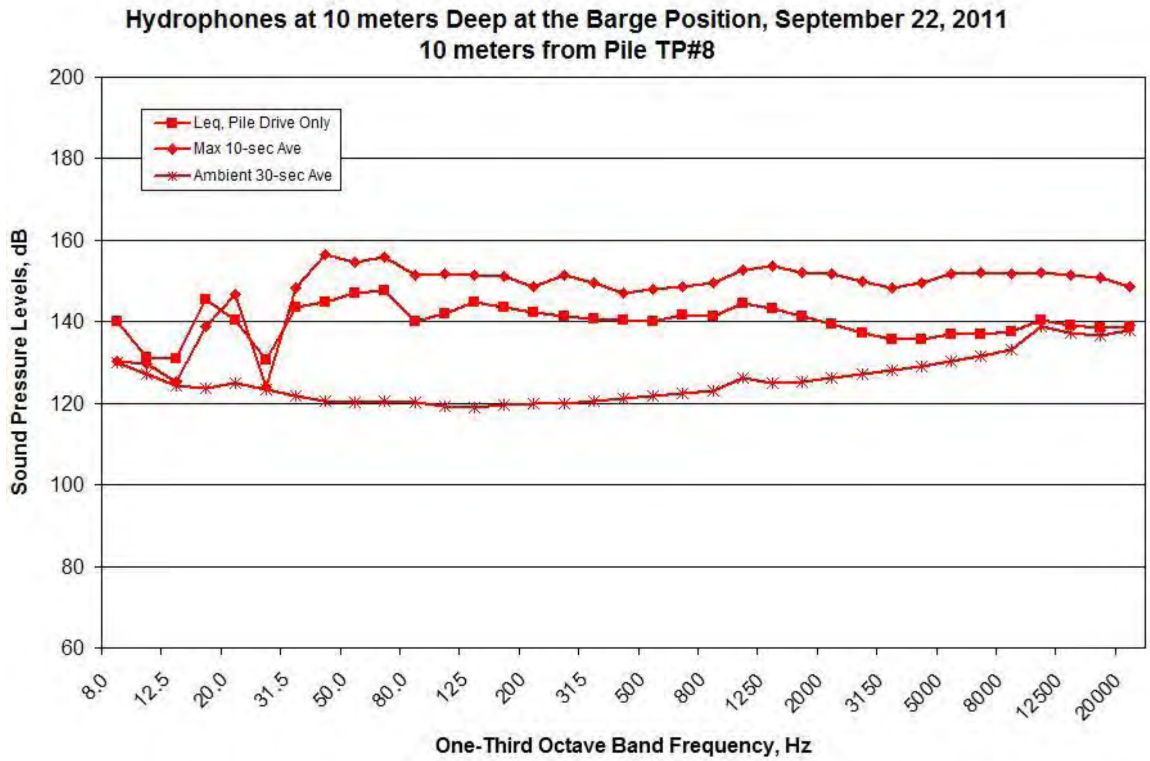

Figure A345. Spectral Data Measured at the BRG Location during TP#8, 9:13-9:29, Measured at Depths of 10 meters on September 22, 2011

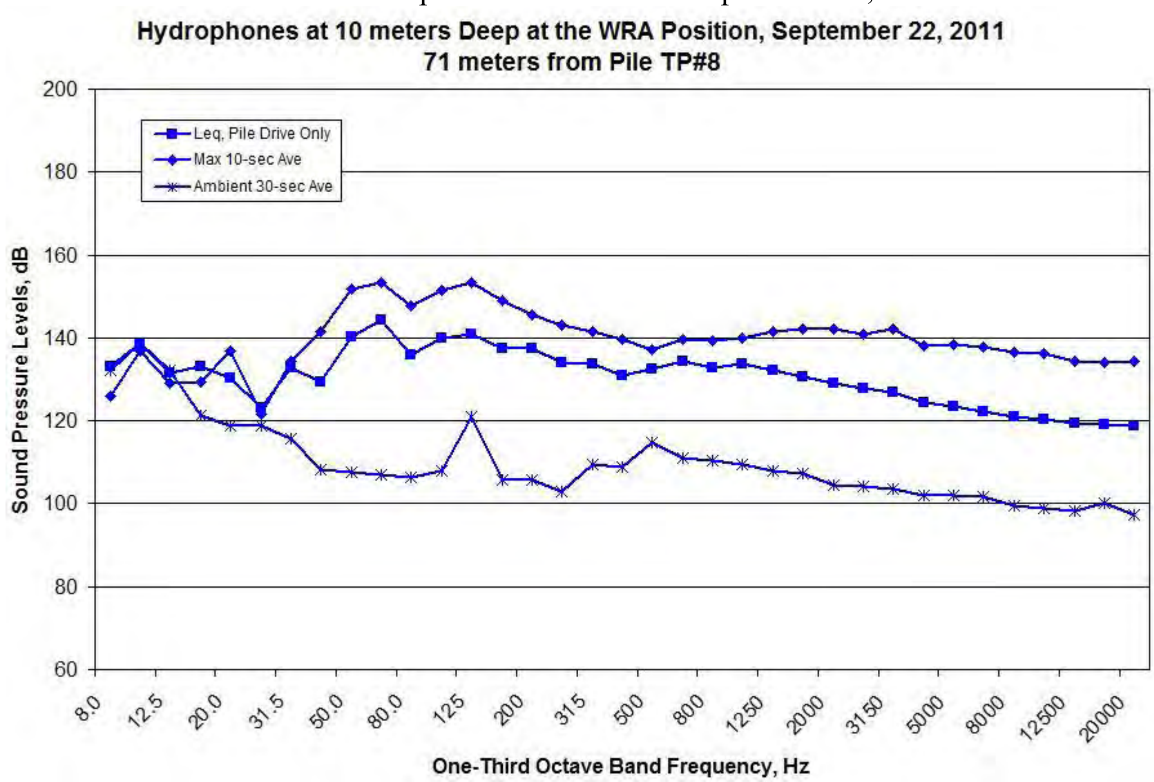

Figure A346. Spectral Data Measured at the WRA Location during TP#8, 9:13-9:29, Measured at Depths of 10 meters on September 22, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A347. Spectral Data Measured at the MID Location during TP#8, 9:13-9:29, Measured at Depths of 10 meters on September 22, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A348. Spectral Data Measured at the NO Location during TP#8, 9:13-9:29, Measured at Depths of 10 meters on September 22, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A349. Spectral Data Measured at the SO Location during TP#8, 9:13-9:29, Measured at Depths of 10 meters on September 22, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A350. Spectral Data Measured at the RFT Location during TP#8, 9:13-9:29, Measured at Depths of 10 meters on September 22, 2011

TP#11 (Vibratory Installation)

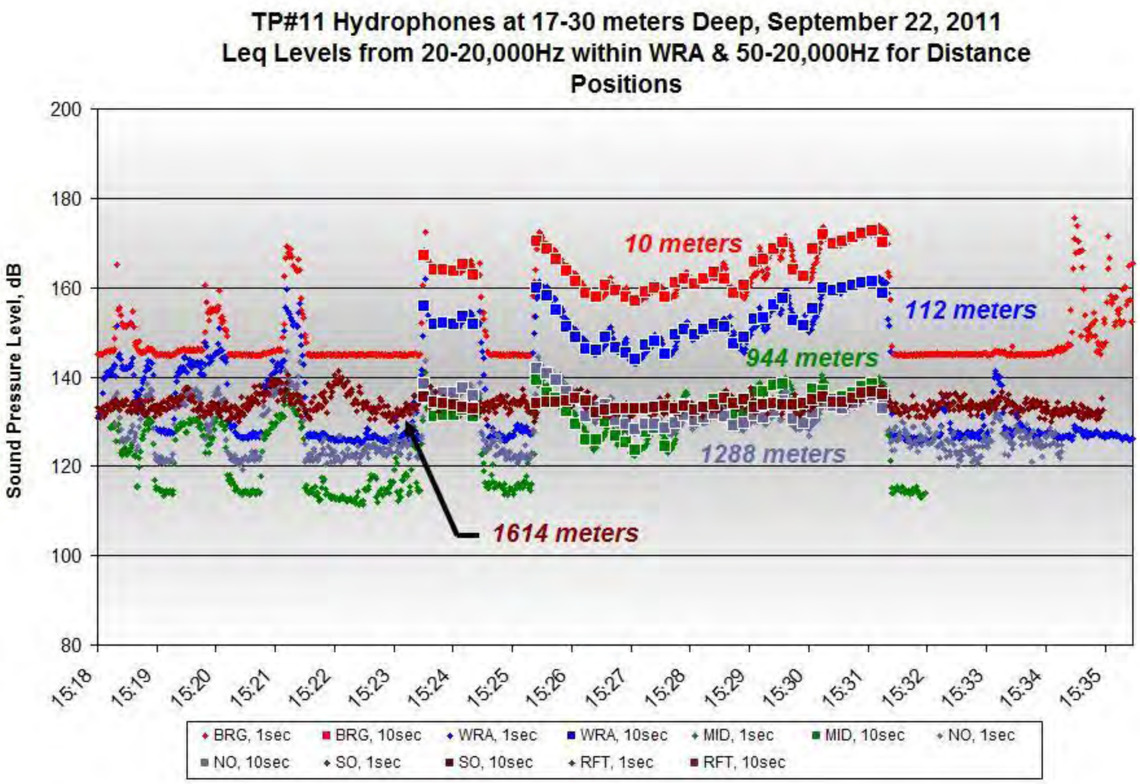

Figure A351. One-second and 10-second Average Data for TP#11, 15:21-15:28, Measured at Depths of 17-30 meters on September 22, 2011

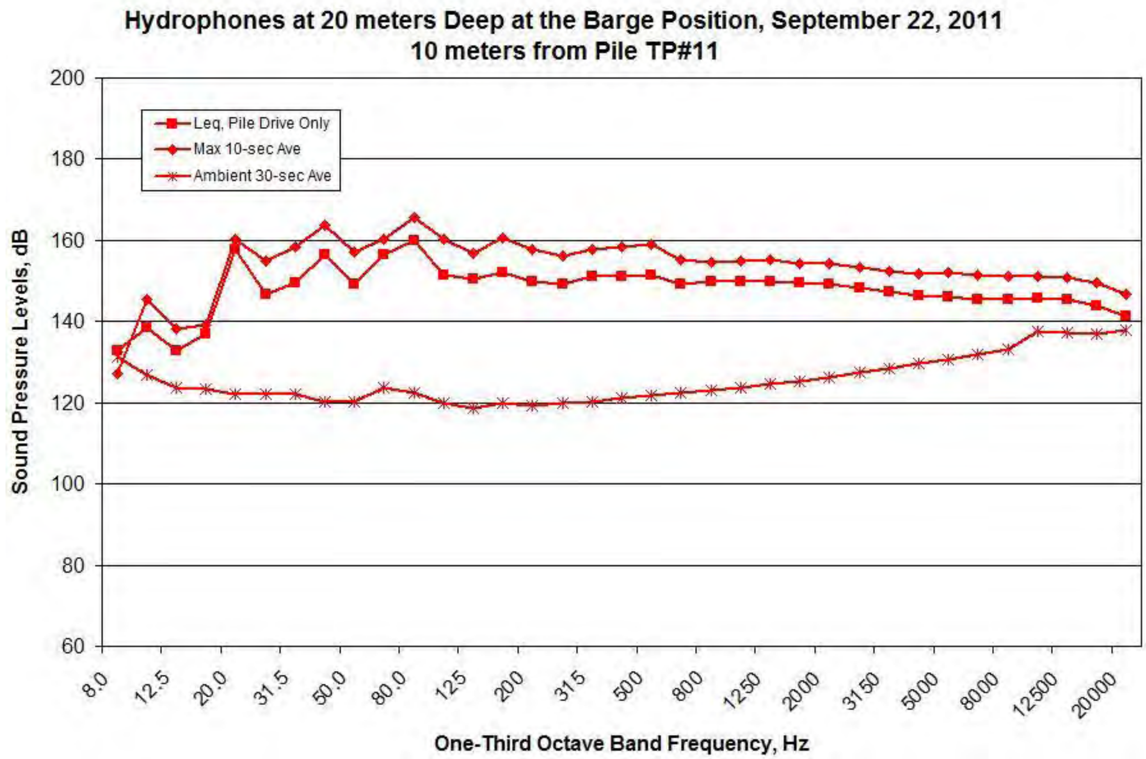

Figure A352. Spectral Data Measured at the BRG Location during TP#11, 15:21-15:28, Measured at Depths of 20 meters on September 22, 2011

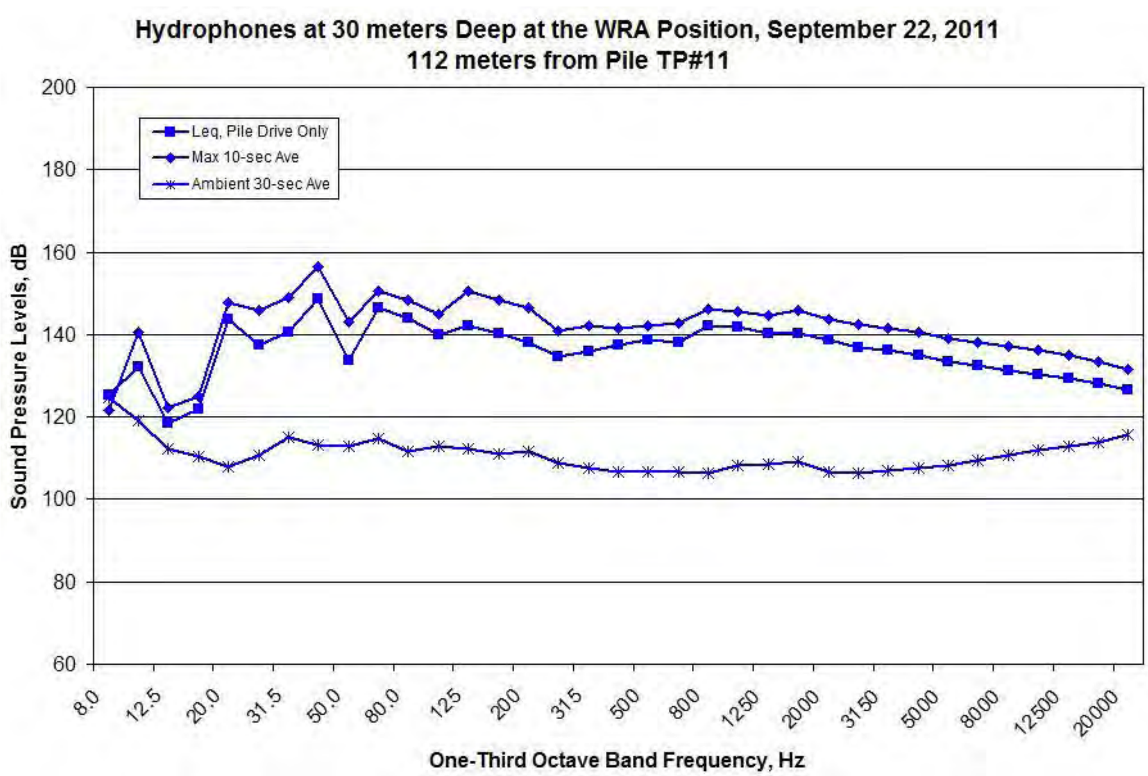

Figure A353. Spectral Data Measured at the WRA Location during TP#11, 15:21-15:28, Measured at Depths of 30 meters on September 22, 2011

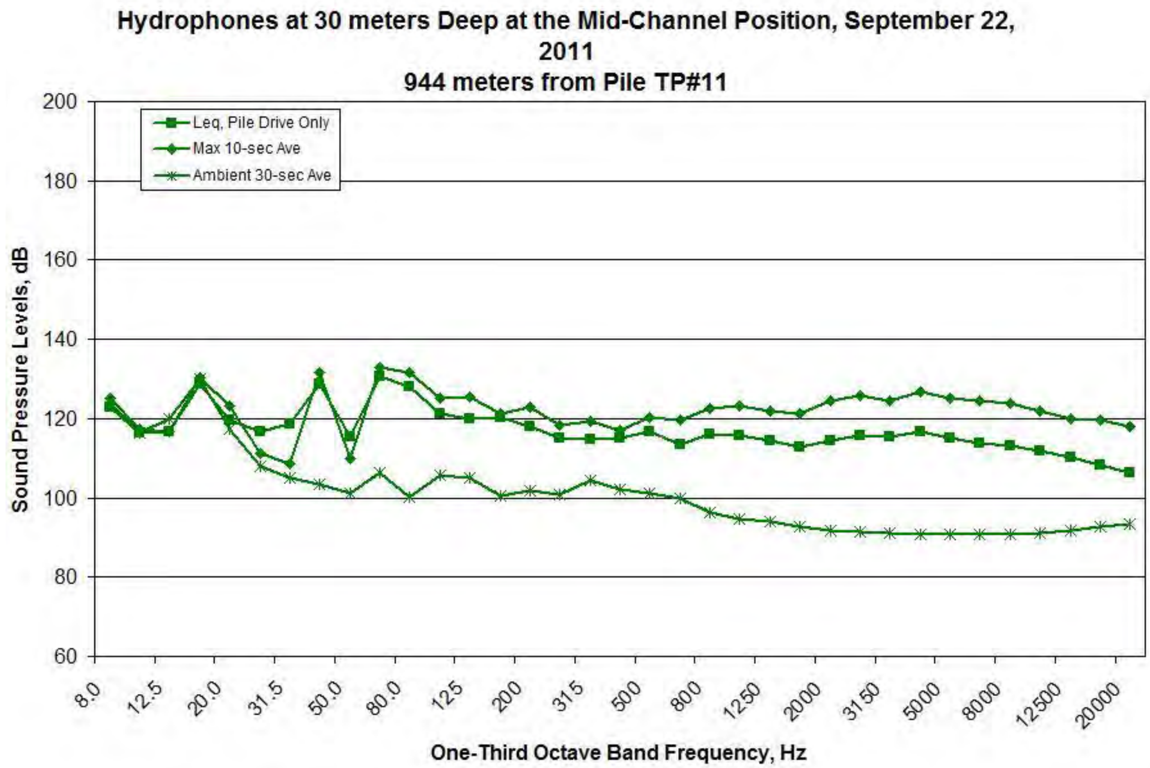

Figure A354. Spectral Data Measured at the MID Location during TP#11, 15:21-15:28, Measured at Depths of 30 meters on September 22, 2011

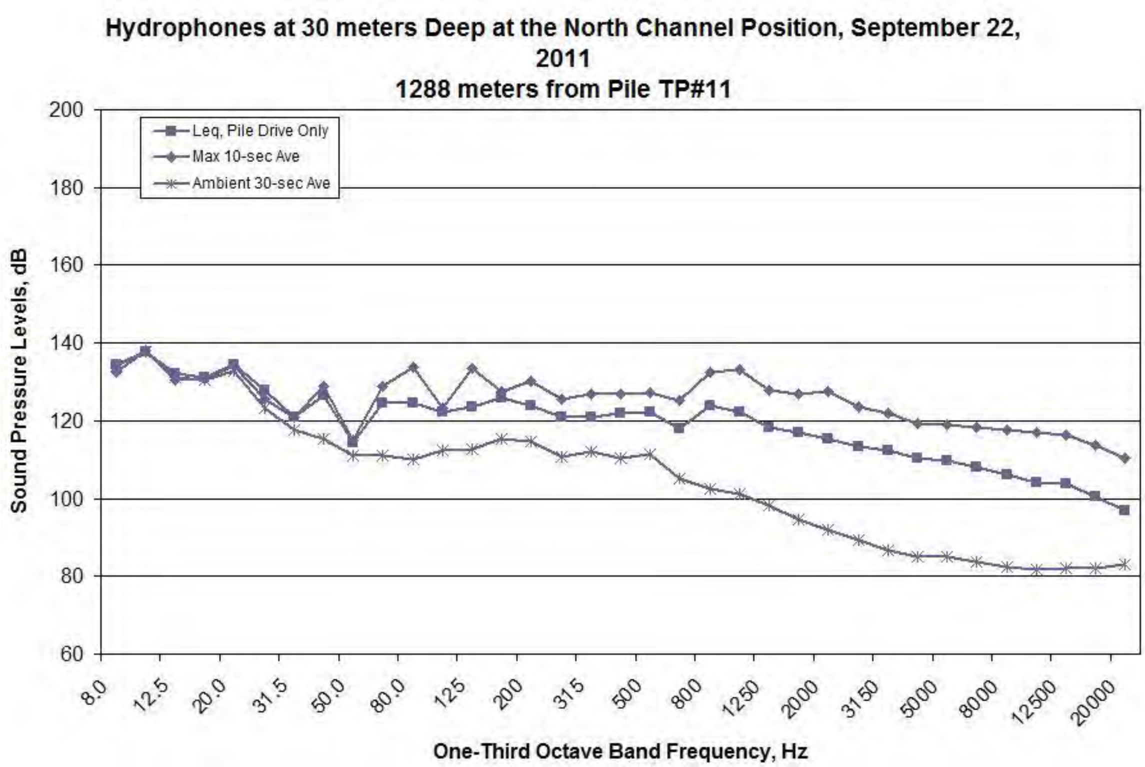

Figure A355. Spectral Data Measured at the NO Location during TP#11, 15:21-15:28, Measured at Depths of 30 meters on September 22, 2011

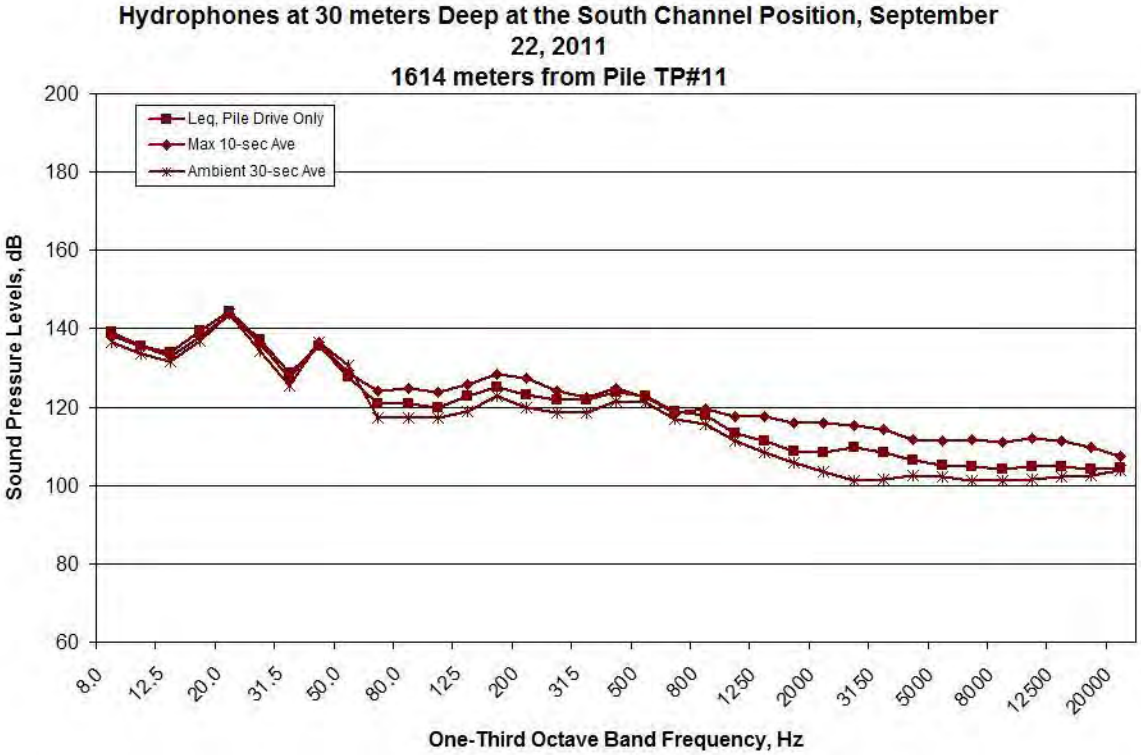

Figure A356. Spectral Data Measured at the SO Location during TP#11, 15:21-15:28, Measured at Depths of 30 meters on September 22, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A357. Spectral Data Measured at the RFT Location during TP#11, 15:21-15:28, Measured at Depths of 17 meters on September 22, 2011

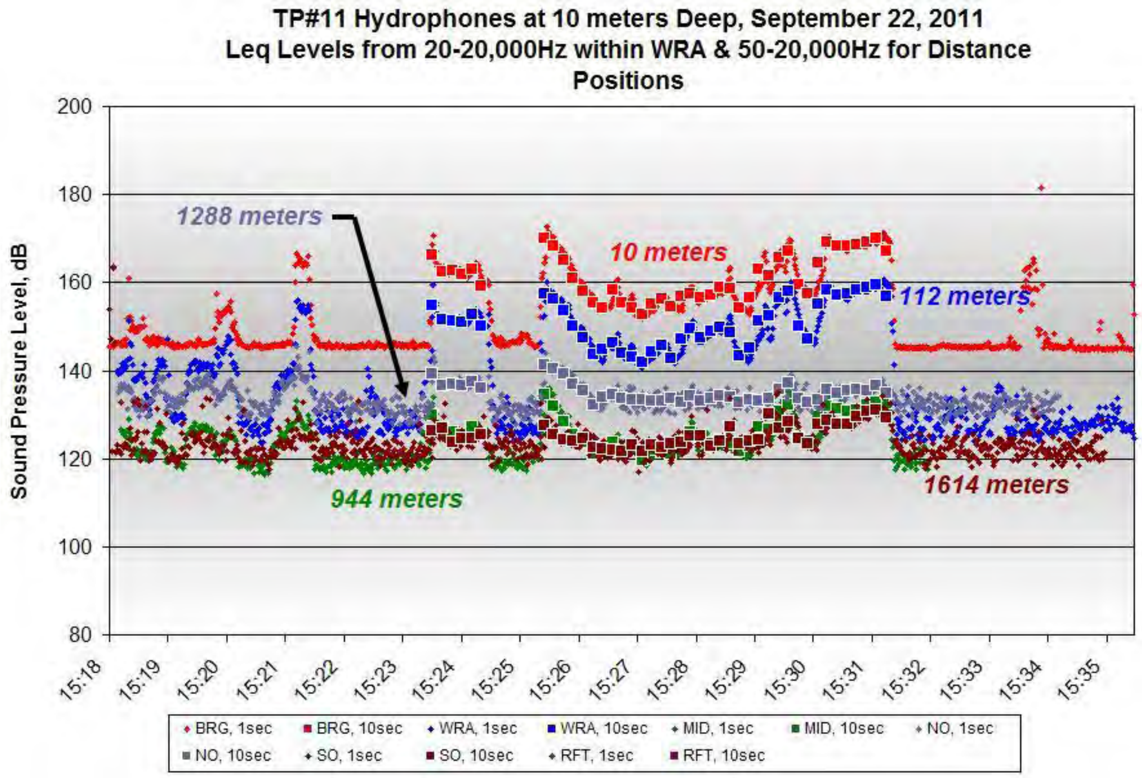

Figure A358. One-second and 10-second Average Data for TP#11, 15:21-15:28, Measured at Depths of 10 meters on September 22, 2011

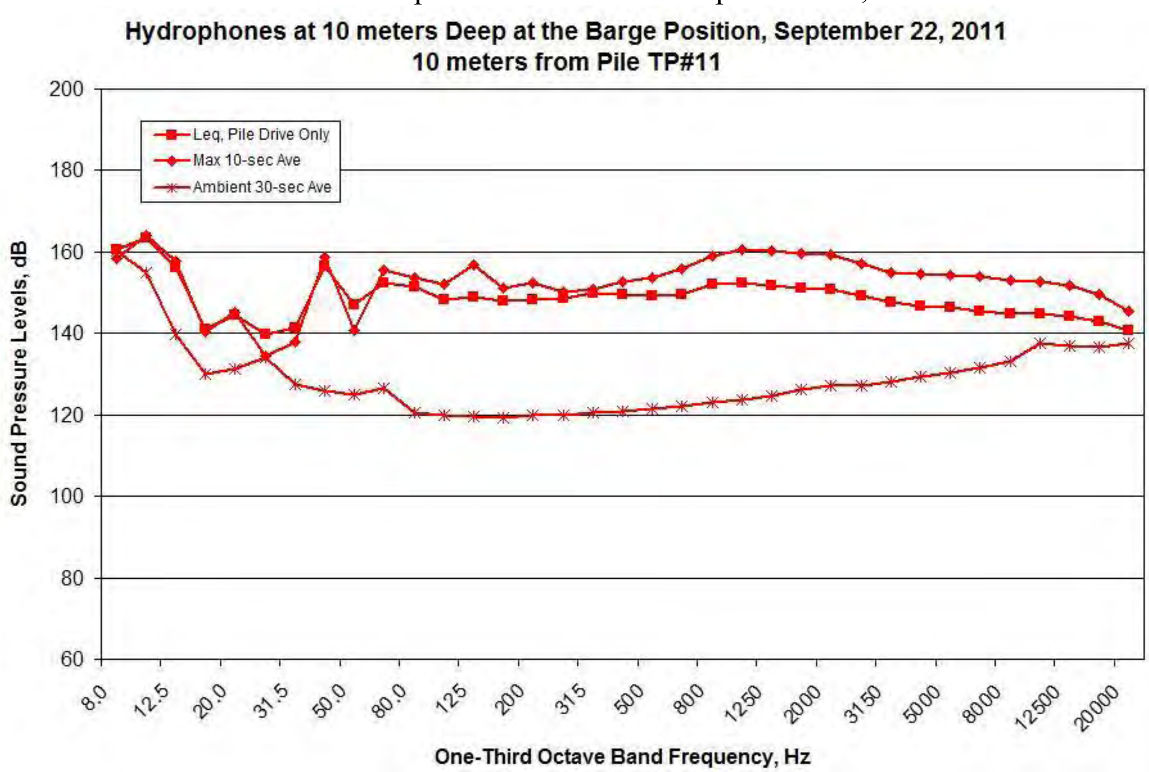

Figure A359. Spectral Data Measured at the BRG Location during TP#11, 15:21-15:28, Measured at Depths of 10 meters on September 22, 2011

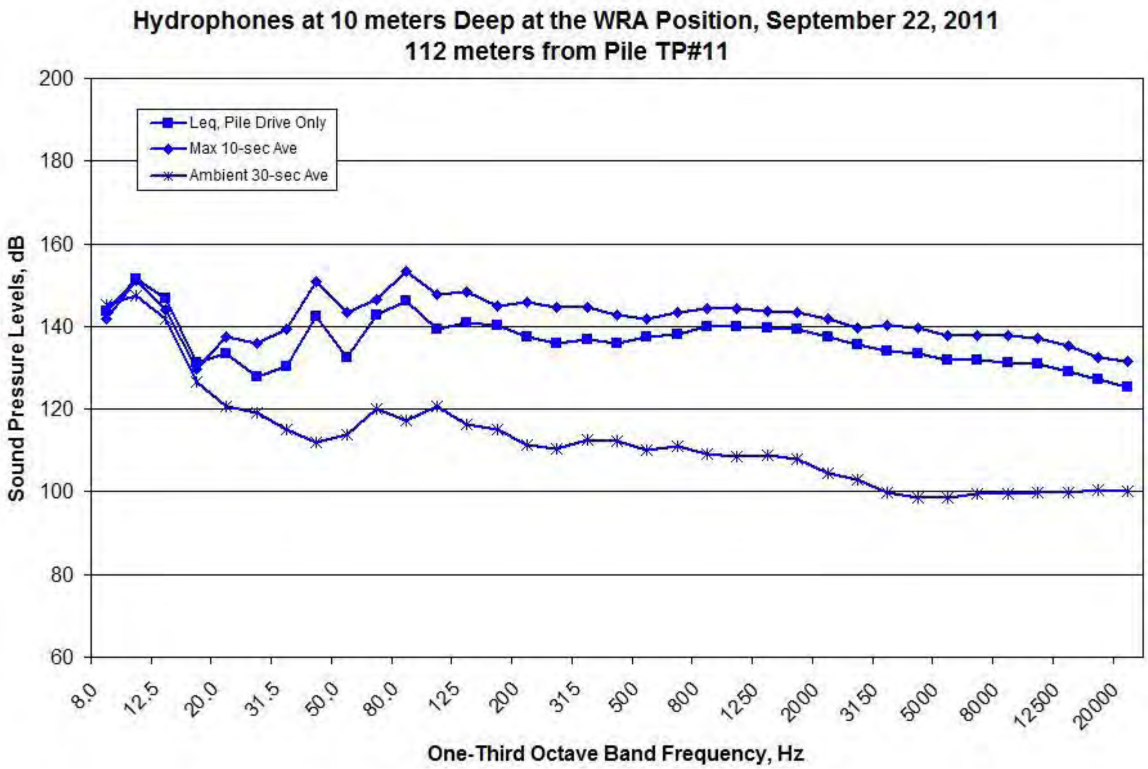

Figure A360. Spectral Data Measured at the WRA Location during TP#11, 15:21-15:28, Measured at Depths of 10 meters on September 22, 2011

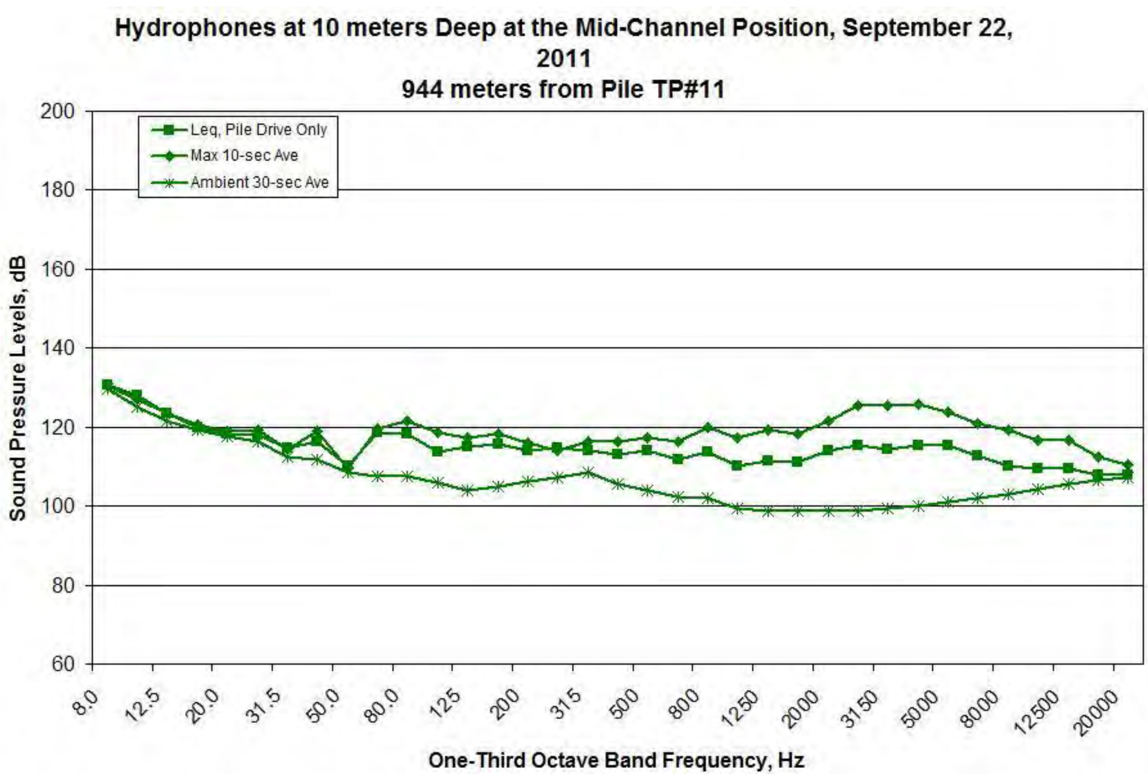

Figure A361. Spectral Data Measured at the MID Location during TP#11, 15:21-15:28, Measured at Depths of 10 meters on September 22, 2011

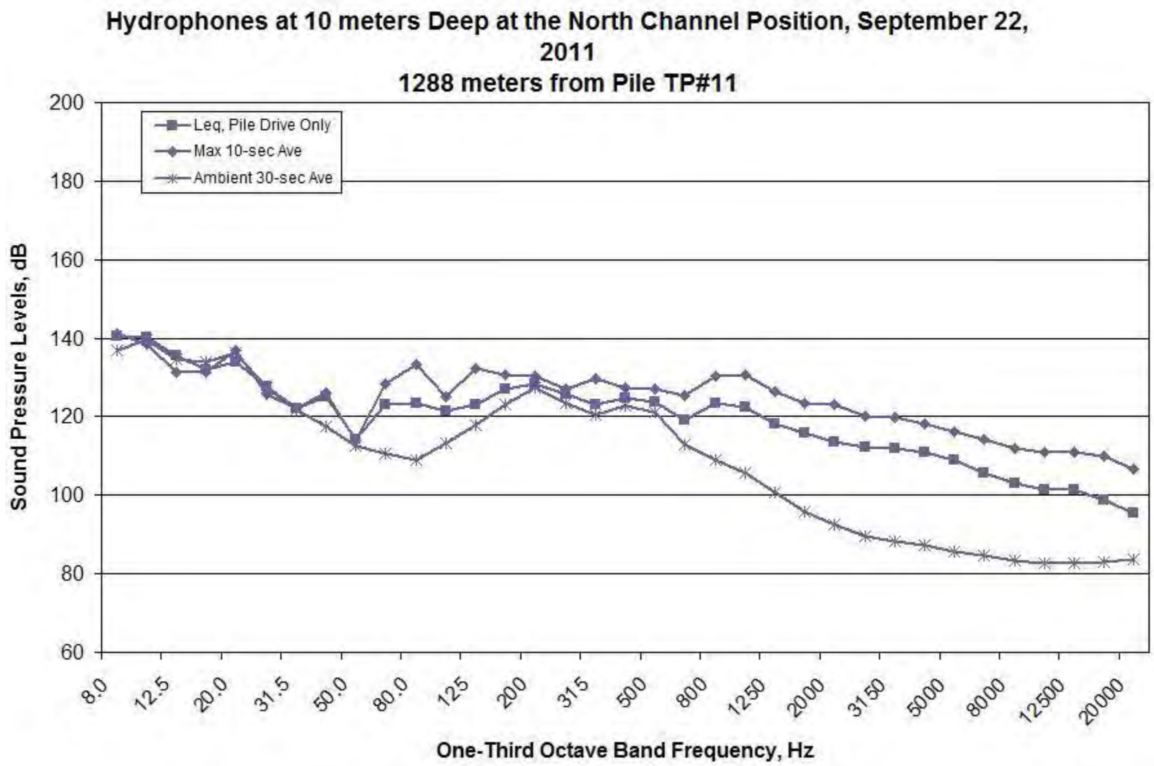

Figure A362. Spectral Data Measured at the NO Location during TP#11, 15:21-15:28, Measured at Depths of 10 meters on September 22, 2011

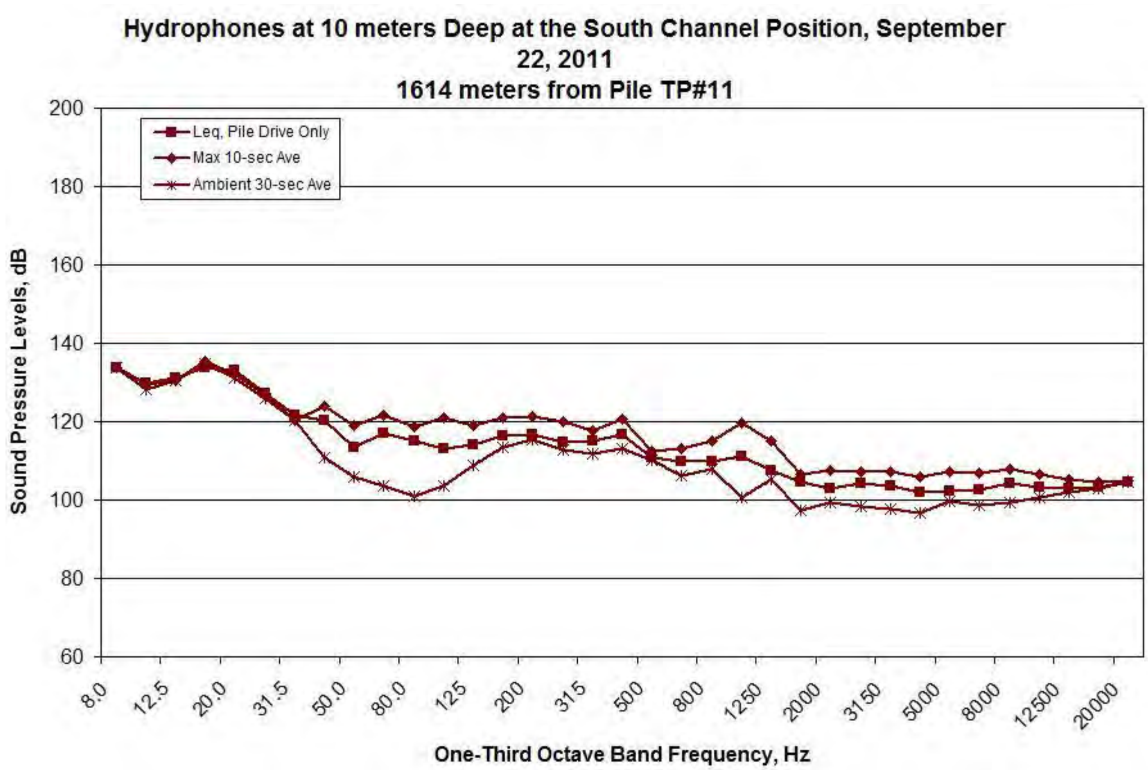

Figure A363. Spectral Data Measured at the SO Location during TP#11, 15:21-15:28, Measured at Depths of 10 meters on September 22, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A364. Spectral Data Measured at the RFT Location during TP#11, 15:21-15:28, Measured at Depths of 10 meters on September 22, 2011

9/23/2011 – TP#6 (Vibratory Installation)

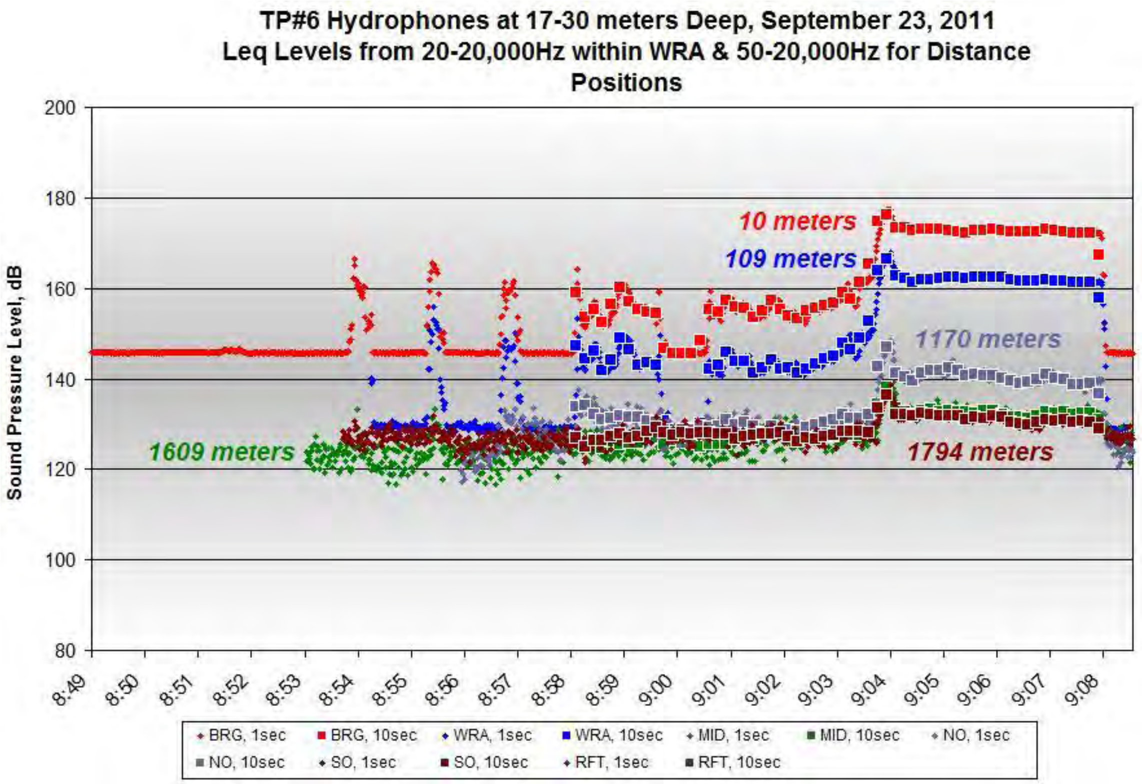

Figure A365. One-second and 10-second Average Data for TP#6, 8:54-9:04, Measured at Depths of 17-30 meters on September 23, 2011

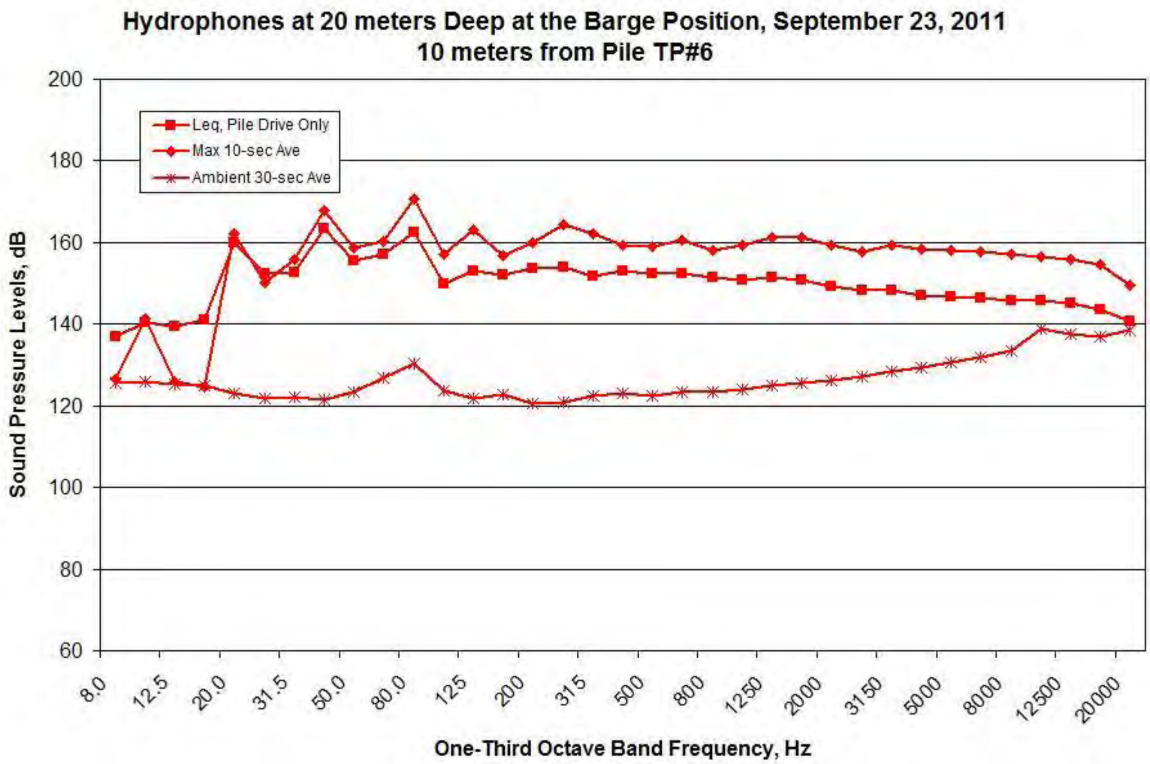

Figure A366. Spectral Data Measured at the BRG Location during TP#6, 8:54-9:04, Measured at Depths of 20 meters on September 23, 2011

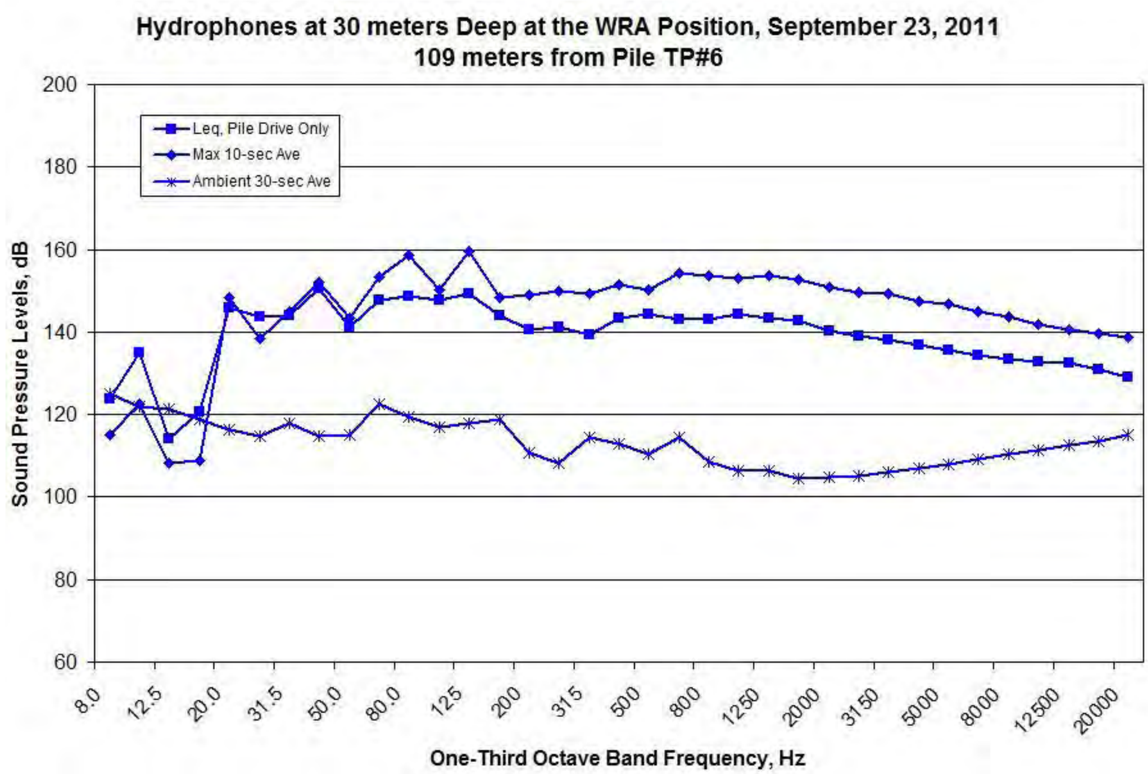

Figure A367. Spectral Data Measured at the WRA Location during TP#6, 8:54-9:04, Measured at Depths of 30 meters on September 23, 2011

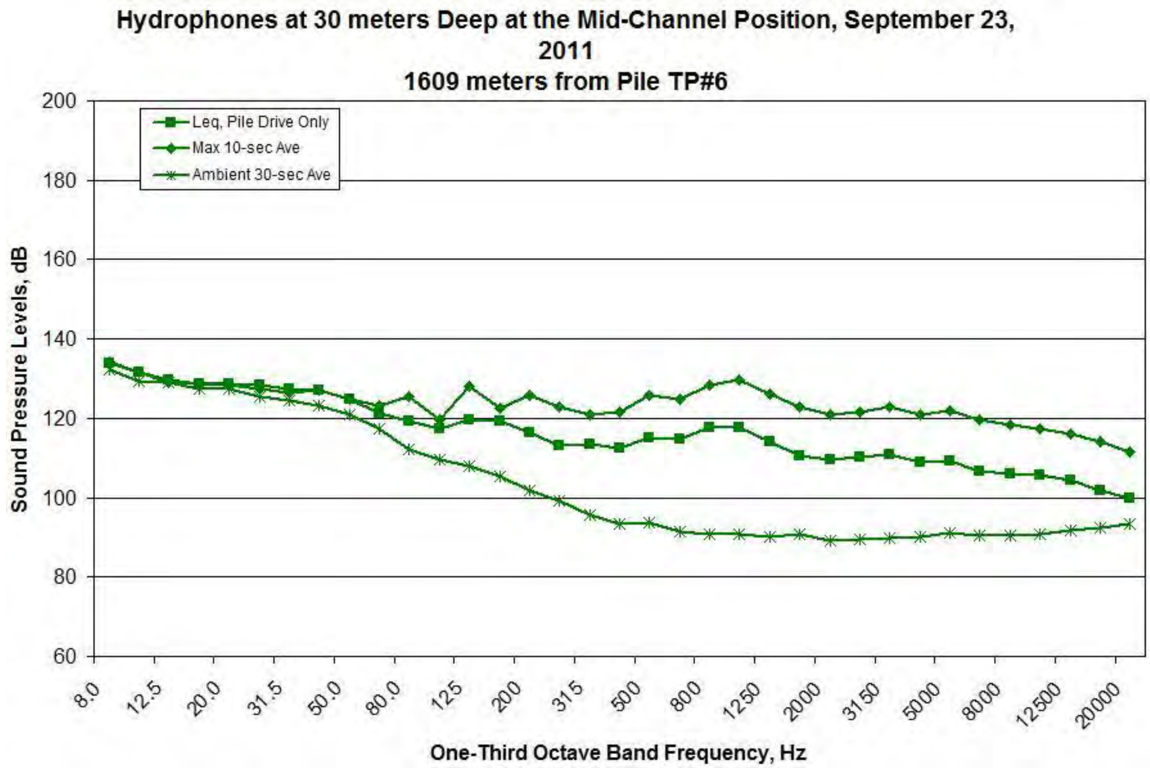

Figure A368. Spectral Data Measured at the MID Location during TP#6, 8:54-9:04, Measured at Depths of 30 meters on September 23, 2011

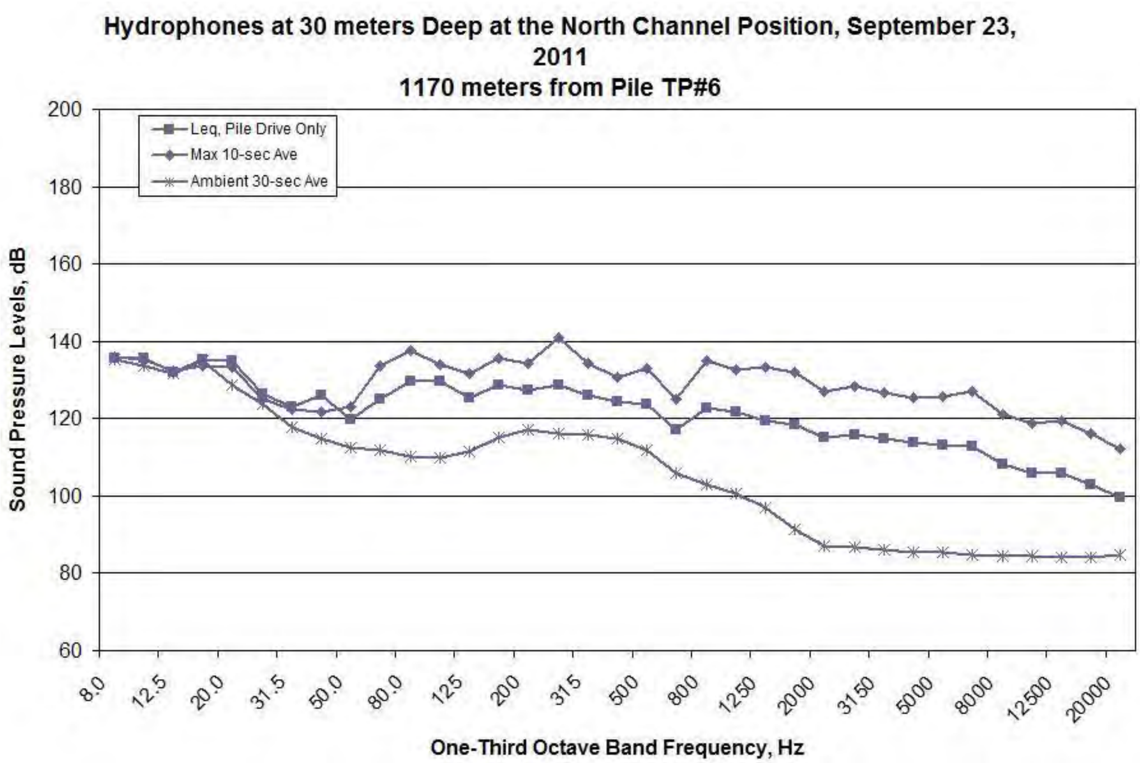

Figure A369. Spectral Data Measured at the NO Location during TP#6, 8:54-9:04, Measured at Depths of 30 meters on September 23, 2011

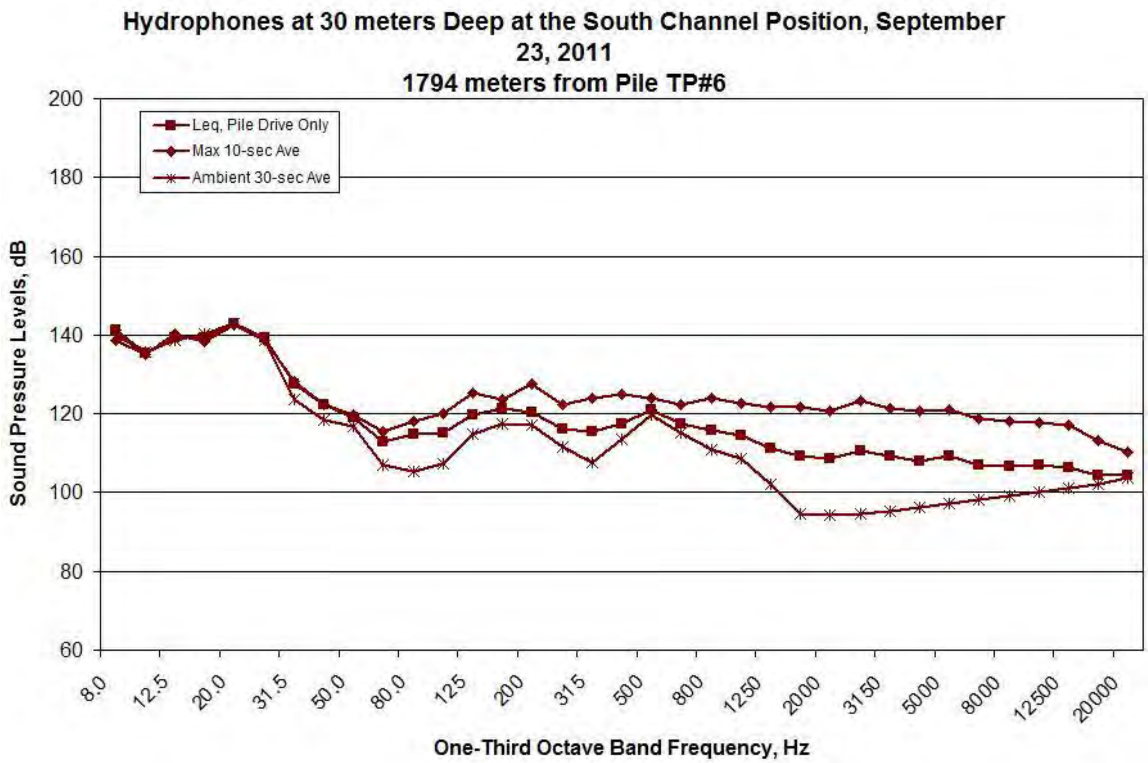

Figure A370. Spectral Data Measured at the SO Location during TP#6, 8:54-9:04, Measured at Depths of 30 meters on September 23, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS
Figure A371. Spectral Data Measured at the RFT Location during TP#6, 8:54-9:04, Measured at Depths of 17 meters on September 23, 2011

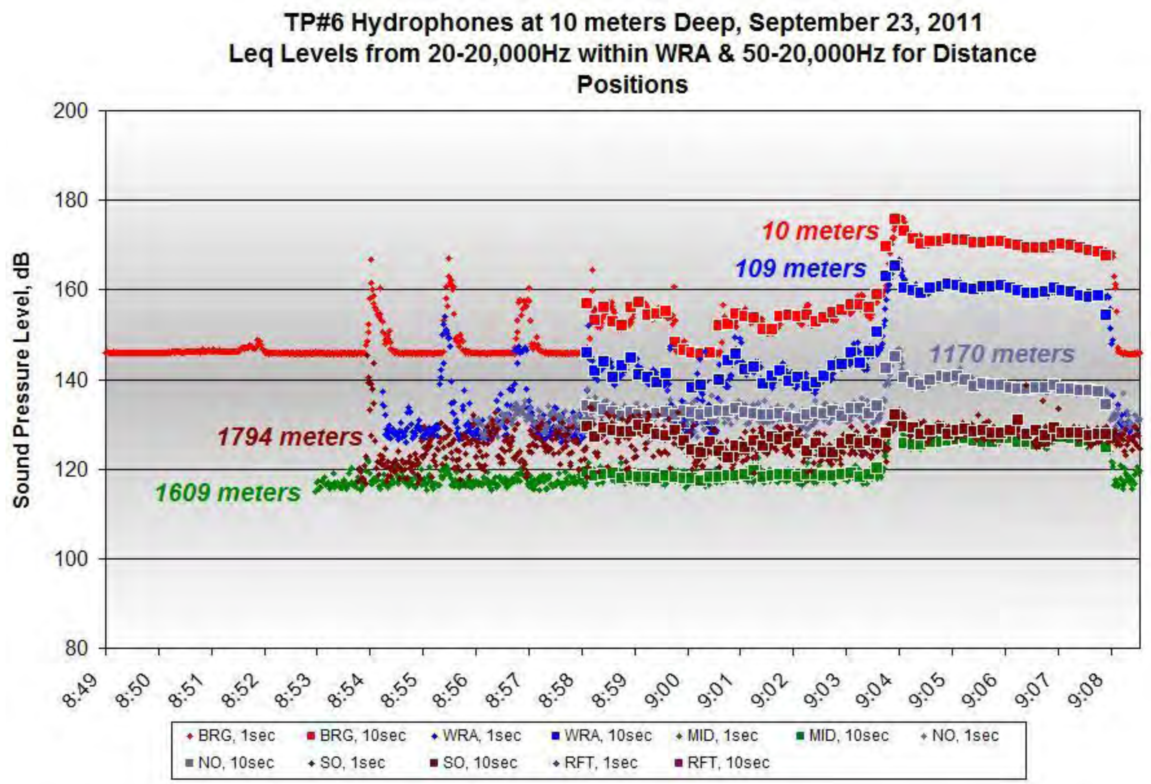

Figure A372. One-second and 10-second Average Data for TP#6, 8:54-9:04, Measured at Depths of 10 meters on September 23, 2011

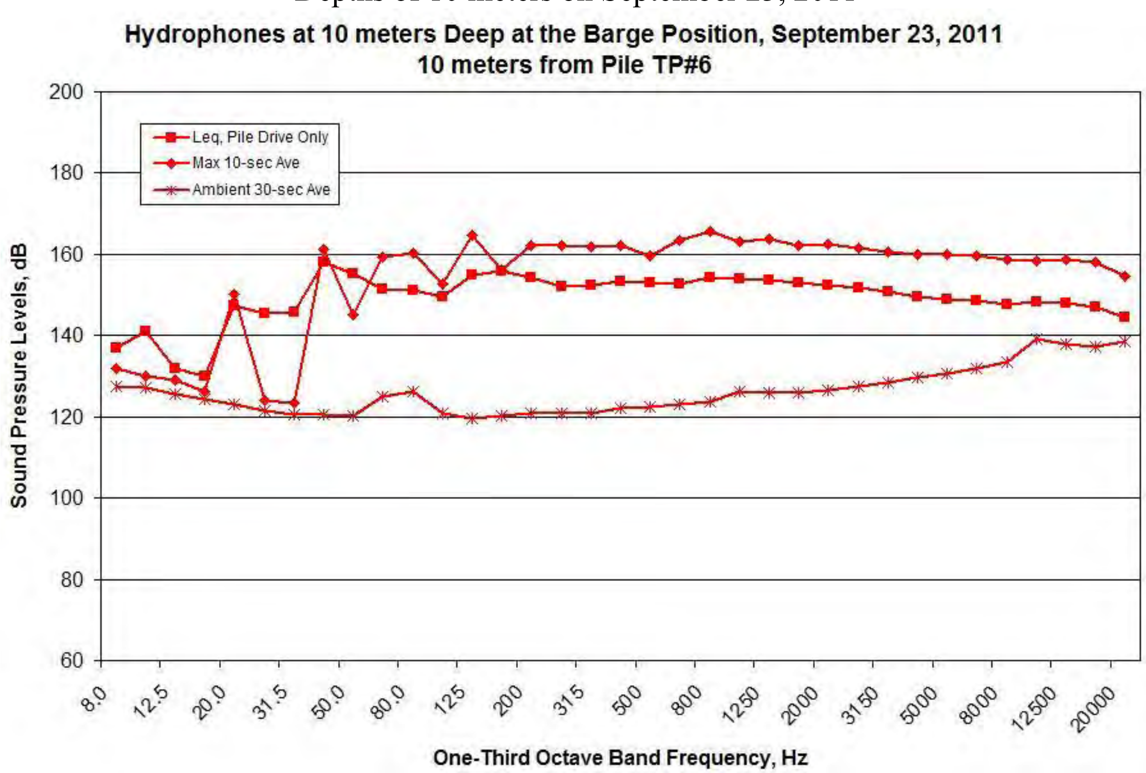

Figure A373. Spectral Data Measured at the BRG Location during TP#6, 8:54-9:04, Measured at Depths of 10 meters on September 23, 2011

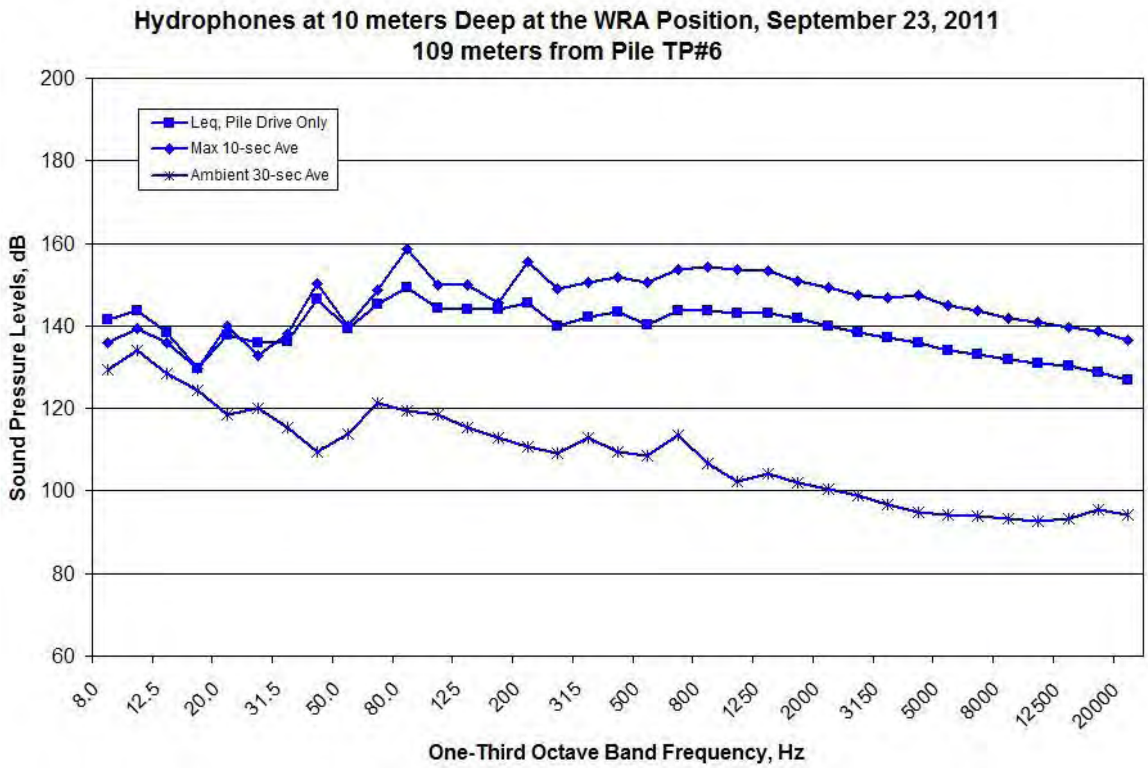

Figure A374. Spectral Data Measured at the WRA Location during TP#6, 8:54-9:04, Measured at Depths of 10 meters on September 23, 2011

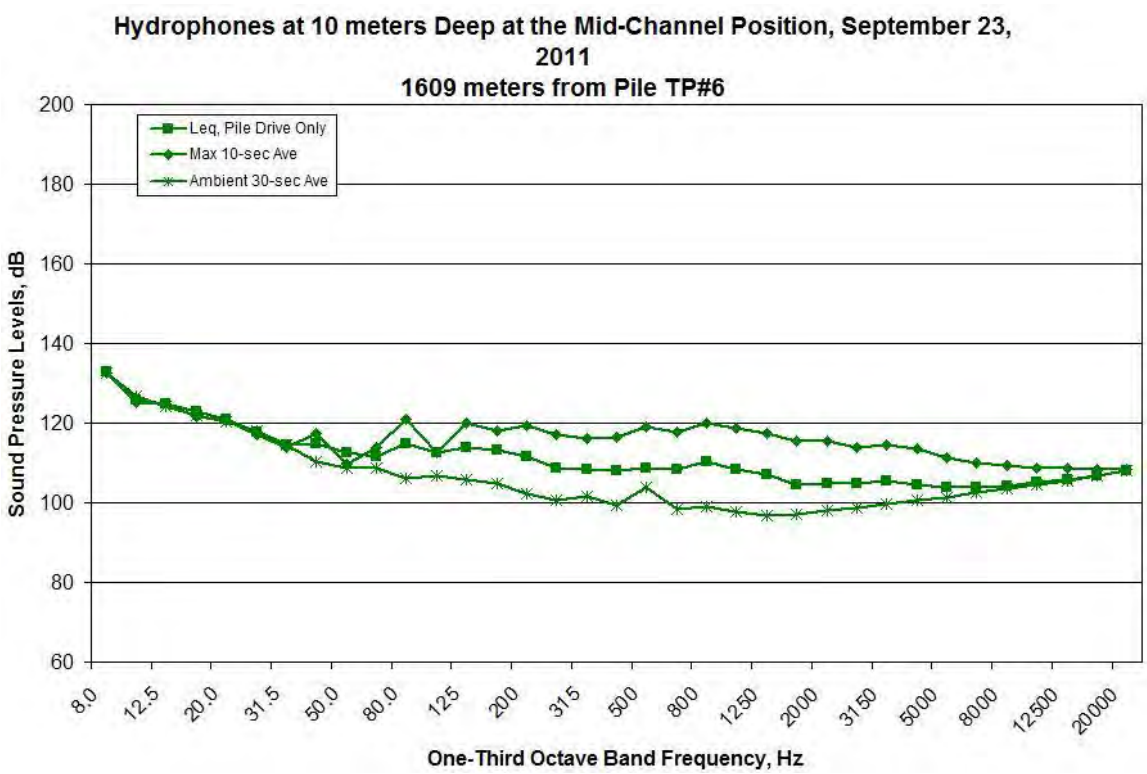

Figure A375. Spectral Data Measured at the MID Location during TP#6, 8:54-9:04, Measured at Depths of 10 meters on September 23, 2011

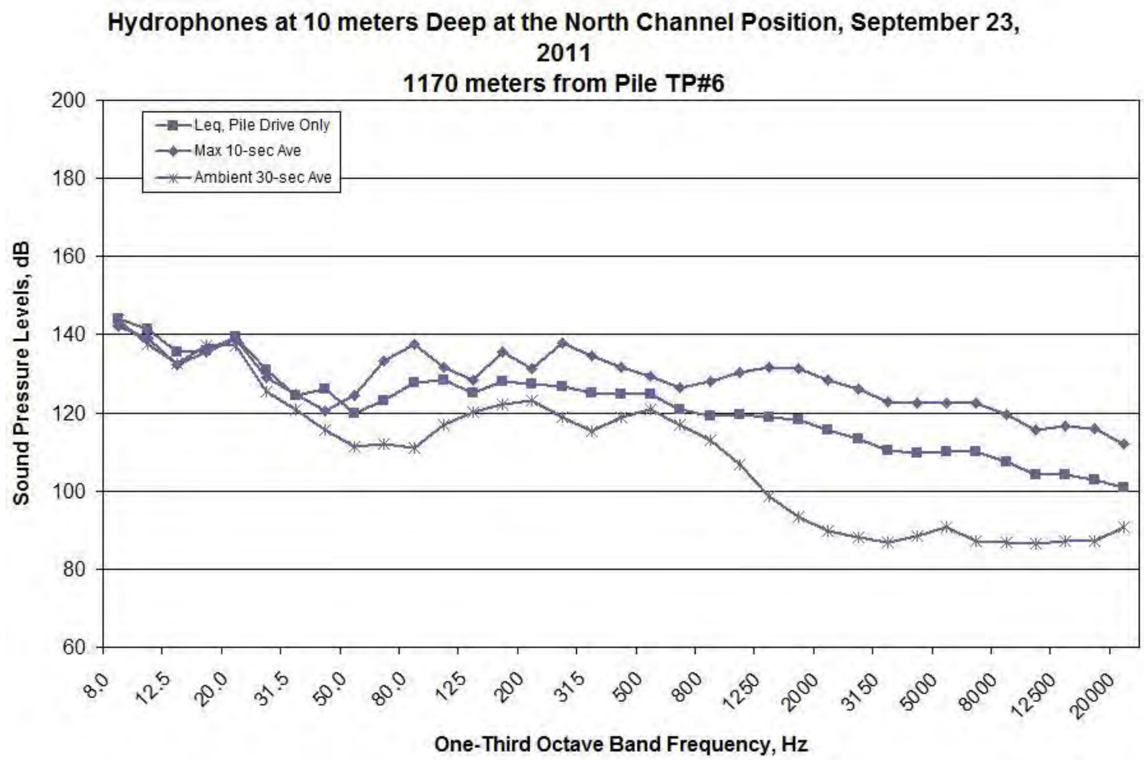

Figure A376. Spectral Data Measured at the NO Location during TP#6, 8:54-9:04, Measured at Depths of 10 meters on September 23, 2011

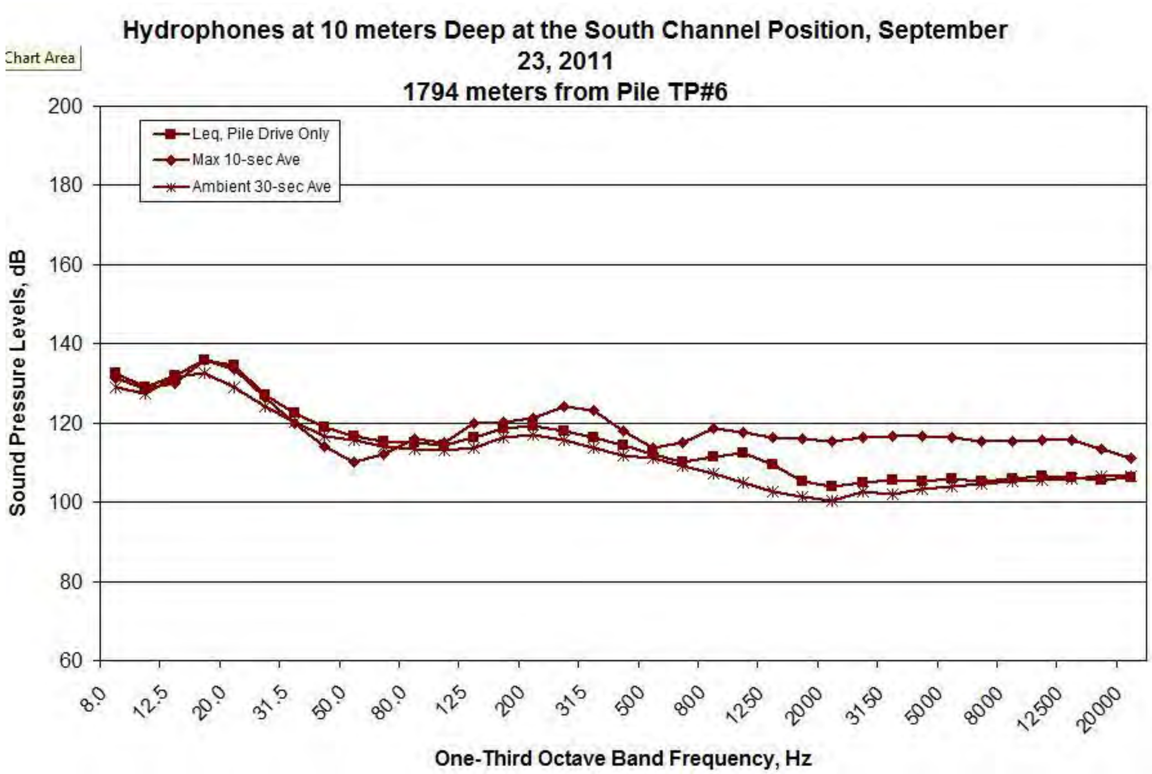

Figure A377. Spectral Data Measured at the SO Location during TP#6, 8:54-9:04, Measured at Depths of 10 meters on September 23, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A378. Spectral Data Measured at the RFT Location during TP#6, 8:54-9:04, Measured at Depths of 10 meters on September 23, 2011

TP#5 (Vibratory Installation)

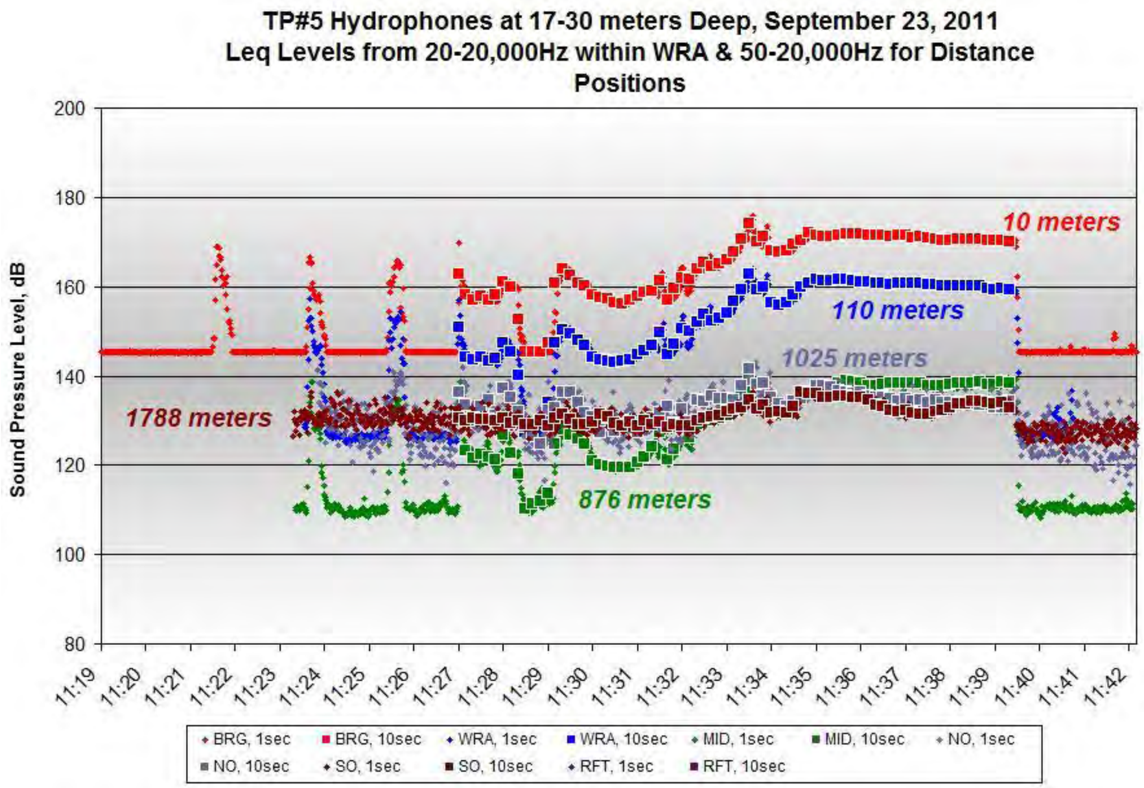

Figure A379. One-second and 10-second Average Data for TP#5, 11:26-11:39, Measured at Depths of 17-30 meters on September 23, 2011

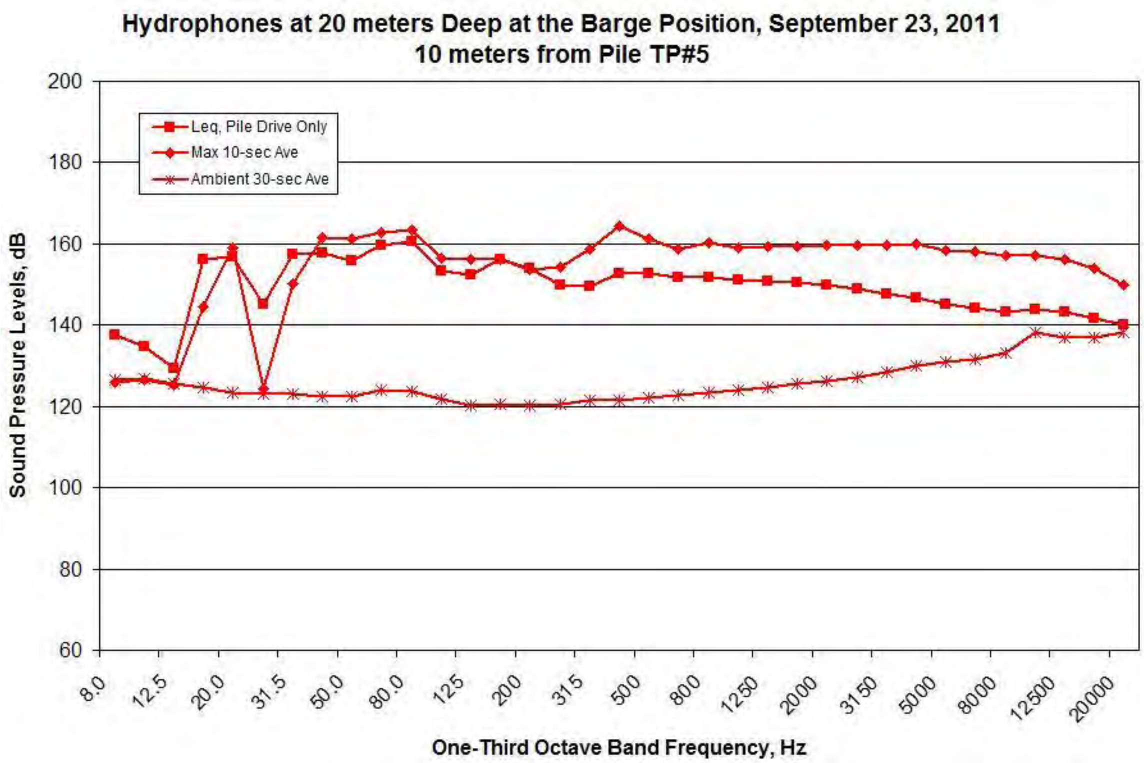

Figure A380. Spectral Data Measured at the BRG Location during TP#5, 11:26-11:39, Measured at Depths of 20 meters on September 23, 2011

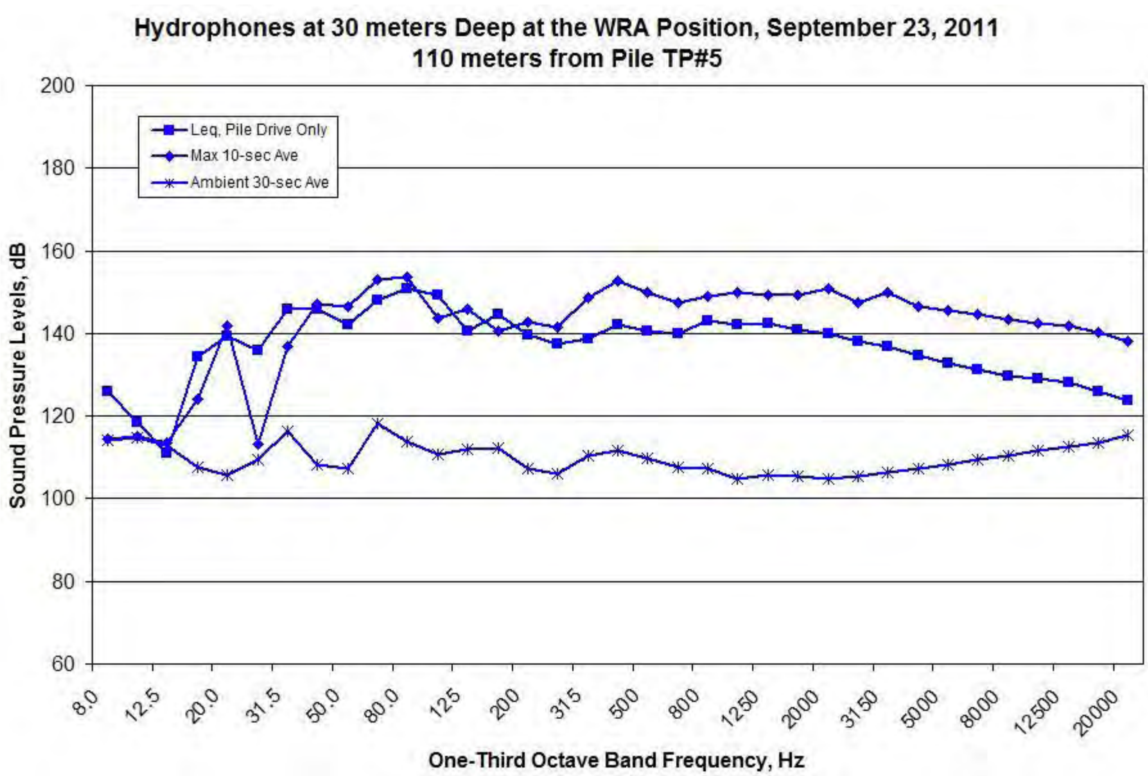

Figure A381. Spectral Data Measured at the WRA Location during TP#5, 11:26-11:39, Measured at Depths of 30 meters on September 23, 2011

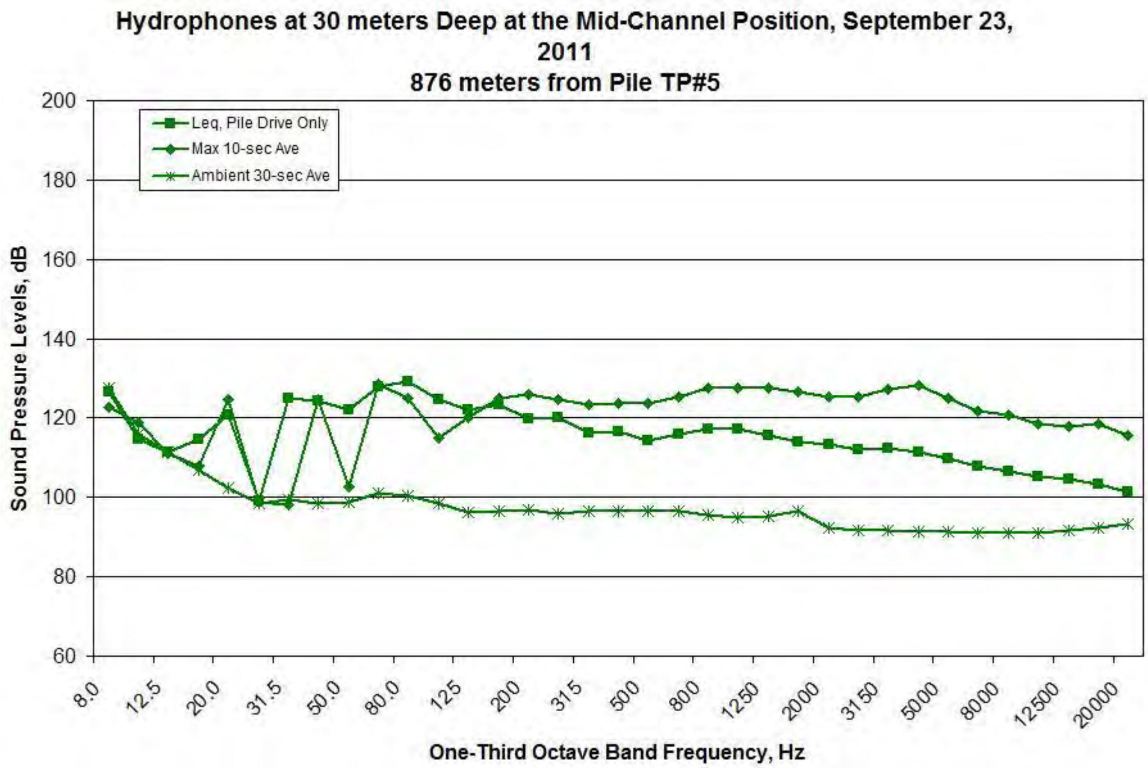

Figure A382. Spectral Data Measured at the MID Location during TP#5, 11:26-11:39, Measured at Depths of 30 meters on September 23, 2011

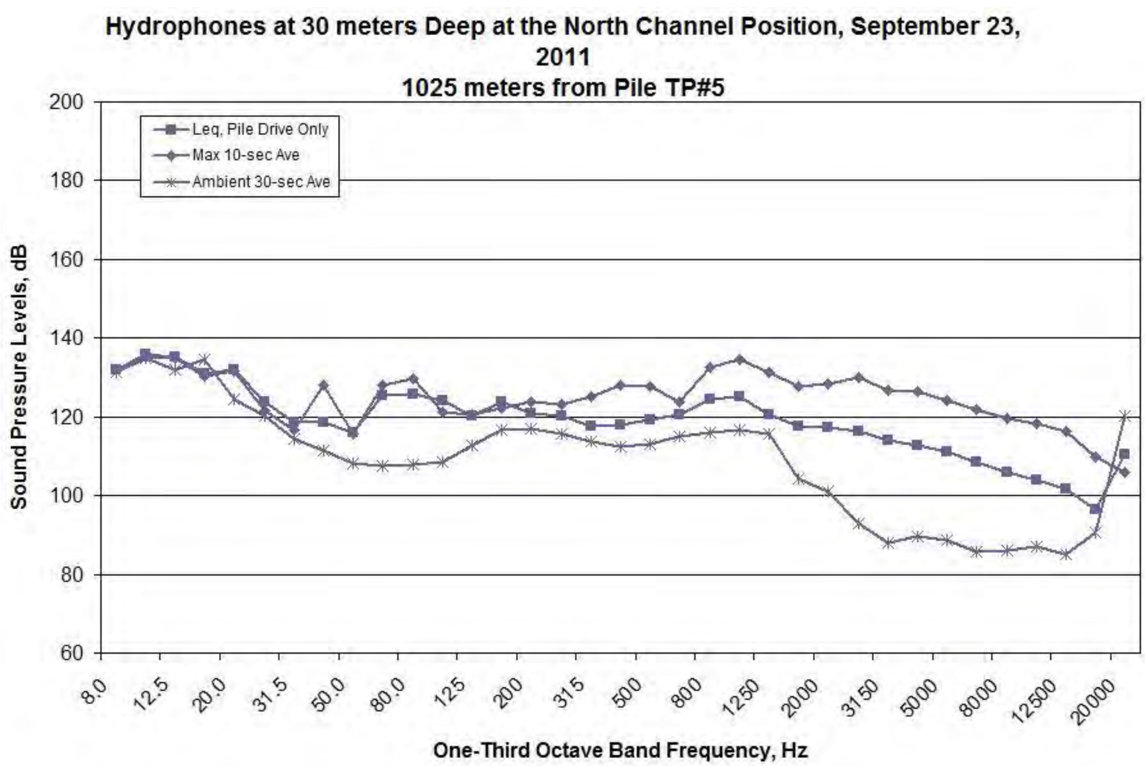

Figure A383. Spectral Data Measured at the NO Location during TP#5, 11:26-11:39, Measured at Depths of 30 meters on September 23, 2011

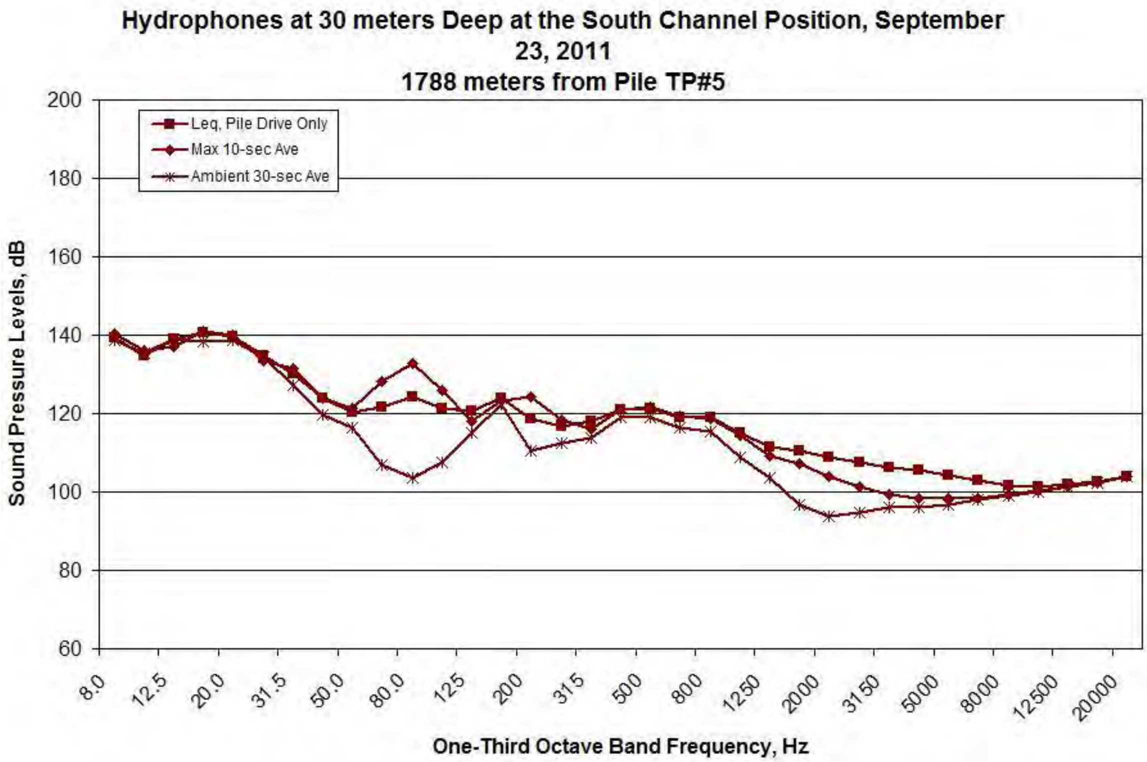

Figure A384. Spectral Data Measured at the SO Location during TP#5, 11:26-11:39, Measured at Depths of 30 meters on September 23, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A385. Spectral Data Measured at the RFT Location during TP#5, 11:26-11:39, Measured at Depths of 17 meters on September 23, 2011

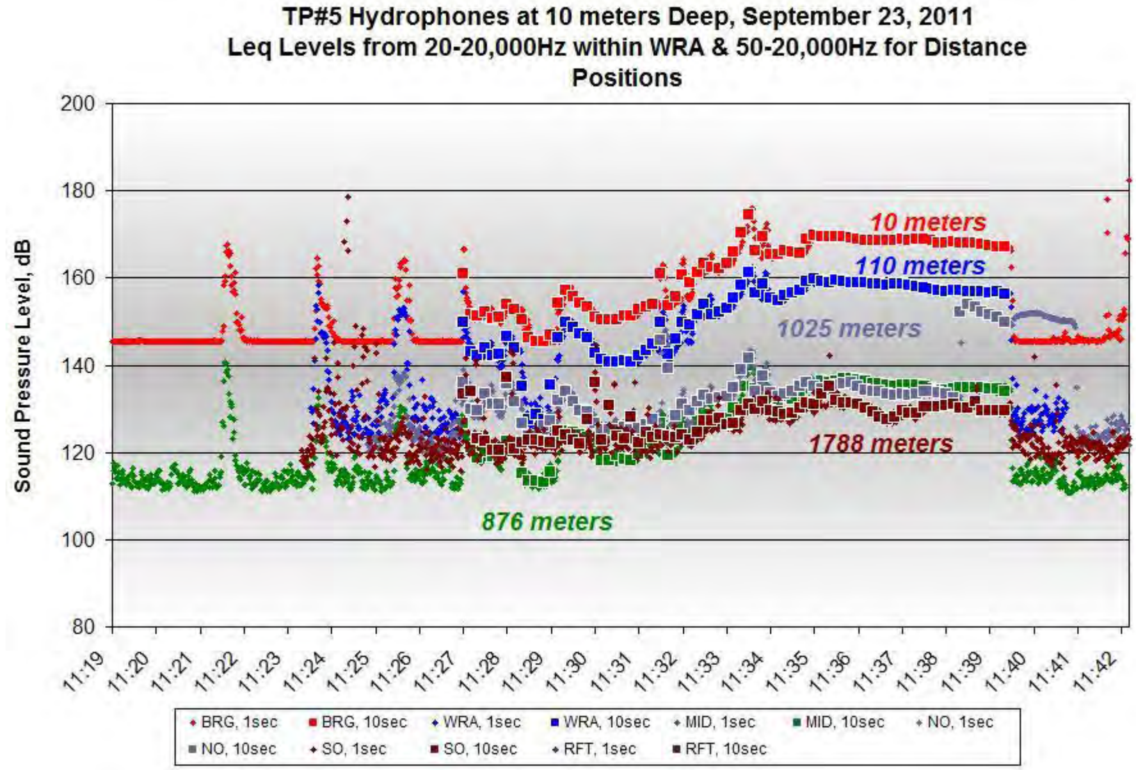

Figure A386. One-second and 10-second Average Data for TP#5, 11:26-11:39, Measured at Depths of 10 meters on September 23, 2011

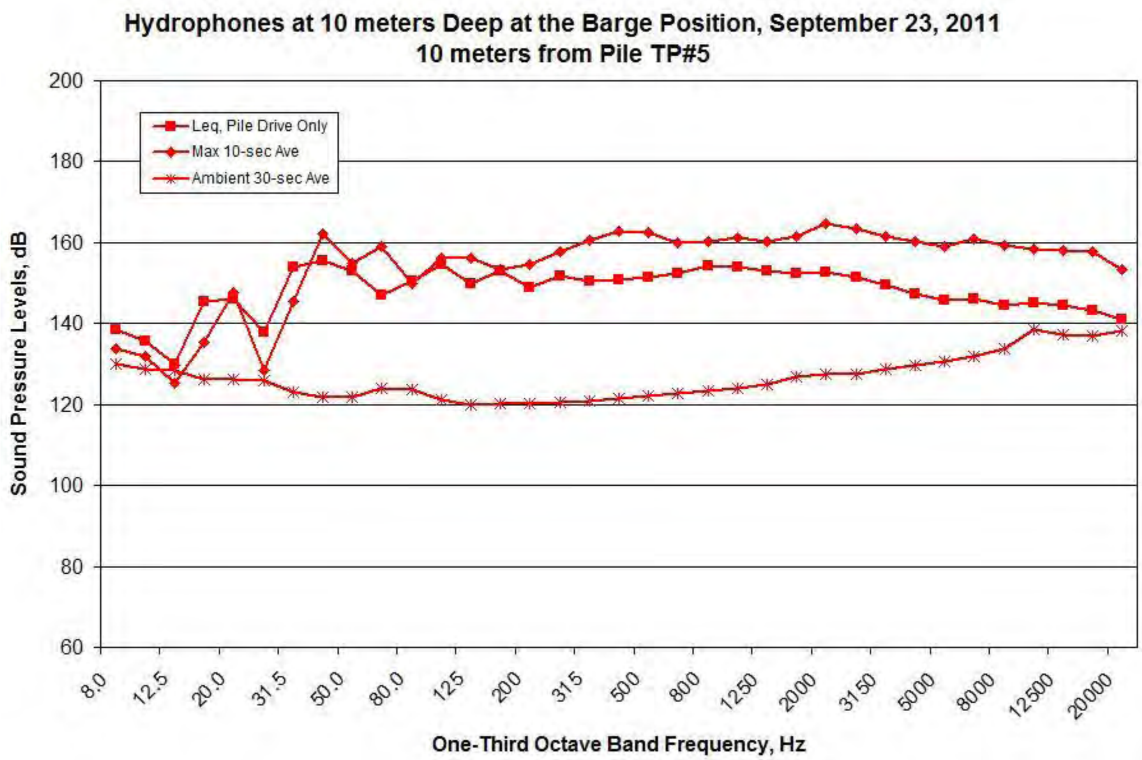

Figure A387. Spectral Data Measured at the BRG Location during TP#5, 11:26-11:39, Measured at Depths of 10 meters on September 23, 2011

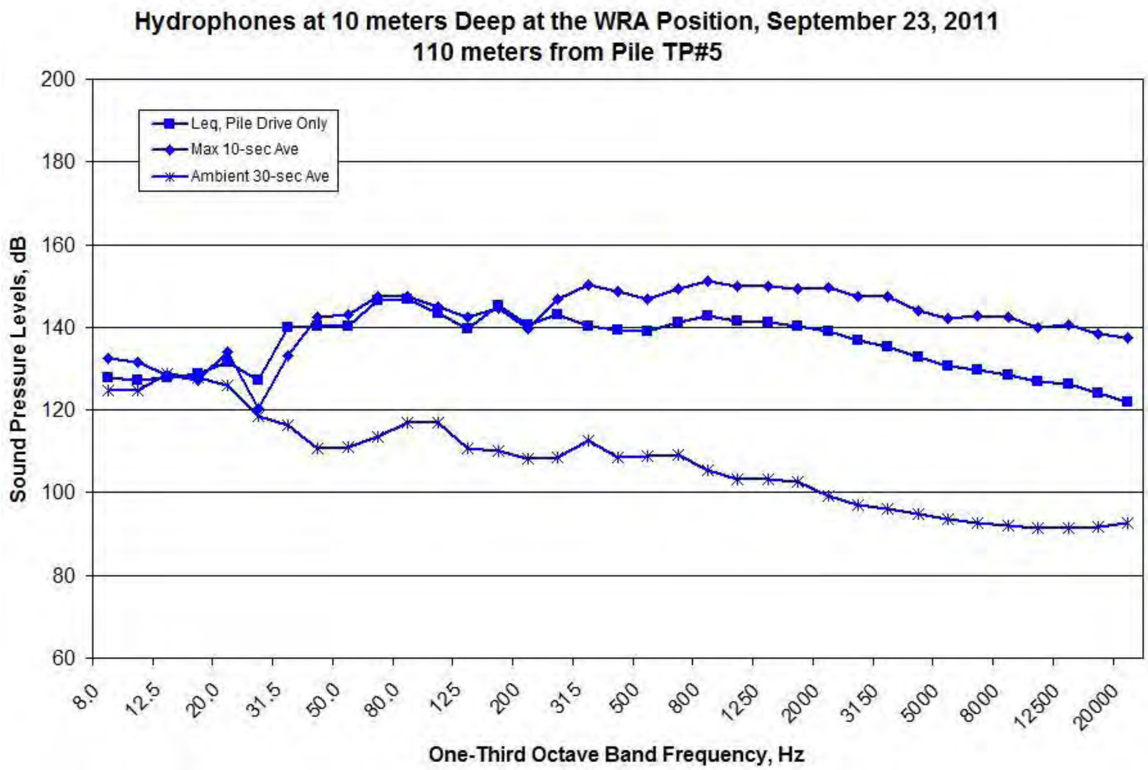

Figure A388. Spectral Data Measured at the WRA Location during TP#5, 11:26-11:39, Measured at Depths of 10 meters on September 23, 2011

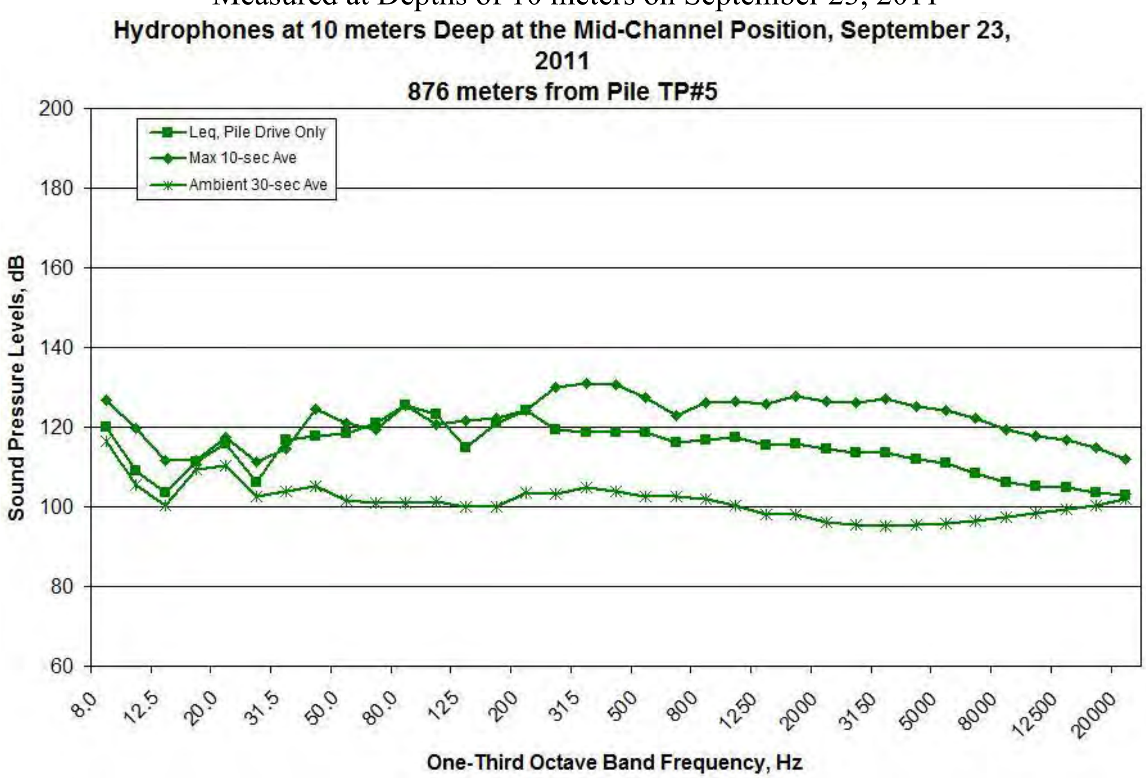

Figure A389. Spectral Data Measured at the MID Location during TP#5, 11:26-11:39, Measured at Depths of 10 meters on September 23, 2011

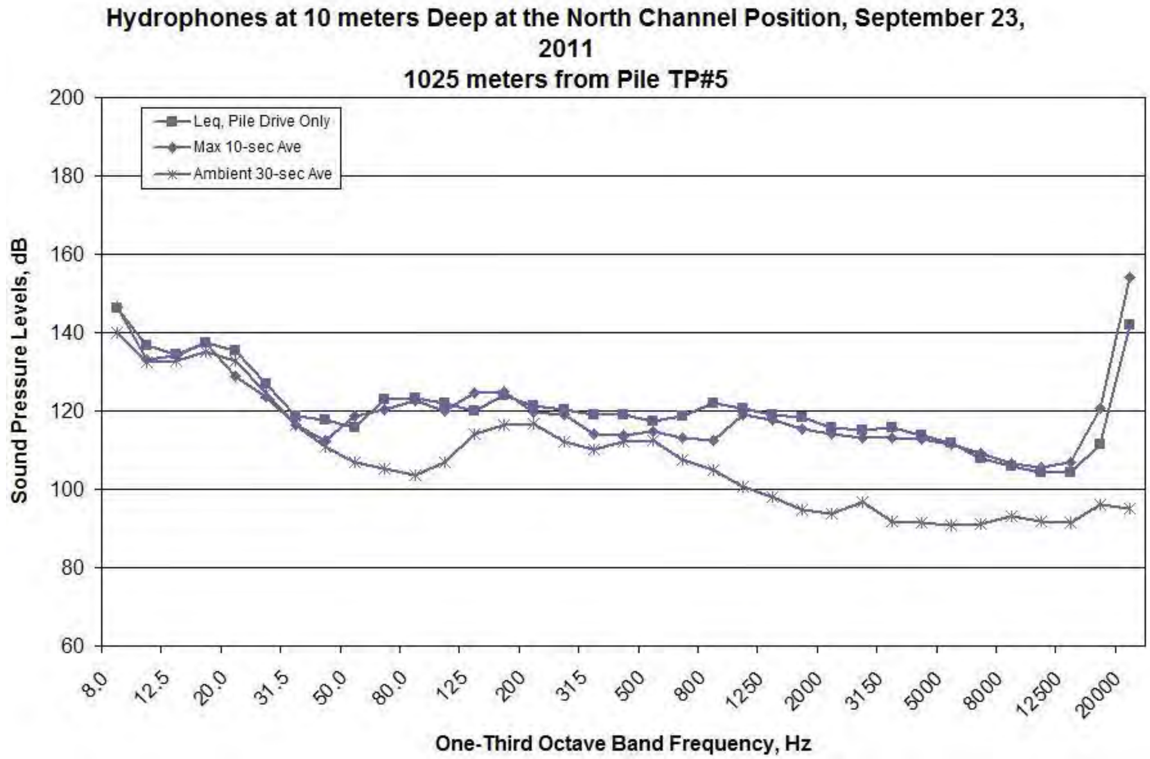

Figure A390. Spectral Data Measured at the NO Location during TP#5, 11:26-11:39, Measured at Depths of 10 meters on September 23, 2011

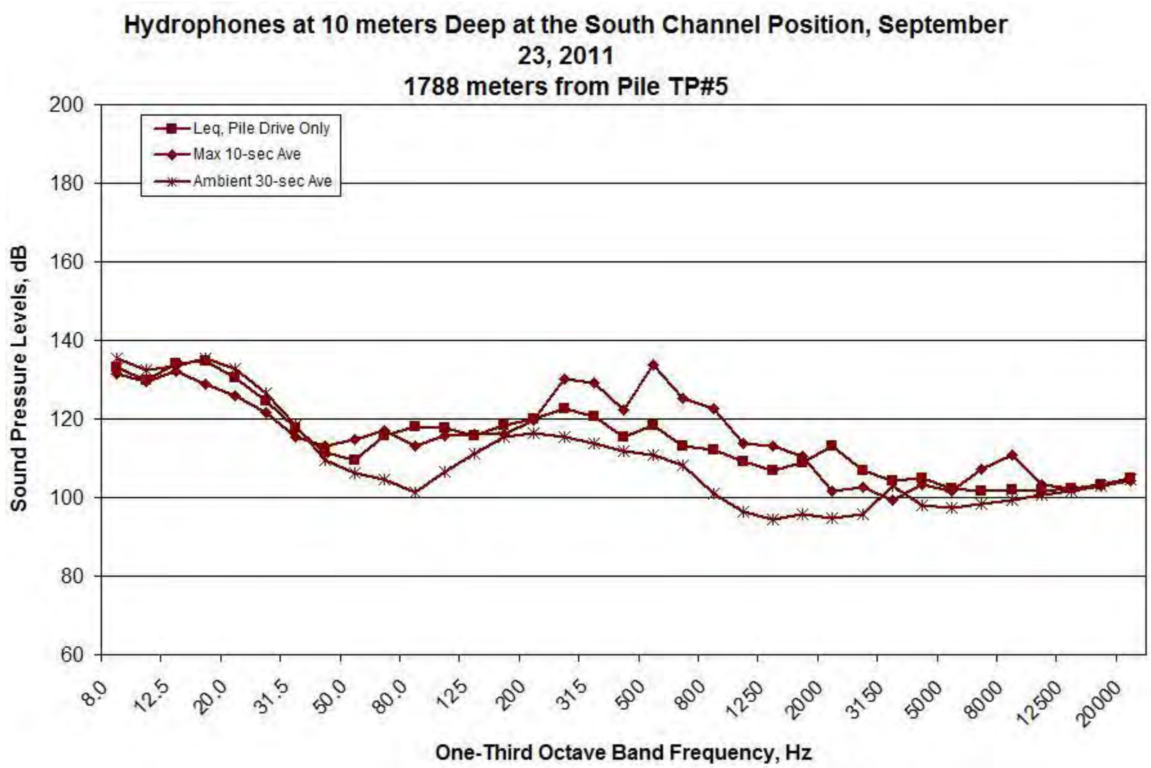

Figure A391. Spectral Data Measured at the SO Location during TP#5, 11:26-11:39, Measured at Depths of 10 meters on September 23, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A392. Spectral Data Measured at the RFT Location during TP#5, 11:26-11:39, Measured at Depths of 10 meters on September 23, 2011

TP#4 Batter Pile (Vibratory Installation)

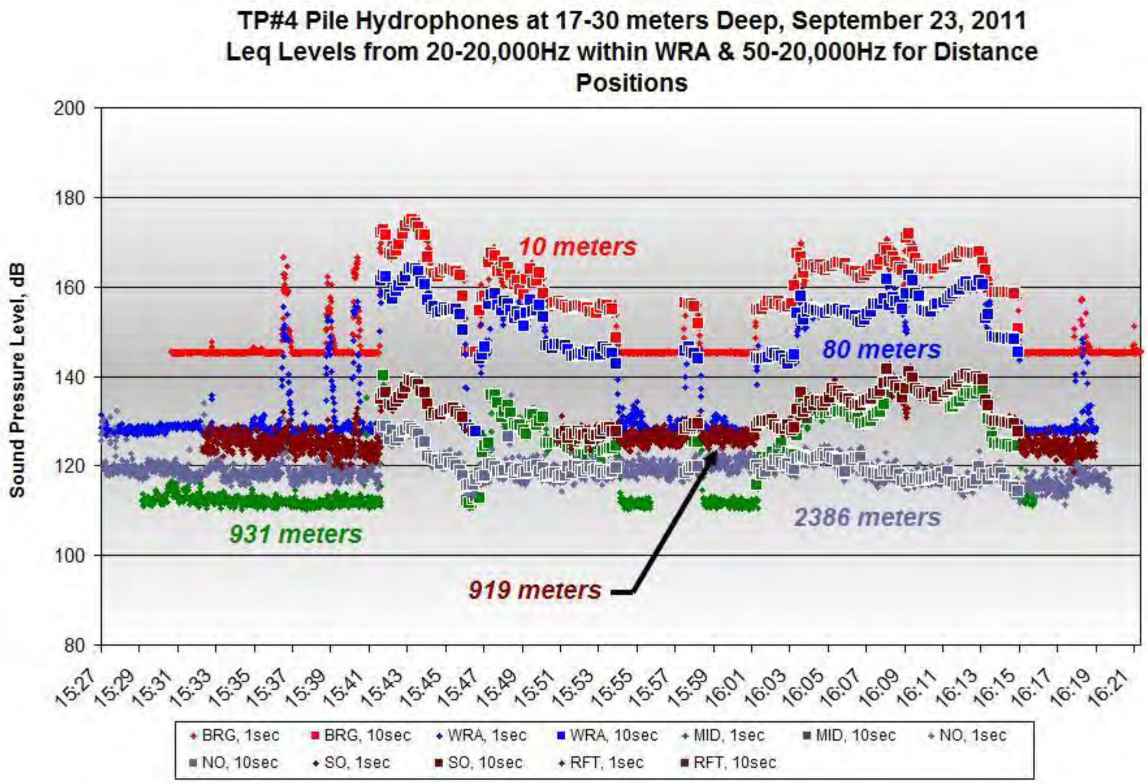

Figure A393. One-second and 10-second Average Data for TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 17-30 meters on September 23, 2011

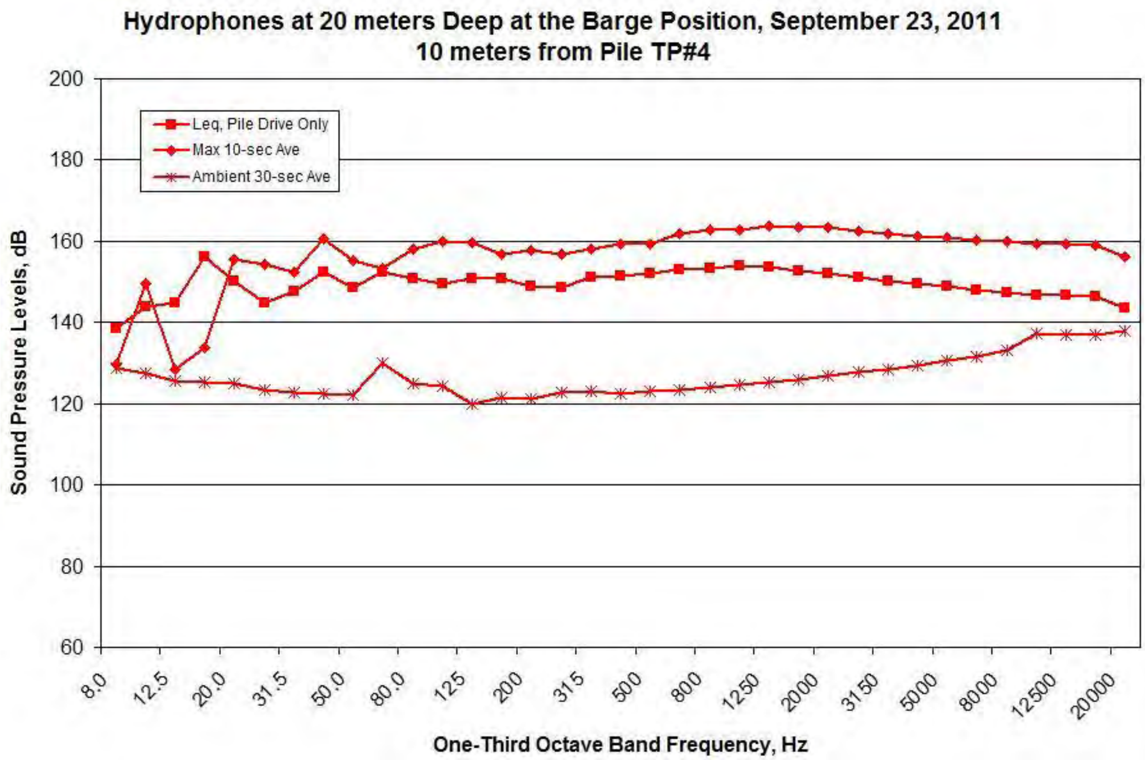

Figure A394. Spectral Data Measured at the BRG Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 20 meters on September 23, 2011

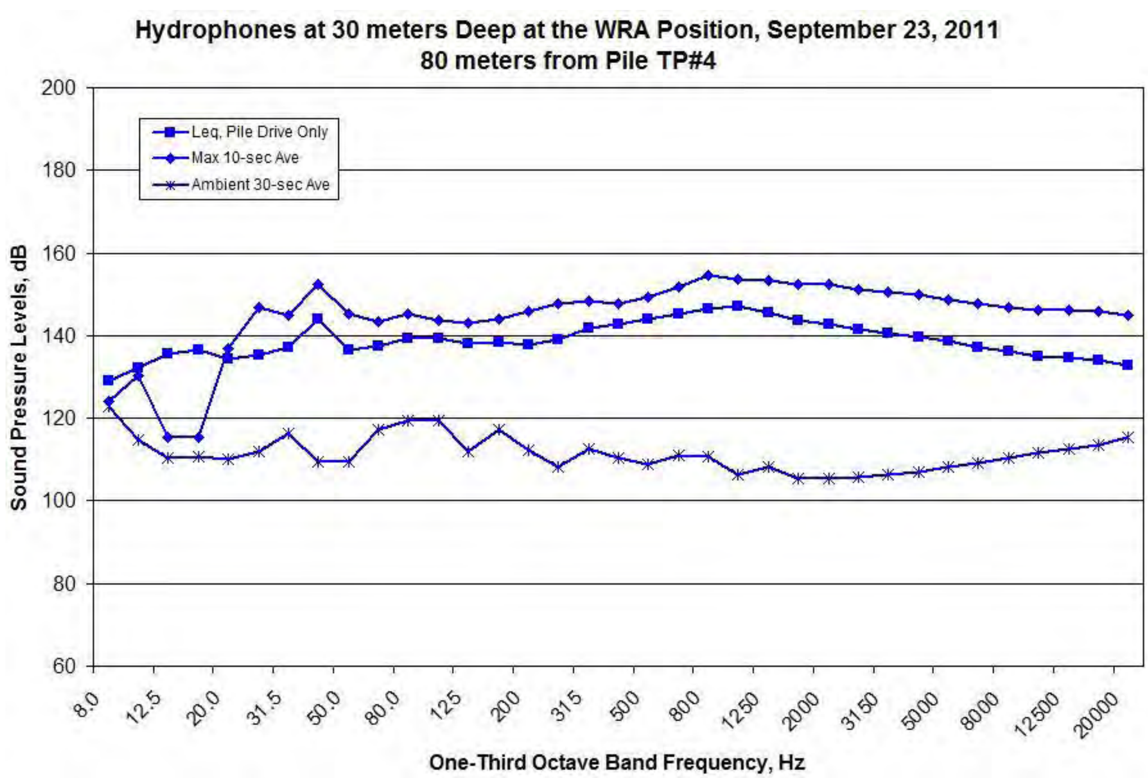

Figure A395. Spectral Data Measured at the WRA Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 30 meters on September 23, 2011

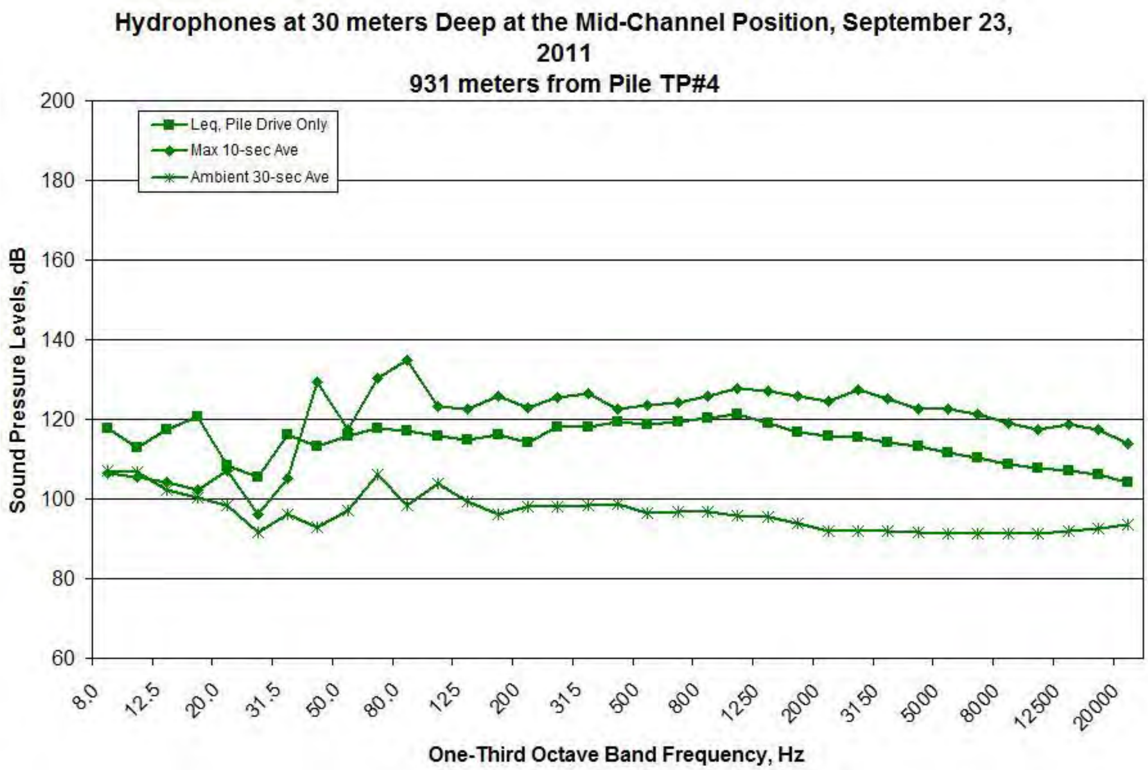

Figure A396. Spectral Data Measured at the MID Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 30 meters on September 23, 2011

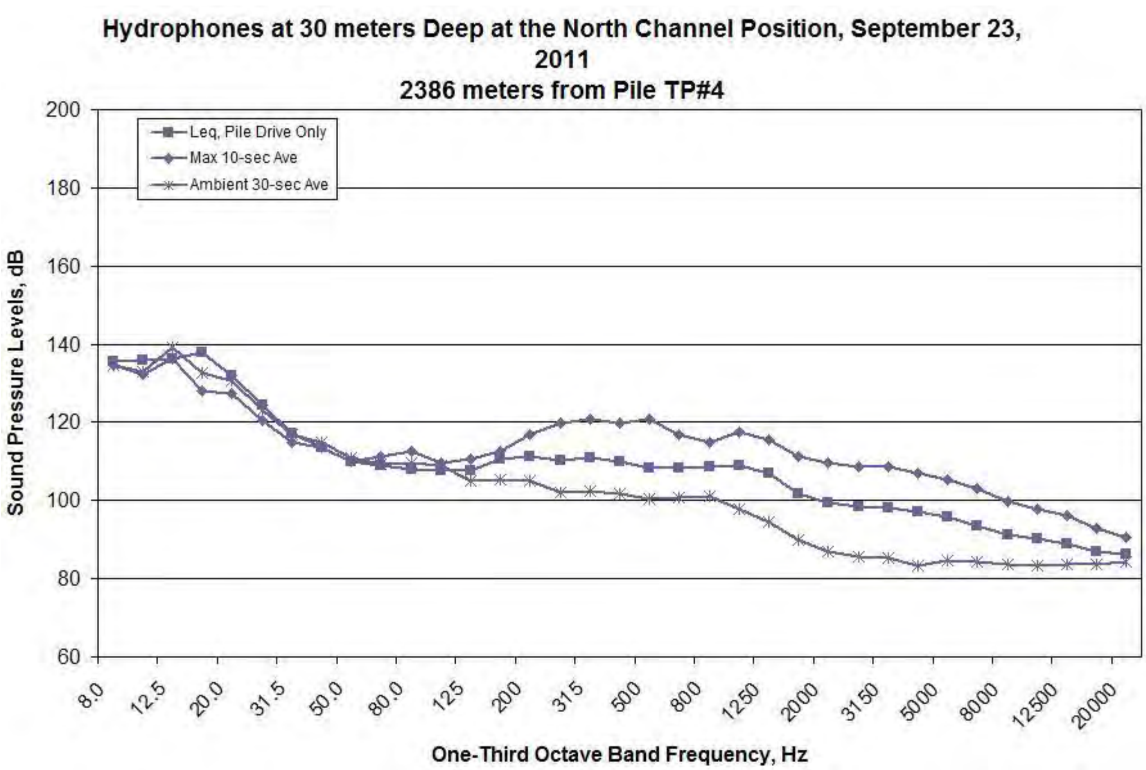

Figure A397. Spectral Data Measured at the NO Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 30 meters on September 23, 2011

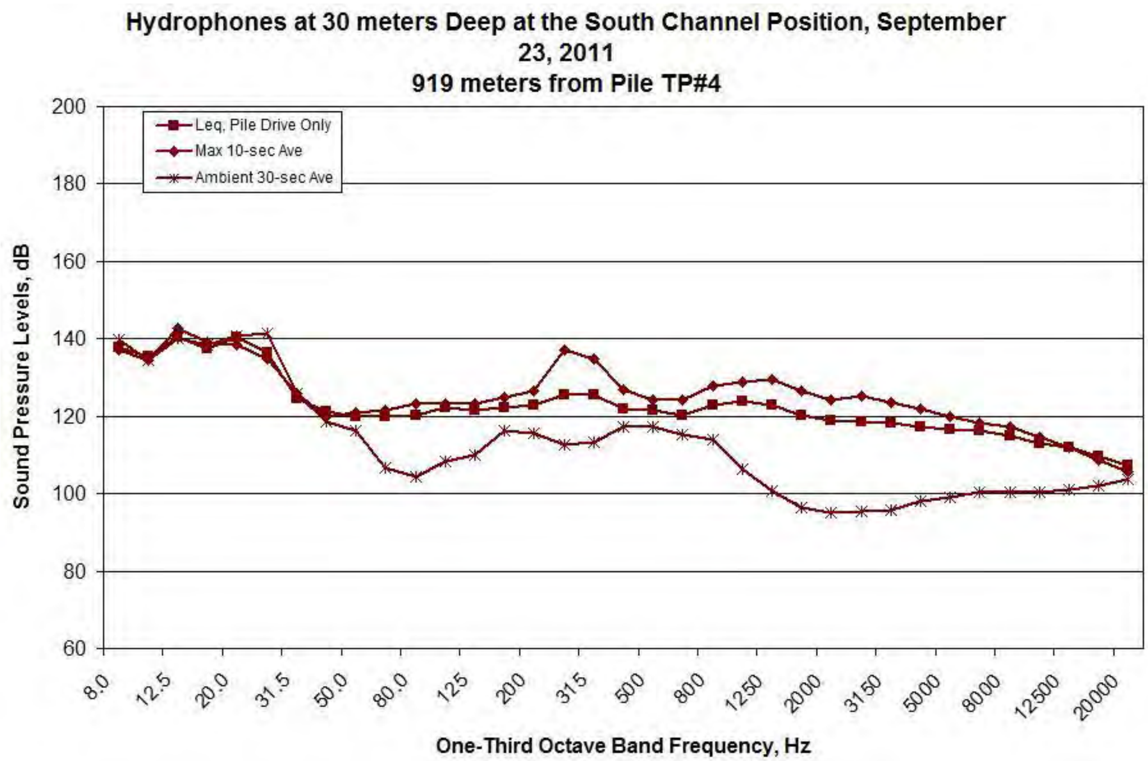

Figure A398. Spectral Data Measured at the SO Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 30 meters on September 23, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A399. Spectral Data Measured at the RFT Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 17 meters on September 23, 2011

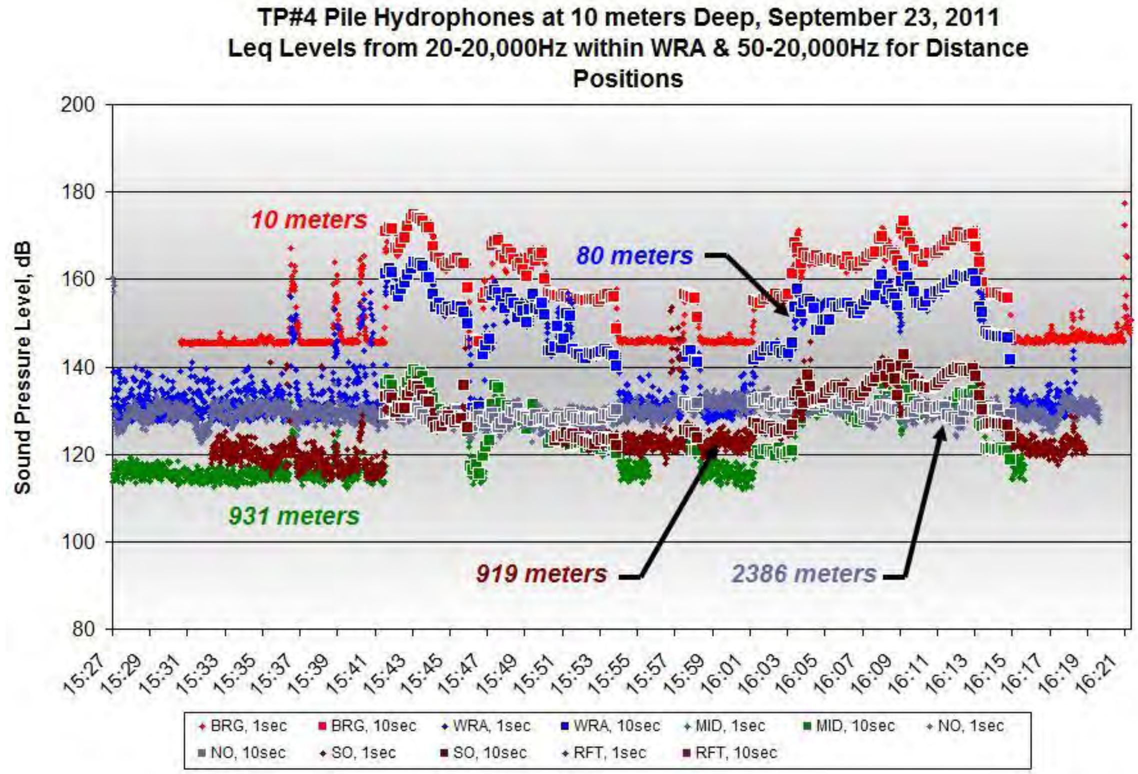

Figure A400. One-second and 10-second Average Data for TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 10 meters on September 23, 2011

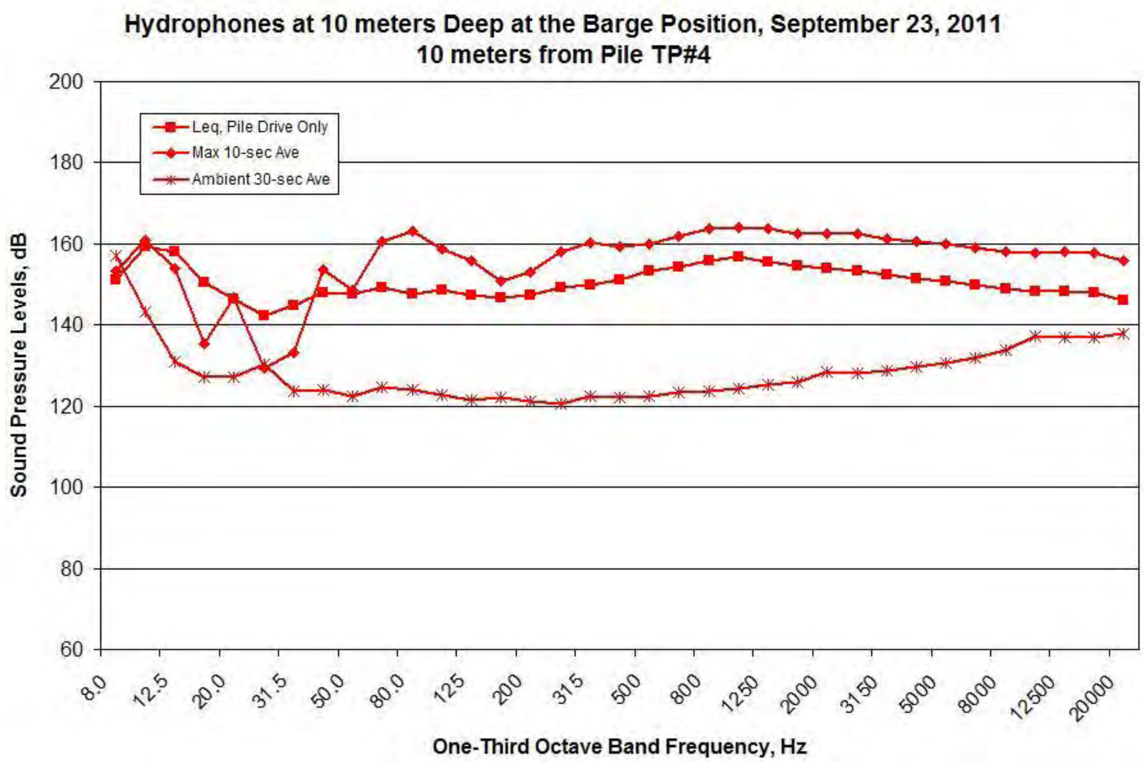

Figure A401. Spectral Data Measured at the BRG Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 10 meters on September 23, 2011

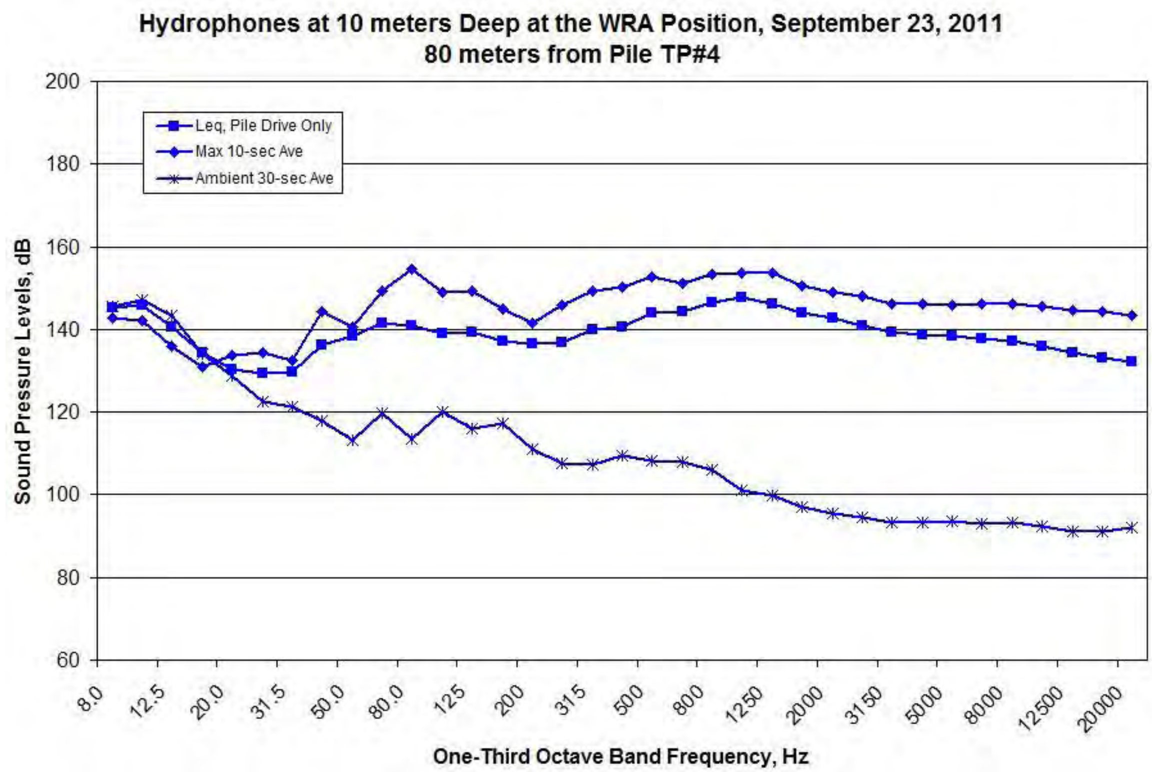

Figure A402. Spectral Data Measured at the WRA Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 10 meters on September 23, 2011

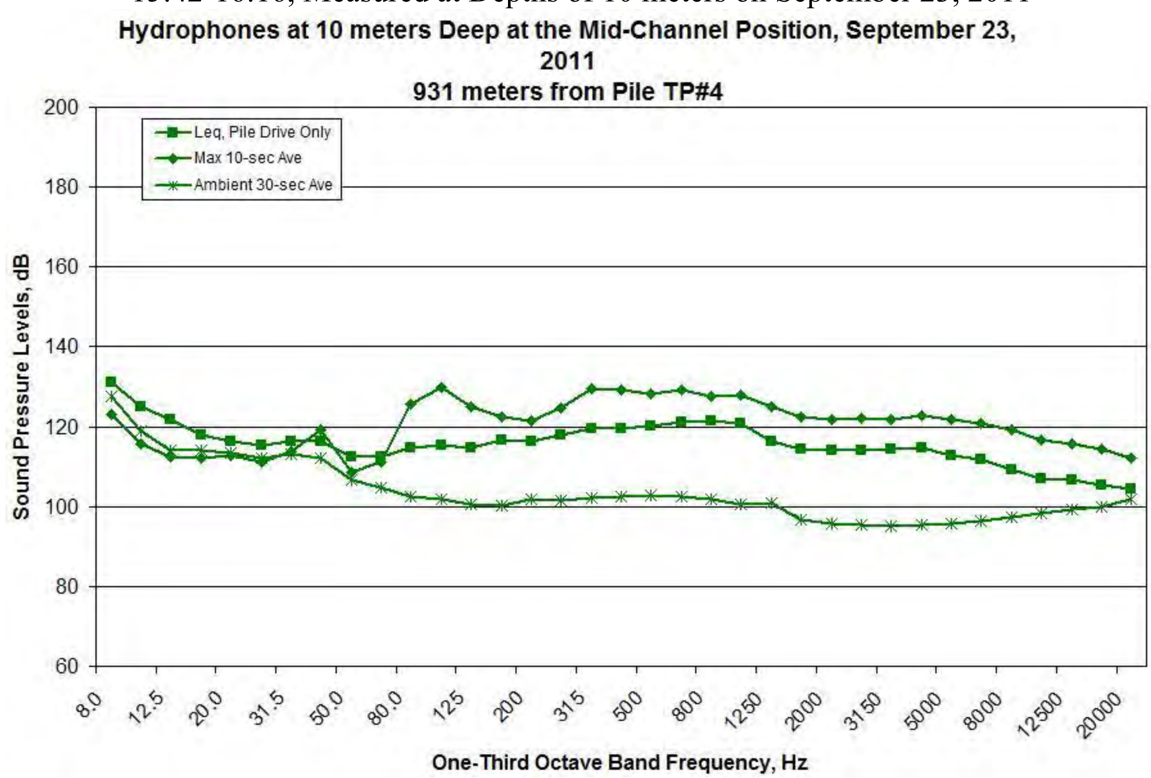

Figure A403. Spectral Data Measured at the MID Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 10 meters on September 23, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A404. Spectral Data Measured at the NO Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 10 meters on September 23, 2011

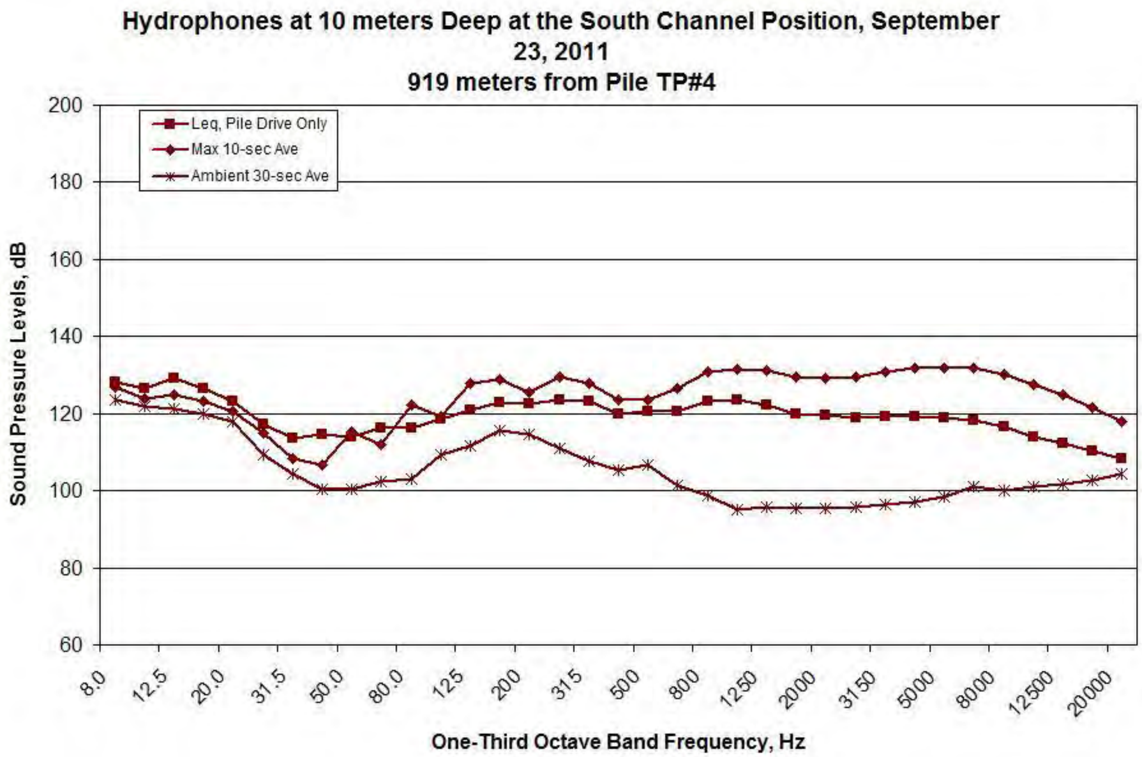

Figure A405. Spectral Data Measured at the SO Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 10 meters on September 23, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A406. Spectral Data Measured at the RFT Location during TP#4 Batter Pile, 15:42-16:16, Measured at Depths of 10 meters on September 23, 2011

9/24/2011 – TP#10 (Vibratory Removal)

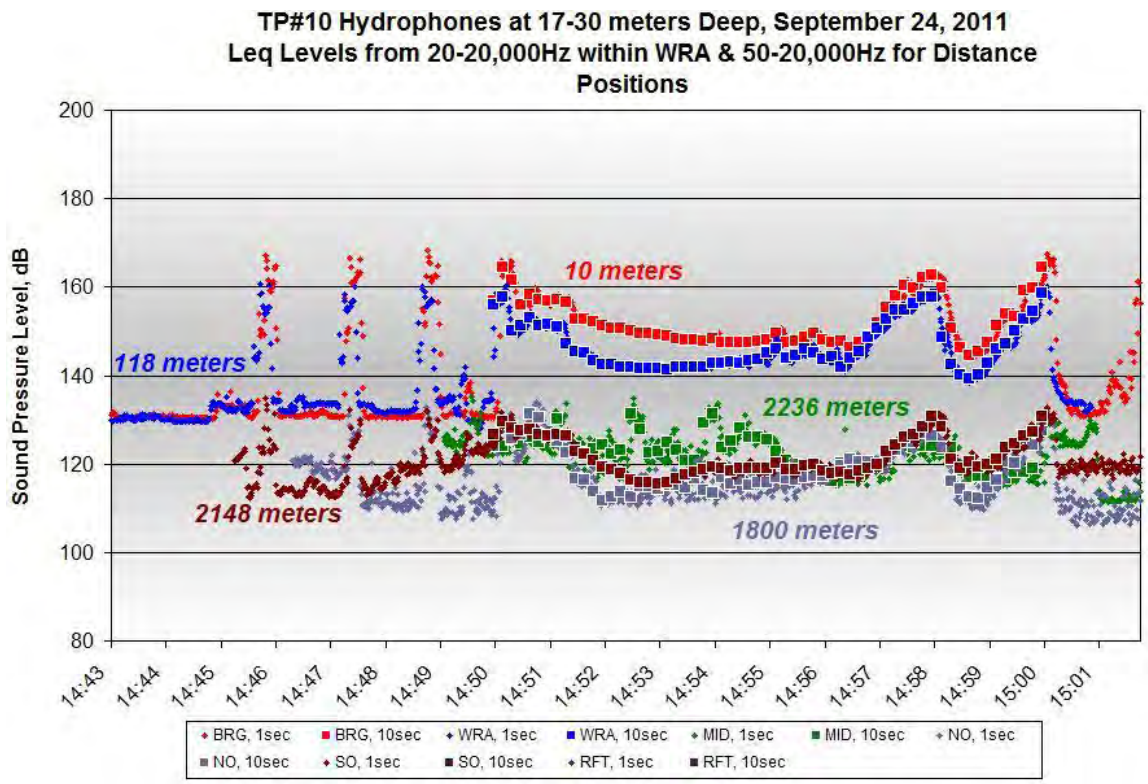

Figure A407. One-second and 10-second Average Data for TP#10, 14:50-15:00, Measured at Depths of 17-30 meters on September 24, 2011

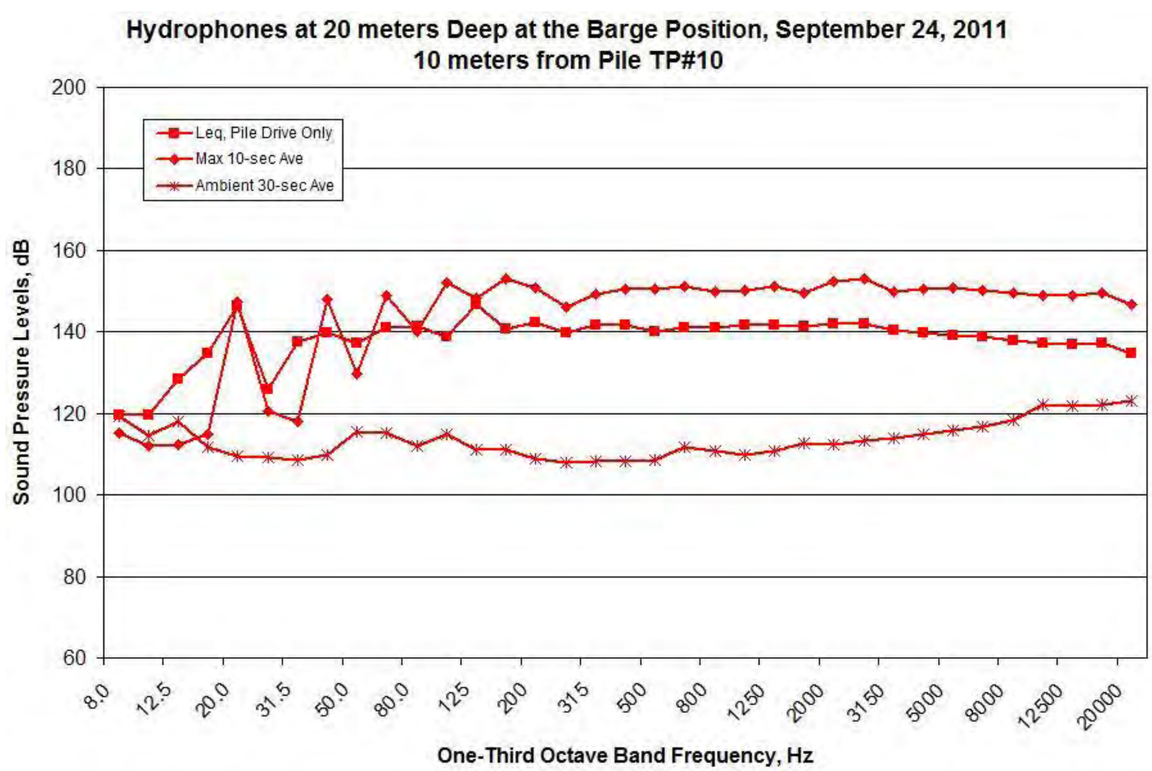

Figure A408. Spectral Data Measured at the BRG Location during TP#10, 14:50-15:00, Measured at Depths of 20 meters on September 24, 2011

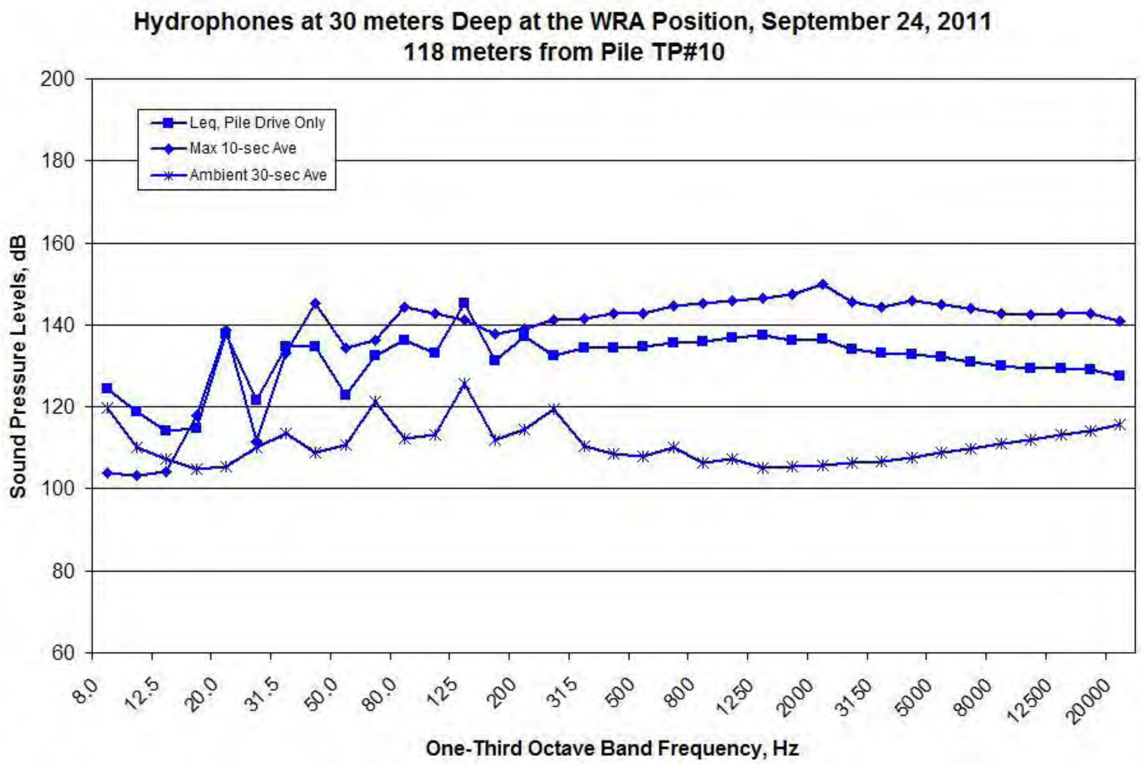

Figure A409. Spectral Data Measured at the WRA Location during TP#10, 14:50-15:00, Measured at Depths of 30 meters on September 24, 2011

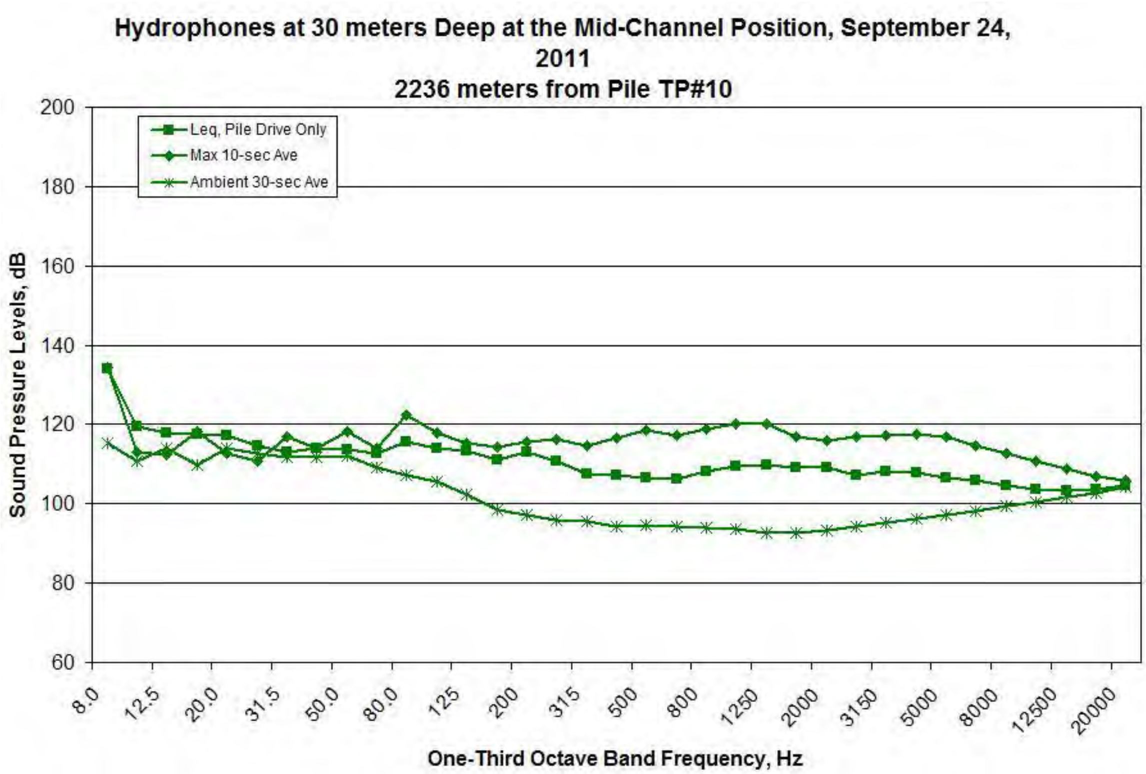

Figure A410. Spectral Data Measured at the MID Location during TP#10, 14:50-15:00, Measured at Depths of 30 meters on September 24, 2011

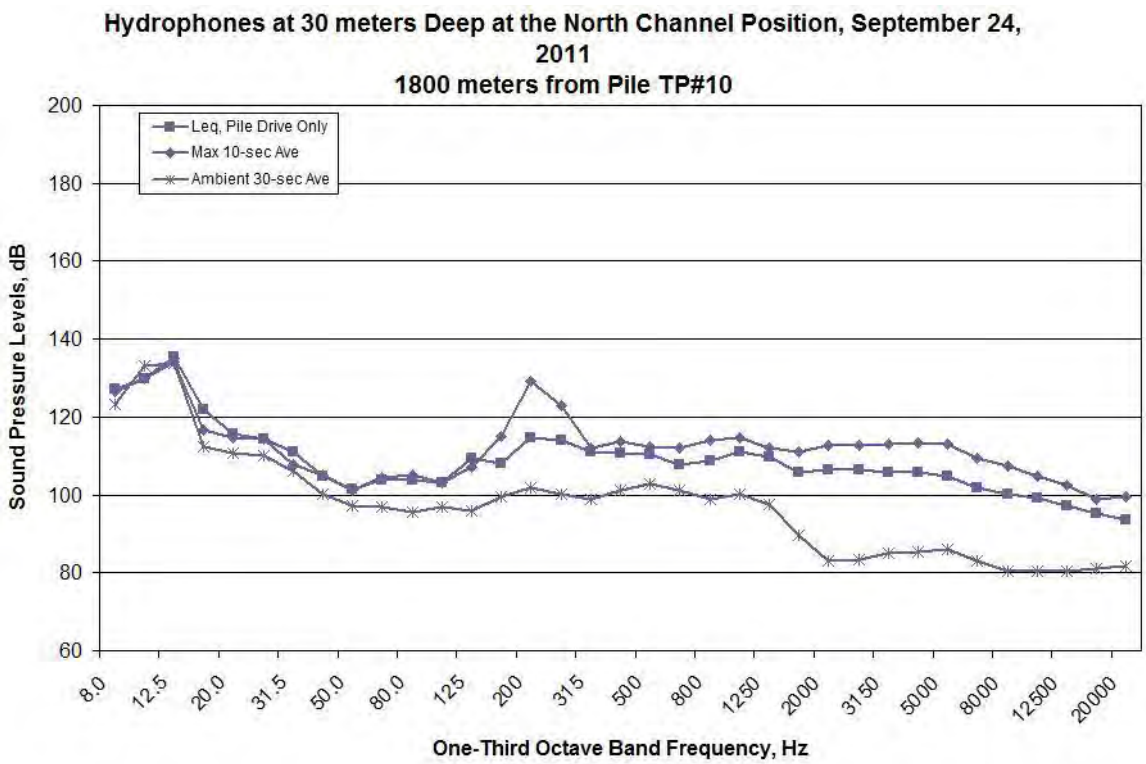

Figure A411. Spectral Data Measured at the NO Location during TP#10, 14:50-15:00, Measured at Depths of 30 meters on September 24, 2011

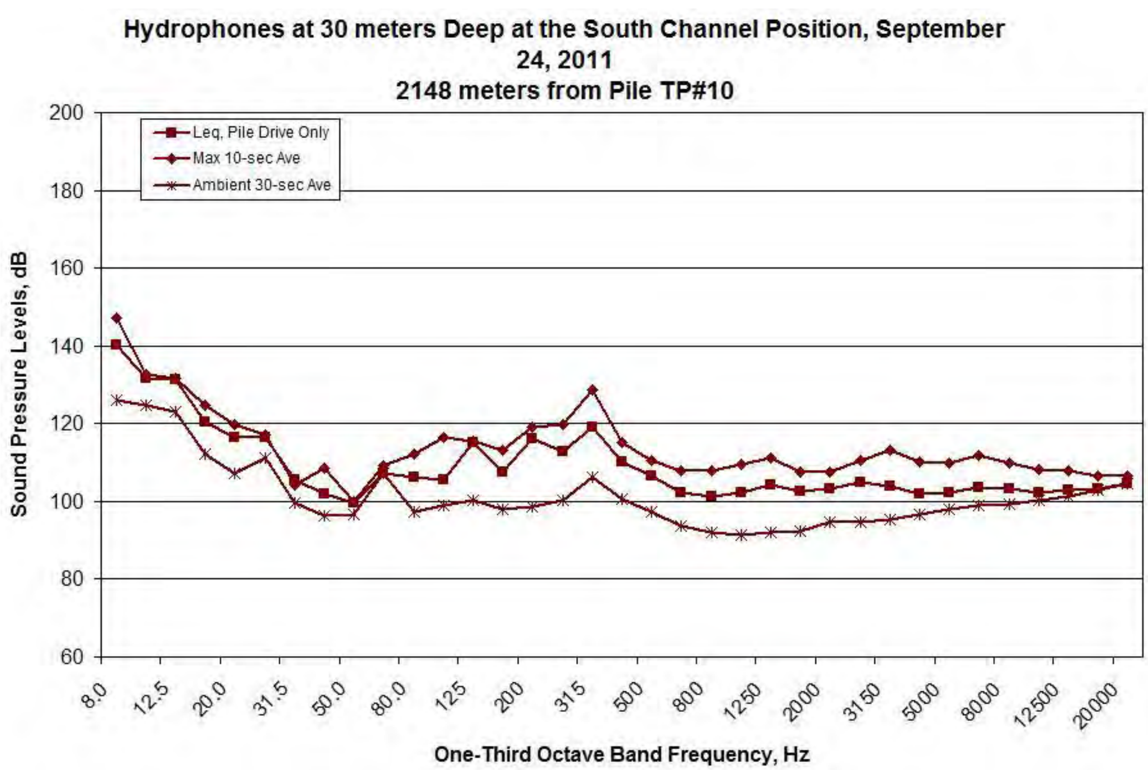

Figure A412. Spectral Data Measured at the SO Location during TP#10, 14:50-15:00, Measured at Depths of 30 meters on September 24, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A413. Spectral Data Measured at the RFT Location during TP#10, 14:50-15:00, Measured at Depths of 17 meters on September 24, 2011

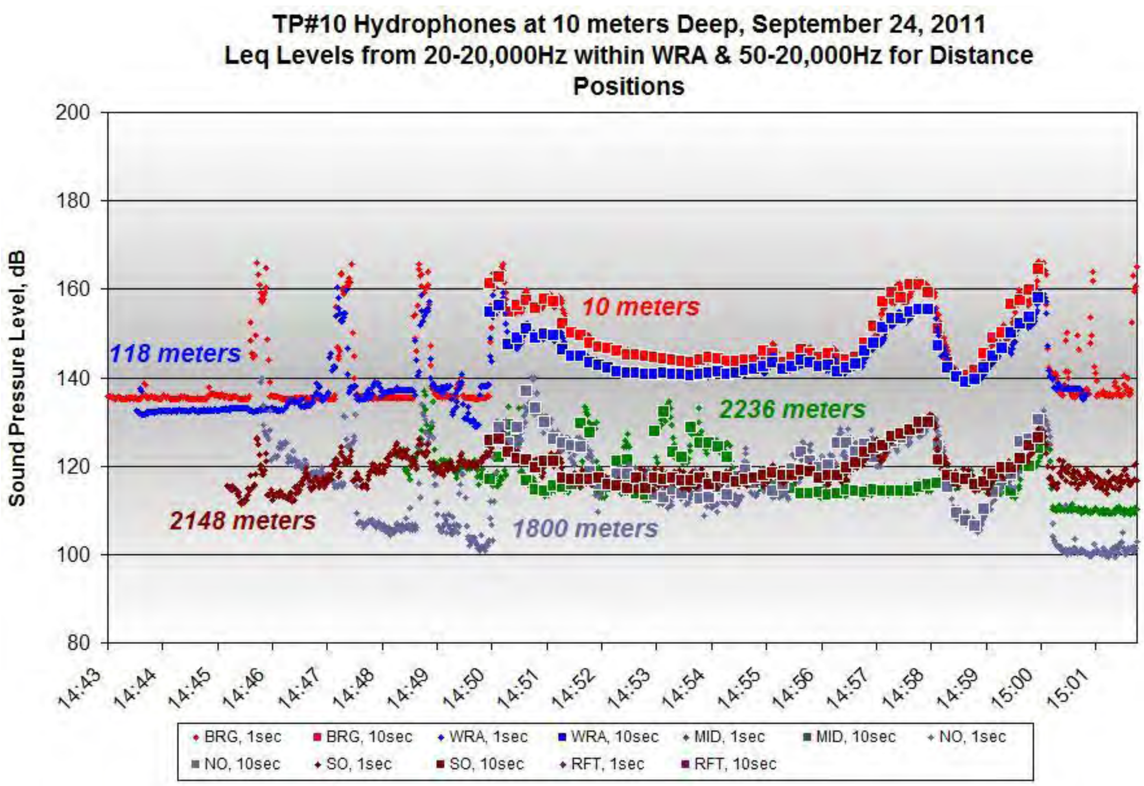

Figure A414. One-second and 10-second Average Data for TP#10, 14:50-15:00, Measured at Depths of 10 meters on September 24, 2011

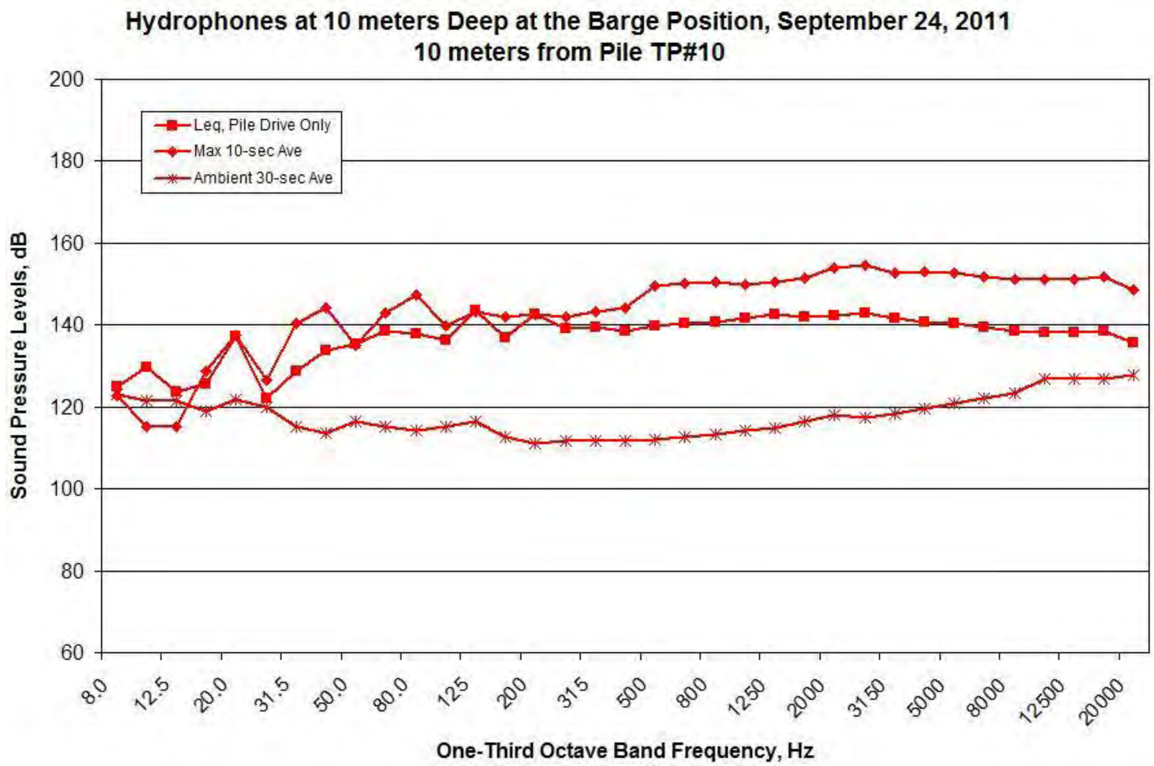

Figure A415. Spectral Data Measured at the BRG Location during TP#10, 14:50-15:00, Measured at Depths of 10 meters on September 24, 2011

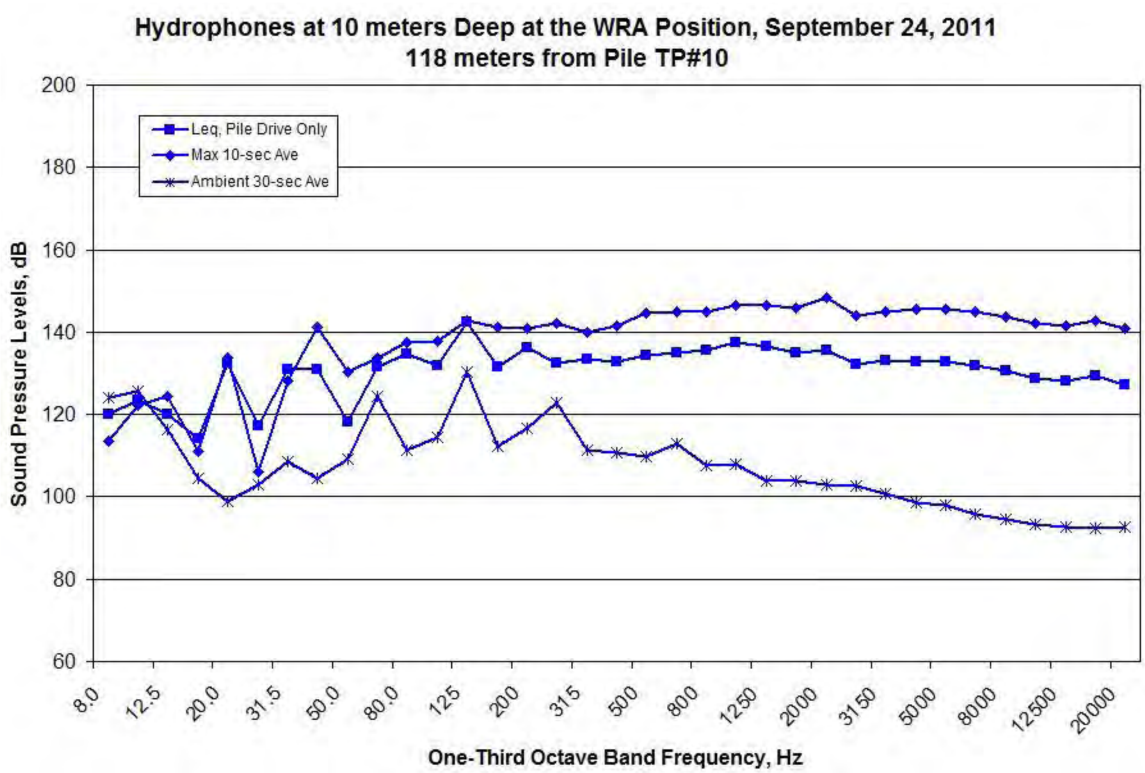

Figure A416. Spectral Data Measured at the WRA Location during TP#10, 14:50-15:00, Measured at Depths of 10 meters on September 24, 2011

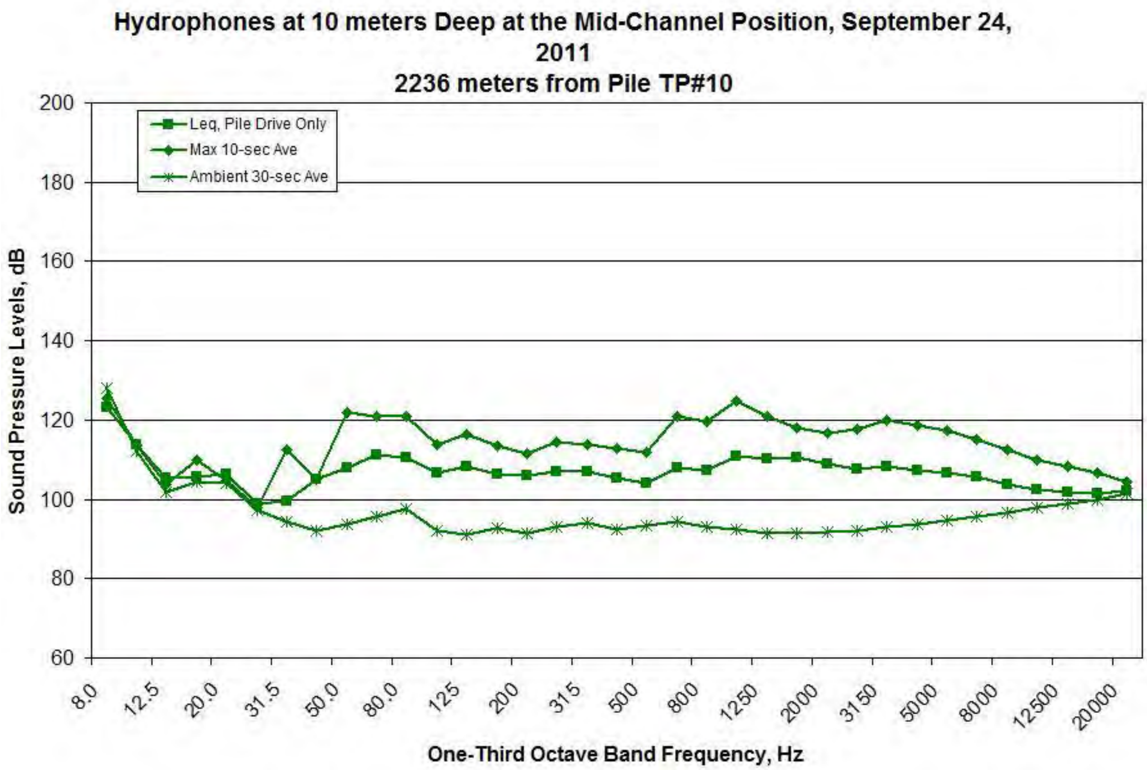

Figure A417. Spectral Data Measured at the MID Location during TP#10, 14:50-15:00, Measured at Depths of 10 meters on September 24, 2011

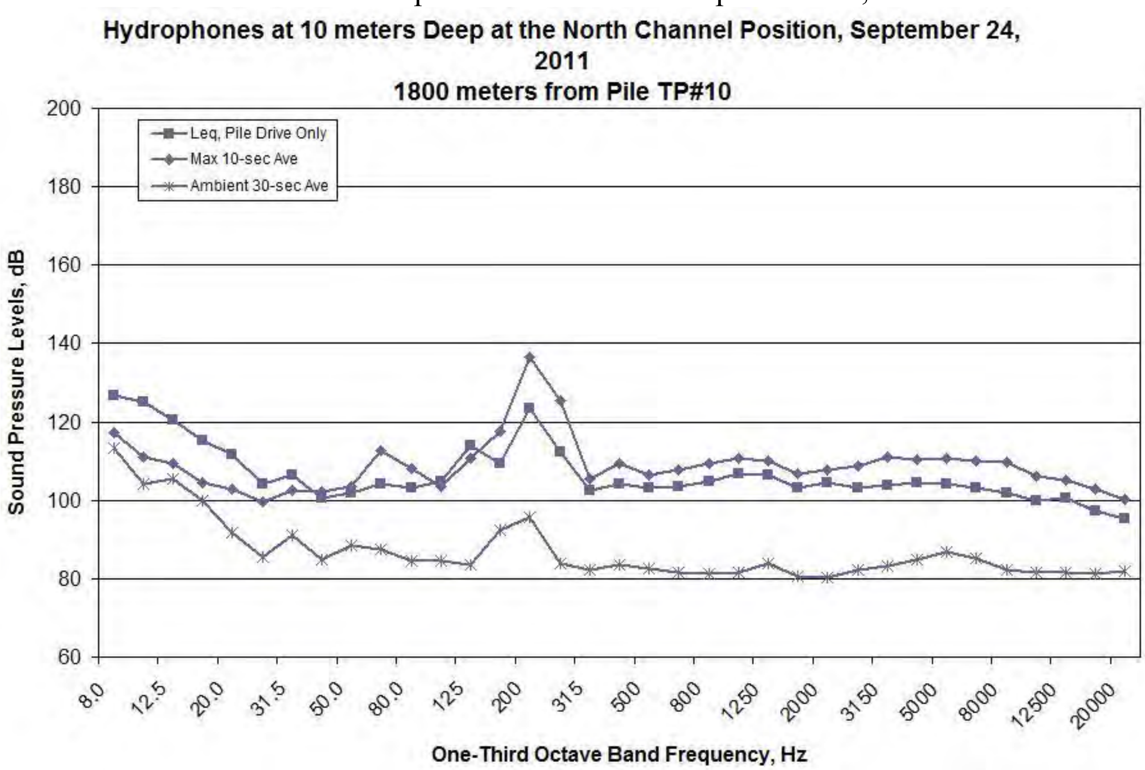

Figure A418. Spectral Data Measured at the NO Location during TP#10, 14:50-15:00, Measured at Depths of 10 meters on September 24, 2011

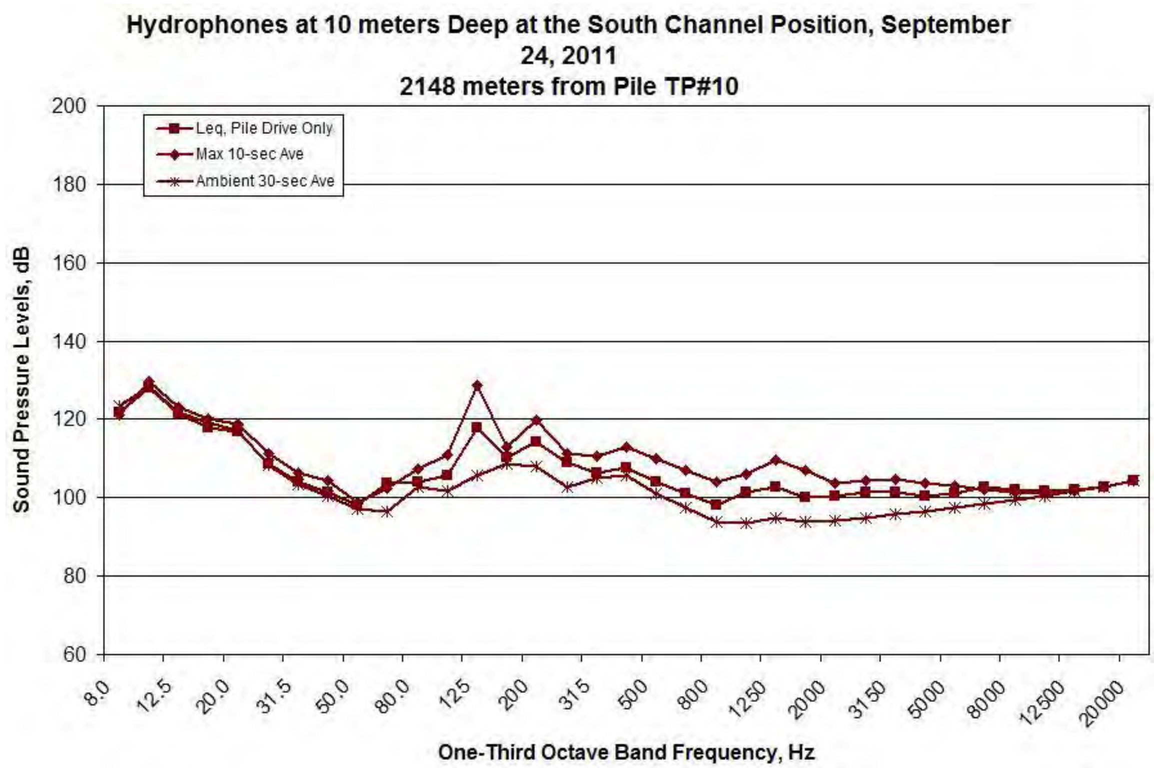

Figure A419. Spectral Data Measured at the SO Location during TP#10, 14:50-15:00, Measured at Depths of 10 meters on September 24, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A420. Spectral Data Measured at the RFT Location during TP#10, 14:50-15:00, Measured at Depths of 10 meters on September 24, 2011

TP#9 RP#3 (Vibratory Installation)

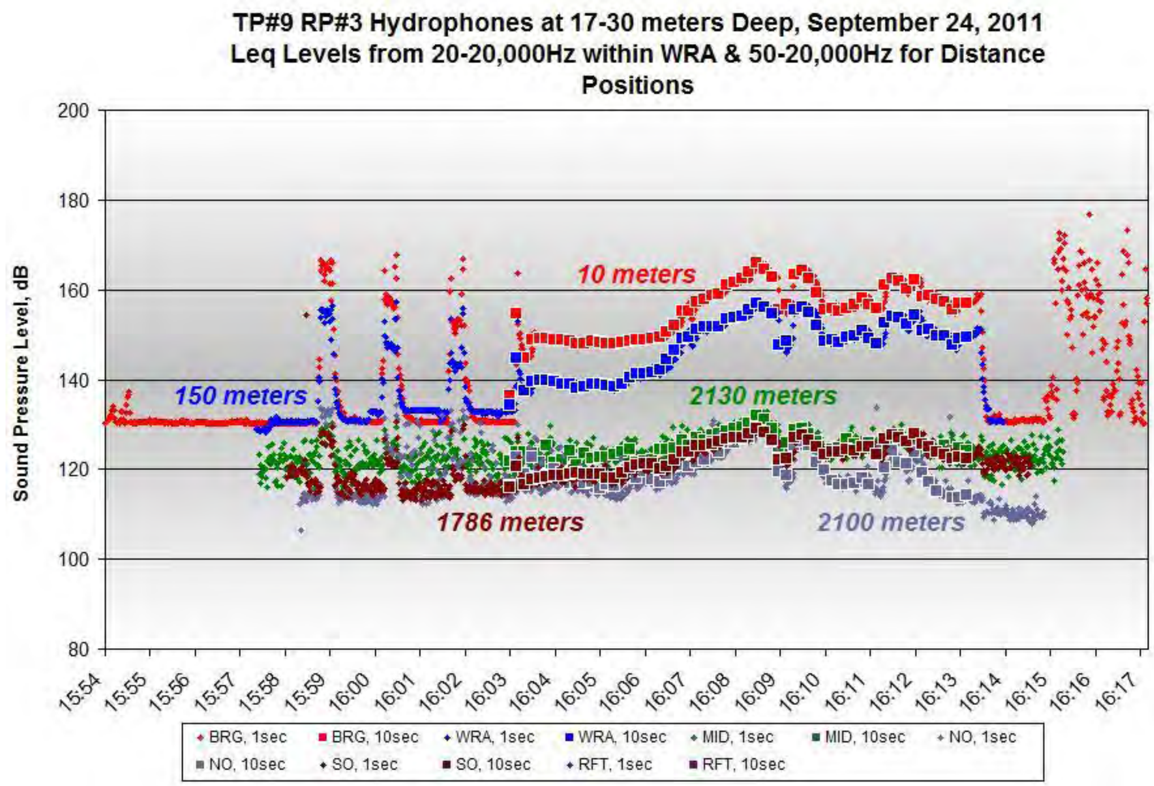

Figure A421. One-second and 10-second Average Data for TP#9 RP#3, 16:03-16:13, Measured at Depths of 17-30 meters on September 24, 2011

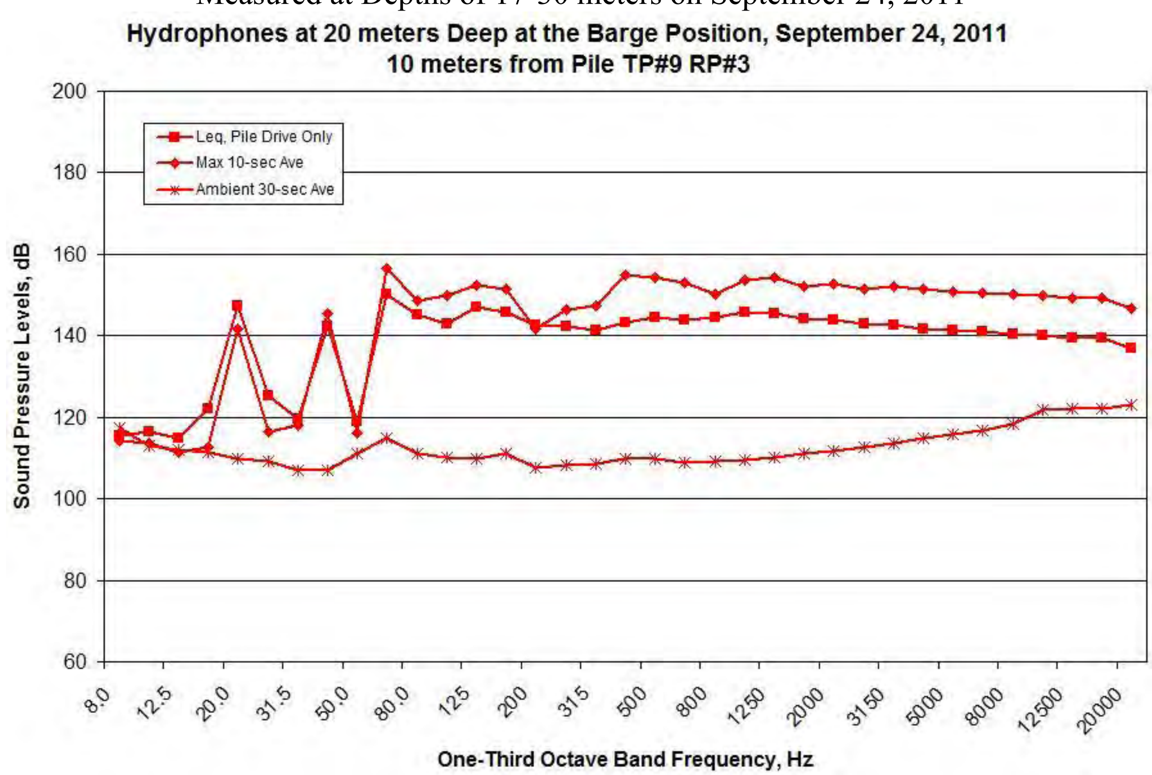

Figure A422. Spectral Data Measured at the BRG Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 20 meters on September 24, 2011

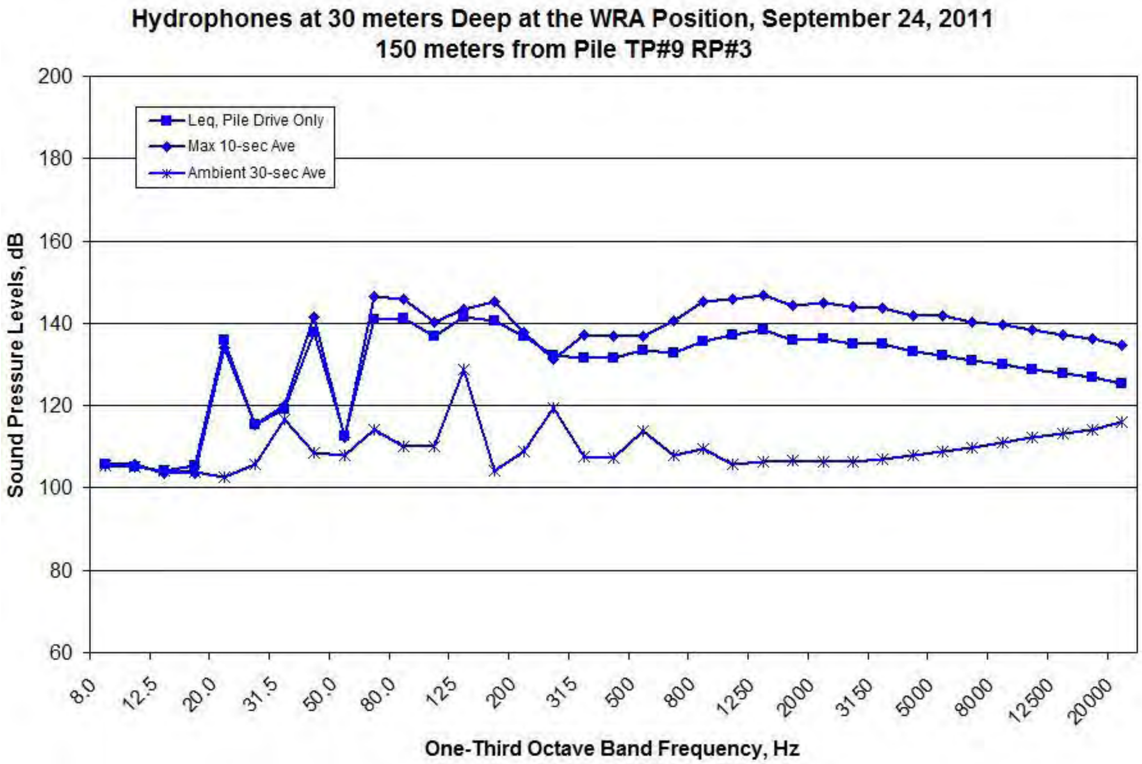

Figure A423. Spectral Data Measured at the WRA Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 30 meters on September 24, 2011

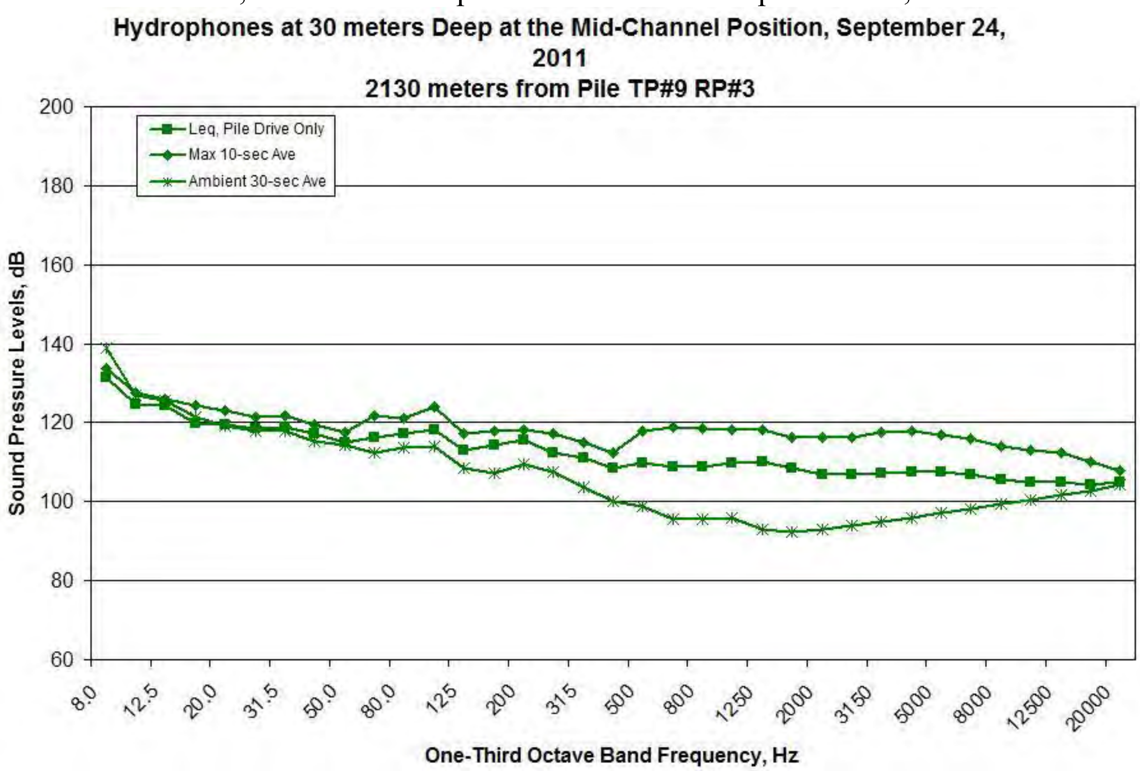

Figure A424. Spectral Data Measured at the MID Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 30 meters on September 24, 2011

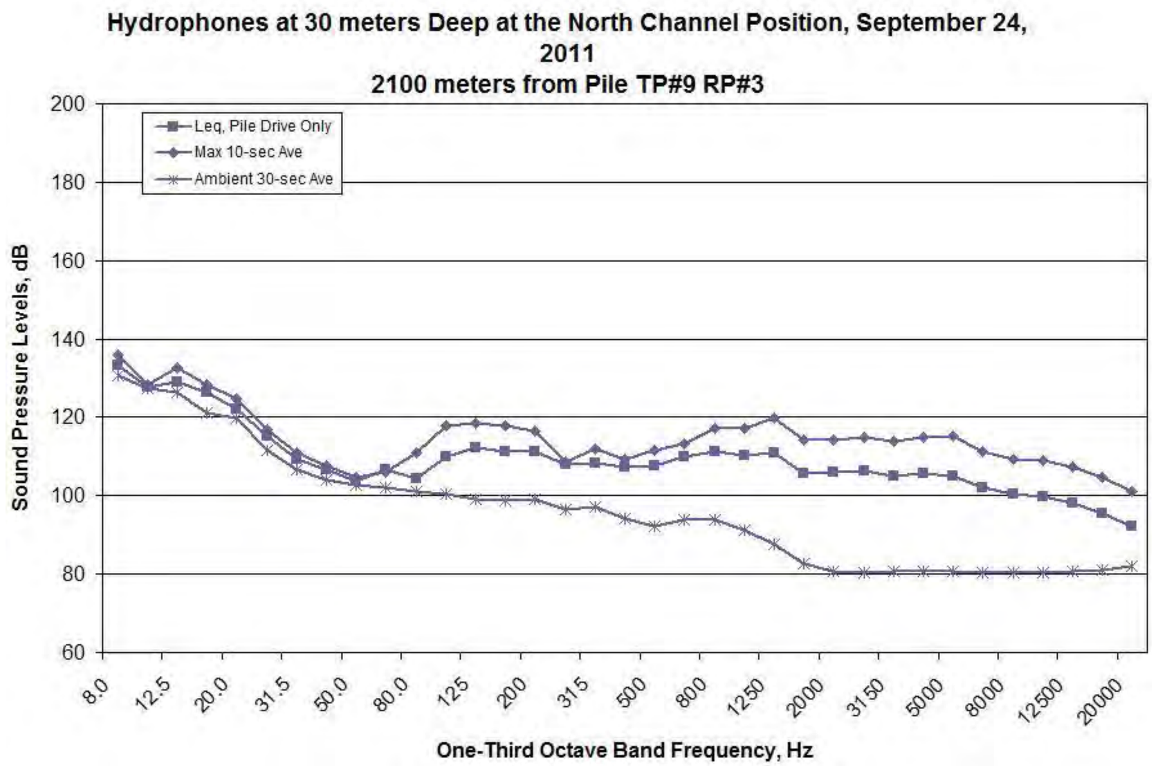

Figure A425. Spectral Data Measured at the NO Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 30 meters on September 24, 2011

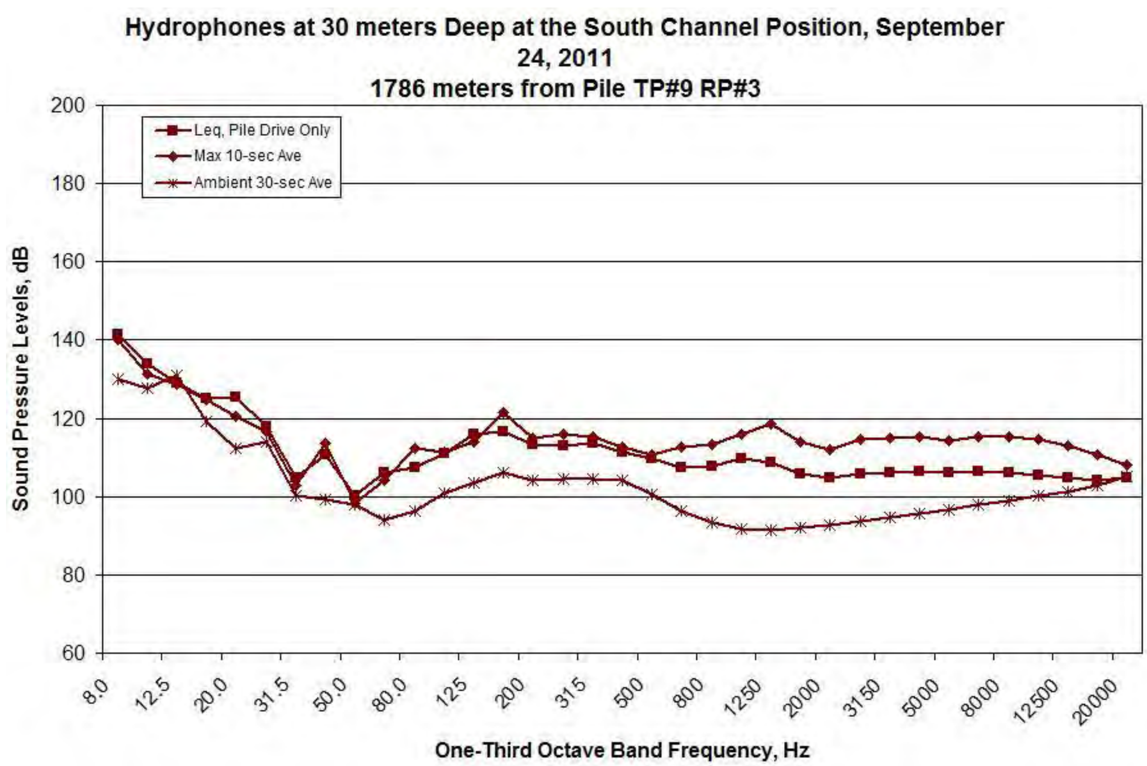

Figure A426. Spectral Data Measured at the SO Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 30 meters on September 24, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A427. Spectral Data Measured at the RFT Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 17 meters on September 24, 2011

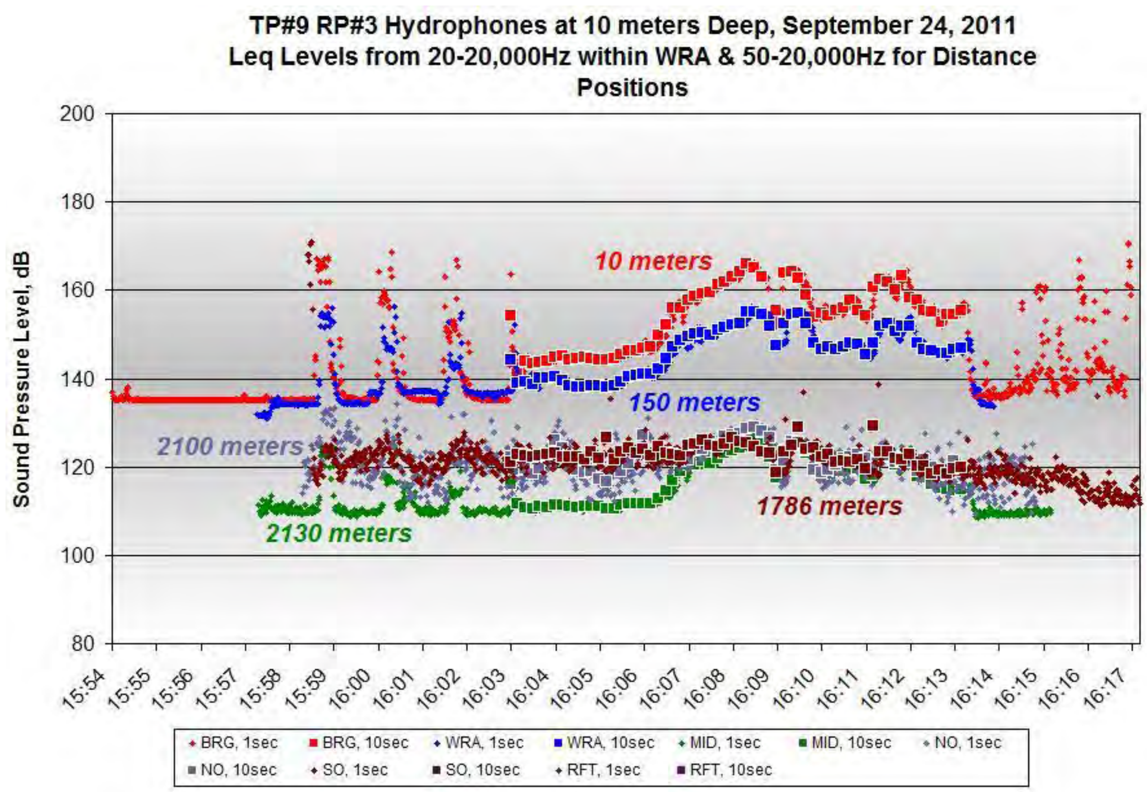

Figure A428. One-second and 10-second Average Data for TP#9 RP#3, 16:03-16:13, Measured at Depths of 10 meters on September 24, 2011

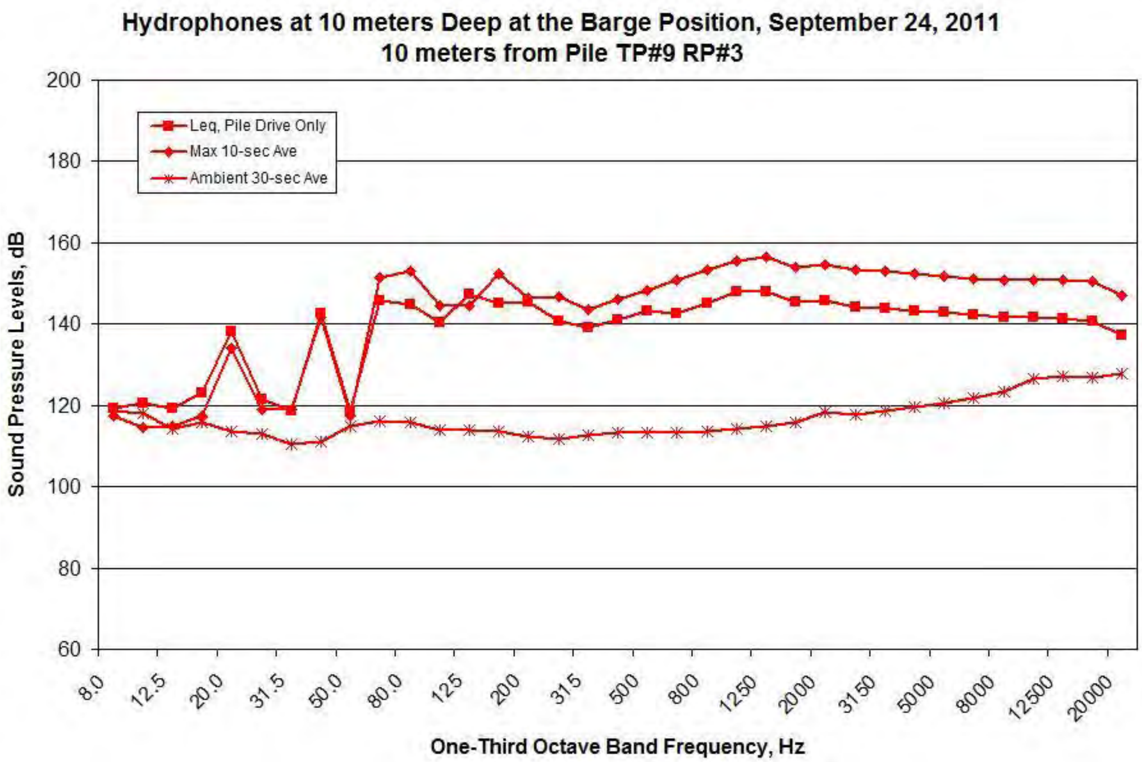

Figure A429. Spectral Data Measured at the BRG Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 10 meters on September 24, 2011

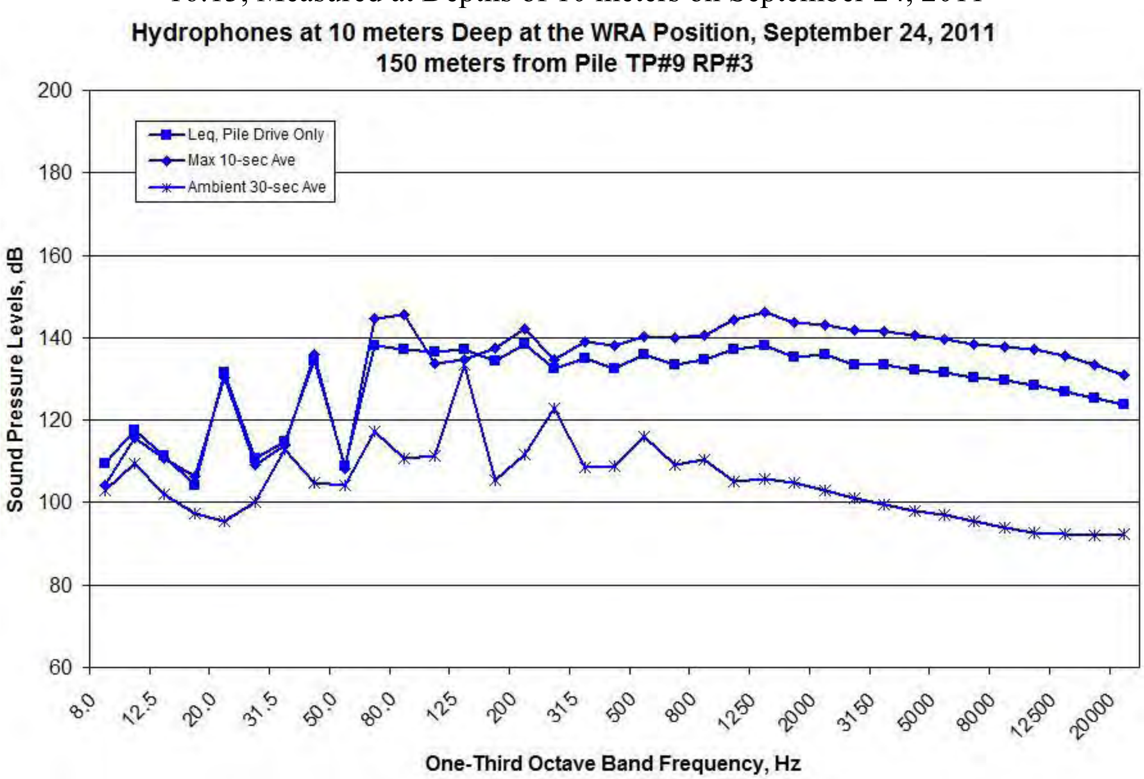

Figure A430. Spectral Data Measured at the WRA Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 10 meters on September 24, 2011

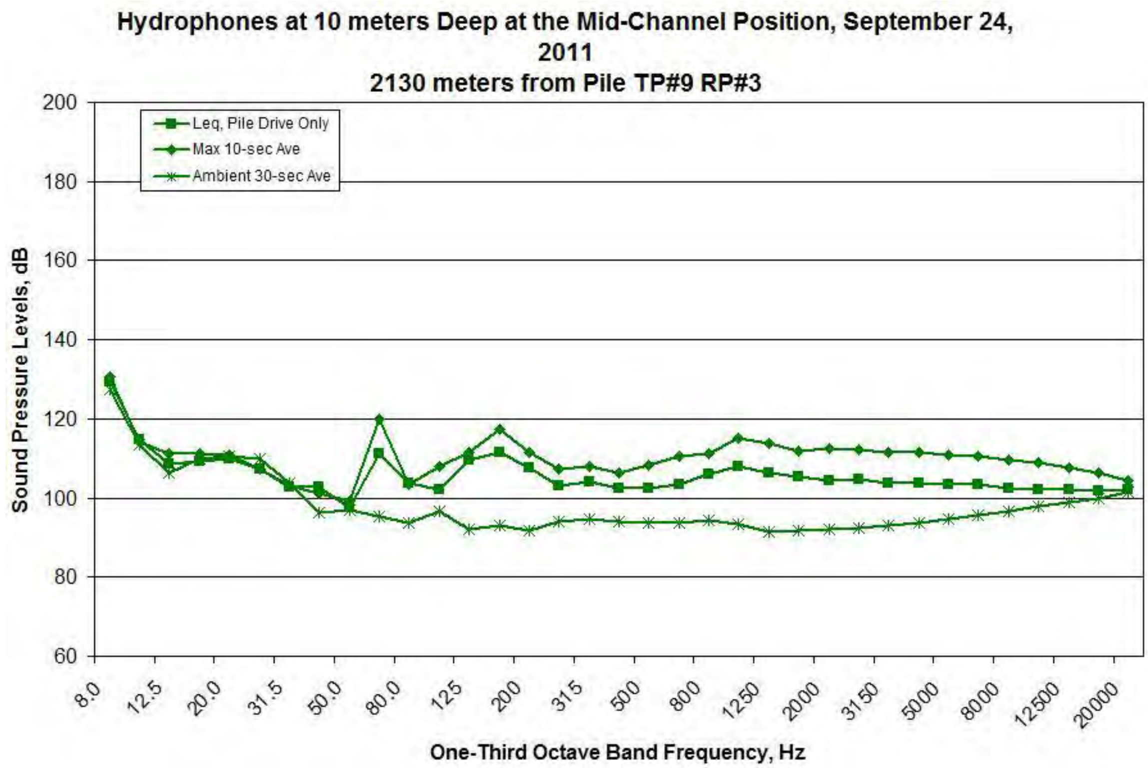

Figure A431. Spectral Data Measured at the MID Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 10 meters on September 24, 2011

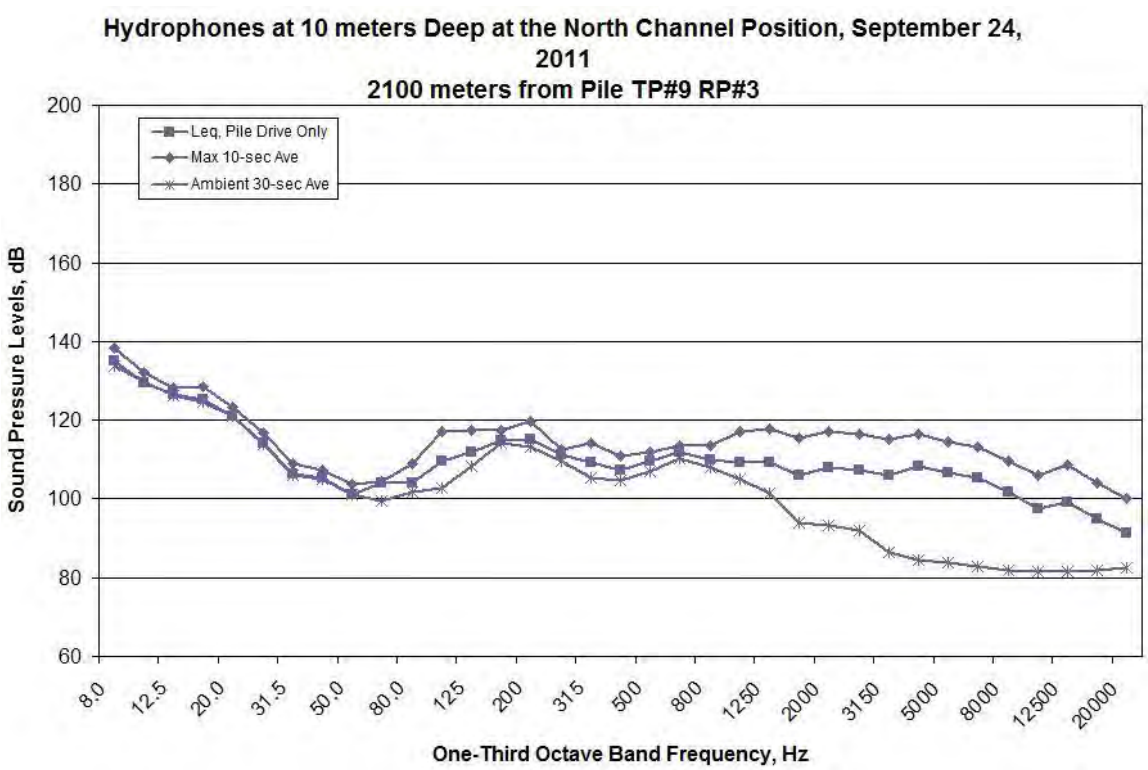

Figure A432. Spectral Data Measured at the NO Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 10 meters on September 24, 2011

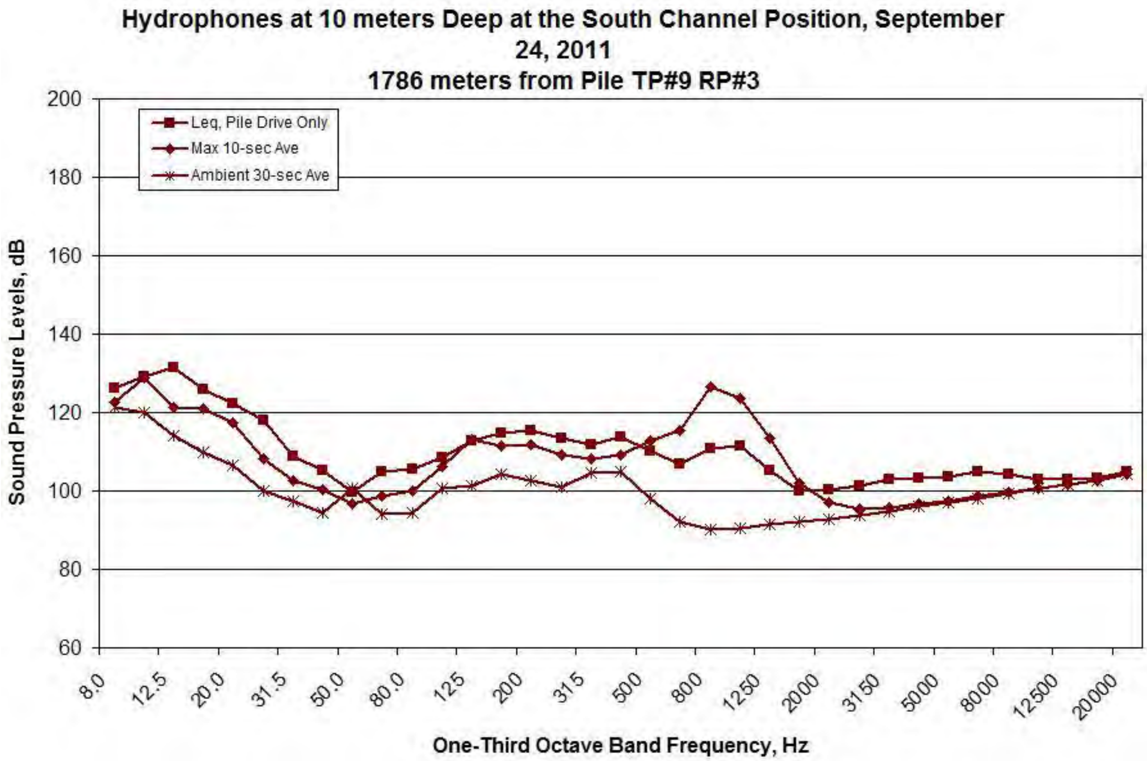

Figure A433. Spectral Data Measured at the SO Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 10 meters on September 24, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A434. Spectral Data Measured at the RFT Location during TP#9 RP#3, 16:03-16:13, Measured at Depths of 10 meters on September 24, 2011

9/26/2011 – TP#8 (Vibratory Removal)

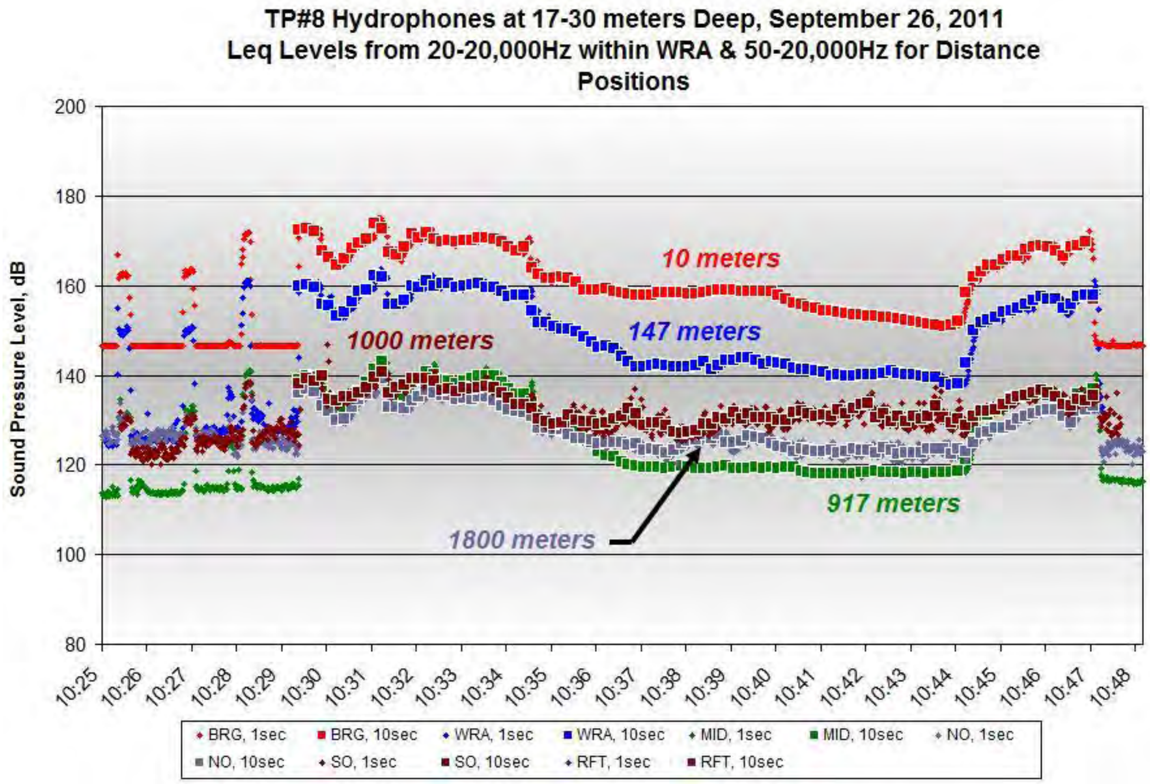

Figure A435. One-second and 10-second Average Data for TP#8, 10:30-10:48, Measured at Depths of 17-30 meters on September 26, 2011

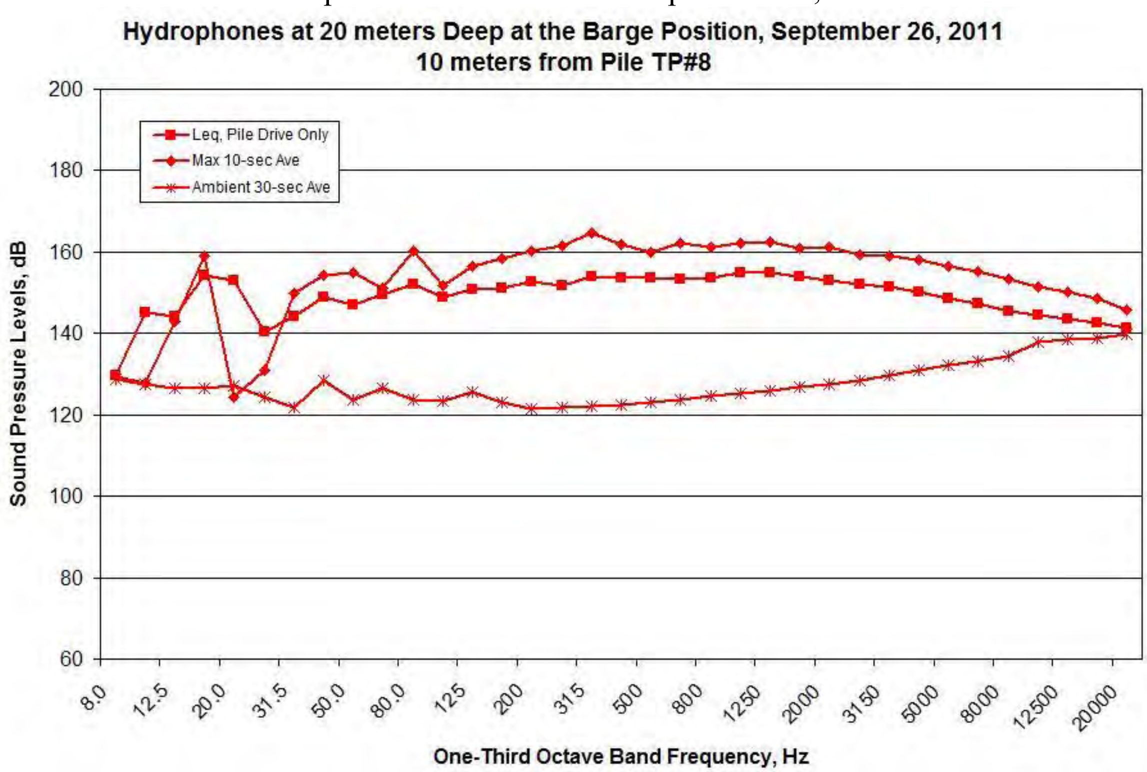

Figure A436. Spectral Data Measured at the BRG Location during TP#8, 10:30-10:48, Measured at Depths of 20 meters on September 26, 2011

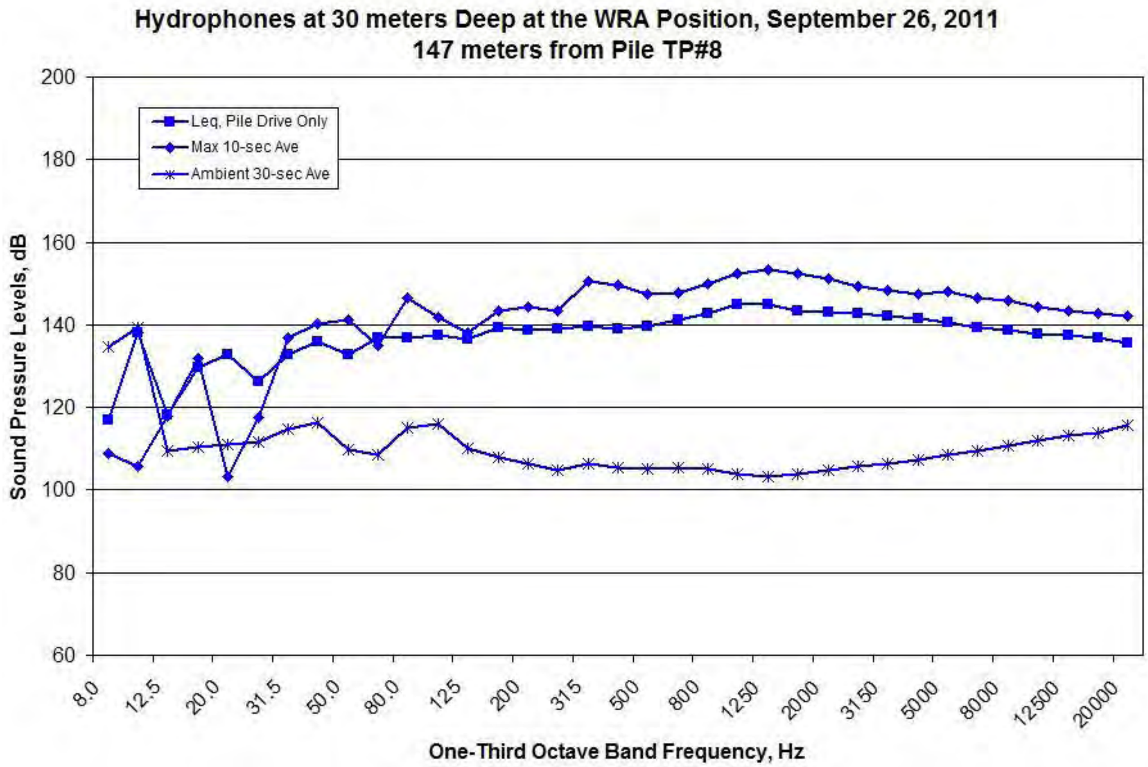

Figure A437. Spectral Data Measured at the WRA Location during TP#8, 10:30-10:48, Measured at Depths of 30 meters on September 26, 2011

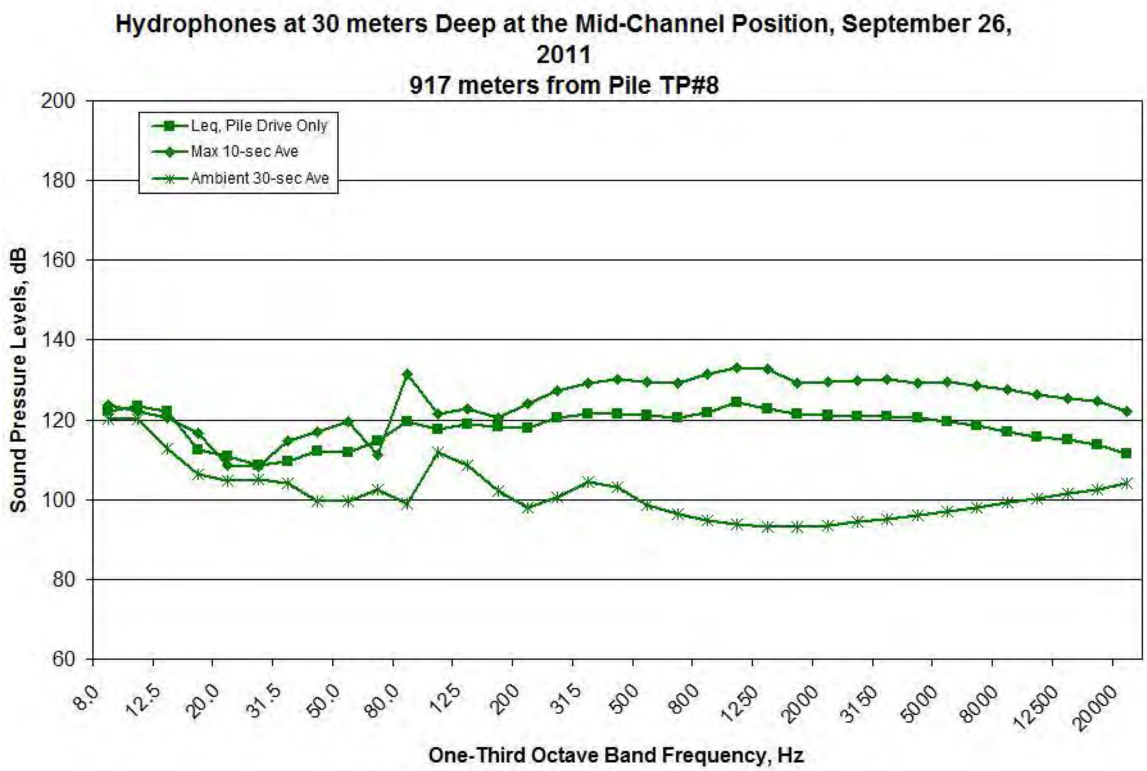

Figure A438. Spectral Data Measured at the MID Location during TP#8, 10:30-10:48, Measured at Depths of 30 meters on September 26, 2011

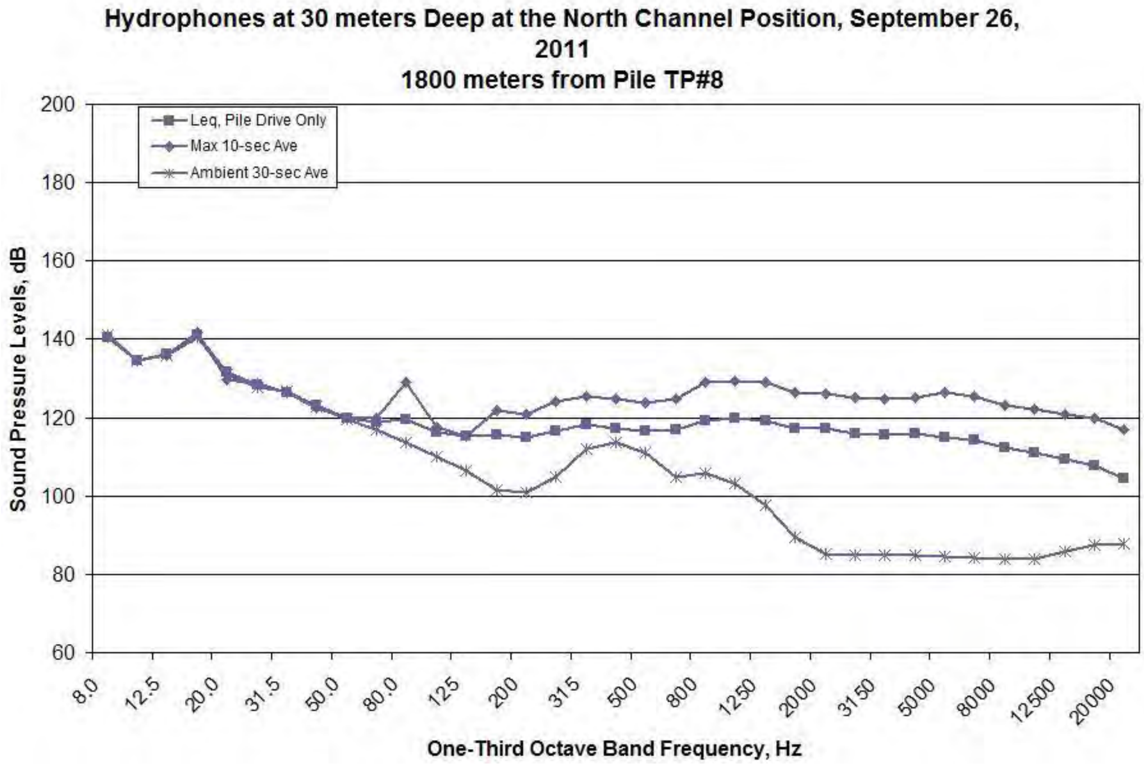

Figure A439. Spectral Data Measured at the NO Location during TP#8, 10:30-10:48, Measured at Depths of 30 meters on September 26, 2011

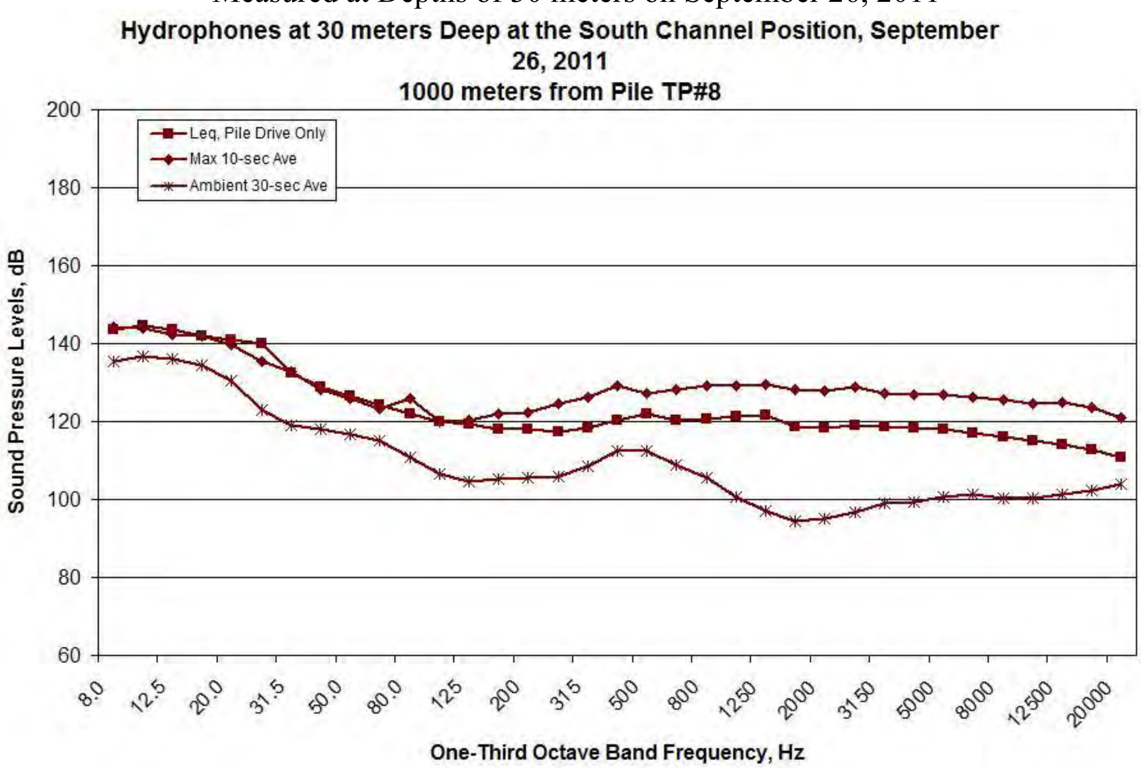

Figure A440. Spectral Data Measured at the SO Location during TP#8, 10:30-10:48, Measured at Depths of 30 meters on September 26, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A441. Spectral Data Measured at the RFT Location during TP#8, 10:30-10:48, Measured at Depths of 17 meters on September 26, 2011

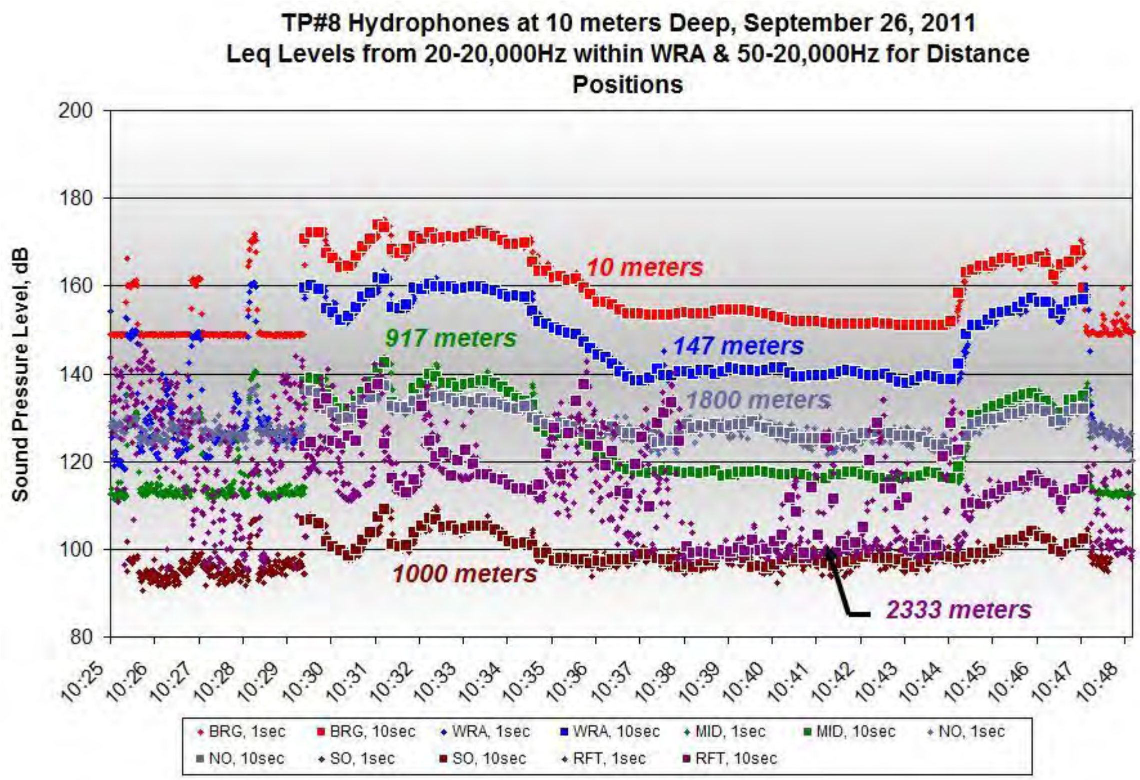

Figure A442. One-second and 10-second Average Data for TP#8, 10:30-10:48, Measured at Depths of 10 meters on September 26, 2011

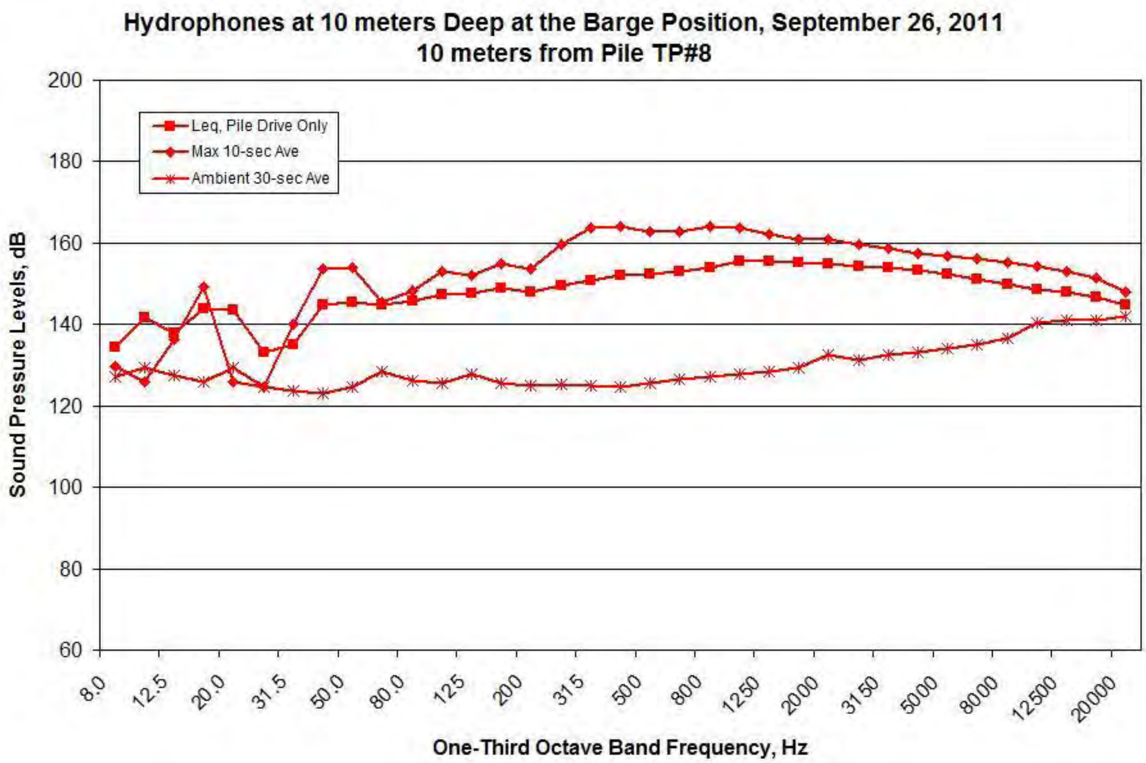

Figure A443. Spectral Data Measured at the BRG Location during TP#8, 10:30-10:48, Measured at Depths of 10 meters on September 26, 2011

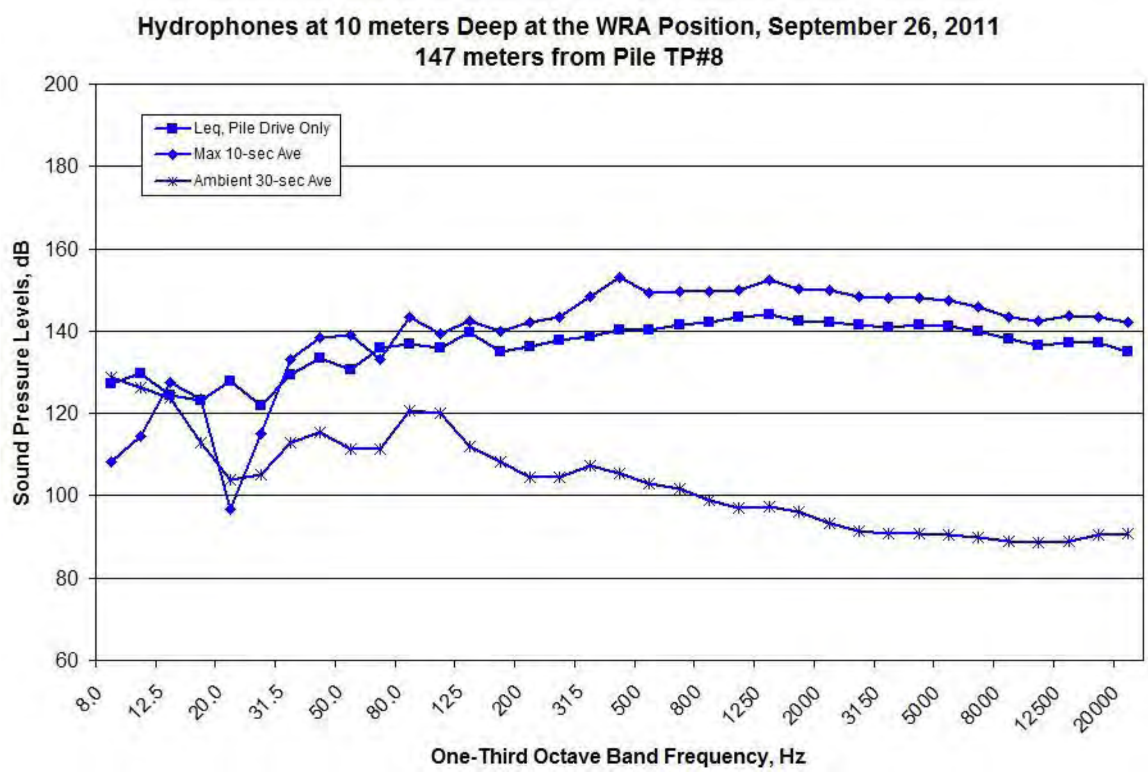

Figure A444. Spectral Data Measured at the WRA Location during TP#8, 10:30-10:48, Measured at Depths of 10 meters on September 26, 2011

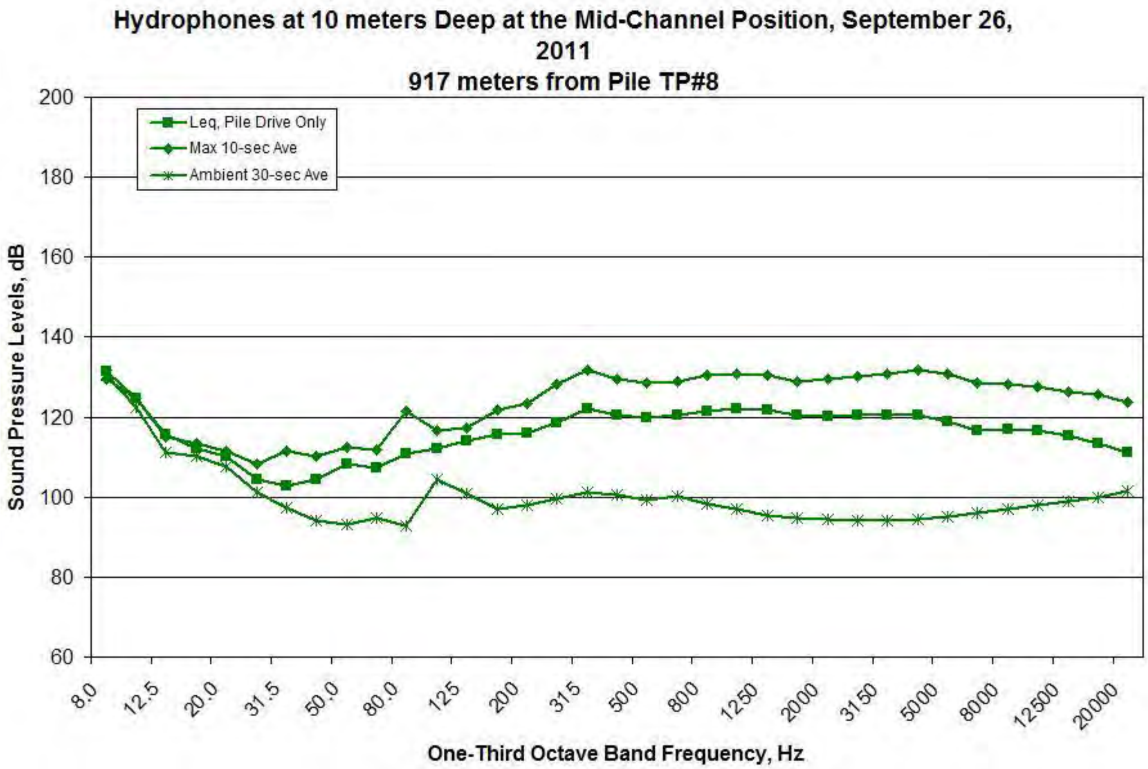

Figure A445. Spectral Data Measured at the MID Location during TP#8, 10:30-10:48, Measured at Depths of 10 meters on September 26, 2011

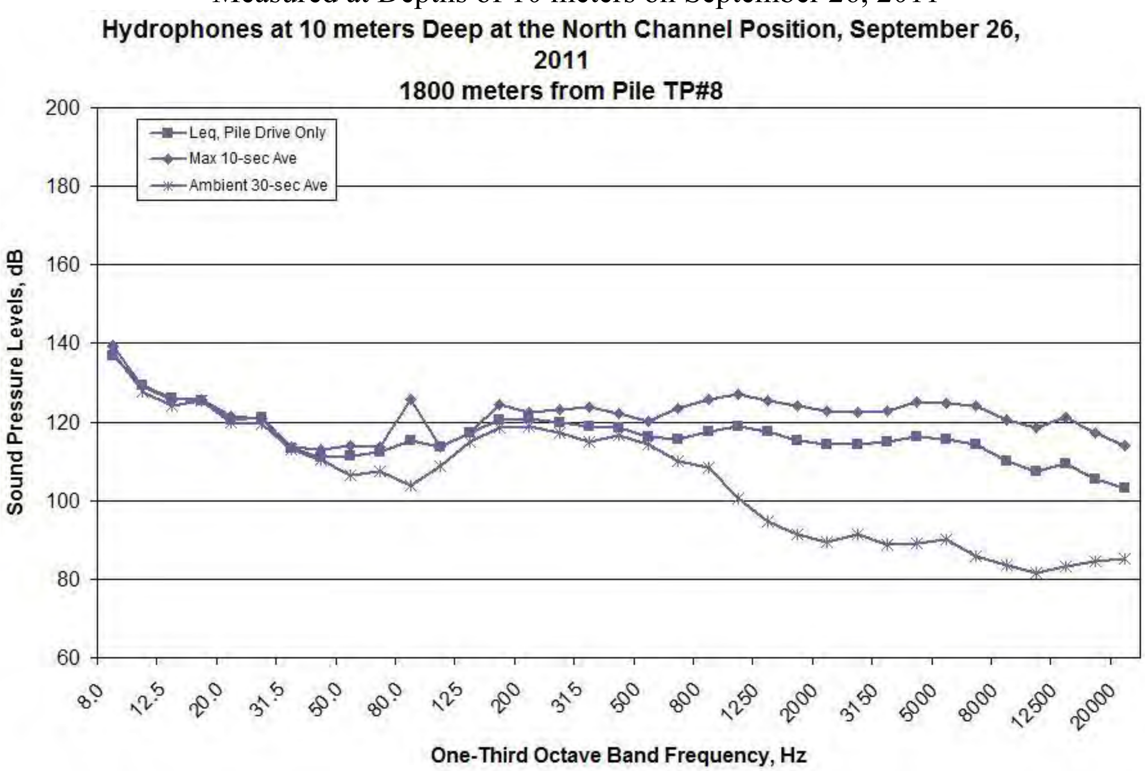

Figure A446. Spectral Data Measured at the NO Location during TP#8, 10:30-10:48, Measured at Depths of 10 meters on September 26, 2011

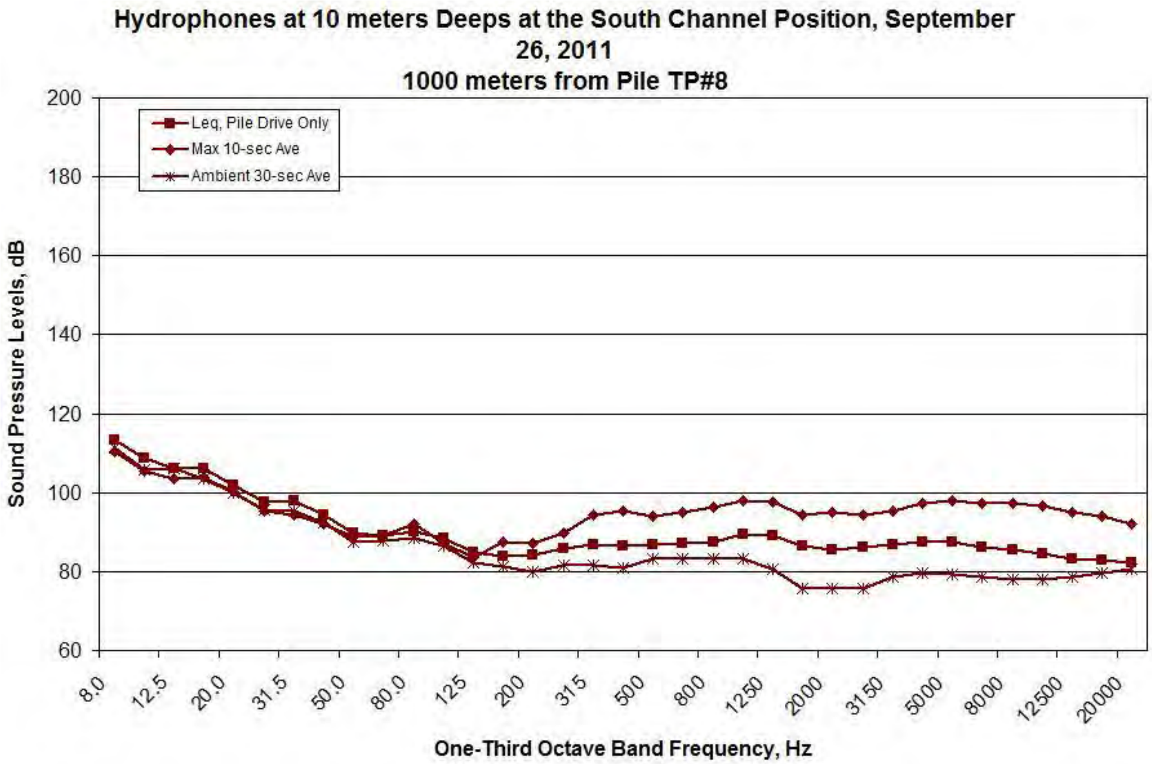

Figure A447. Spectral Data Measured at the SO Location during TP#8, 10:30-10:48, Measured at Depths of 10 meters on September 26, 2011

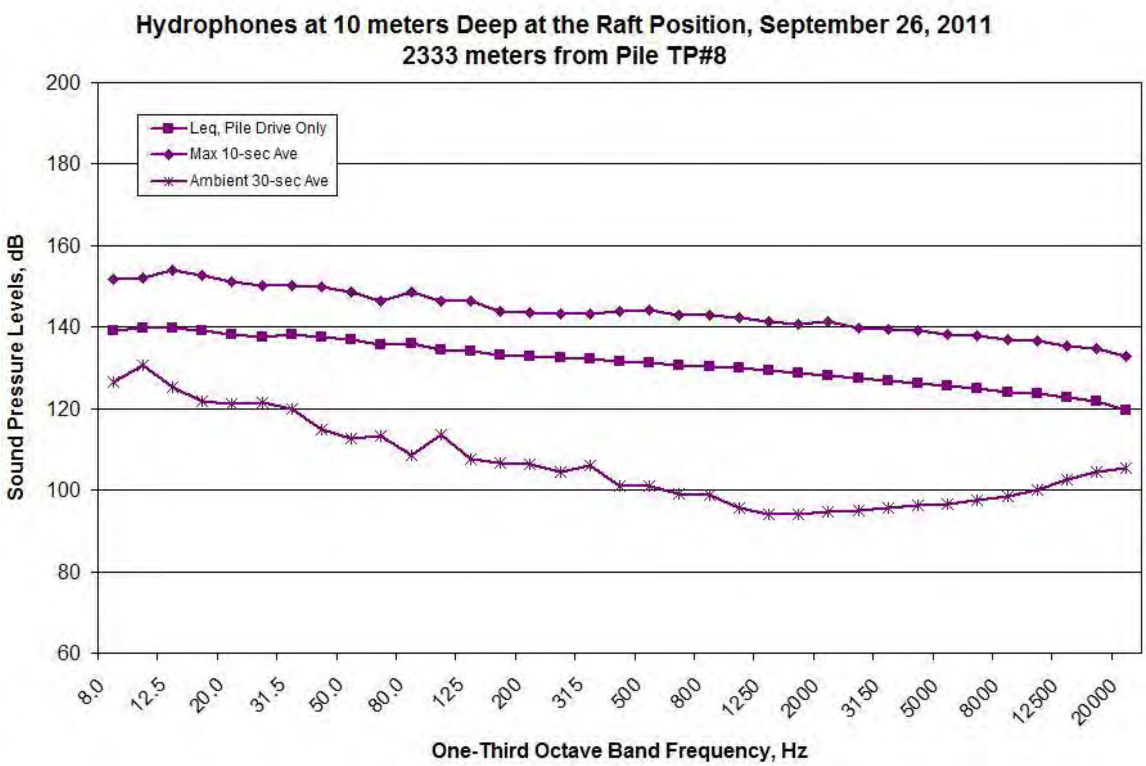

Figure A448. Spectral Data Measured at the RFT Location during TP#8, 10:30-10:48, Measured at Depths of 10 meters on September 26, 2011

TP#9 RP#1 (Vibratory Installation)

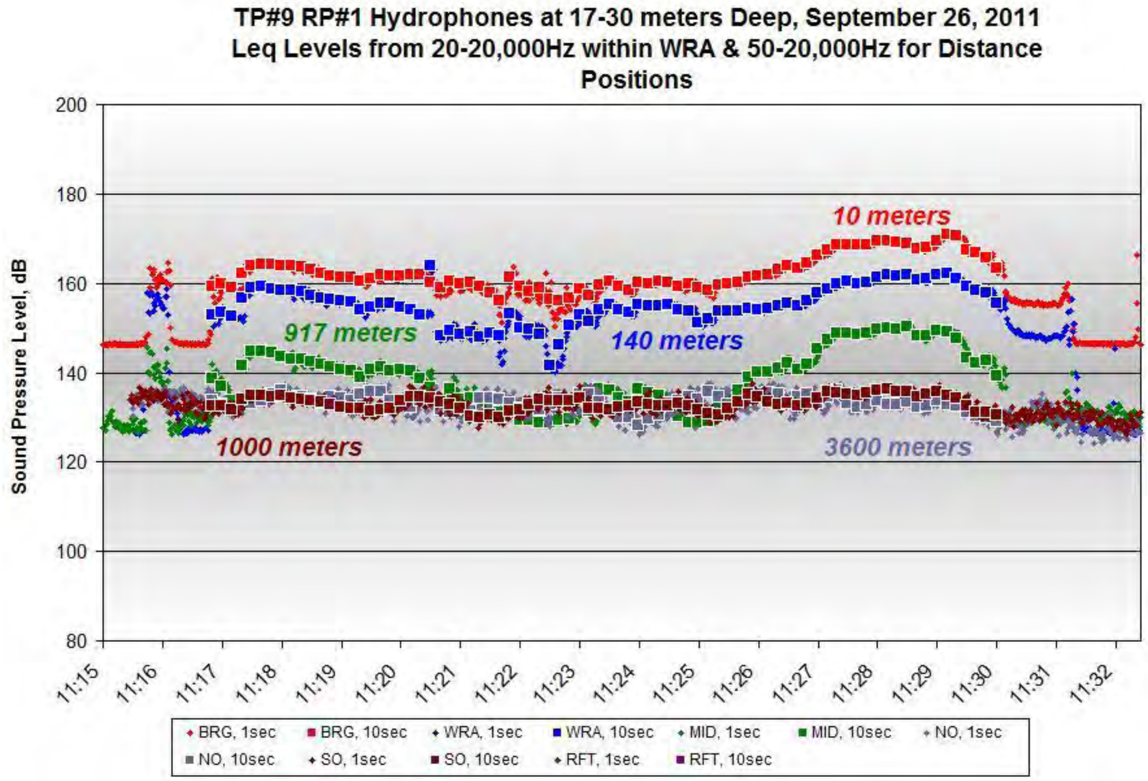

Figure A449. One-second and 10-second Average Data for TP#9 RP#1, 11:18-11:33, Measured at Depths of 17-30 meters on September 26, 2011

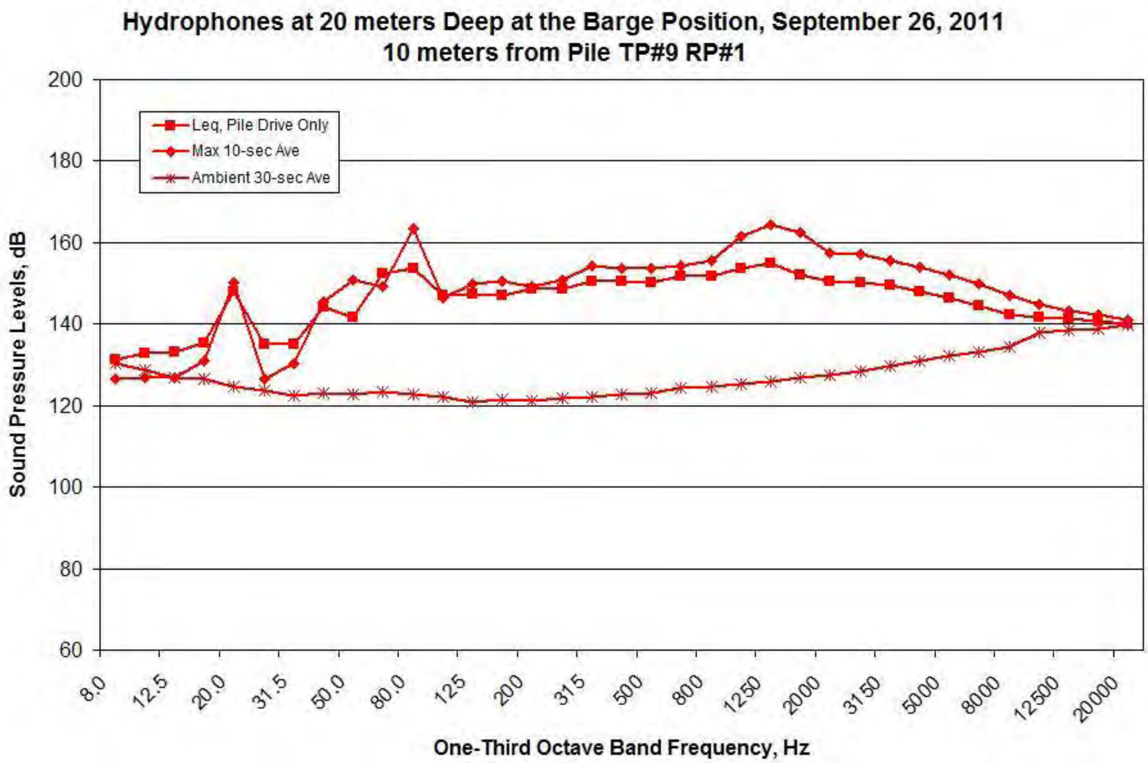

Figure A450. Spectral Data Measured at the BRG Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 20 meters on September 26, 2011

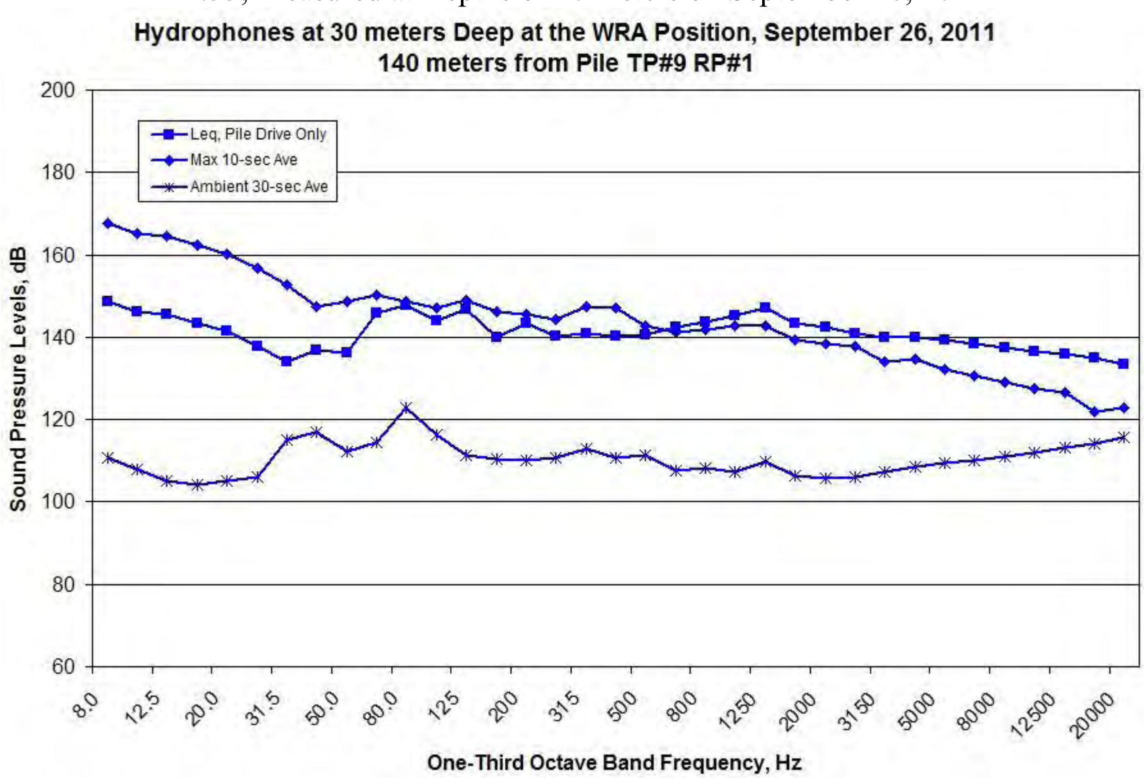

Figure A451. Spectral Data Measured at the WRA Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 30 meters on September 26, 2011

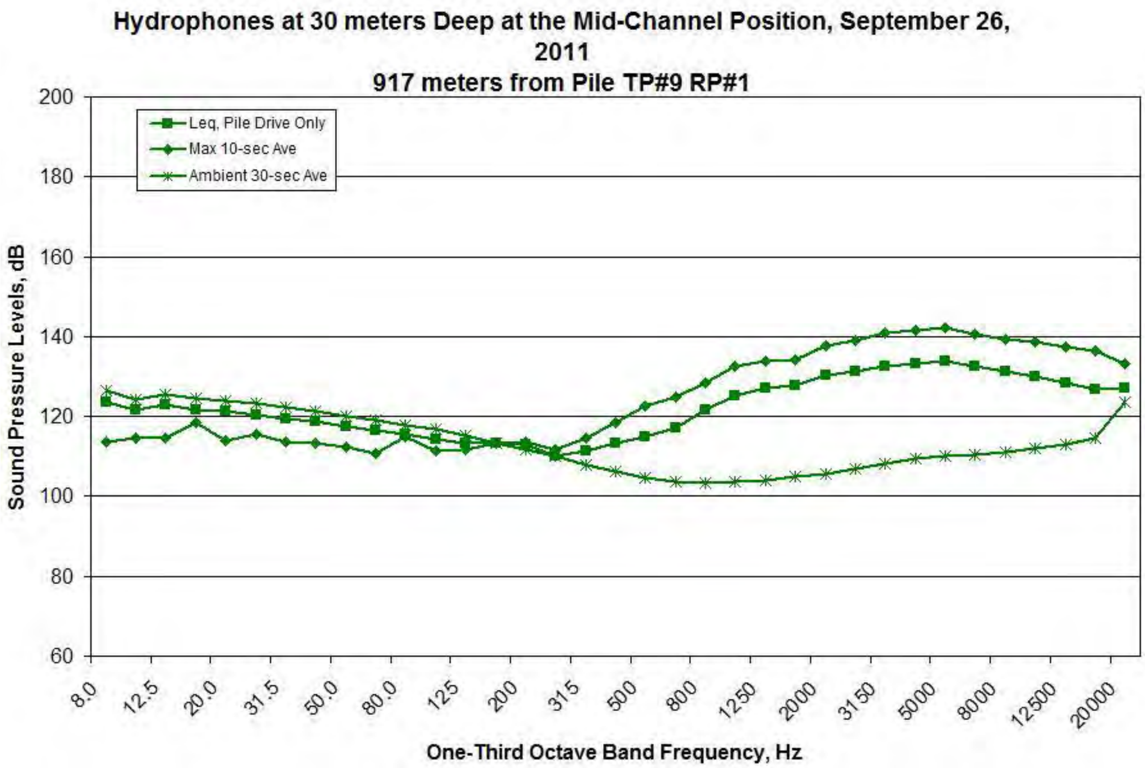

Figure A452. Spectral Data Measured at the MID Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 30 meters on September 26, 2011

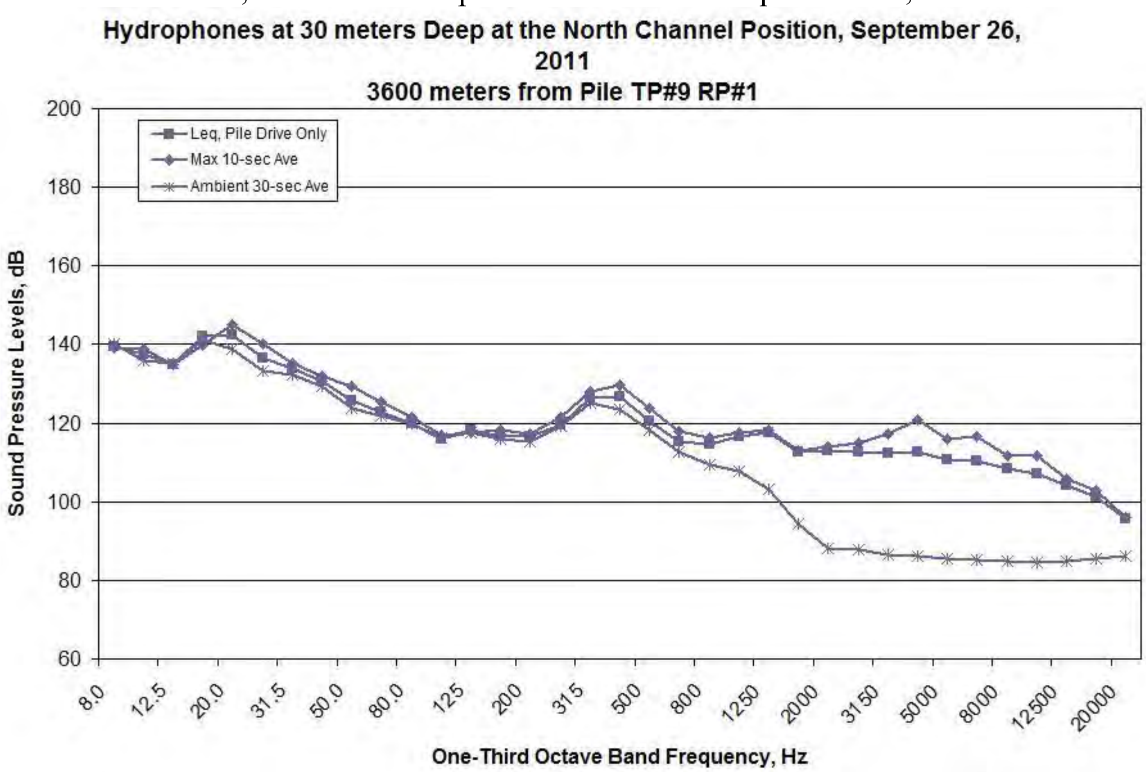

Figure A453. Spectral Data Measured at the NO Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 30 meters on September 26, 2011

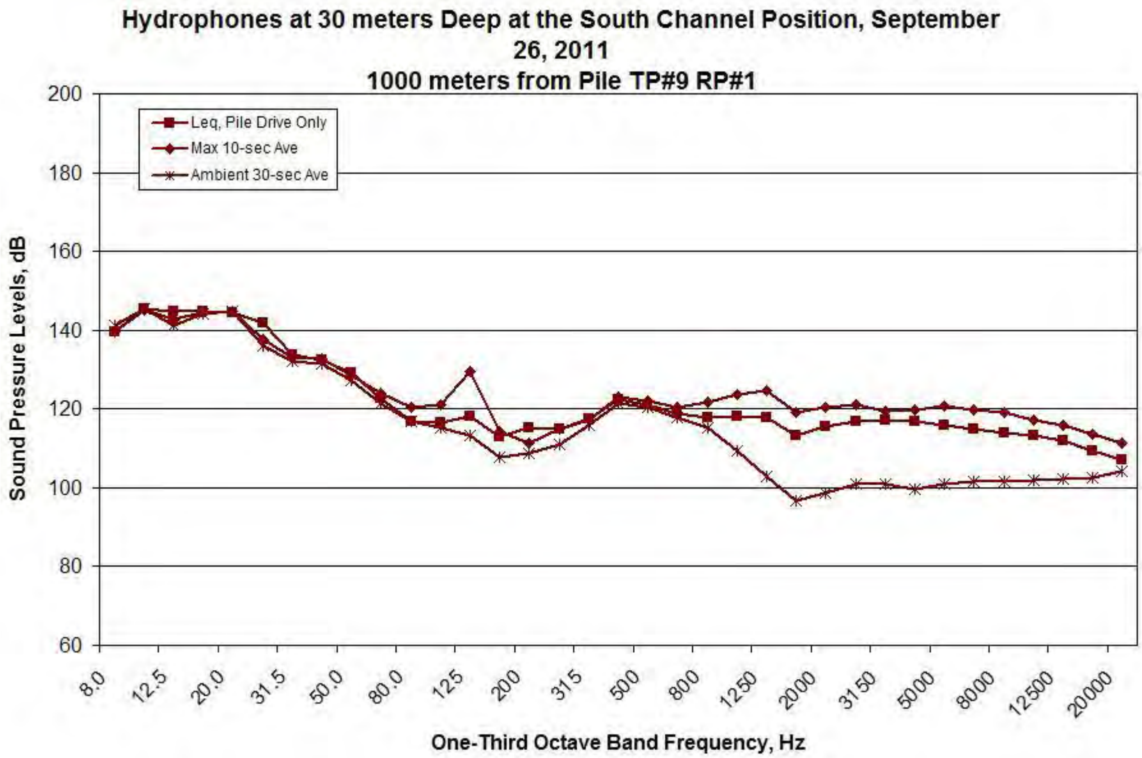

Figure A454. Spectral Data Measured at the SO Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 30 meters on September 26, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A455. Spectral Data Measured at the RFT Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 17 meters on September 26, 2011

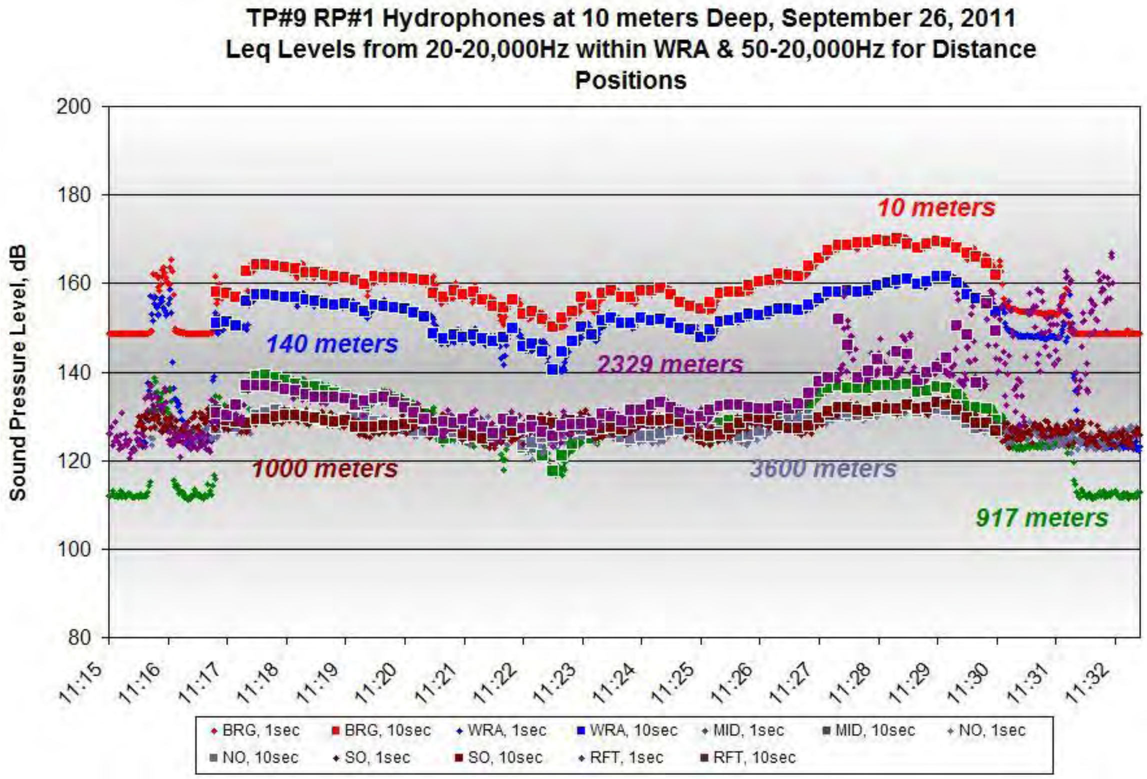

Figure A456. One-second and 10-second Average Data for TP#9 RP#1, 11:18-11:33, Measured at Depths of 10 meters on September 26, 2011

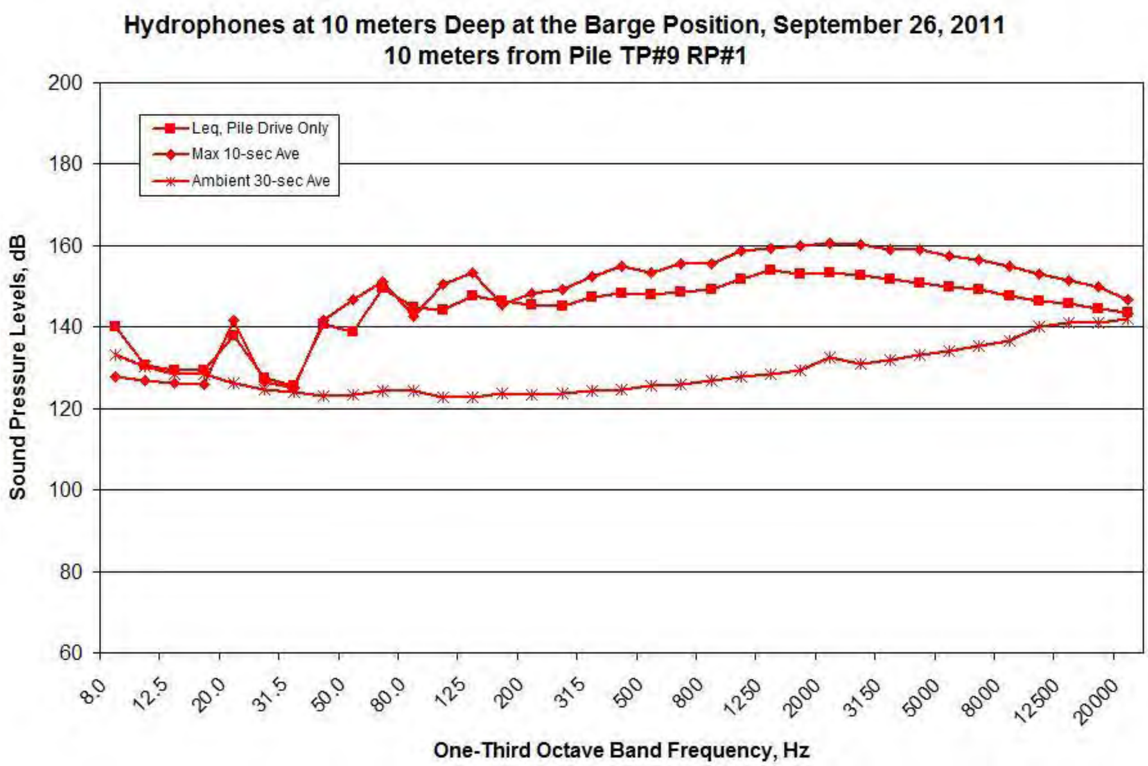

Figure A457. Spectral Data Measured at the BRG Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 10 meters on September 26, 2011

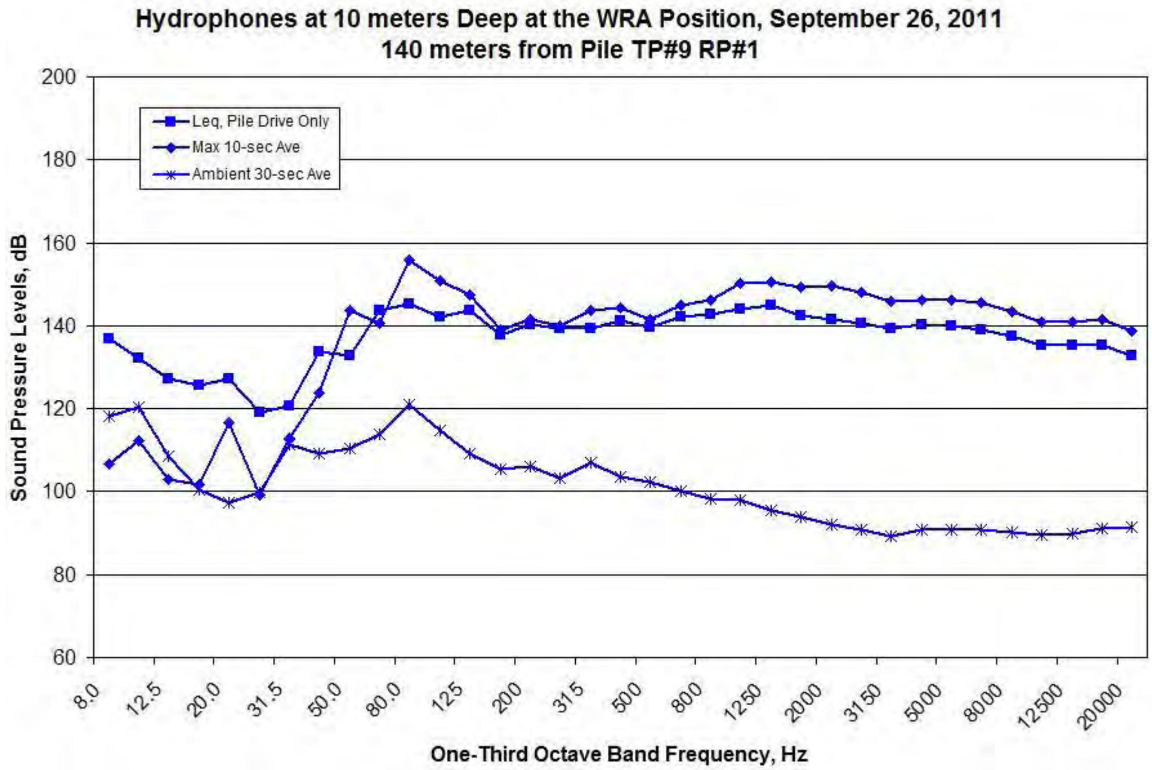

Figure A458. Spectral Data Measured at the WRA Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 10 meters on September 26, 2011

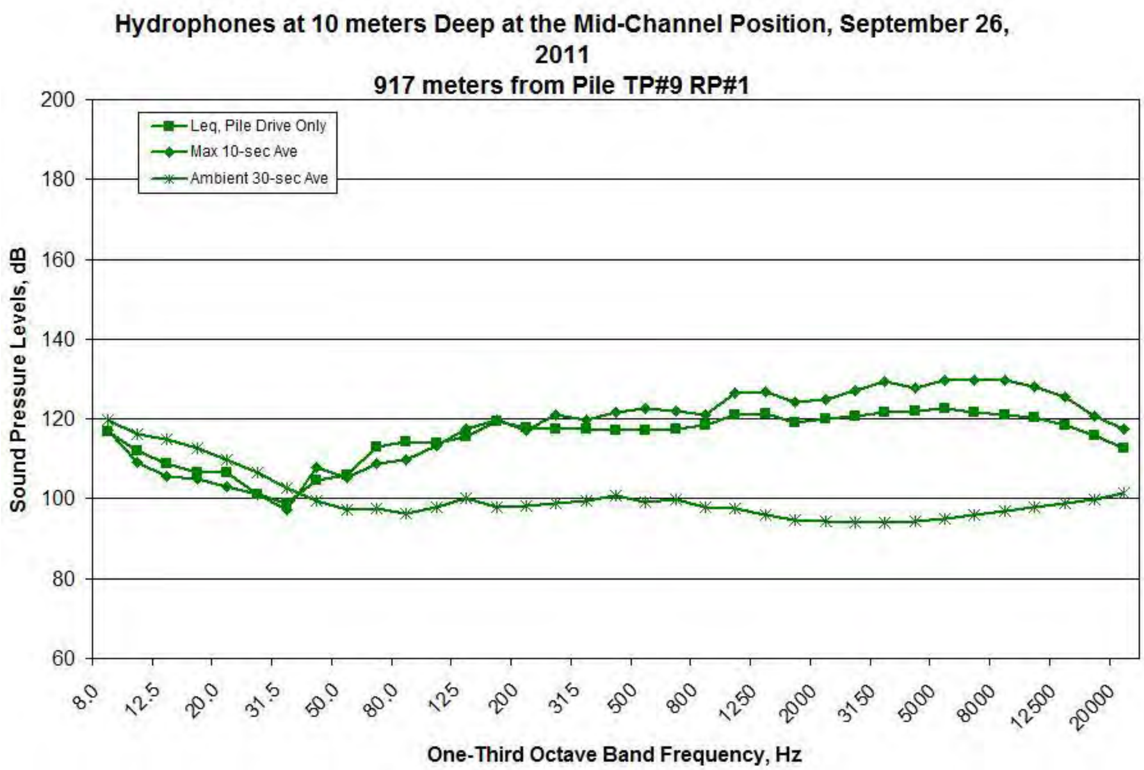

Figure A459. Spectral Data Measured at the MID Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 10 meters on September 26, 2011

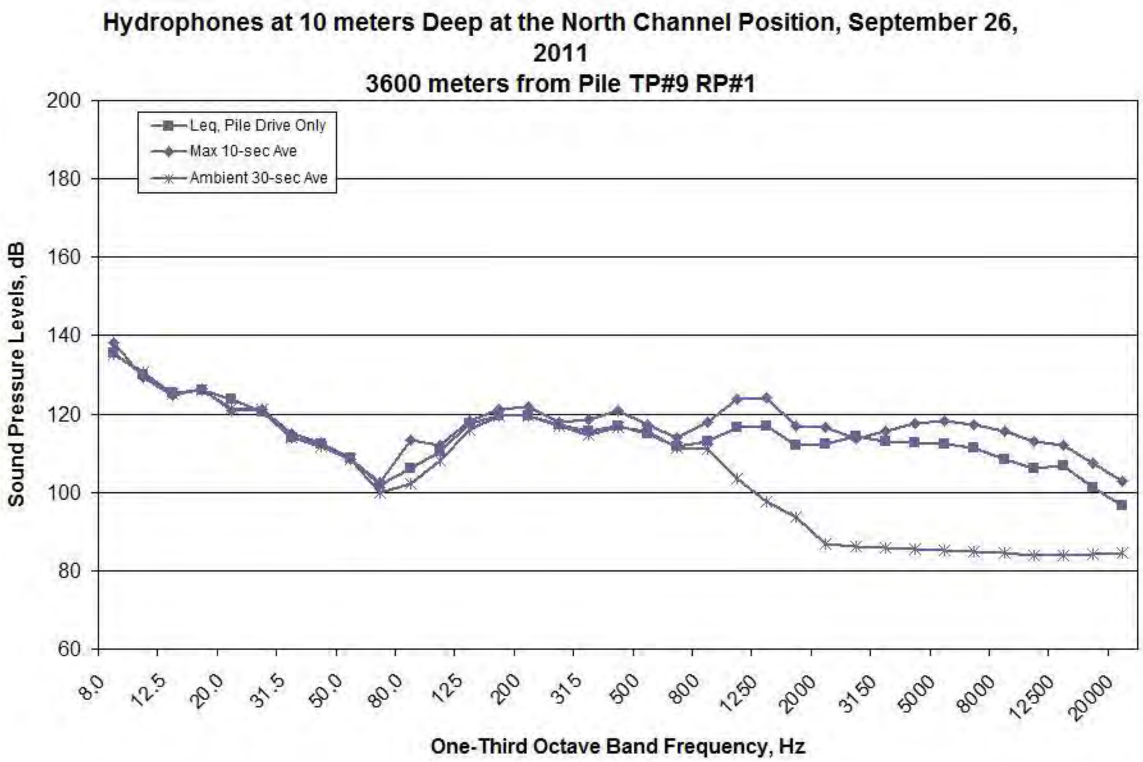

Figure A460. Spectral Data Measured at the NO Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 10 meters on September 26, 2011

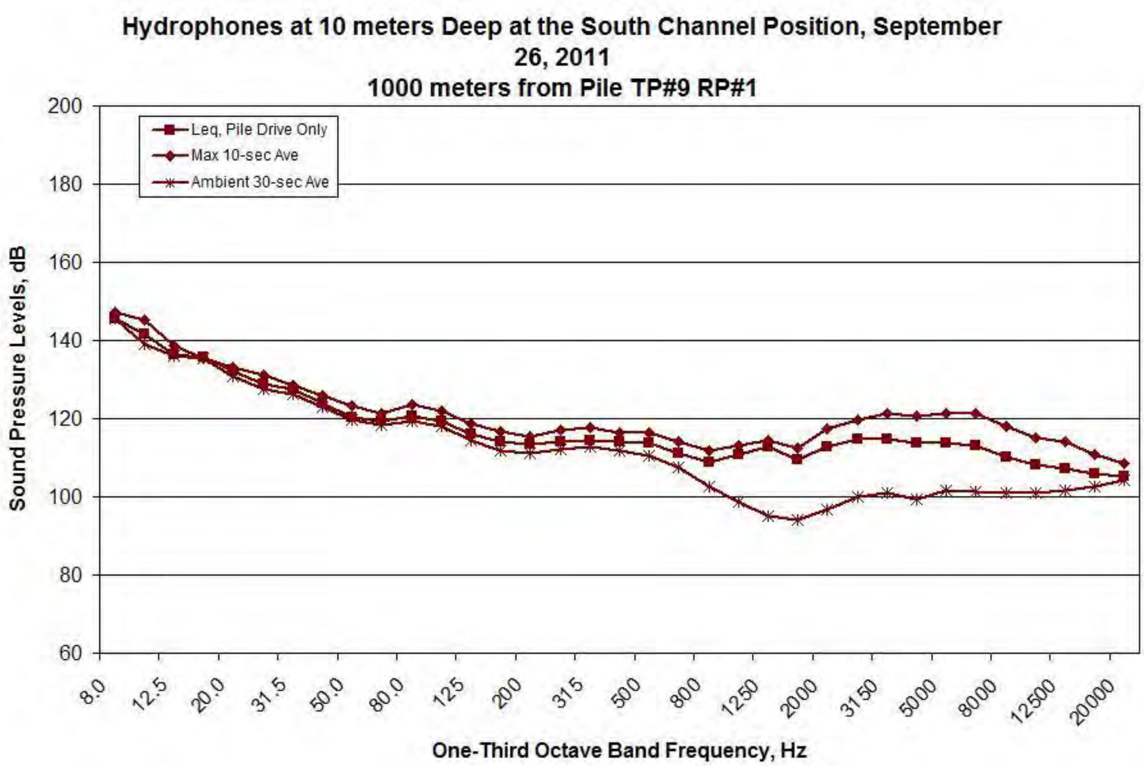

Figure A461. Spectral Data Measured at the SO Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 10 meters on September 26, 2011

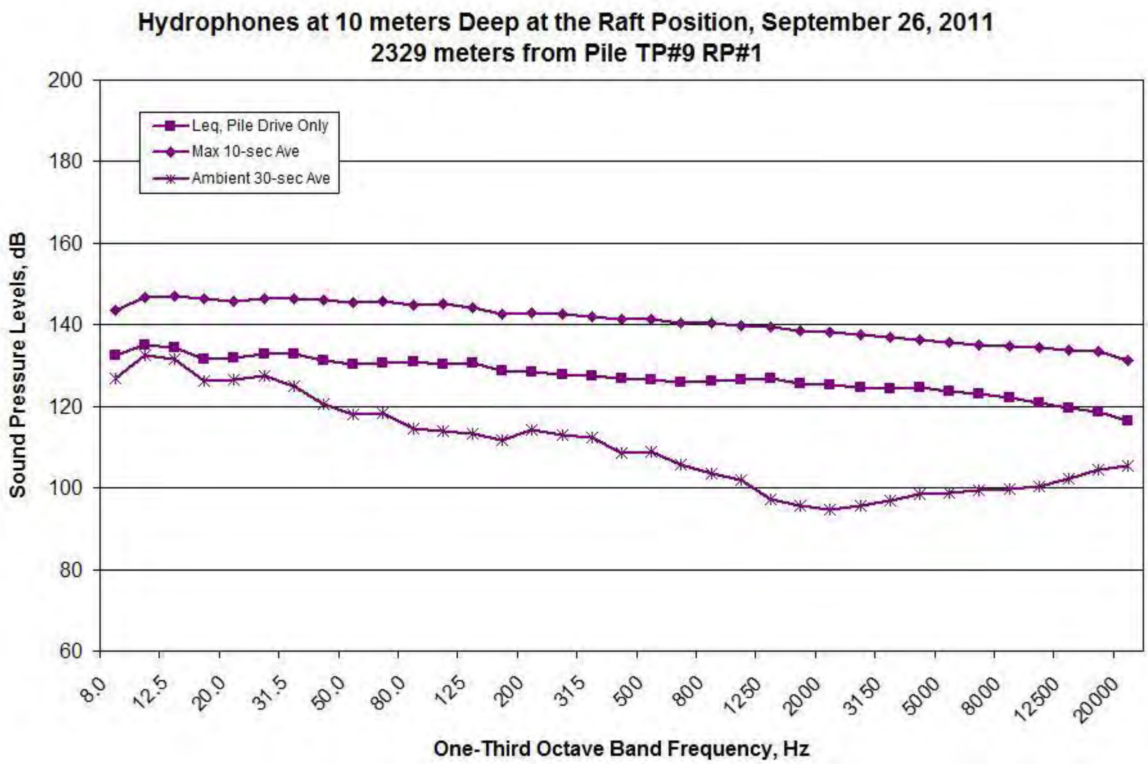

Figure A462. Spectral Data Measured at the RFT Location during TP#9 RP#1, 11:18-11:33, Measured at Depths of 10 meters on September 26, 2011

9/29/2011 – TP#12 (Vibratory Removal)

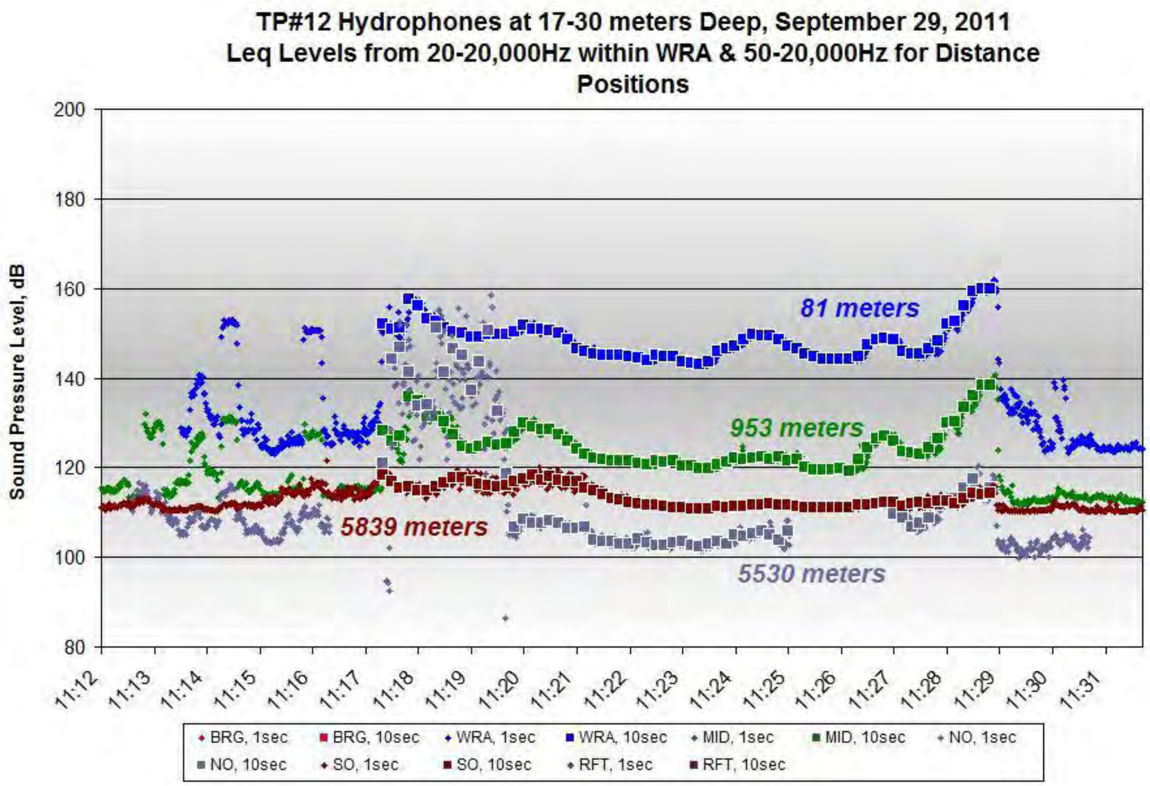

Figure A463. One-second and 10-second Average Data for TP#12, 11:17-11:29, Measured at Depths of 17-30 meters on September 29, 2011

DATA NOT USABLE

Figure A464. Spectral Data Measured at the BRG Location during TP#12, 11:17-11:29, Measured at Depths of 20 meters on September 29, 2011

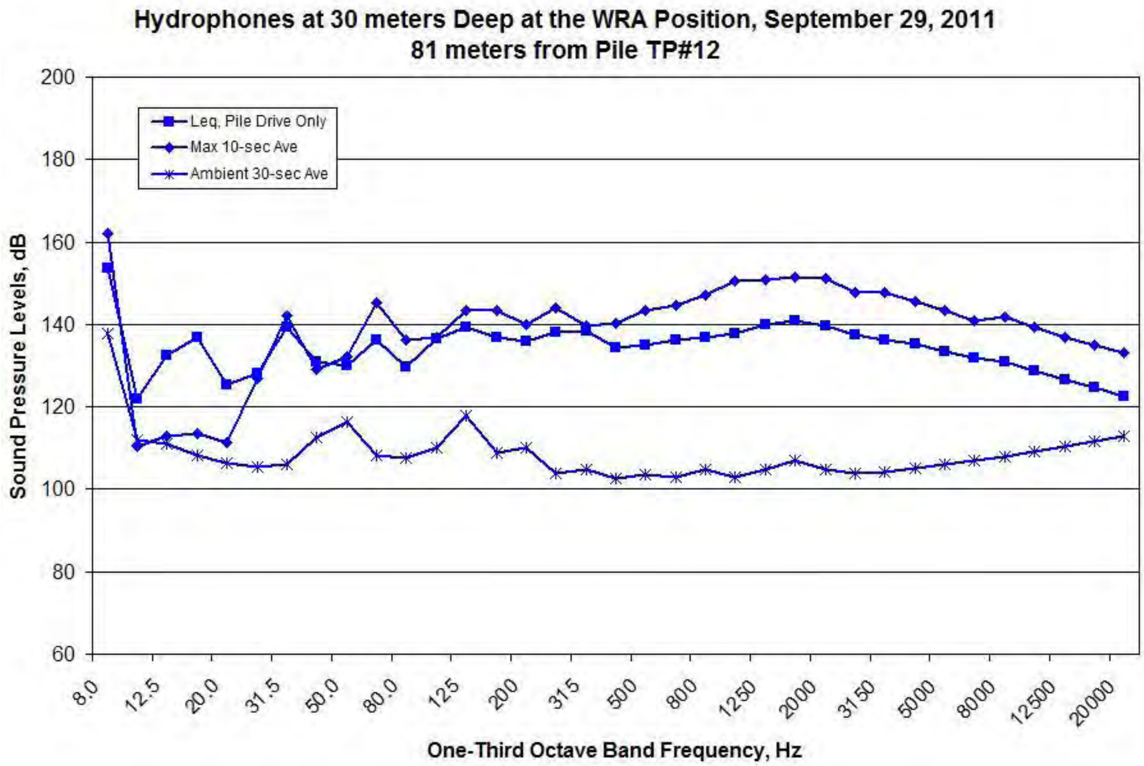

Figure A465. Spectral Data Measured at the WRA Location during TP#12, 11:17-11:29, Measured at Depths of 30 meters on September 29, 2011

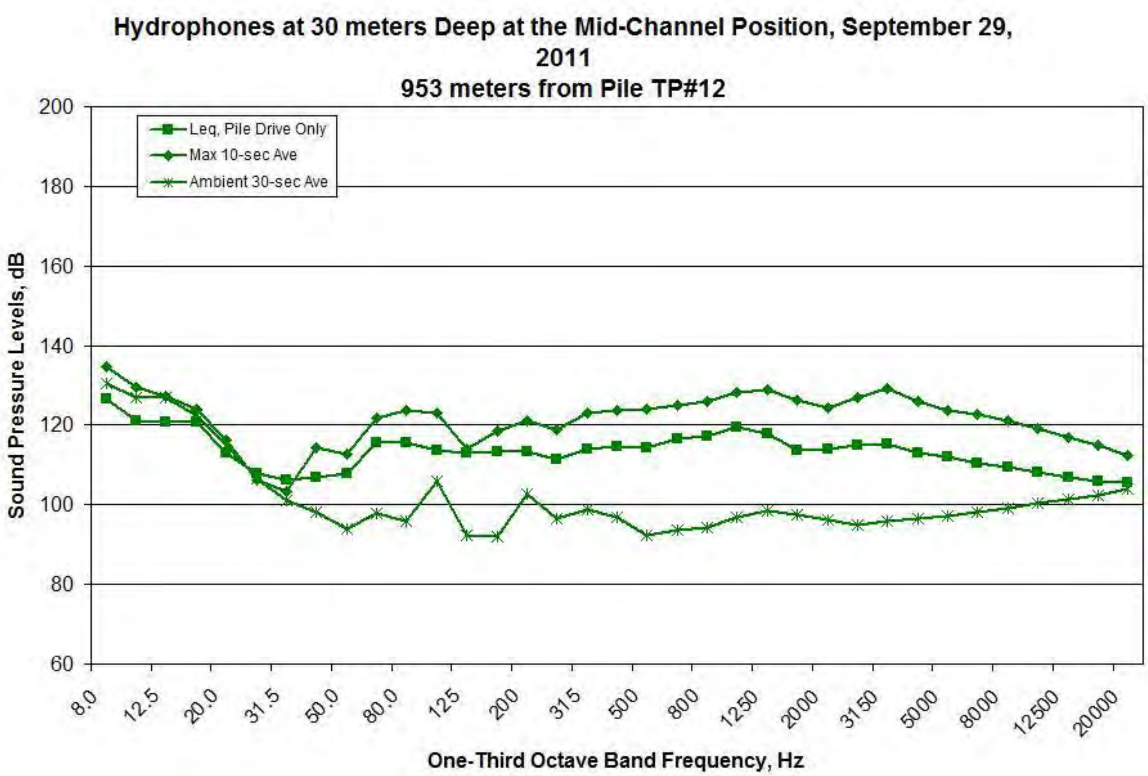

Figure A466. Spectral Data Measured at the MID Location during TP#12, 11:17-11:29, Measured at Depths of 30 meters on September 29, 2011

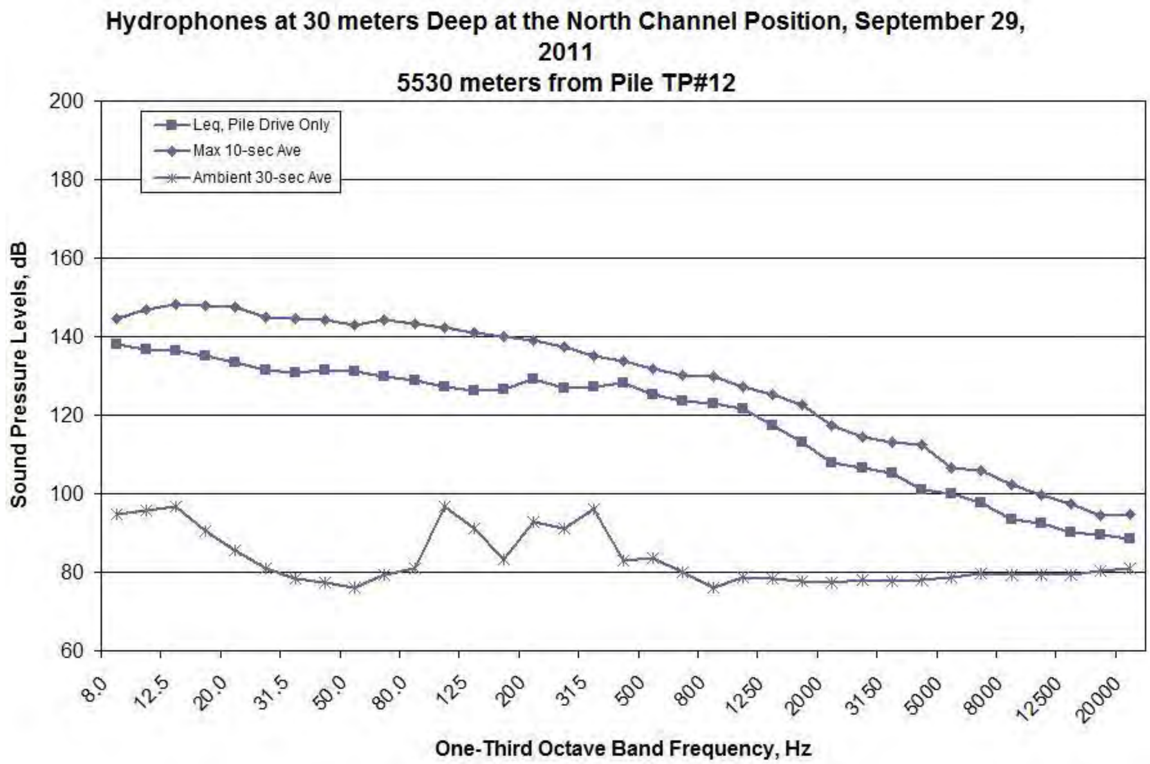

Figure A467. Spectral Data Measured at the NO Location during TP#12, 11:17-11:29, Measured at Depths of 30 meters on September 29, 2011

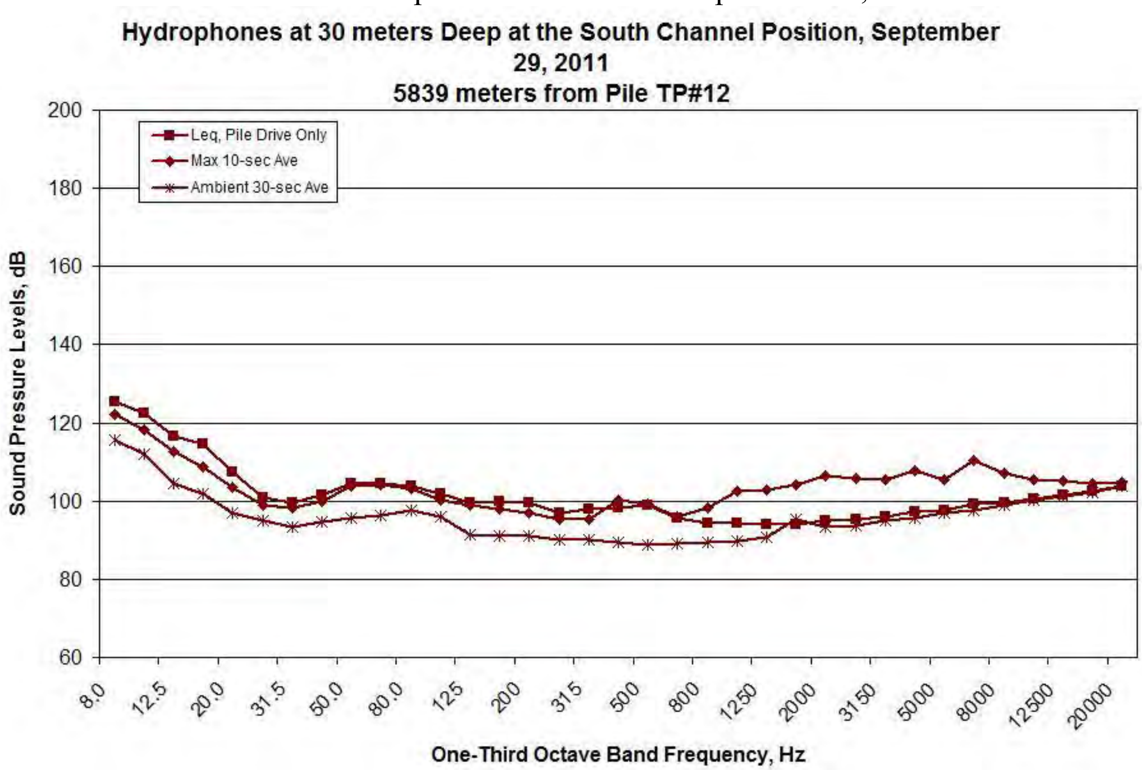

Figure A468. Spectral Data Measured at the SO Location during TP#12, 11:17-11:29, Measured at Depths of 30 meters on September 29, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A469. Spectral Data Measured at the RFT Location during TP#12, 11:17-11:29, Measured at Depths of 17 meters on September 29, 2011

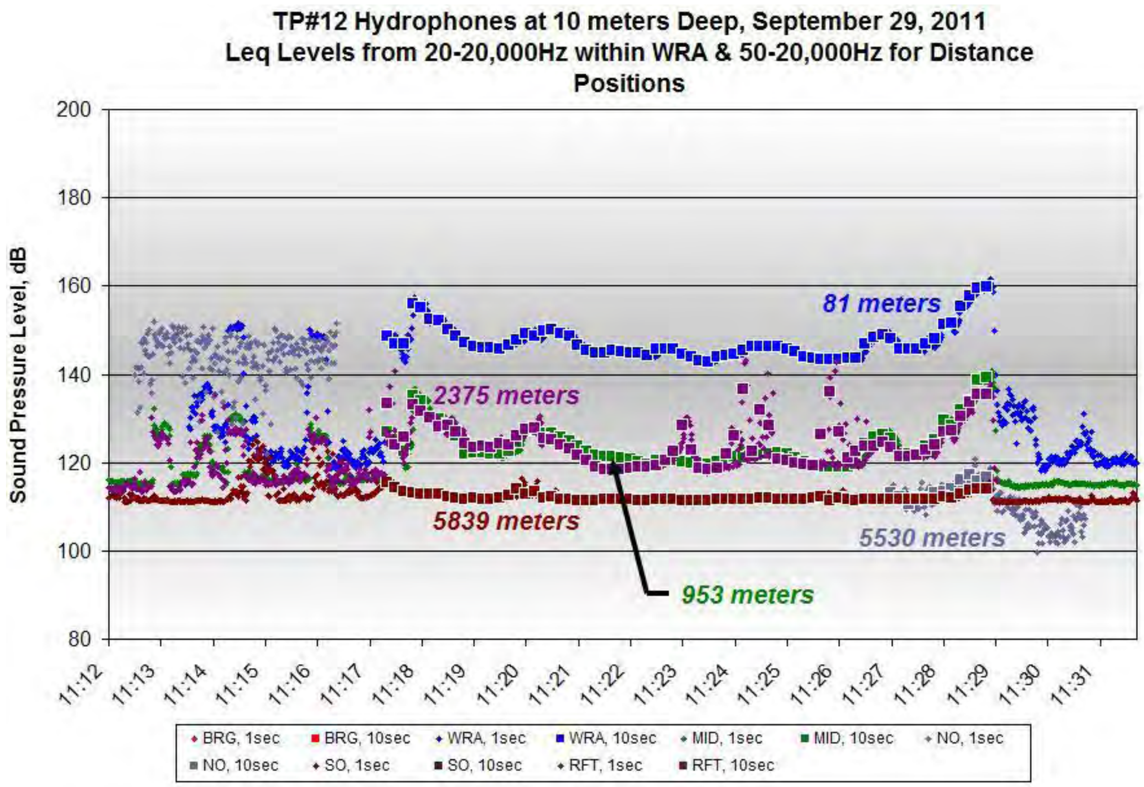

Figure A470. One-second and 10-second Average Data for TP#12, 11:17-11:29, Measured at Depths of 10 meters on September 29, 2011

DATA NOT USABLE

Figure A471. Spectral Data Measured at the BRG Location during TP#12, 11:17-11:29, Measured at Depths of 10 meters on September 29, 2011

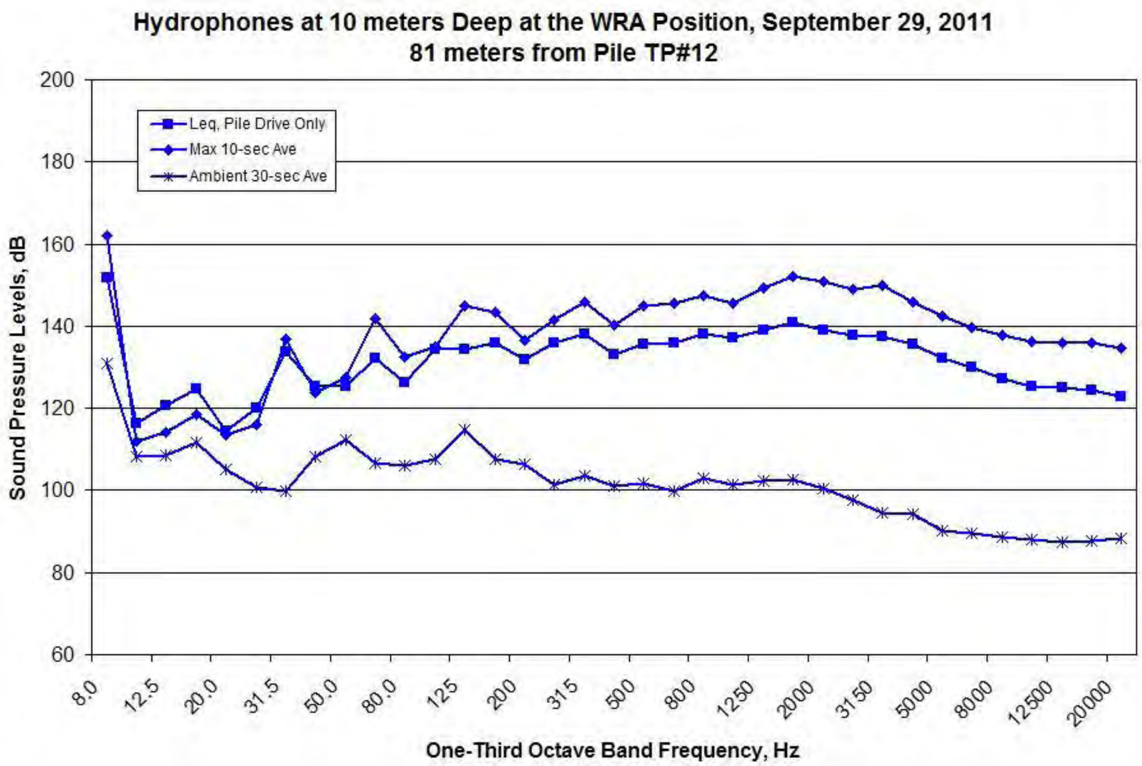

Figure A472. Spectral Data Measured at the WRA Location during TP#12, 11:17-11:29, Measured at Depths of 10 meters on September 29, 2011

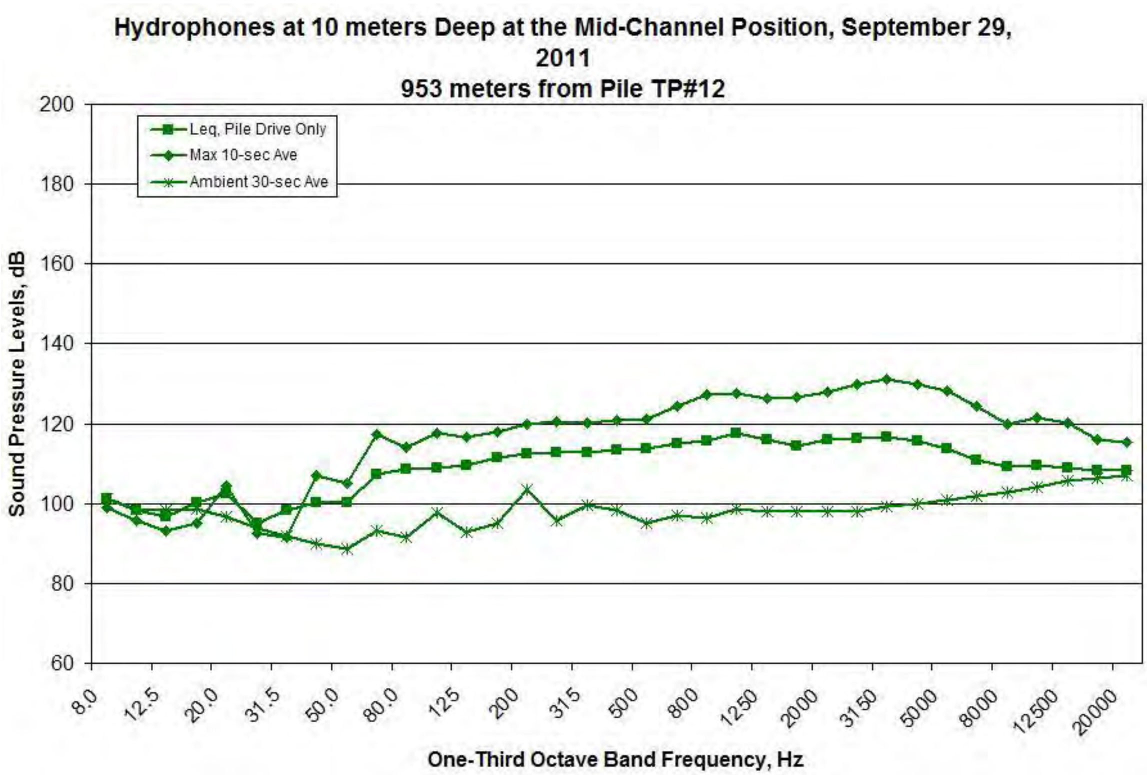

Figure A473. Spectral Data Measured at the MID Location during TP#12, 11:17-11:29, Measured at Depths of 10 meters on September 29, 2011

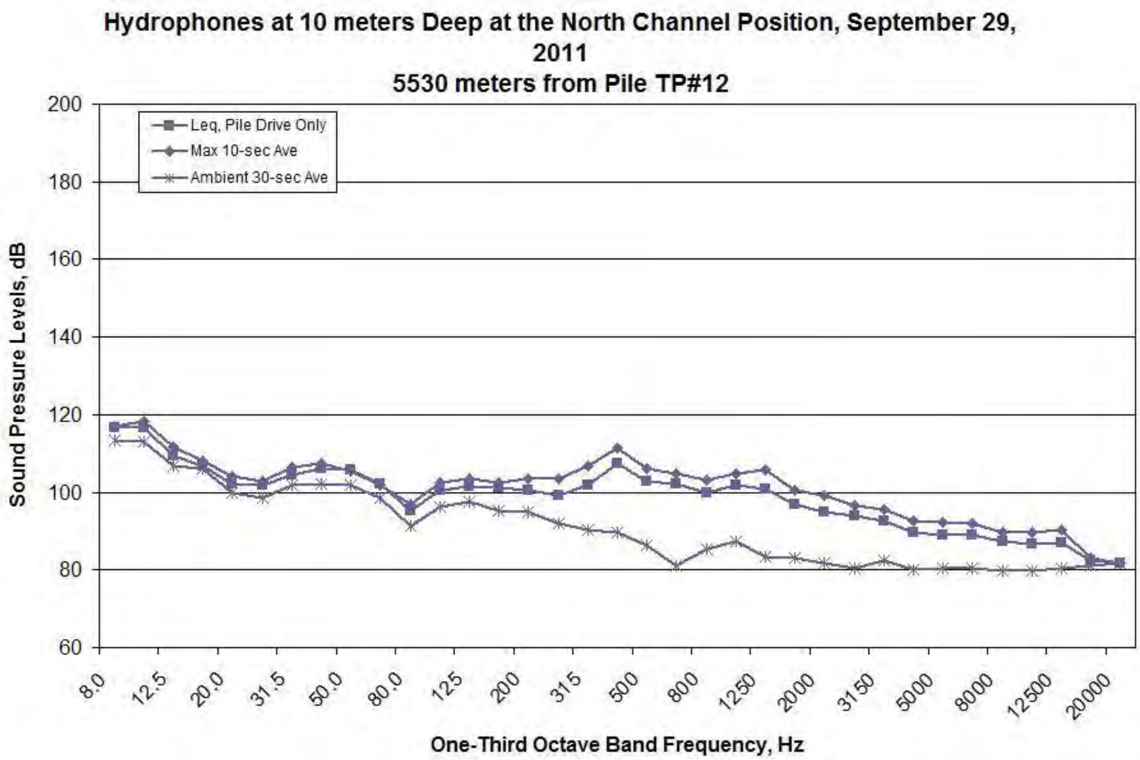

Figure A474. Spectral Data Measured at the NO Location during TP#12, 11:17-11:29, Measured at Depths of 10 meters on September 29, 2011

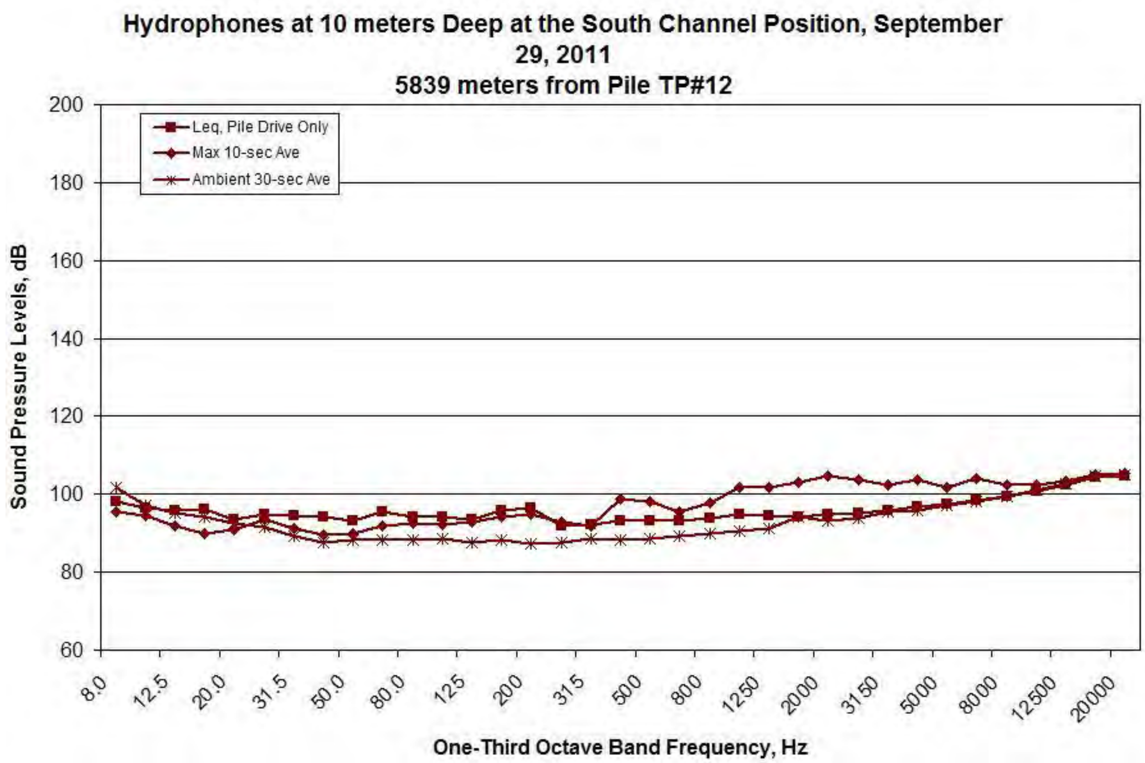

Figure A475. Spectral Data Measured at the SO Location during TP#12, 11:17-11:29, Measured at Depths of 10 meters on September 29, 2011

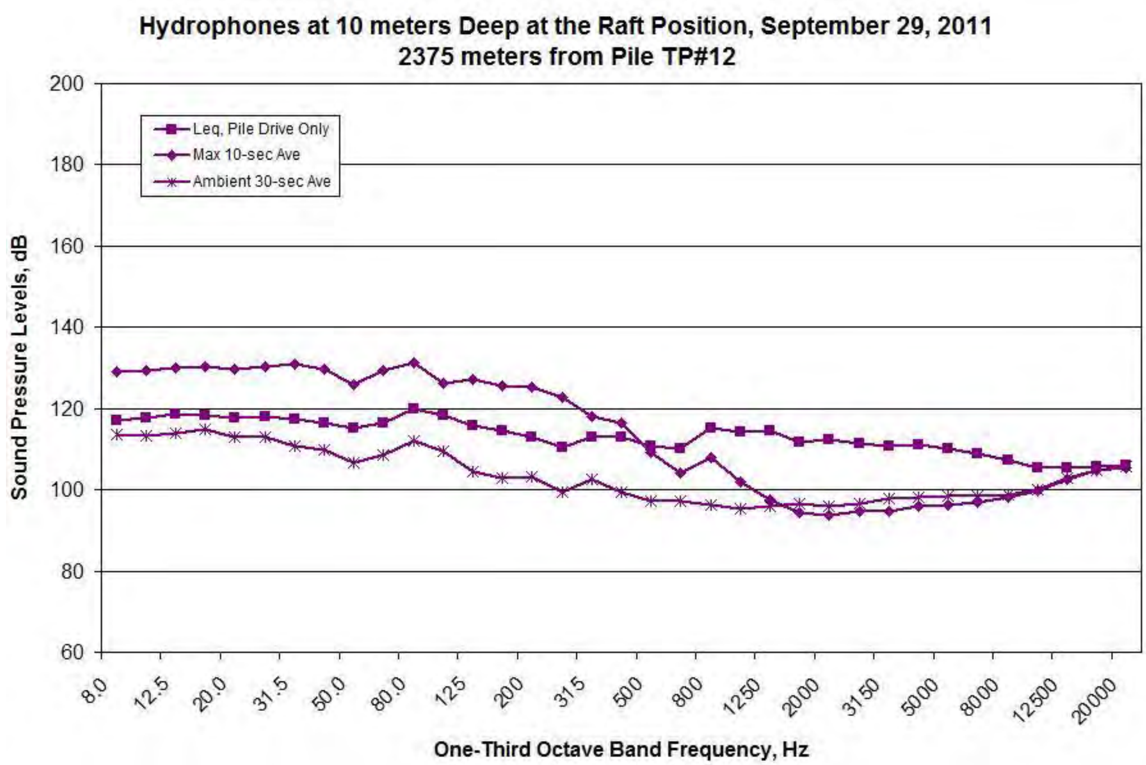

Figure A476. Spectral Data Measured at the RFT Location during TP#12, 11:17-11:29, Measured at Depths of 10 meters on September 29, 2011

TP#9 RP#2 (Vibratory Installation)

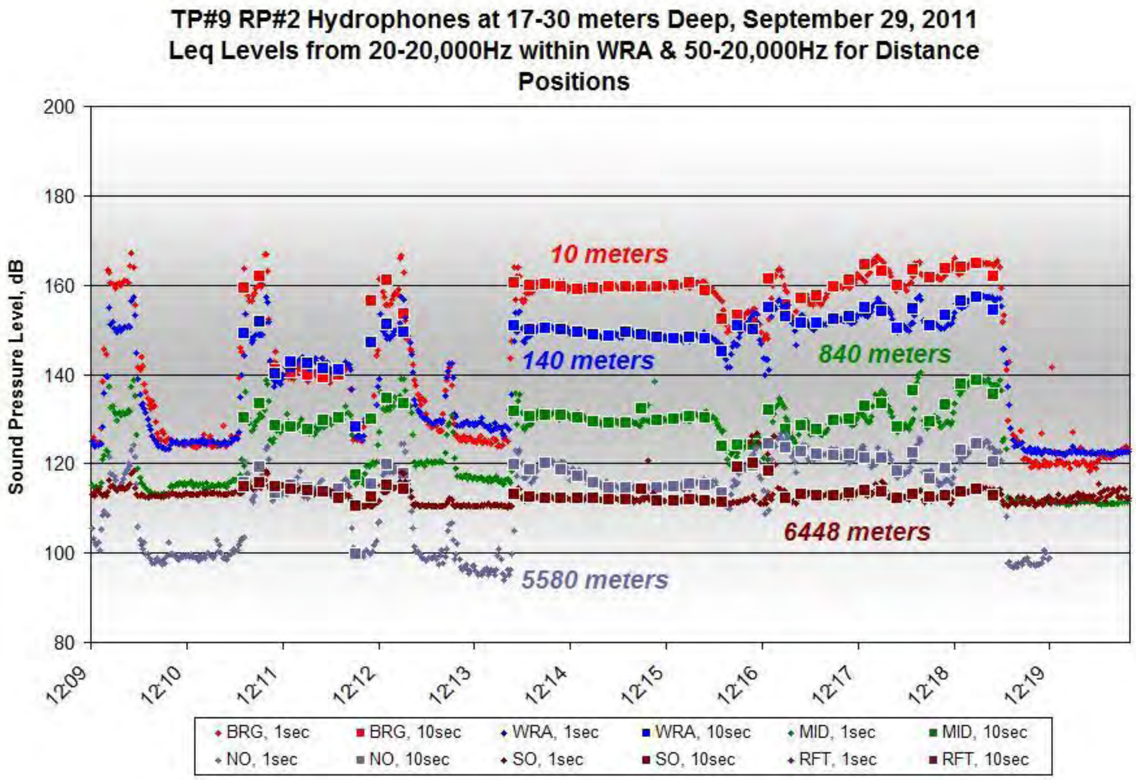

Figure A477. One-second and 10-second Average Data for TP#9 RP#2, 12:12-12:18, Measured at Depths of 17-30 meters on September 29, 2011

NO SPECTRA DATA AVAILABLE

Figure A478. Spectral Data Measured at the BRG Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 20 meters on September 29, 2011

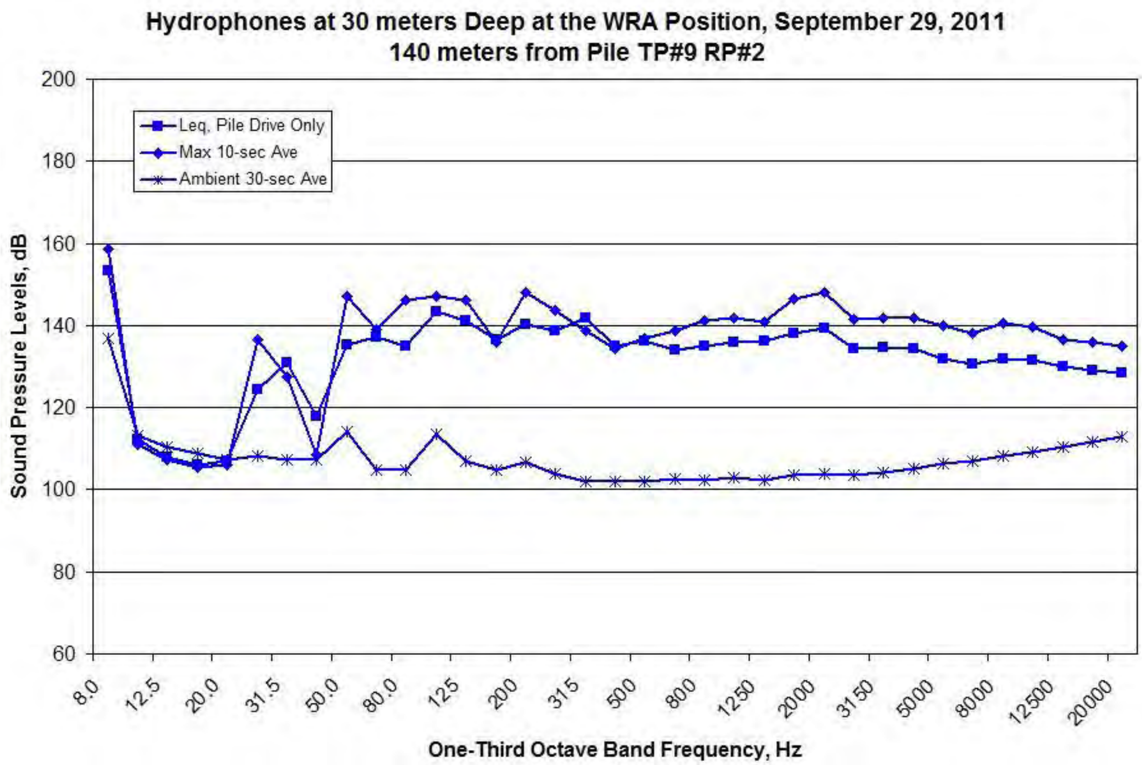

Figure A479. Spectral Data Measured at the WRA Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 30 meters on September 29, 2011

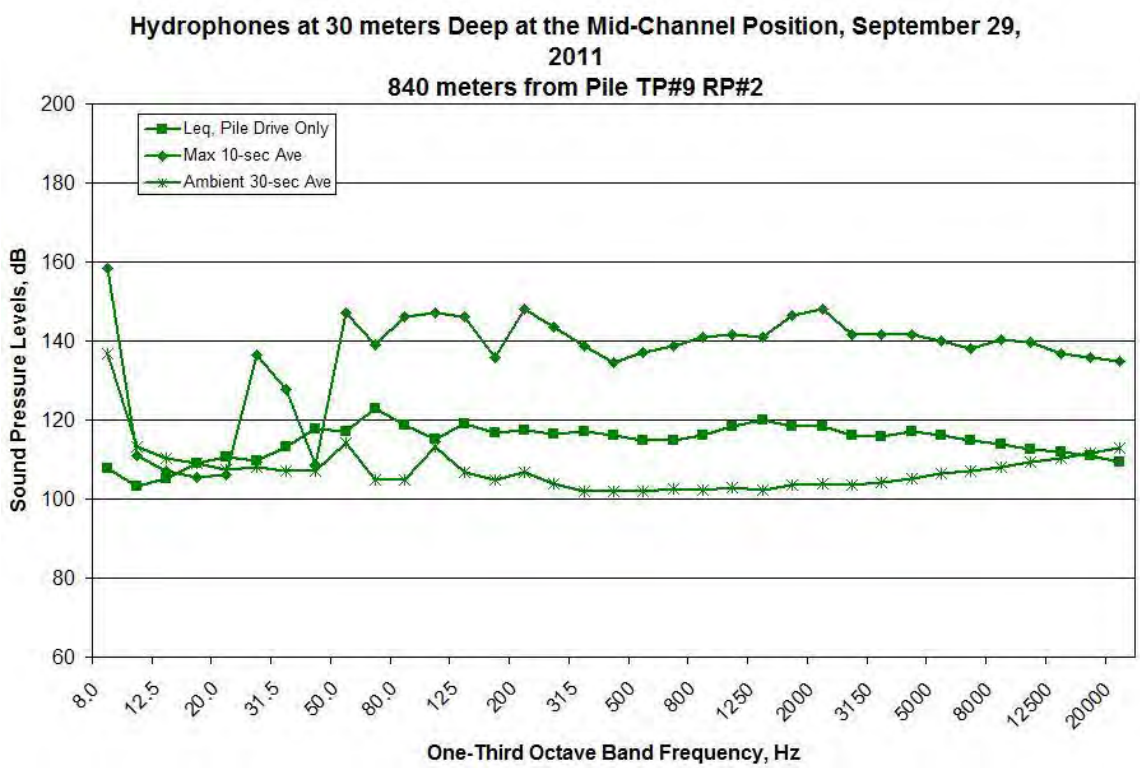

Figure A480. Spectral Data Measured at the MID Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 30 meters on September 29, 2011

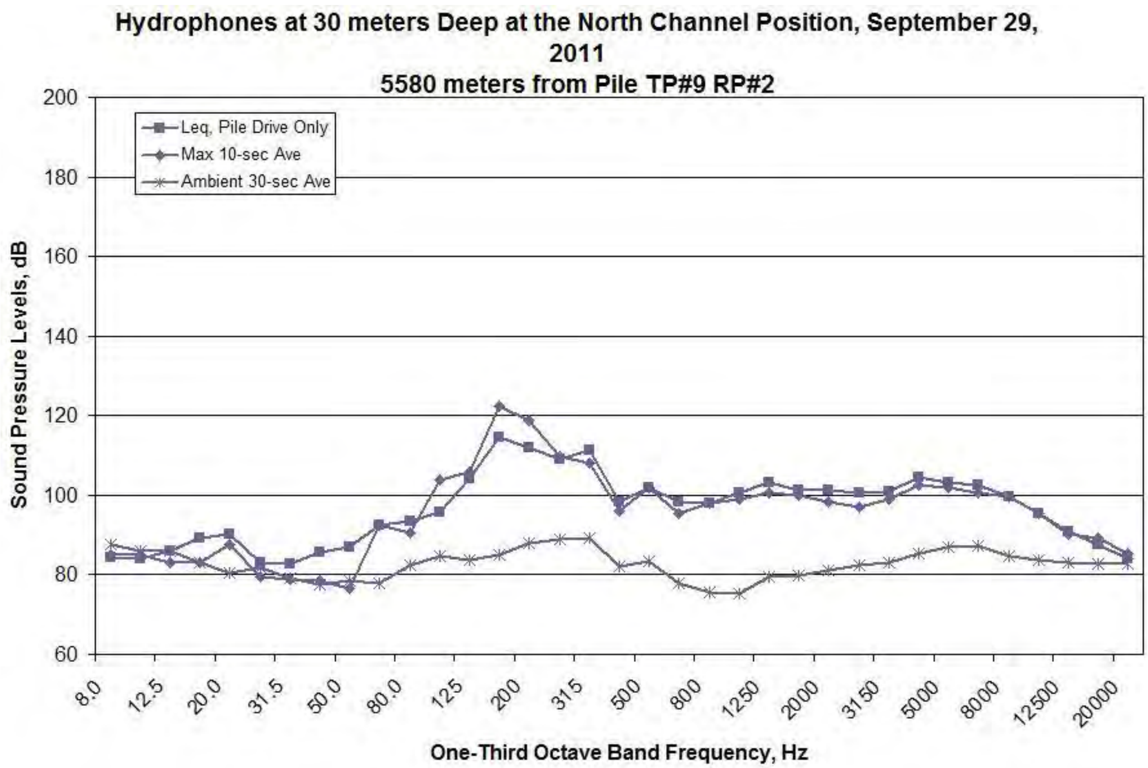

Figure A481. Spectral Data Measured at the NO Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 30 meters on September 29, 2011

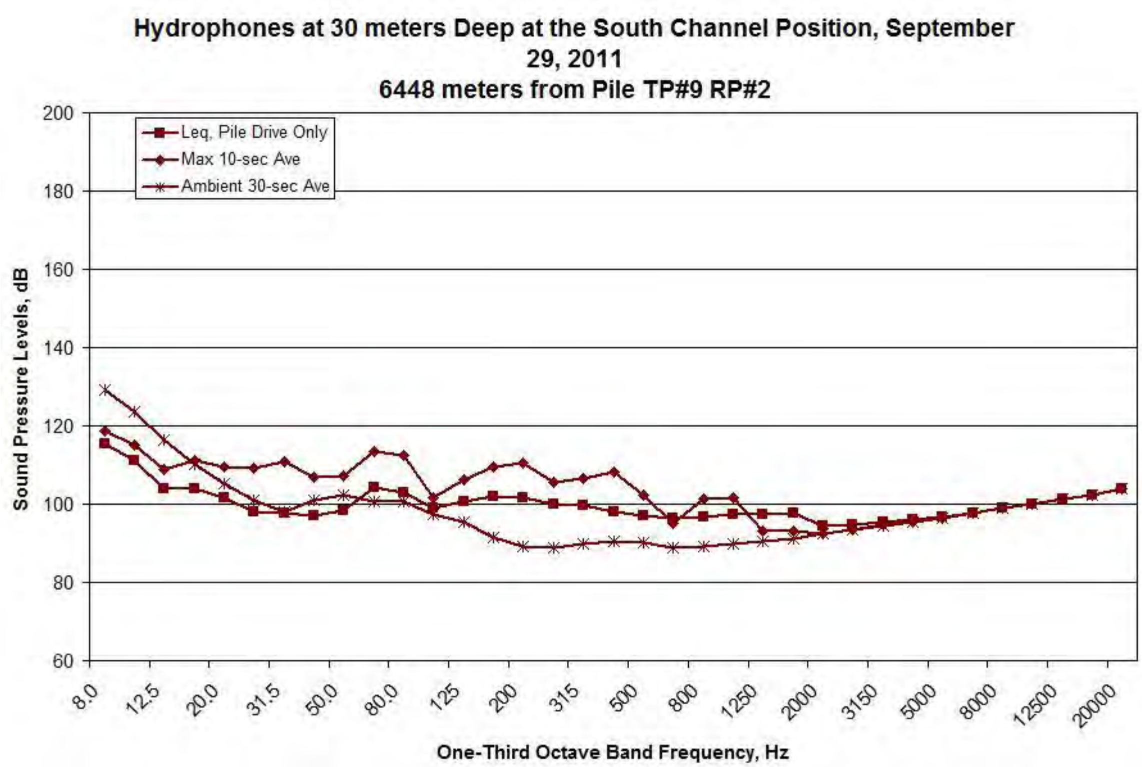

Figure A482. Spectral Data Measured at the SO Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 30 meters on September 29, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A482. Spectral Data Measured at the RFT Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 17 meters on September 29, 2011

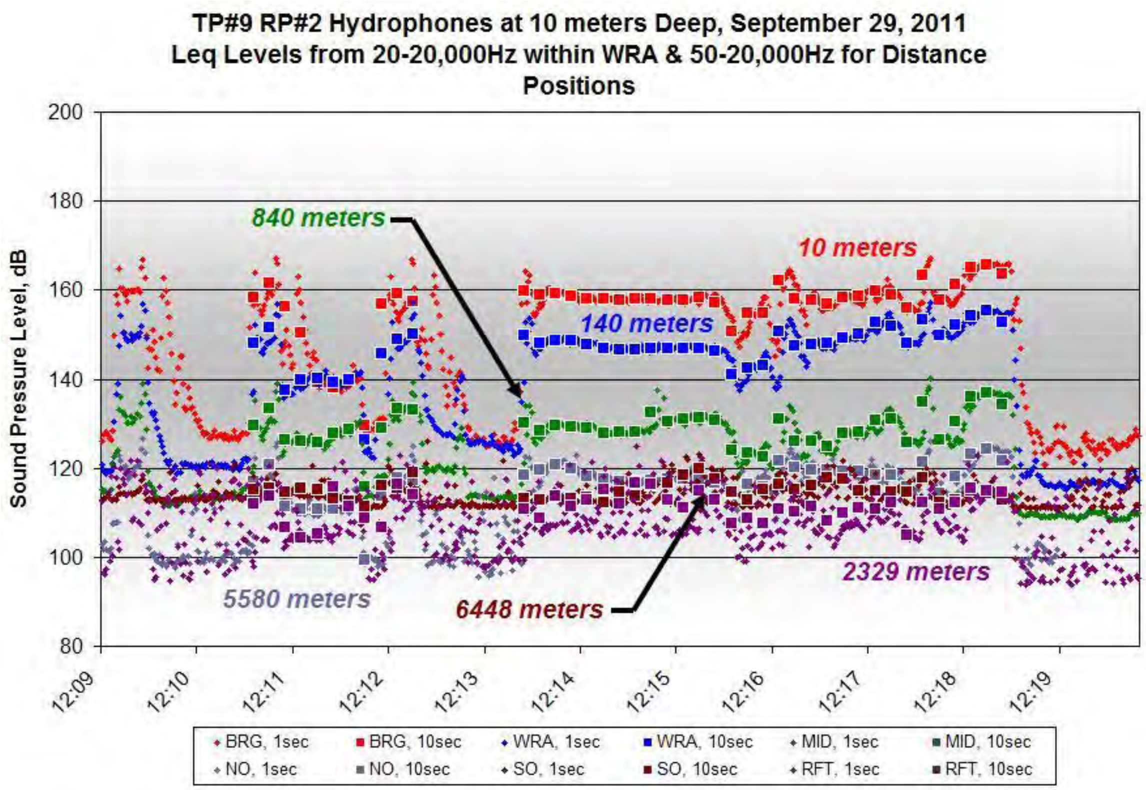

Figure A483. One-second and 10-second Average Data for TP#9 RP#2, 12:12-12:18, Measured at Depths of 10 meters on September 29, 2011

NO SPECTRA DATA AVAILABLE

Figure A484. Spectral Data Measured at the BRG Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 10 meters on September 29, 2011

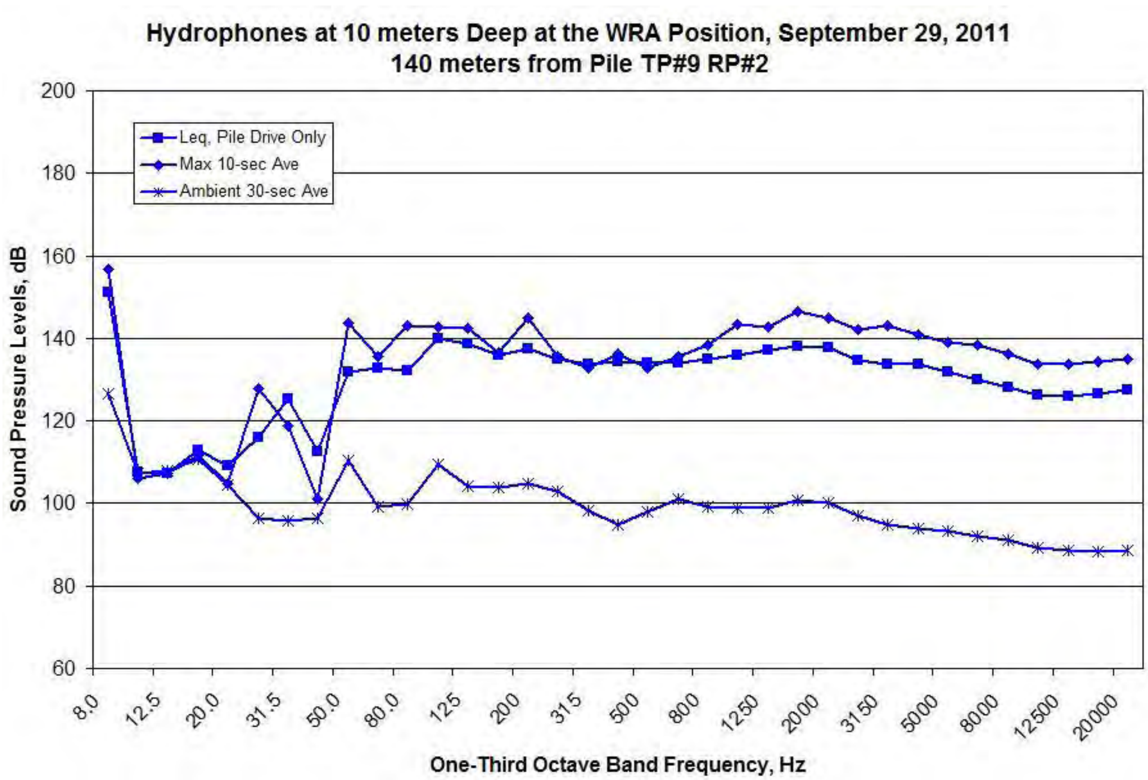

Figure A485. Spectral Data Measured at the WRA Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 10 meters on September 29, 2011

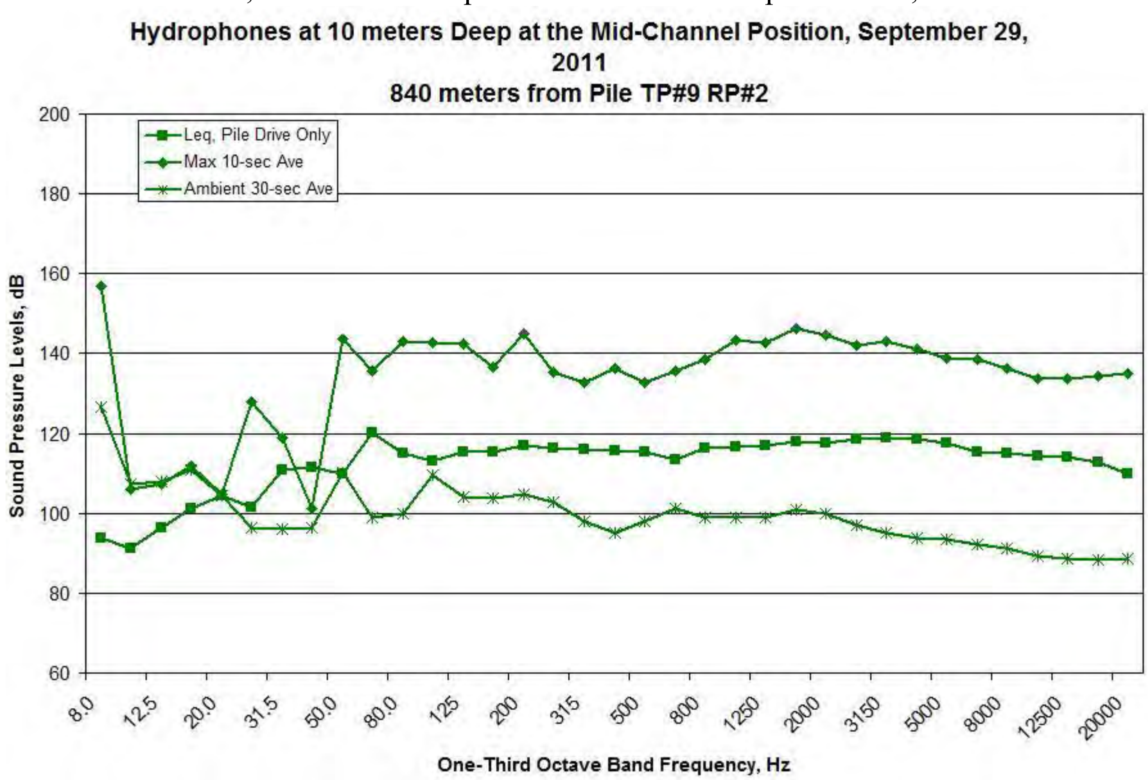

Figure A486. Spectral Data Measured at the MID Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 10 meters on September 29, 2011

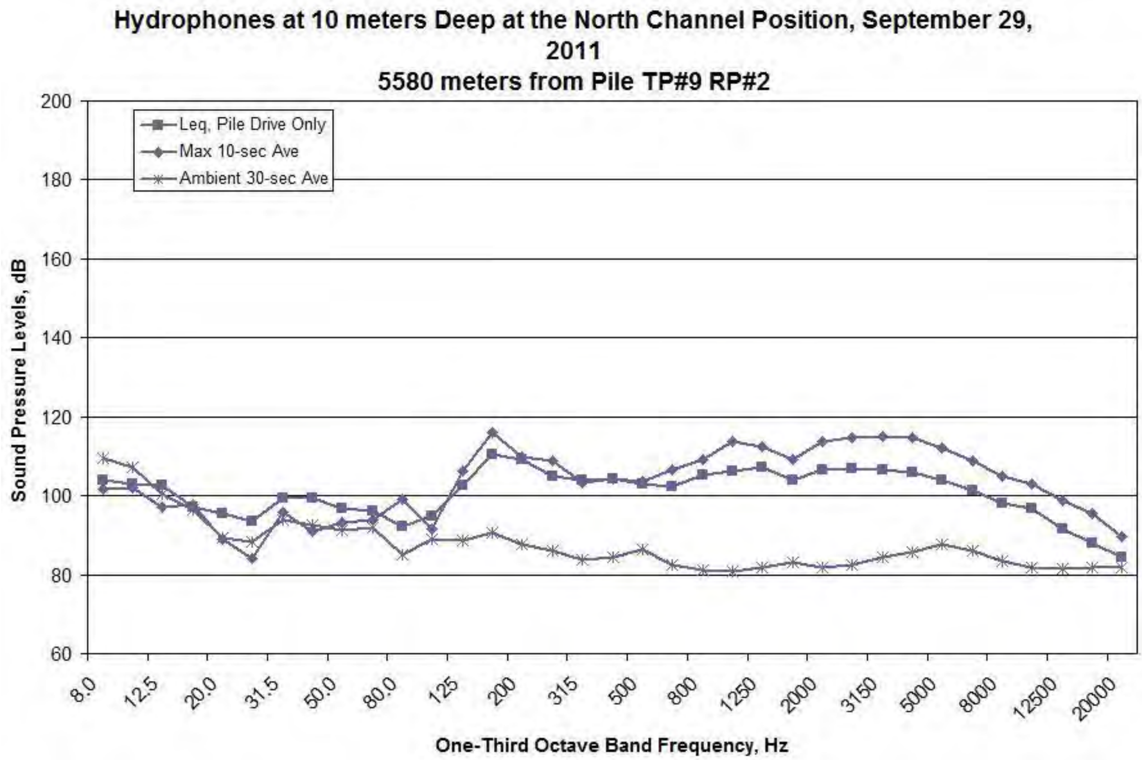

Figure A487. Spectral Data Measured at the NO Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 10 meters on September 29, 2011

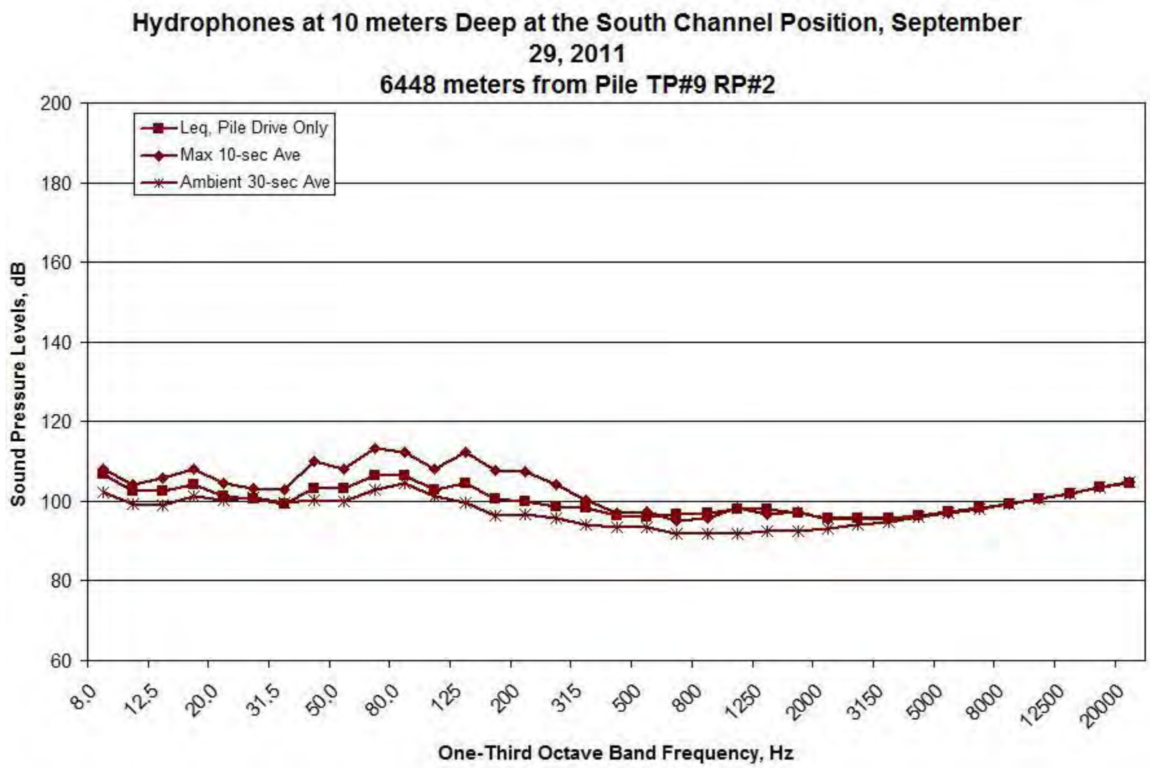

Figure A488. Spectral Data Measured at the SO Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 10 meters on September 29, 2011

TOO NOISY

Figure A489. Spectral Data Measured at the RFT Location during TP#9 RP#2, 12:12-12:18, Measured at Depths of 10 meters on September 29, 2011

TP#11 (Vibratory Removal)

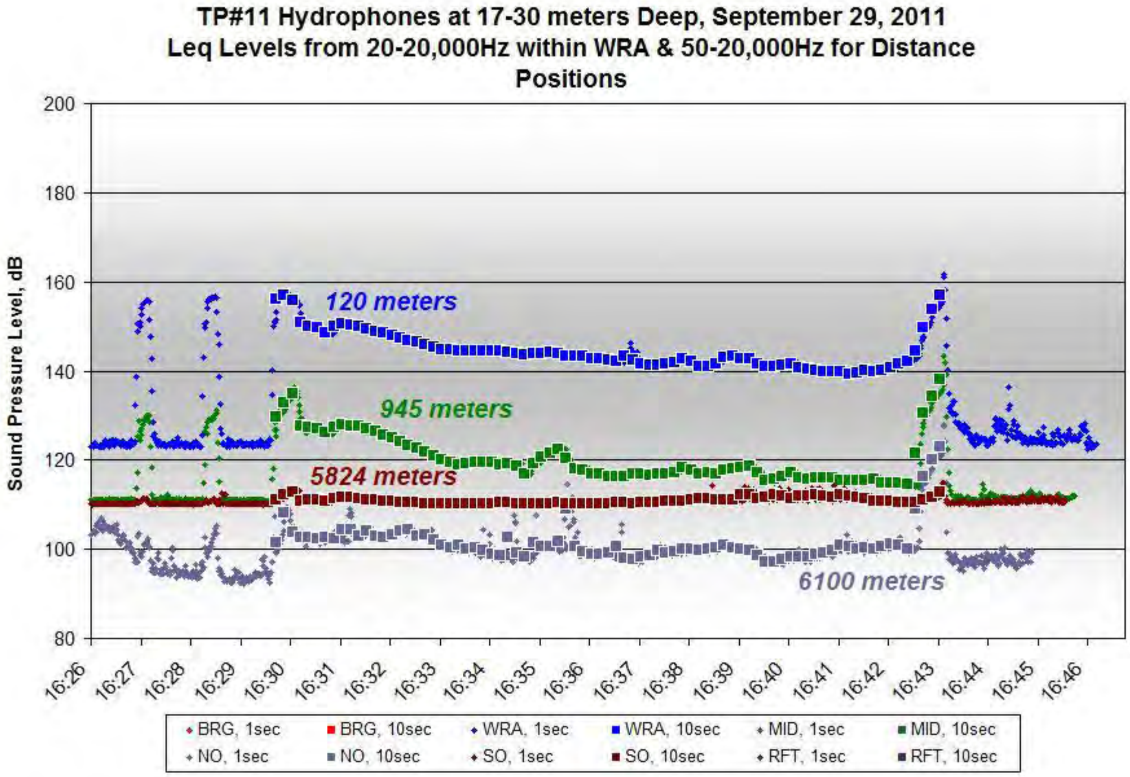

Figure A490. One-second and 10-second Average Data for TP#11, 16:29-16:43, Measured at Depths of 17-30 meters on September 29, 2011

DATA NOT USABLE

Figure A491. Spectral Data Measured at the BRG Location during TP#11, 16:29-16:43, Measured at Depths of 20 meters on September 29, 2011

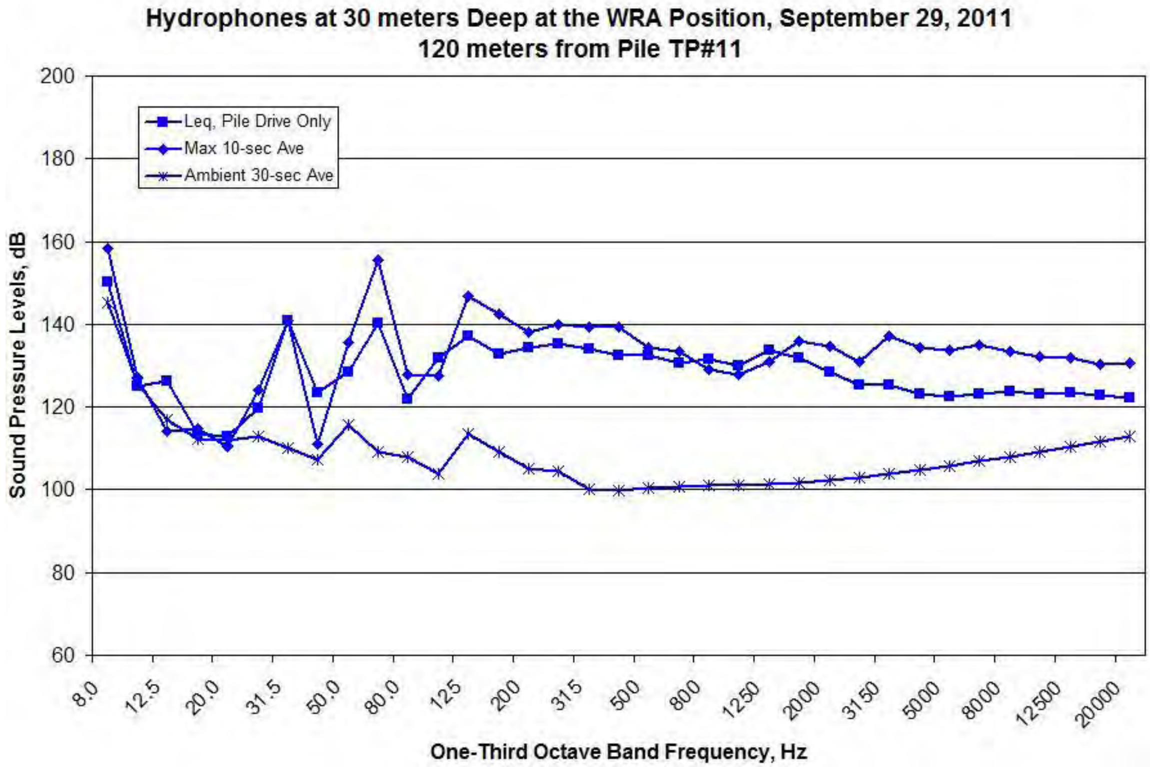

Figure A492. Spectral Data Measured at the WRA Location during TP#11, 16:29-16:43, Measured at Depths of 30 meters on September 29, 2011

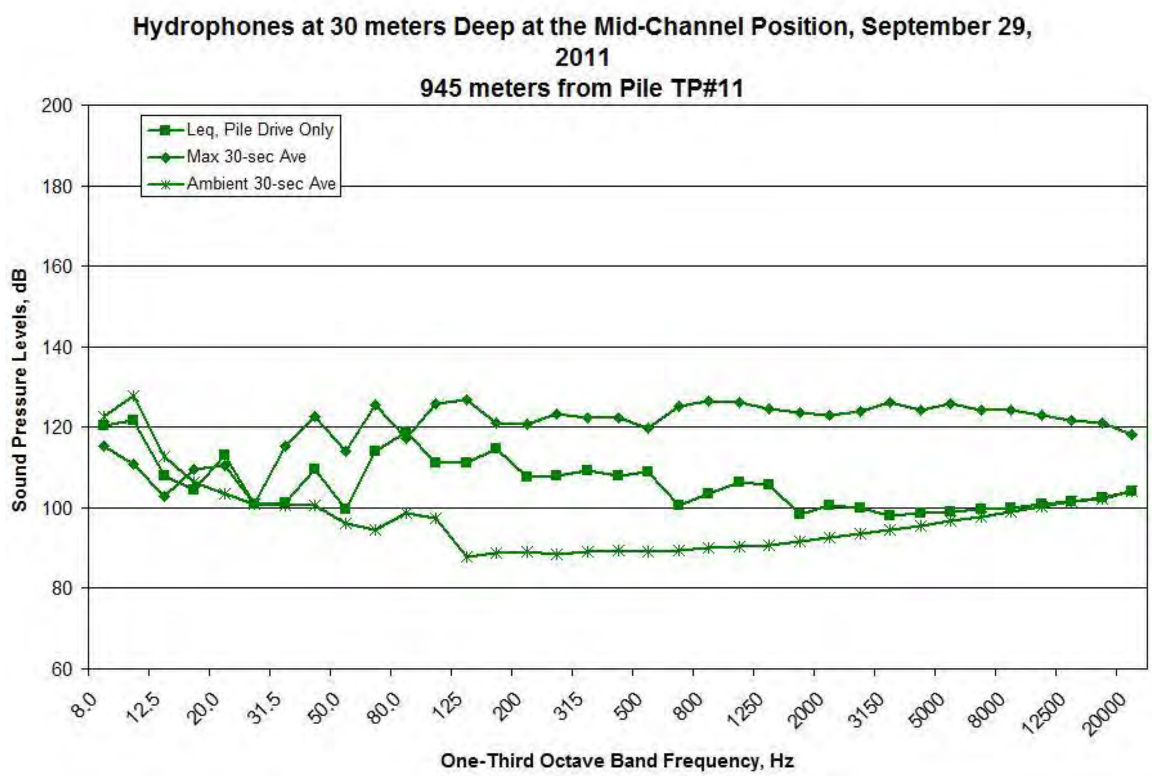

Figure A493. Spectral Data Measured at the MID Location during TP#11, 16:29-16:43, Measured at Depths of 30 meters on September 29, 2011

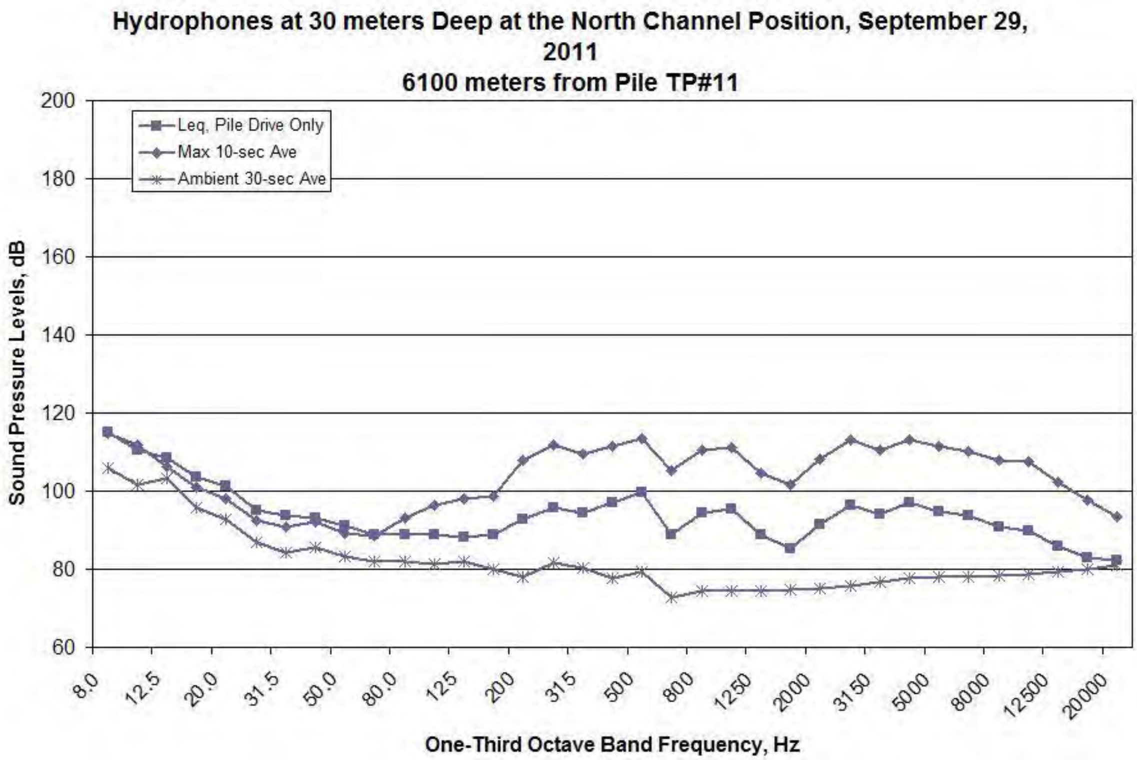

Figure A494. Spectral Data Measured at the NO Location during TP#11, 16:29-16:43, Measured at Depths of 30 meters on September 29, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A495. Spectral Data Measured at the SO Location during TP#11, 16:29-16:43, Measured at Depths of 30 meters on September 29, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A496. Spectral Data Measured at the RFT Location during TP#11, 16:29-16:43, Measured at Depths of 17 meters on September 29, 2011

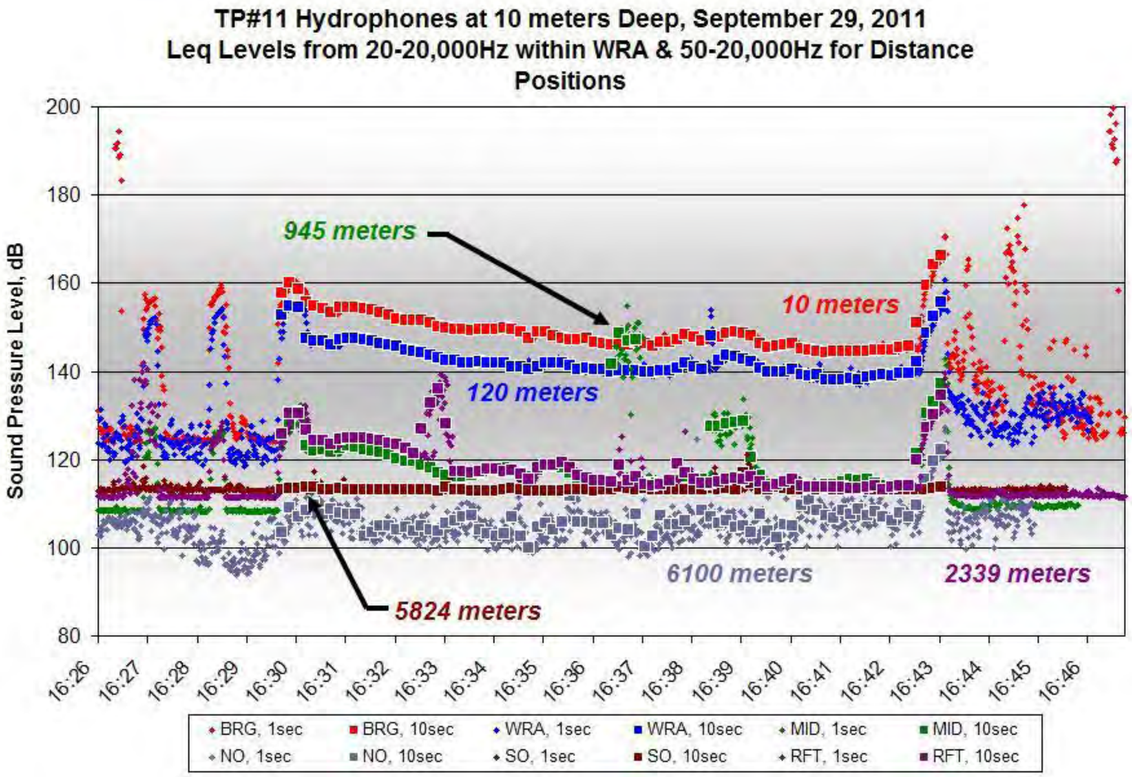

Figure A497. One-second and 10-second Average Data for TP#11, 16:29-16:43, Measured at Depths of 10 meters on September 29, 2011

NO SPECTRA DATA AVAILABLE

Figure A498. Spectral Data Measured at the BRG Location during TP#11, 16:29-16:43, Measured at Depths of 10 meters on September 29, 2011

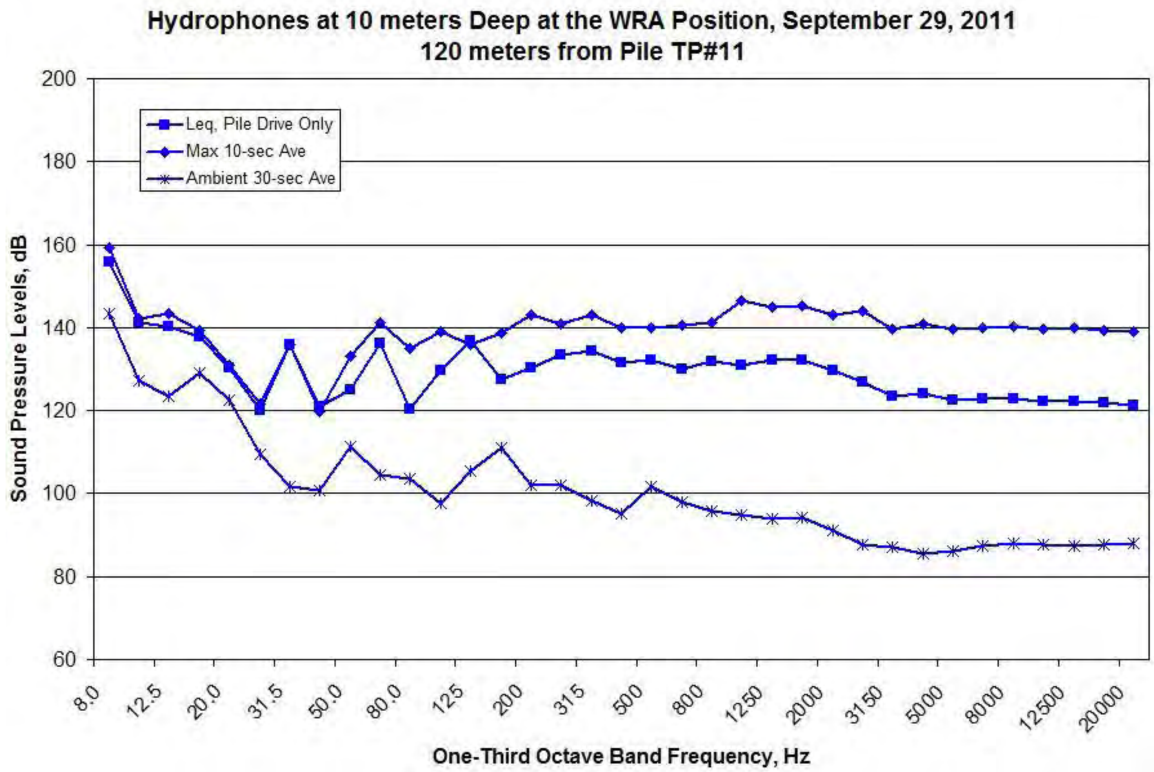

Figure A499. Spectral Data Measured at the WRA Location during TP#11, 16:29-16:43, Measured at Depths of 10 meters on September 29, 2011

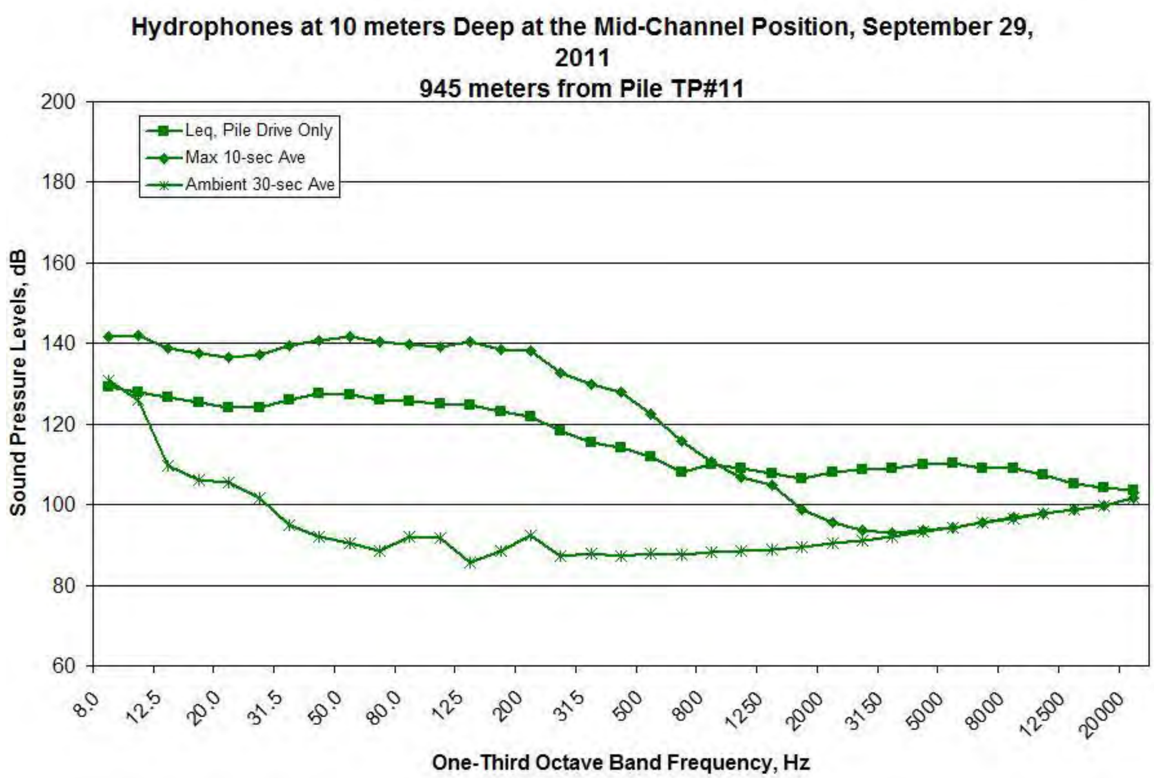

Figure A500. Spectral Data Measured at the MID Location during TP#11, 16:29-16:43, Measured at Depths of 10 meters on September 29, 2011

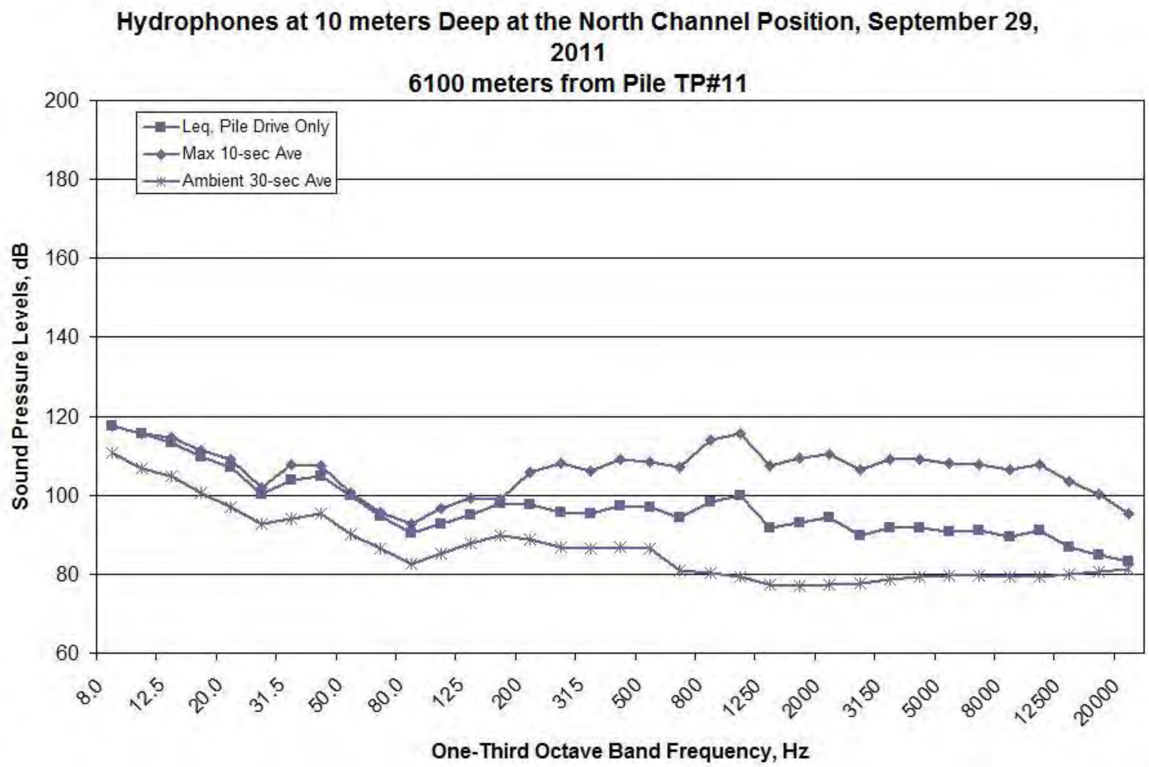

Figure A501. Spectral Data Measured at the NO Location during TP#11, 16:29-16:43, Measured at Depths of 10 meters on September 29, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A502. Spectral Data Measured at the SO Location during TP#11, 16:29-16:43, Measured at Depths of 10 meters on September 29, 2011

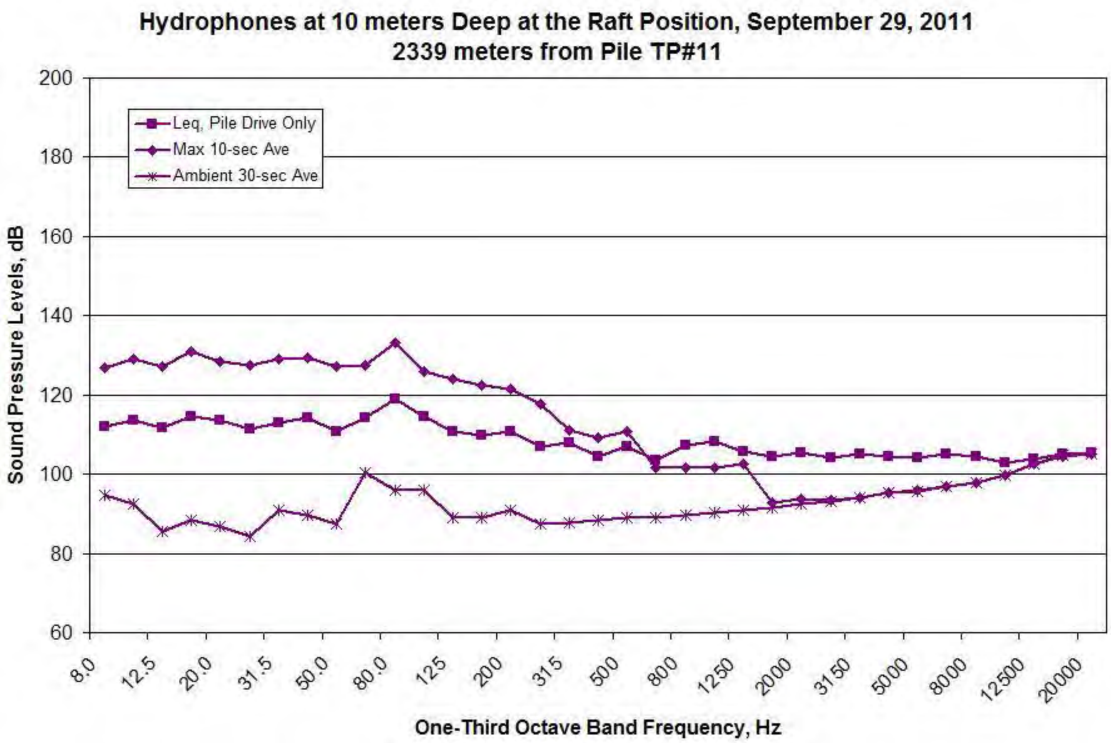

Figure A503. Spectral Data Measured at the RFT Location during TP#11, 16:29-16:43, Measured at Depths of 10 meters on September 29, 2011

TP#9 MP#1 (Vibratory Installation)

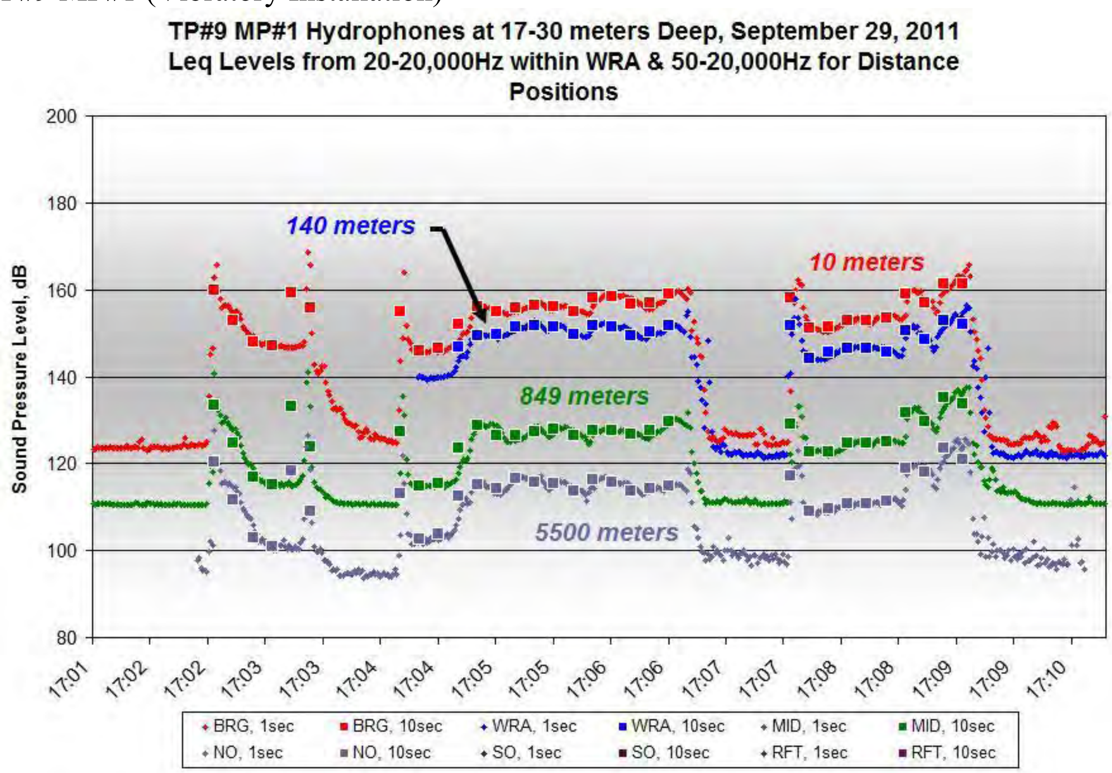

Figure A504. One-second and 10-second Average Data for TP#9 MP#1, 17:02-17:09, Measured at Depths of 17-30 meters on September 29, 2011

NO SPECTRA DATA AVAILABLE

Figure A505. Spectral Data Measured at the BRG Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 20 meters on September 29, 2011

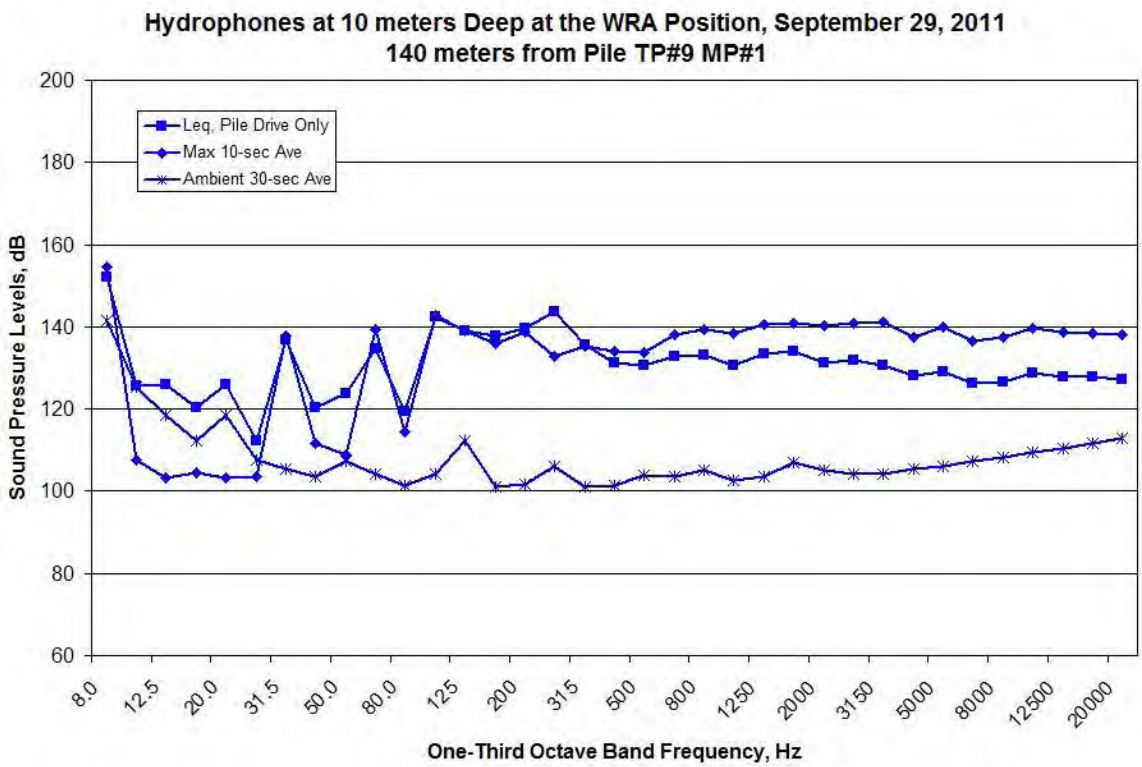

Figure A506. Spectral Data Measured at the WRA Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 30 meters on September 29, 2011

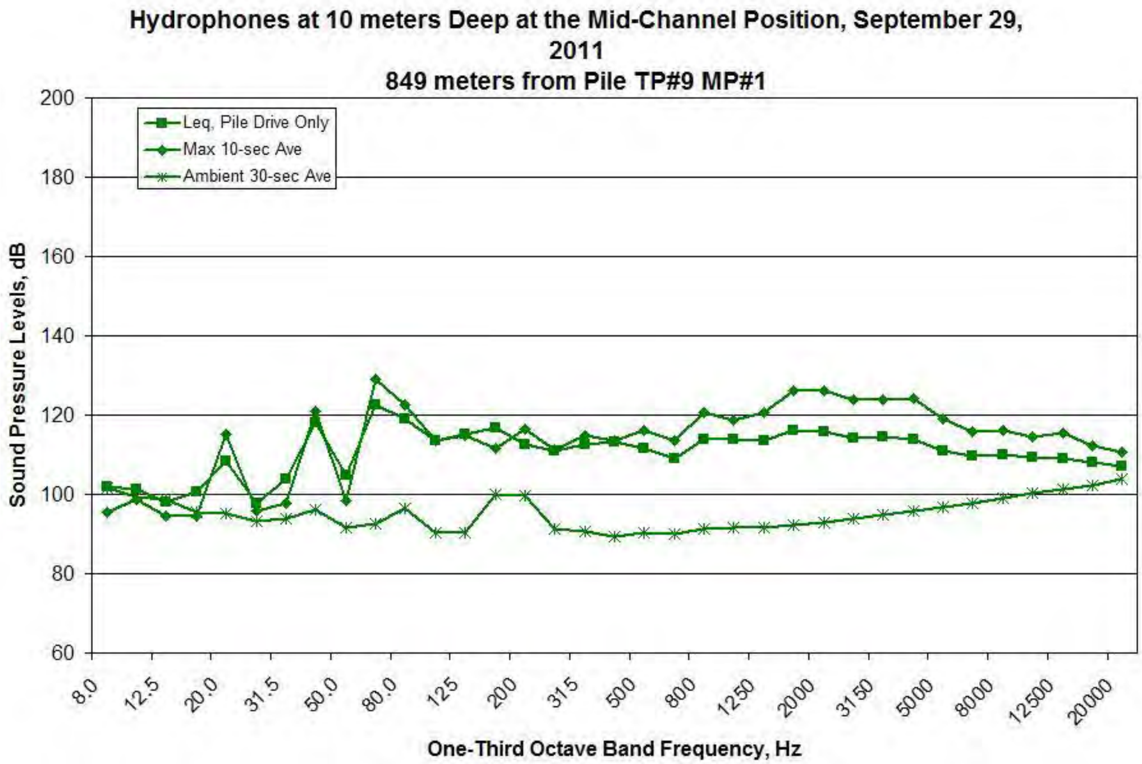

Figure A507. Spectral Data Measured at the MID Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 30 meters on September 29, 2011

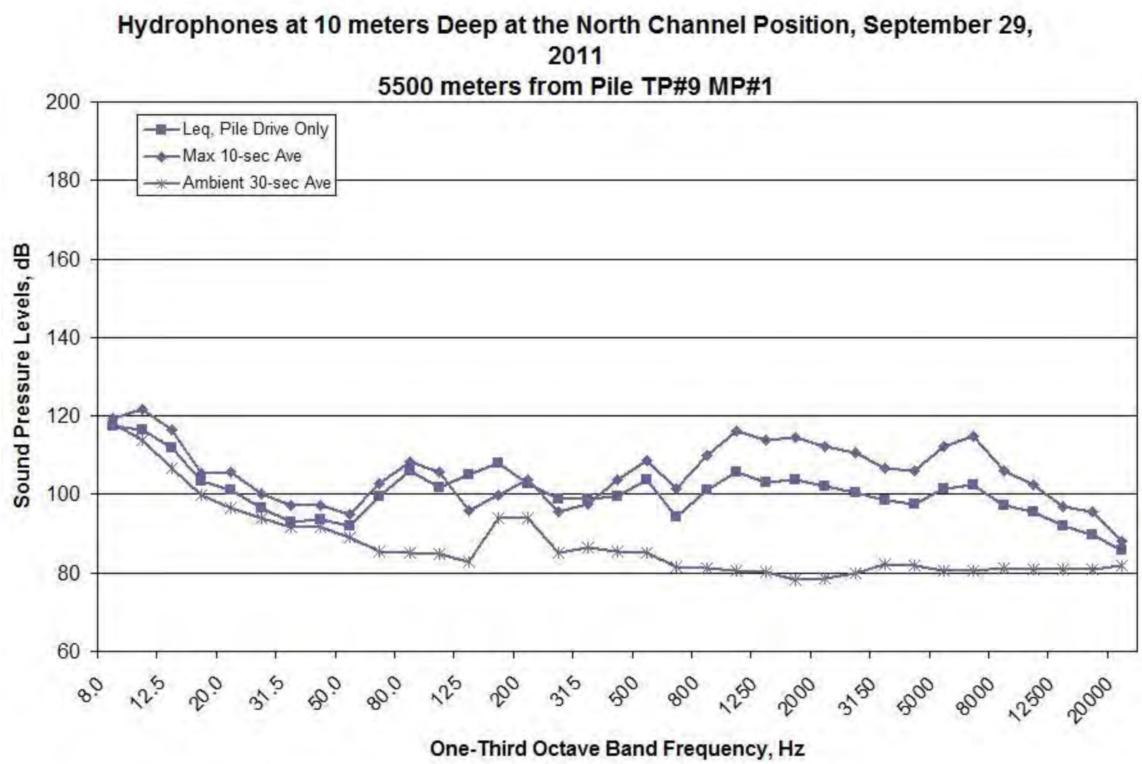

Figure A508. Spectral Data Measured at the NO Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 30 meters on September 29, 2011

NO DATA AVAILABLE – RECORDER TURNED OFF

Figure A509. Spectral Data Measured at the SO Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 30 meters on September 29, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A510. Spectral Data Measured at the RFT Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 17 meters on September 29, 2011

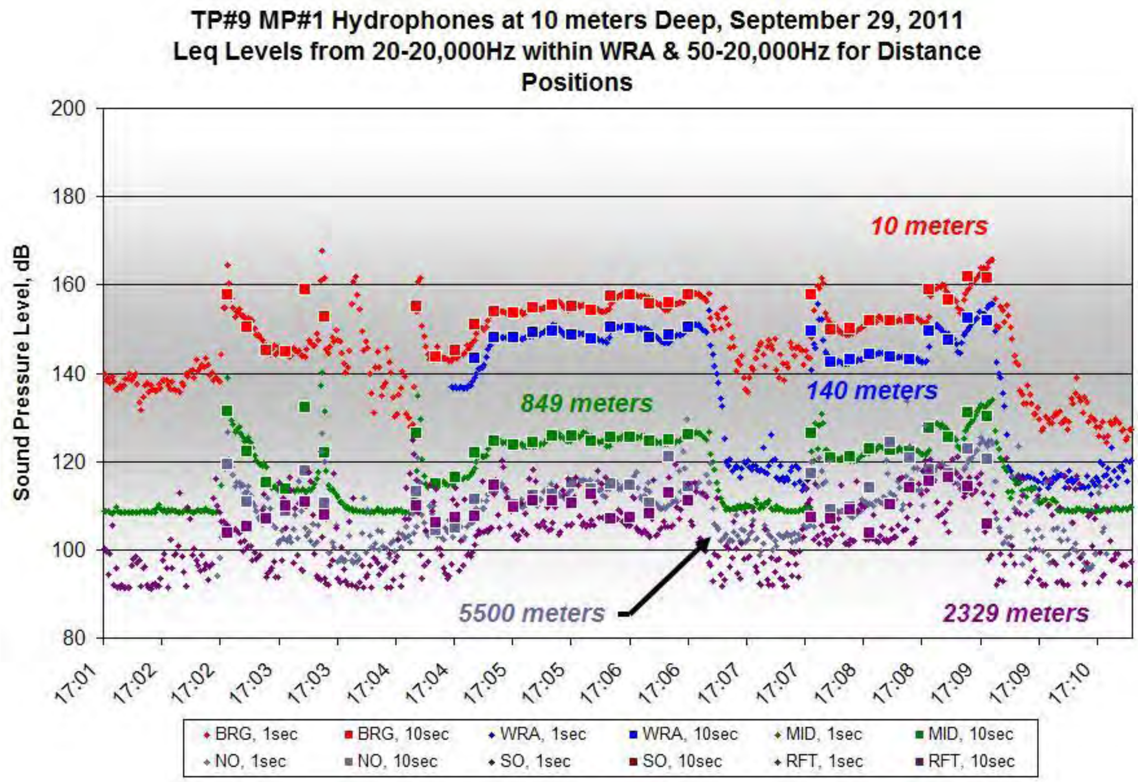

Figure A511. One-second and 10-second Average Data for TP#9 MP#1, 17:02-17:09, Measured at Depths of 10 meters on September 29, 2011

NO SPECTRA DATA AVAILABLE

Figure A512. Spectral Data Measured at the BRG Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 10 meters on September 29, 2011

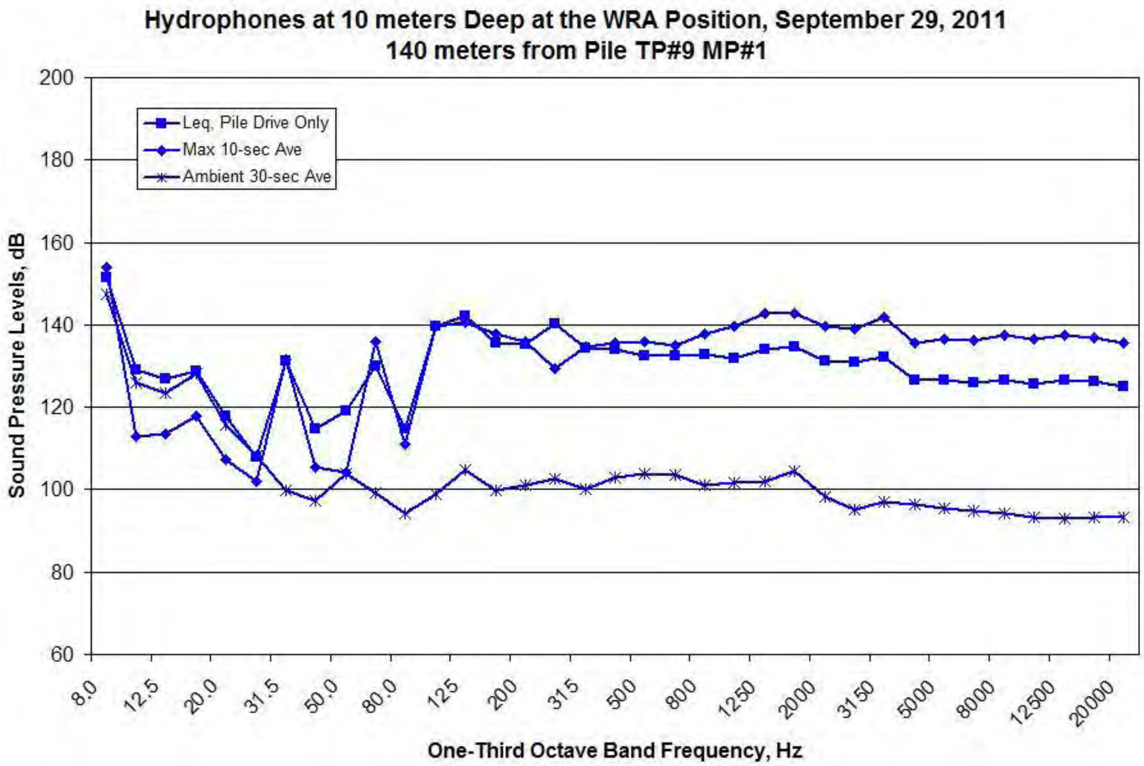

Figure A513. Spectral Data Measured at the WRA Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 10 meters on September 29, 2011

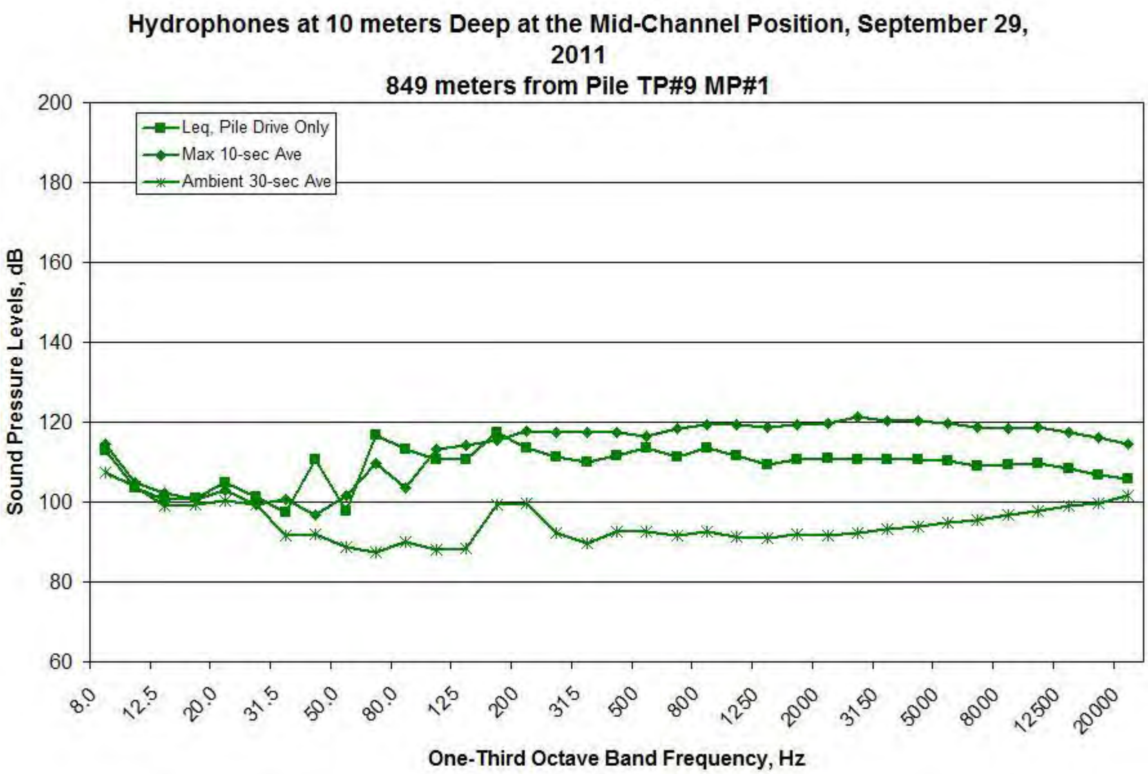

Figure A514. Spectral Data Measured at the MID Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 10 meters on September 29, 2011

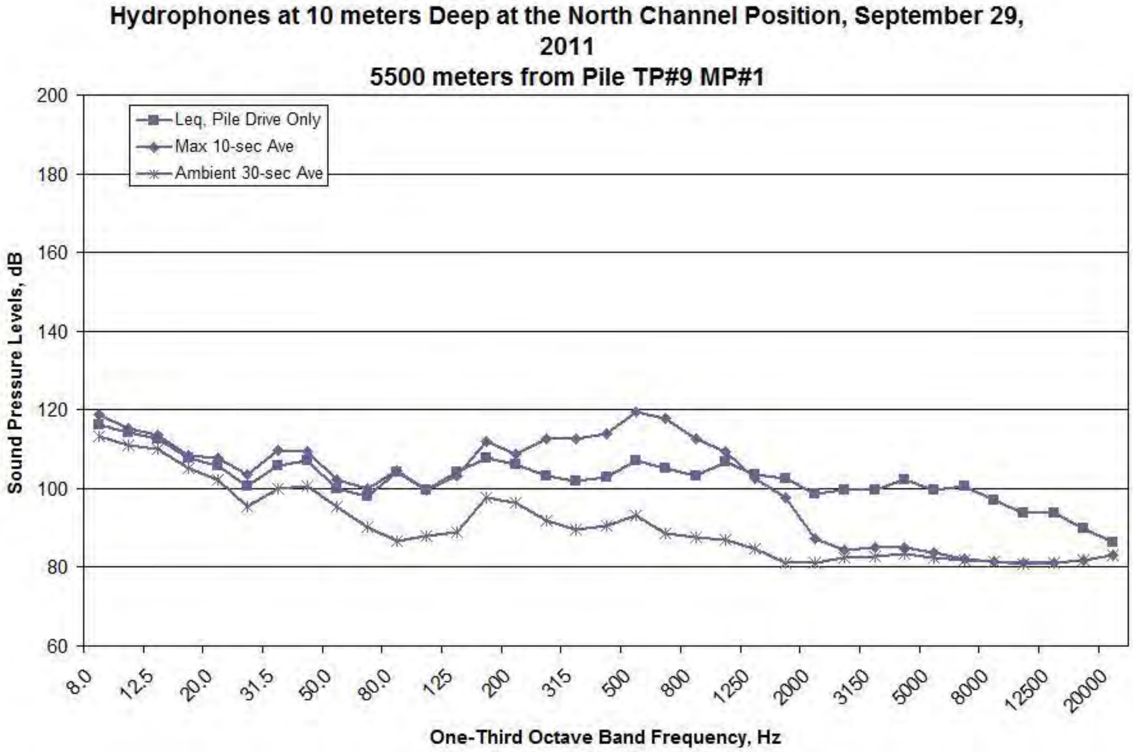

Figure A515. Spectral Data Measured at the NO Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 10 meters on September 29, 2011

NO DATA AVAILABLE – RECORDER TURNED OFF

Figure A516. Spectral Data Measured at the SO Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 10 meters on September 29, 2011

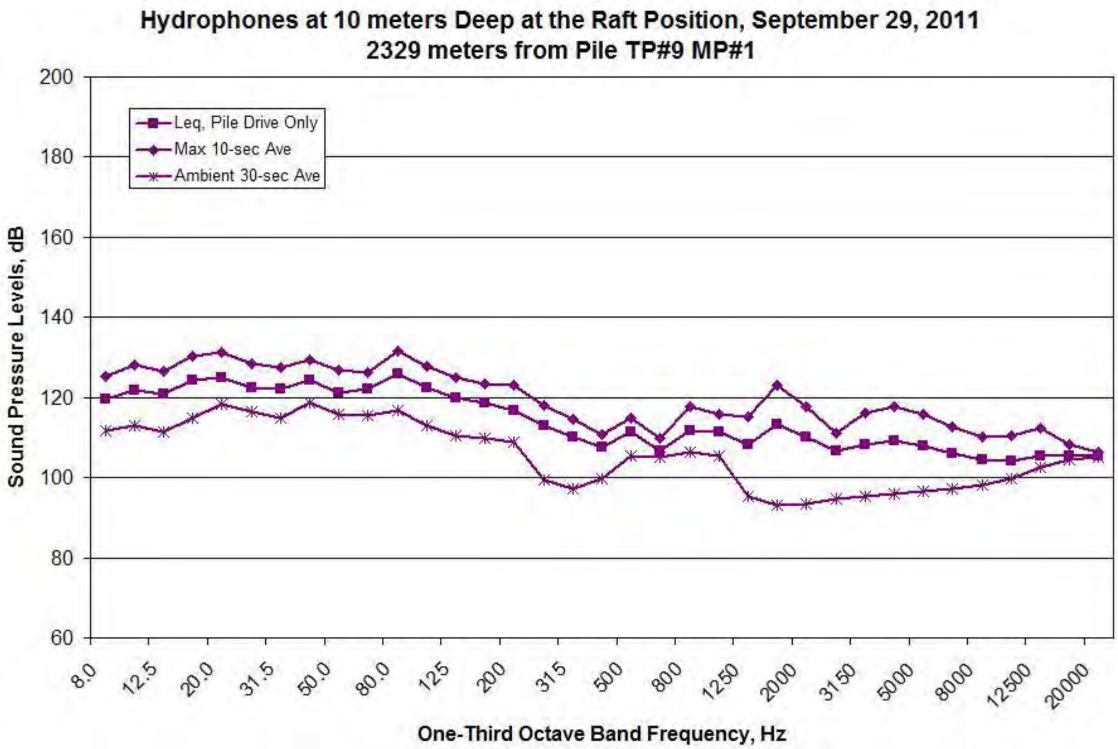

Figure A517. Spectral Data Measured at the RFT Location during TP#9 MP#1, 17:02-17:09, Measured at Depths of 10 meters on September 29, 2011

9/30/2011 – TP#13 (Vibratory Removal)

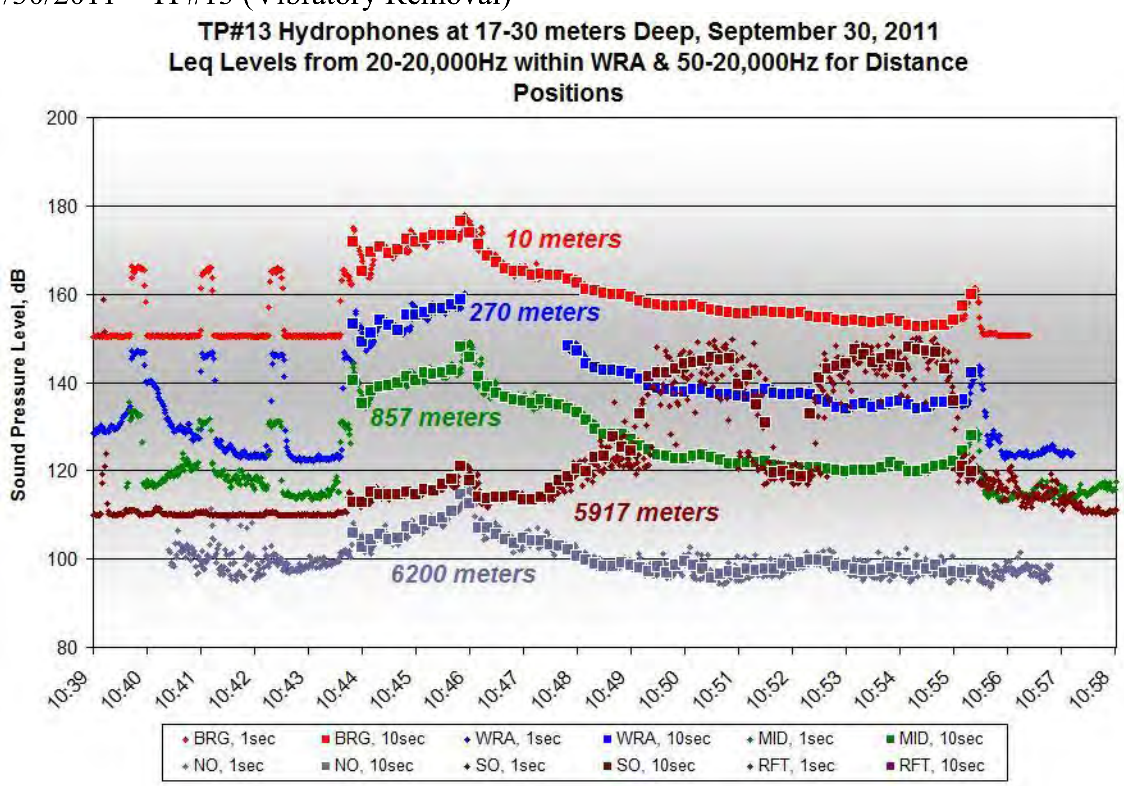

Figure A518. One-second and 10-second Average Data for TP#13, 10:43-10:55, Measured at Depths of 17-30 meters on September 30, 2011

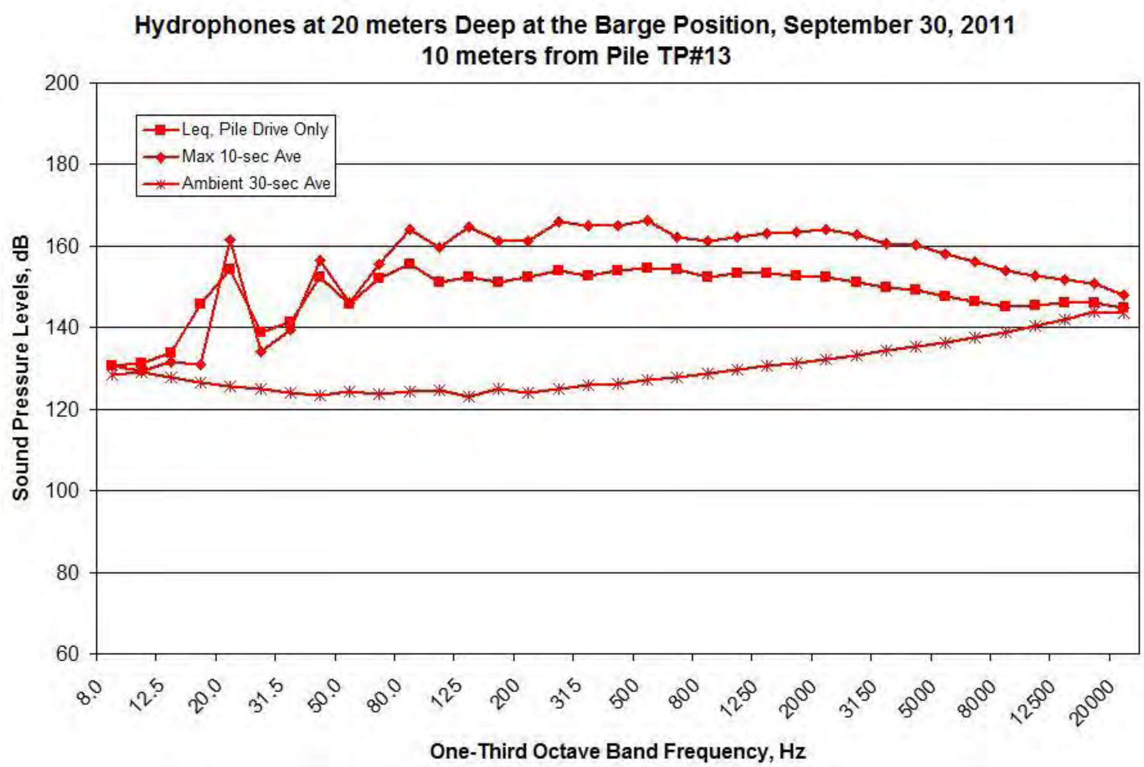

Figure A519. Spectral Data Measured at the BRG Location during TP#13, 10:43-10:55, Measured at Depths of 20 meters on September 30, 2011

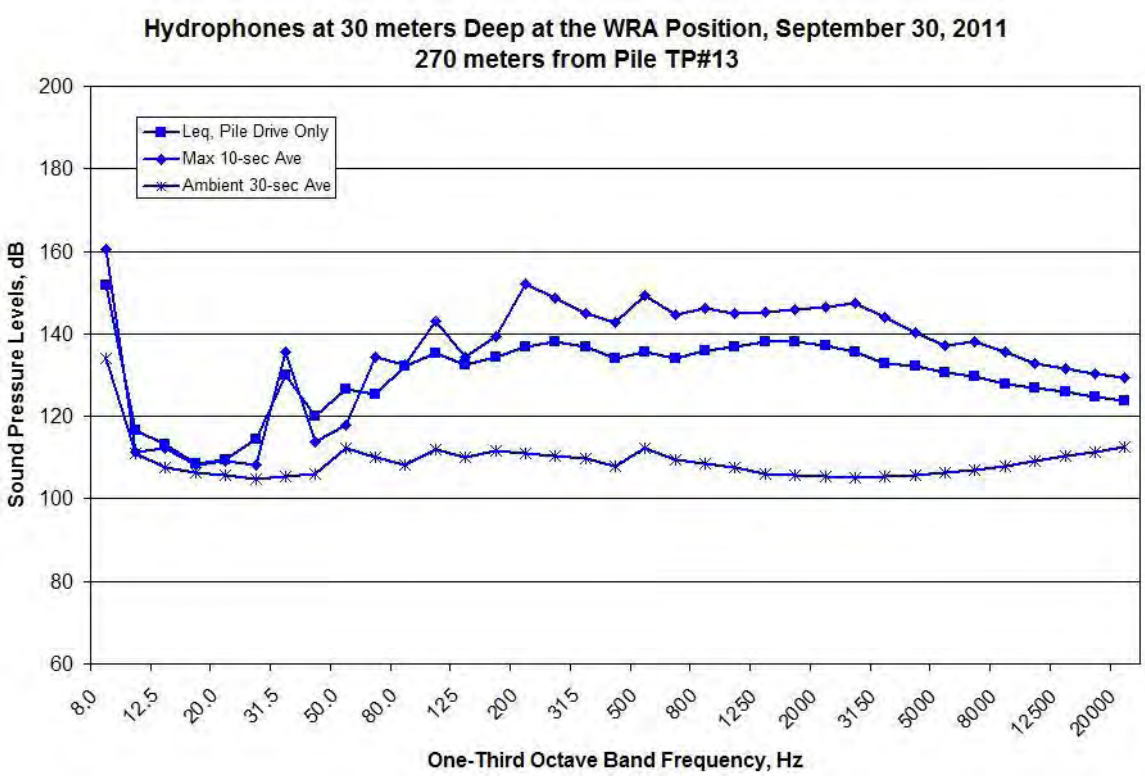

Figure A520. Spectral Data Measured at the WRA Location during TP#13, 10:43-10:55, Measured at Depths of 30 meters on September 30, 2011

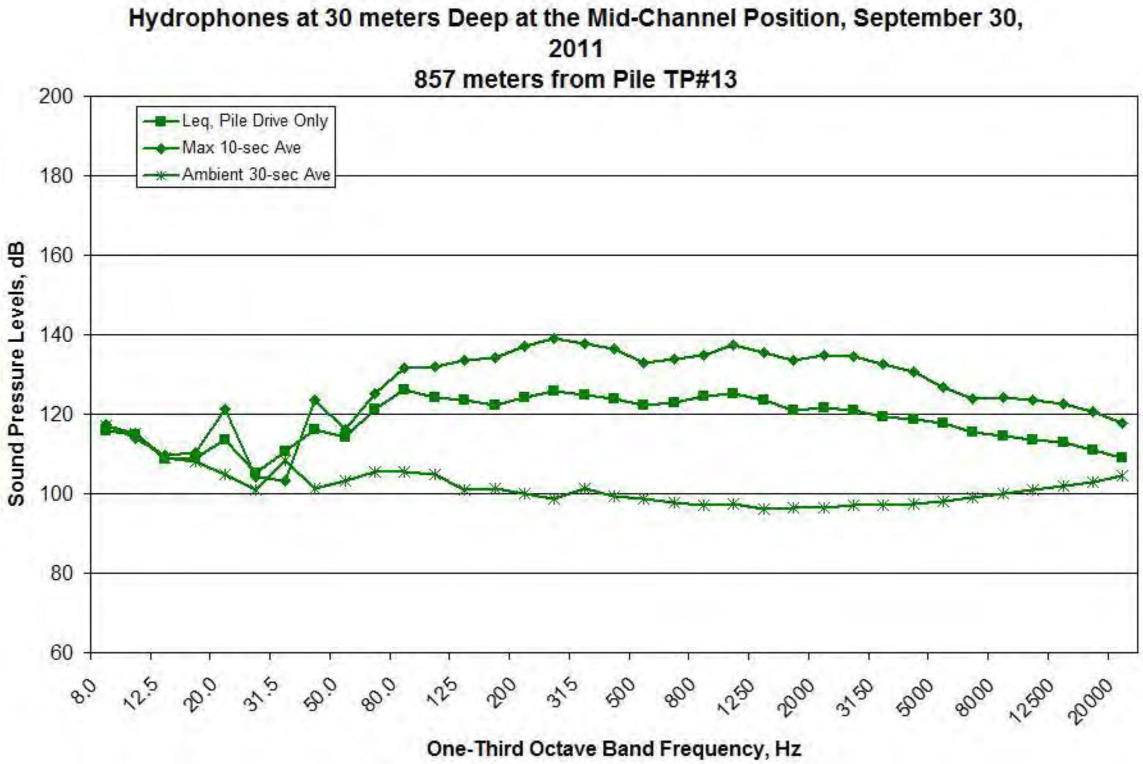

Figure A521. Spectral Data Measured at the MID Location during TP#13, 10:43-10:55, Measured at Depths of 30 meters on September 30, 2011

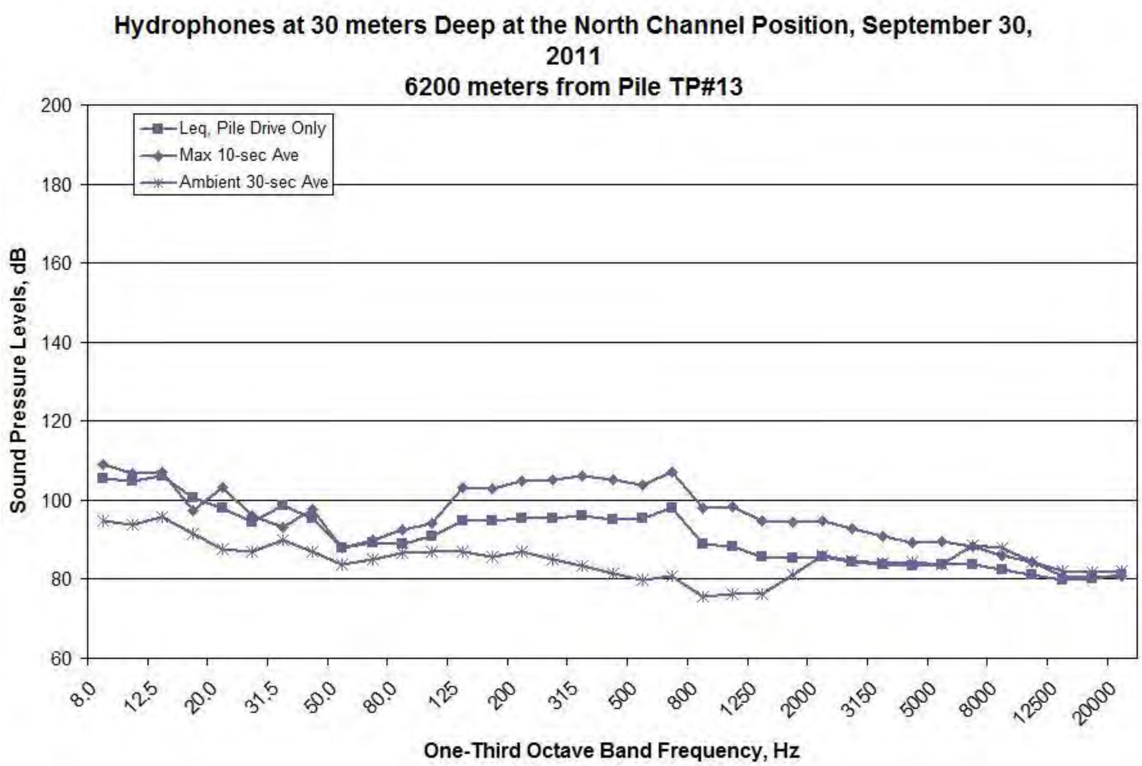

Figure A522. Spectral Data Measured at the NO Location during TP#13, 10:43-10:55, Measured at Depths of 30 meters on September 30, 2011

DATA NOT USABLE– TOO MUCH NOISE

Figure A523. Spectral Data Measured at the SO Location during TP#13, 10:43-10:55, Measured at Depths of 30 meters on September 30, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A524. Spectral Data Measured at the RFT Location during TP#13, 10:43-10:55, Measured at Depths of 17 meters on September 30, 2011

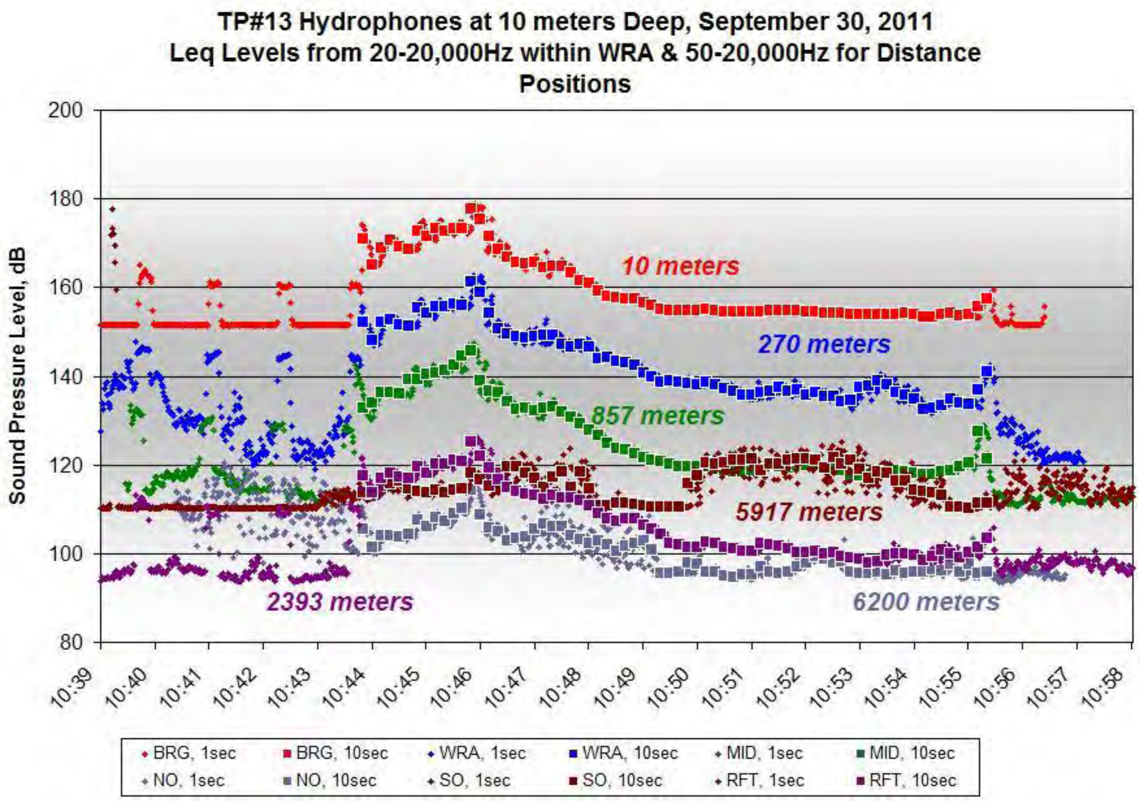

Figure A525. One-second and 10-second Average Data for TP#13, 10:43-10:55, Measured at Depths of 10 meters on September 30, 2011

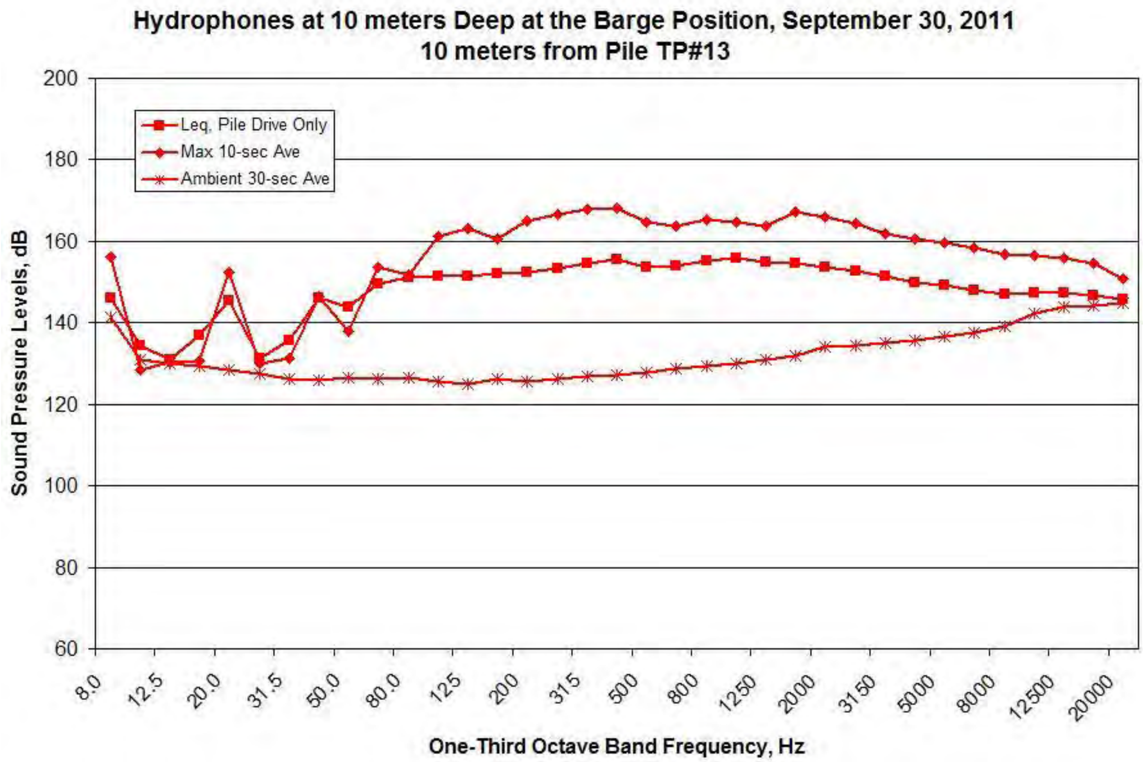

Figure A526. Spectral Data Measured at the BRG Location during TP#13, 10:43-10:55, Measured at Depths of 10 meters on September 30, 2011

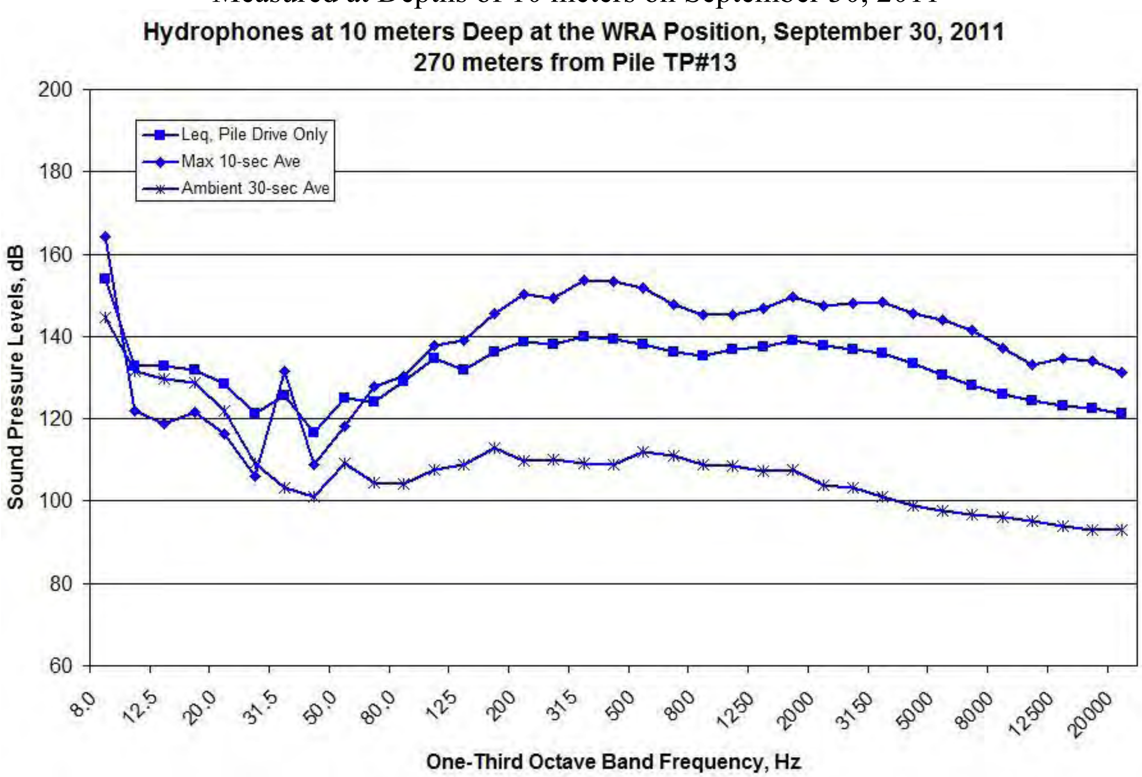

Figure A527. Spectral Data Measured at the WRA Location during TP#13, 10:43-10:55, Measured at Depths of 10 meters on September 30, 2011

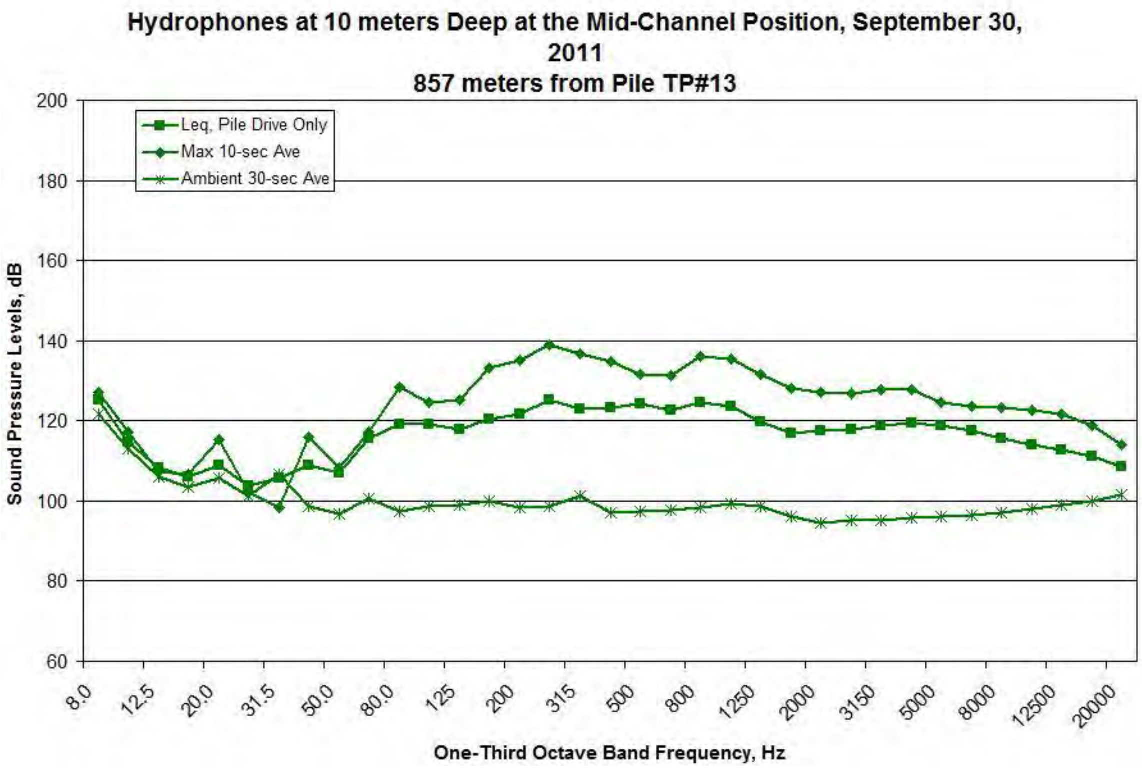

Figure A528. Spectral Data Measured at the MID Location during TP#13, 10:43-10:55, Measured at Depths of 10 meters on September 30, 2011

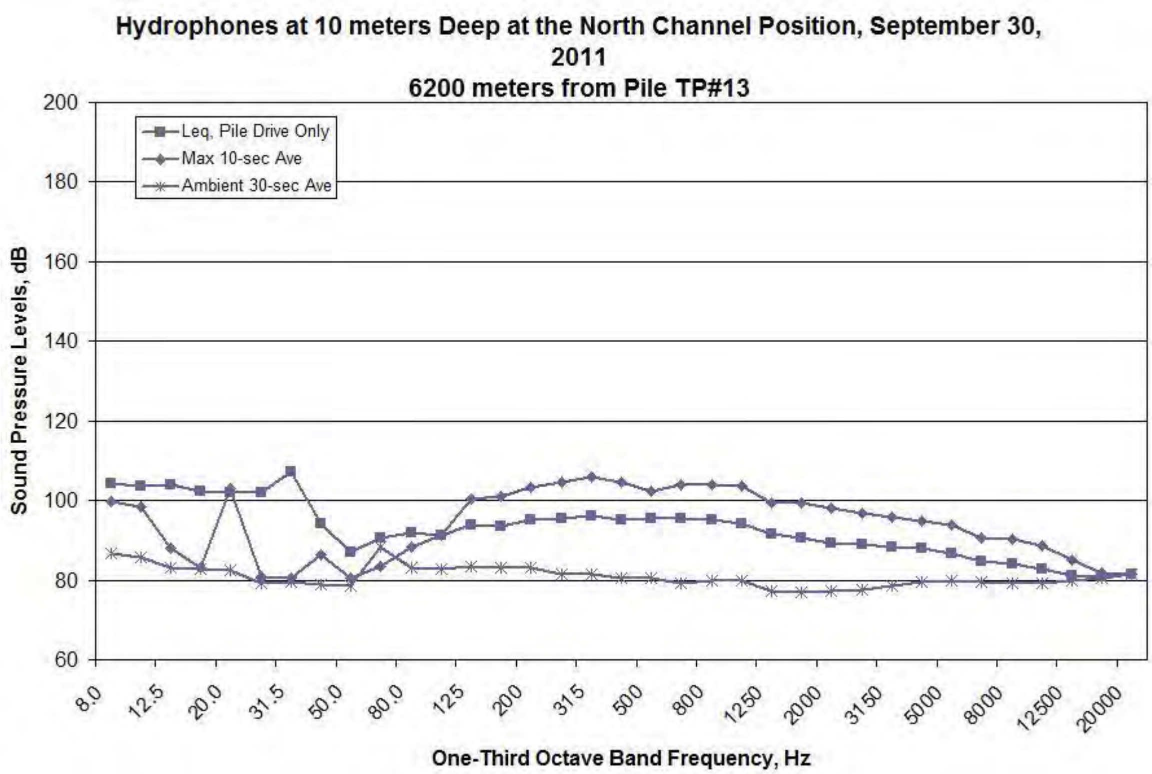

Figure A529. Spectral Data Measured at the NO Location during TP#13, 10:43-10:55, Measured at Depths of 10 meters on September 30, 2011

DATA NOT USABLE – TOO MUCH NOISE

Figure A530. Spectral Data Measured at the SO Location during TP#13, 10:43-10:55, Measured at Depths of 10 meters on September 30, 2011

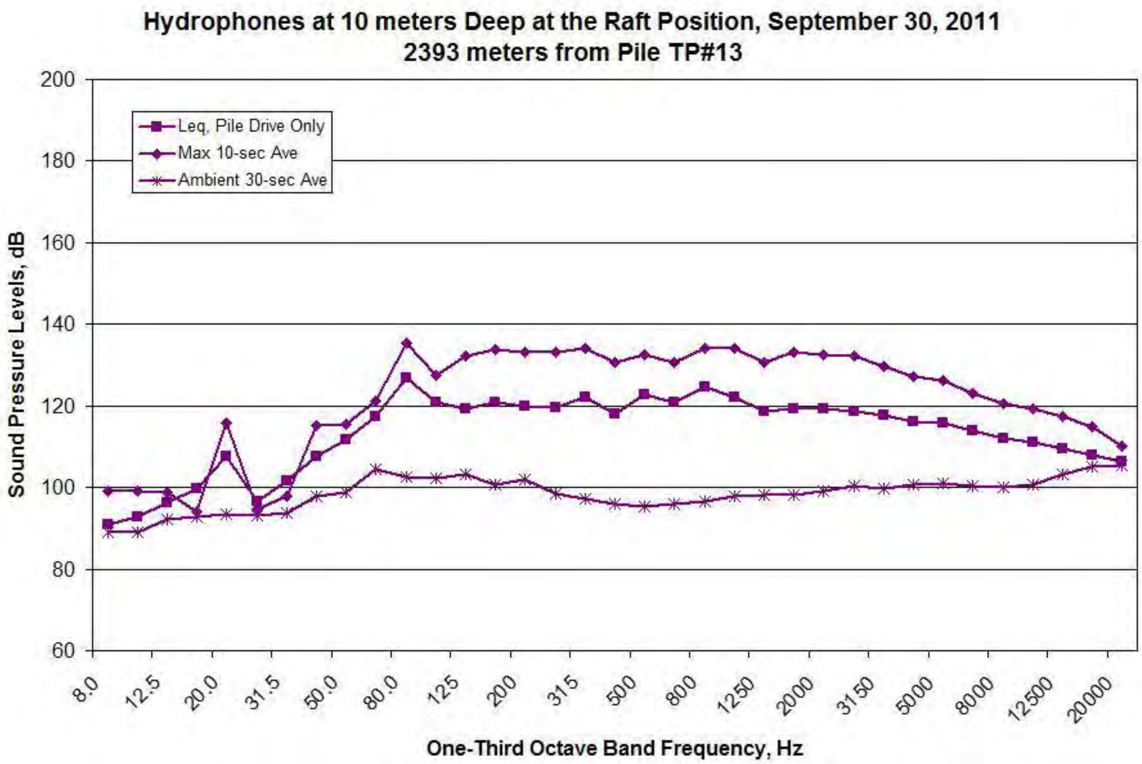

Figure A531. Spectral Data Measured at the RFT Location during TP#13, 10:43-10:55, Measured at Depths of 10 meters on September 30, 2011

TP#9 MP#2 (Vibratory Installation)

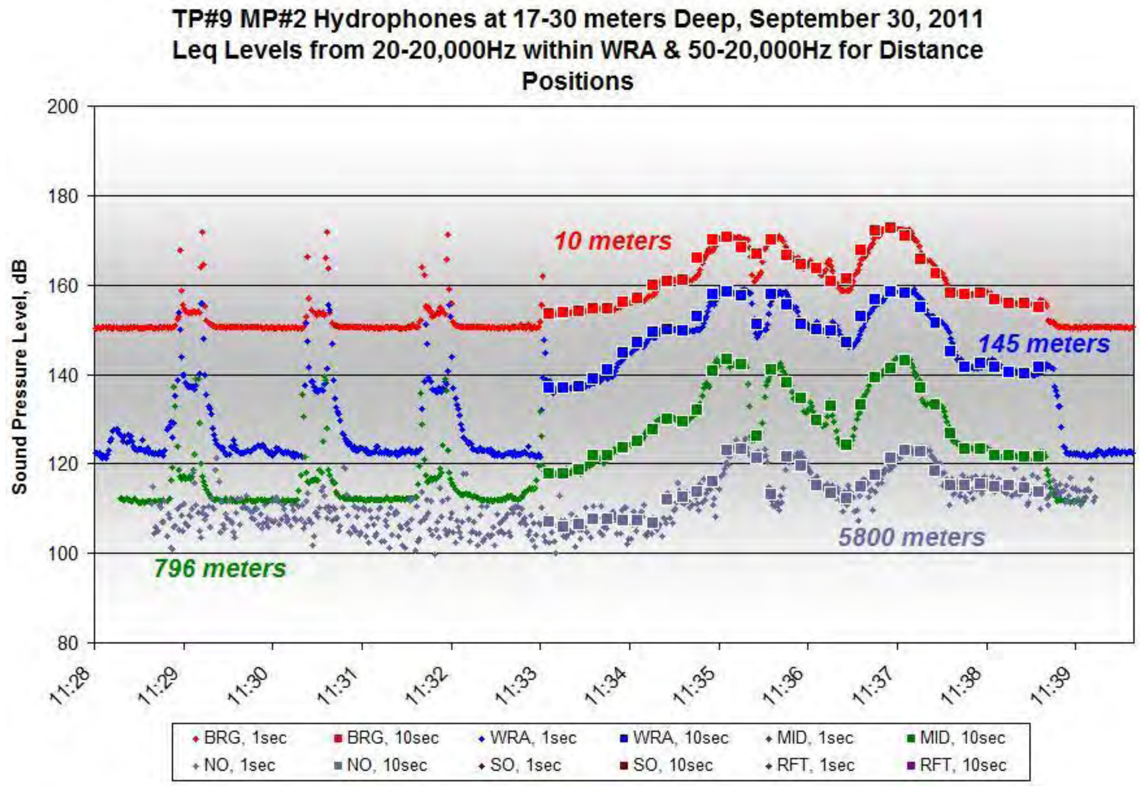

Figure A532. One-second and 10-second Average Data for TP#9 MP#2, 11:33-11:39, Measured at Depths of 17-30 meters on September 30, 2011

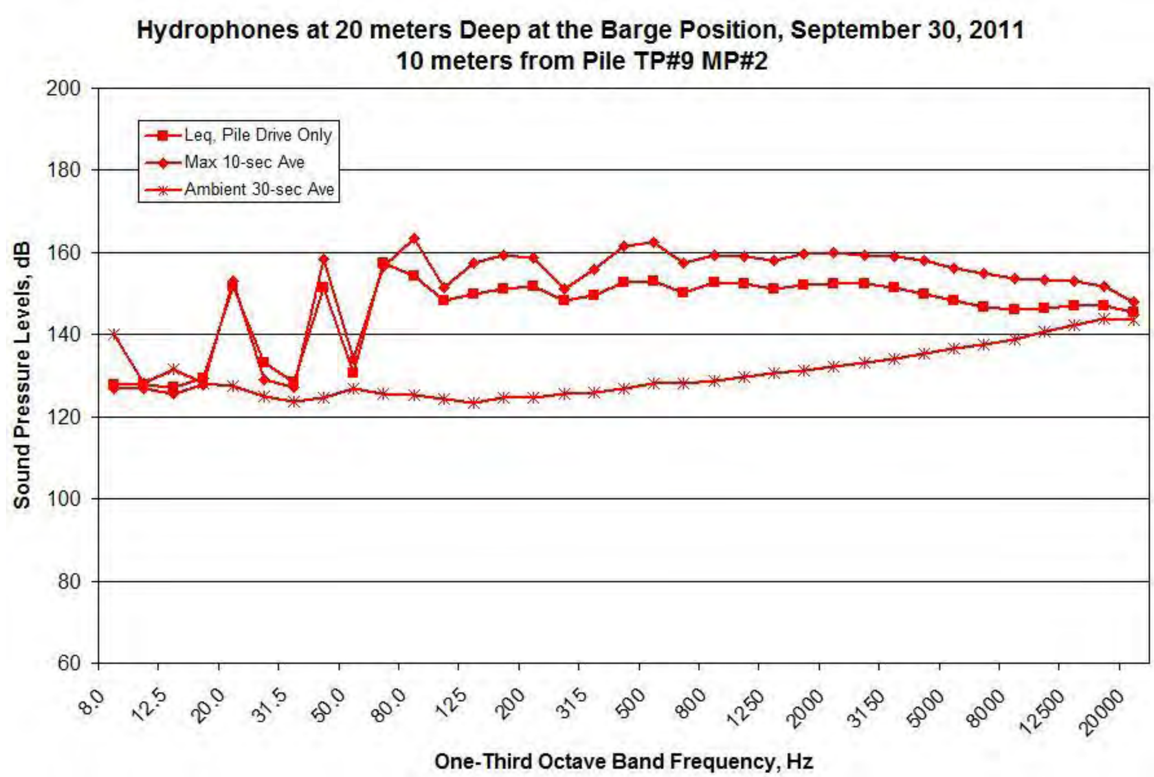

Figure A533. Spectral Data Measured at the BRG Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 20 meters on September 30, 2011

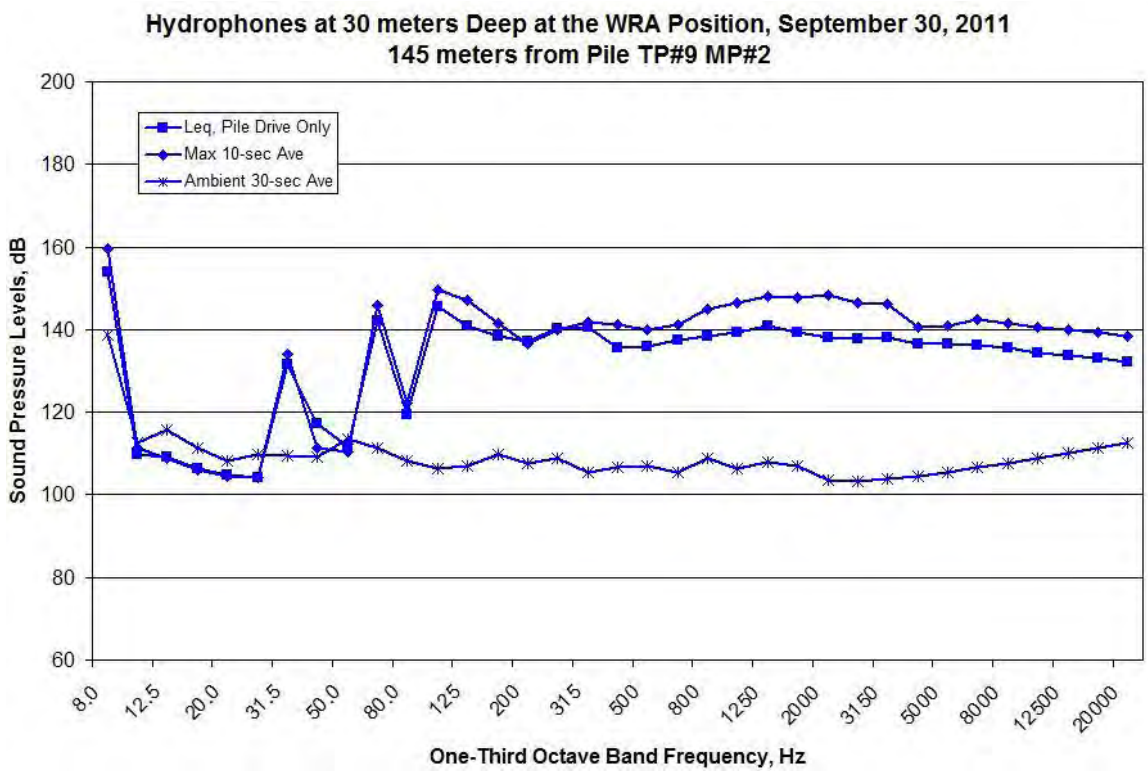

Figure A534. Spectral Data Measured at the WRA Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 30 meters on September 30, 2011

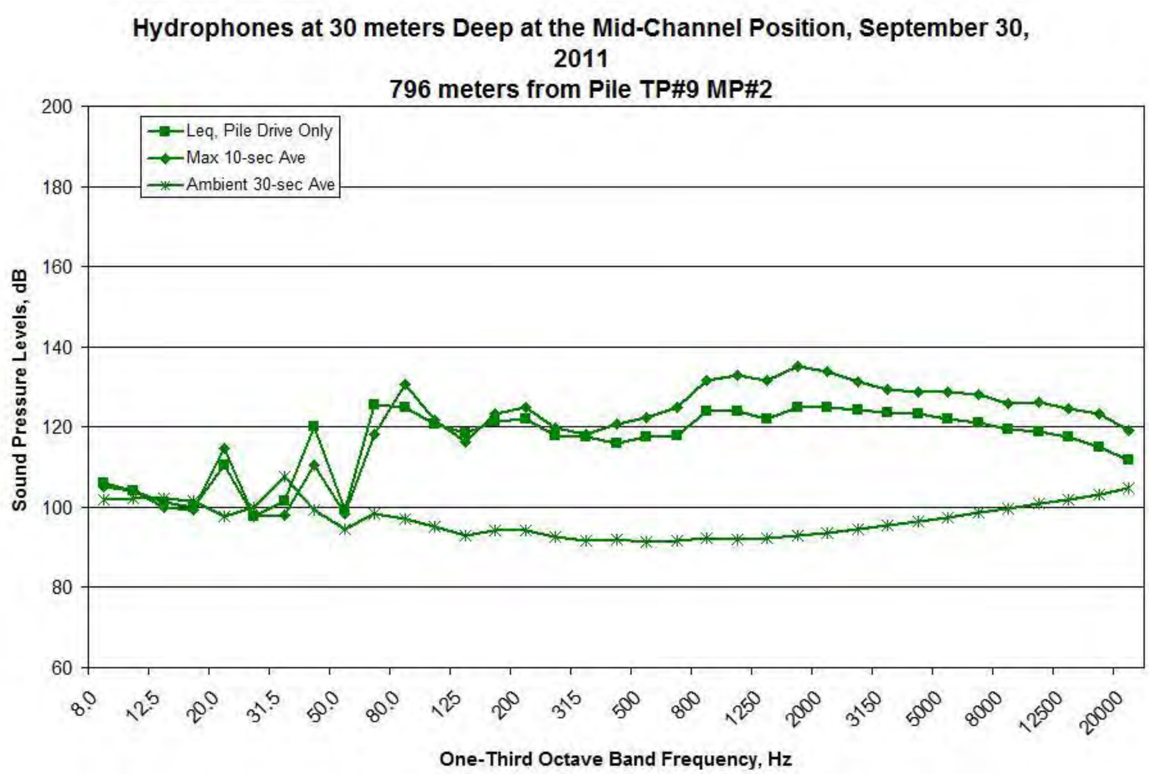

Figure A535. Spectral Data Measured at the MID Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 30 meters on September 30, 2011

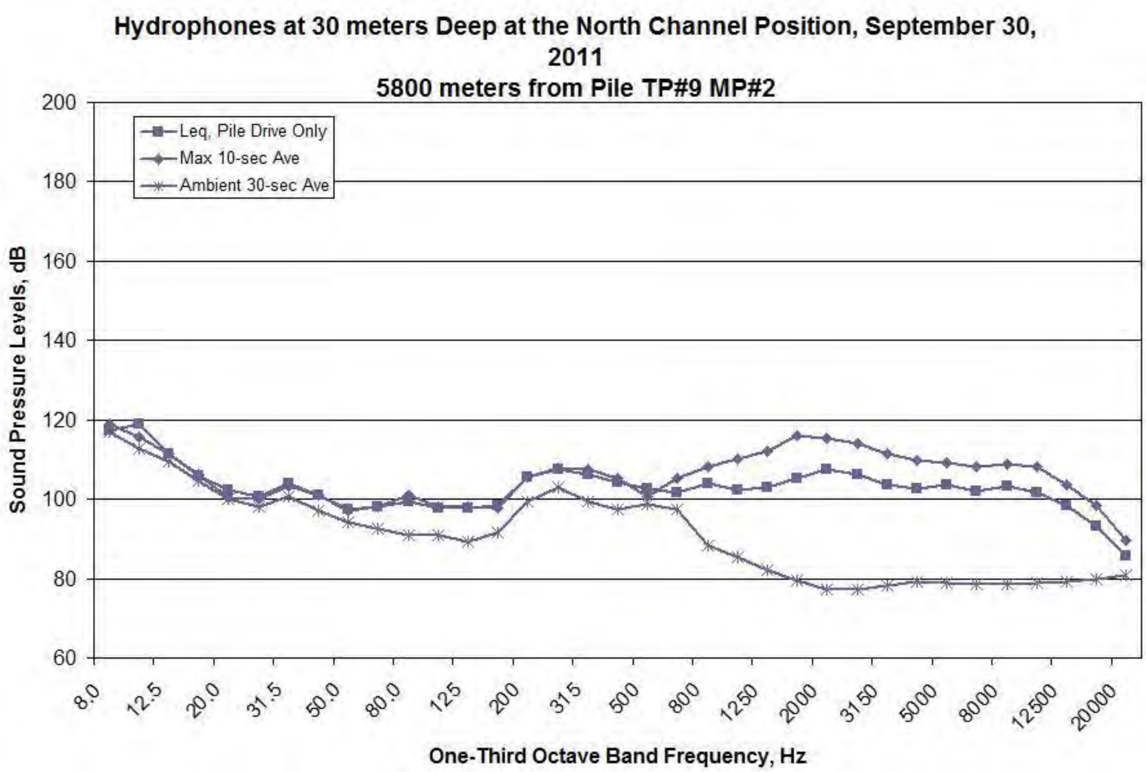

Figure A536. Spectral Data Measured at the NO Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 30 meters on September 30, 2011

DATA NOT USABLE – TOO MUCH NOISE

Figure A537. Spectral Data Measured at the SO Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 30 meters on September 30, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A538. Spectral Data Measured at the RFT Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 17 meters on September 30, 2011

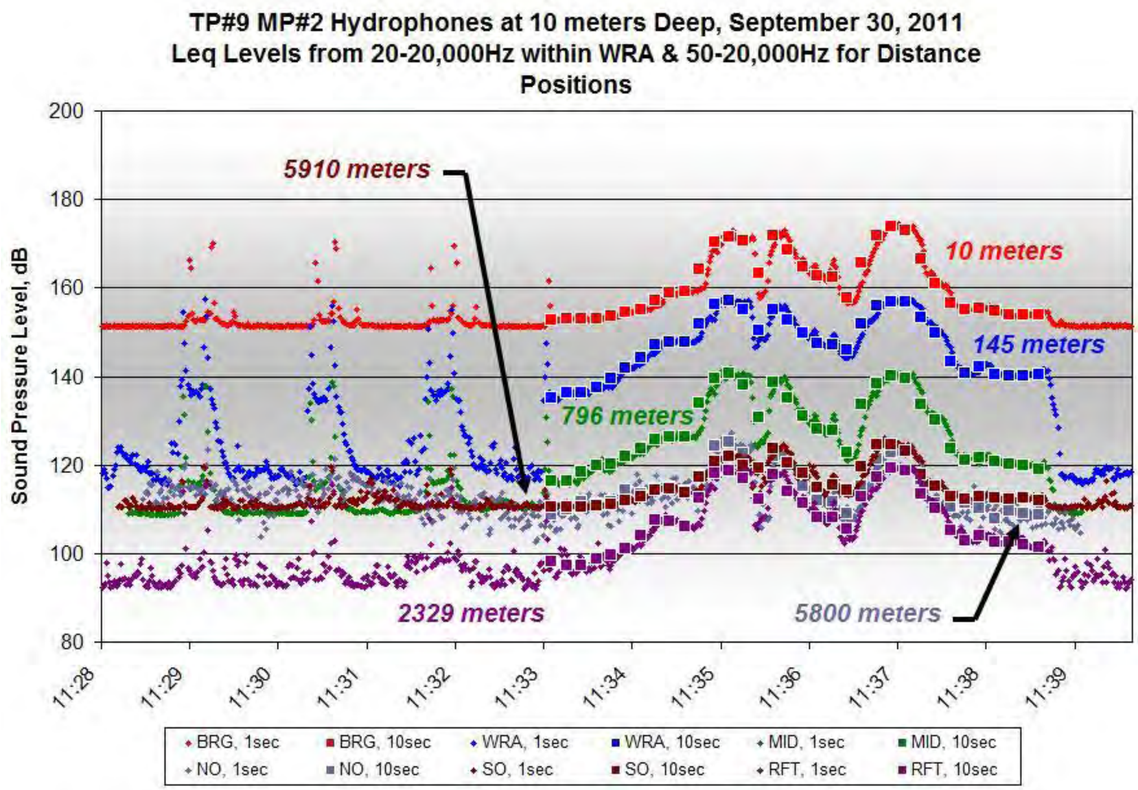

Figure A539. One-second and 10-second Average Data for TP#9 MP#2, 11:33-11:39, Measured at Depths of 10 meters on September 30, 2011

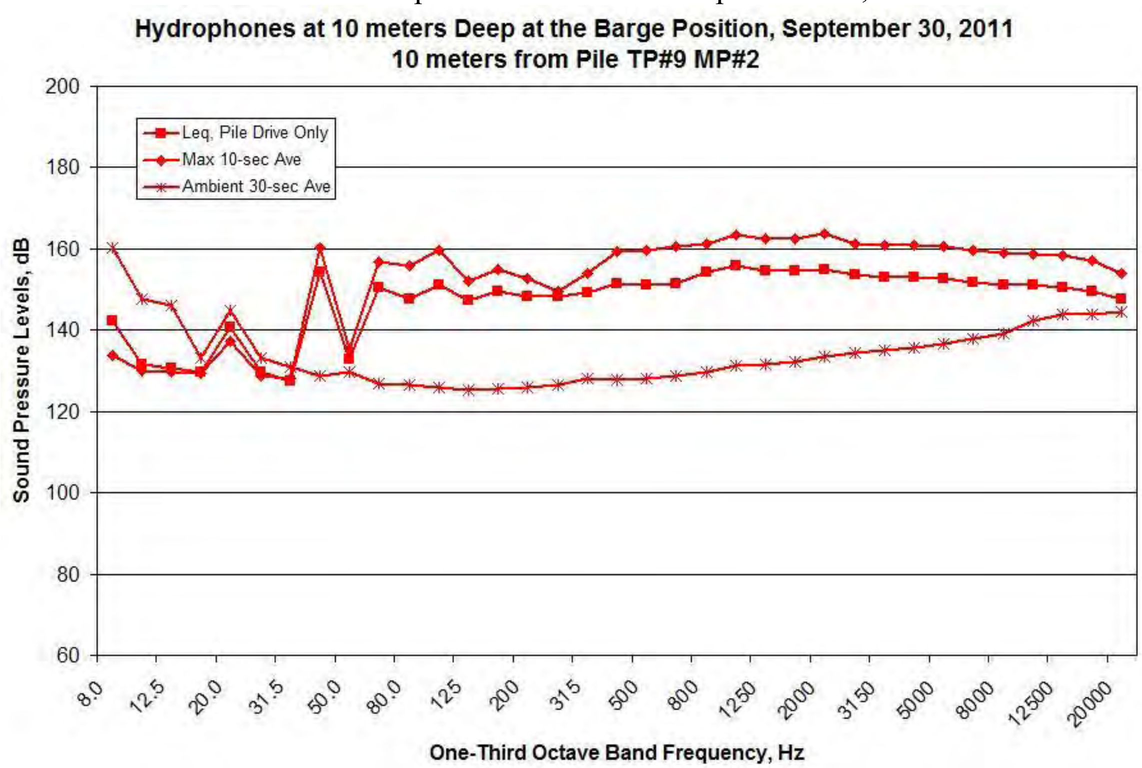

Figure A540. Spectral Data Measured at the BRG Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 10 meters on September 30, 2011

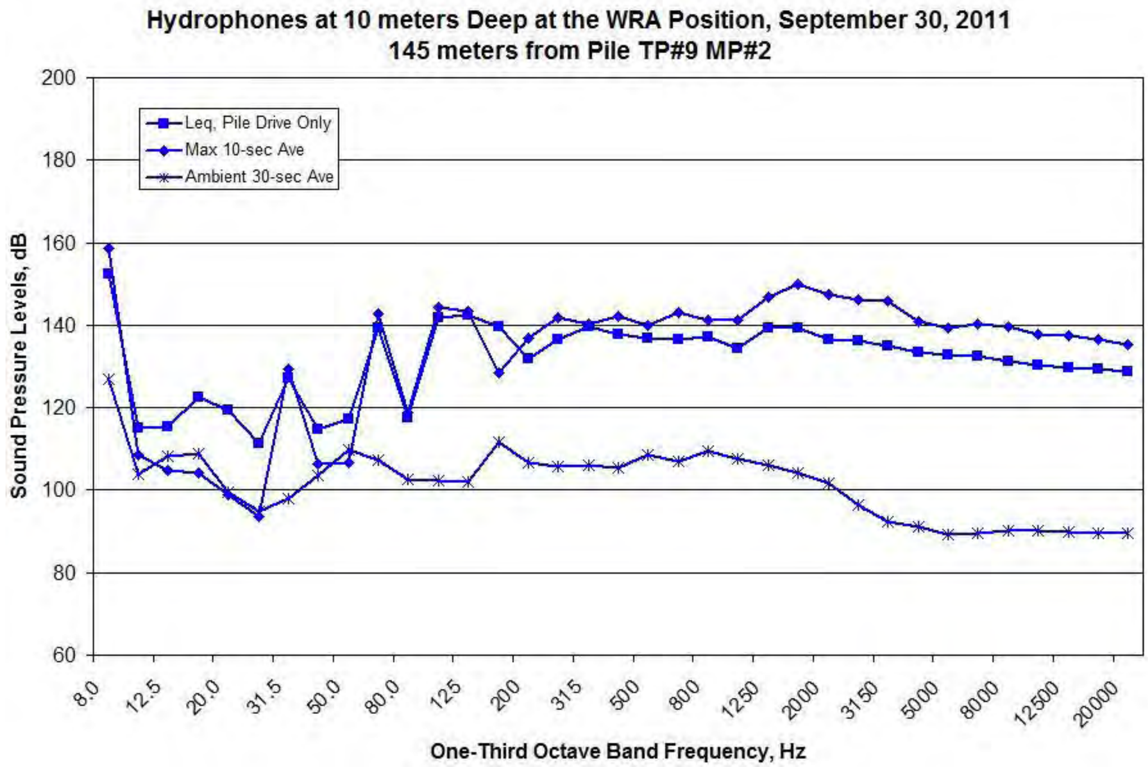

Figure A541. Spectral Data Measured at the WRA Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 10 meters on September 30, 2011

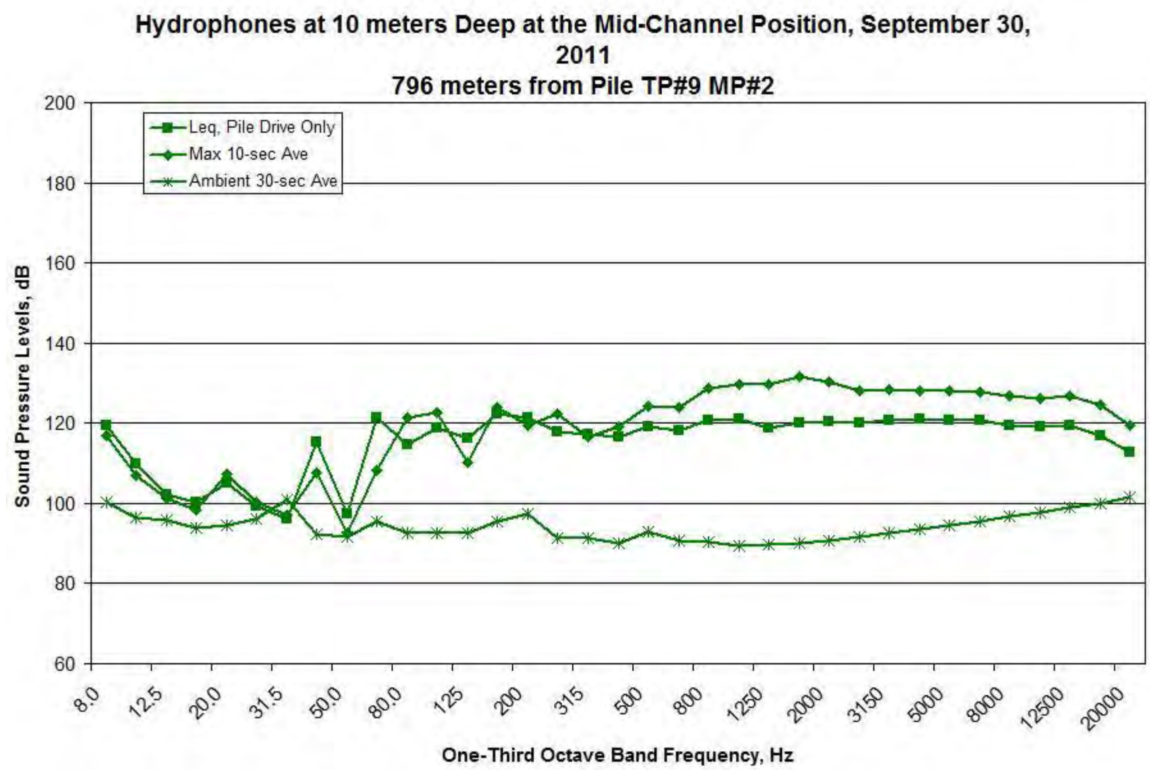

Figure A542. Spectral Data Measured at the MID Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 10 meters on September 30, 2011

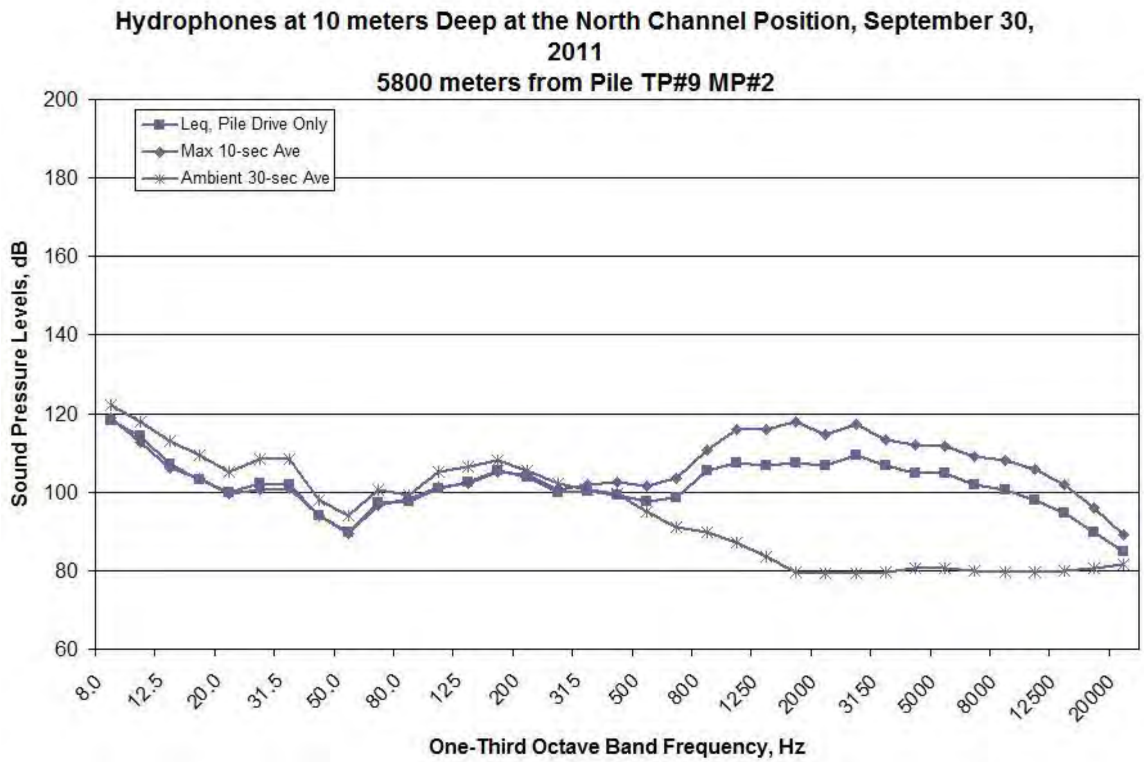

Figure A543. Spectral Data Measured at the NO Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 10 meters on September 30, 2011

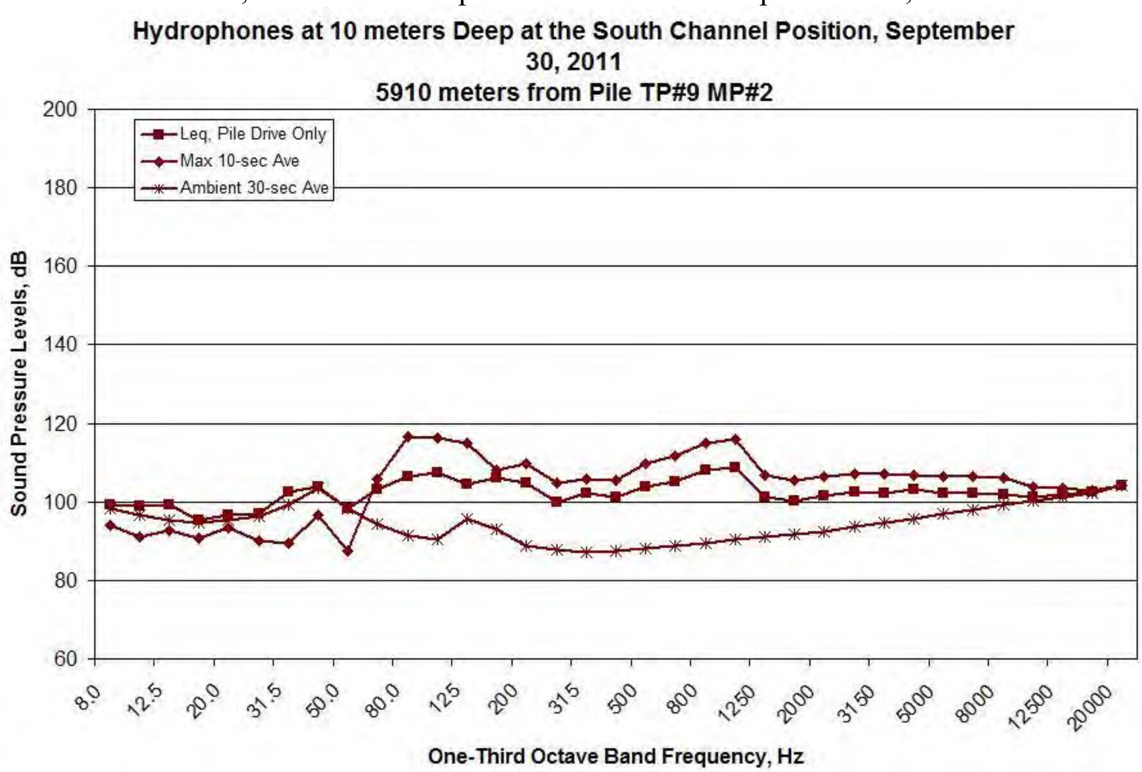

Figure A544. Spectral Data Measured at the SO Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 10 meters on September 30, 2011

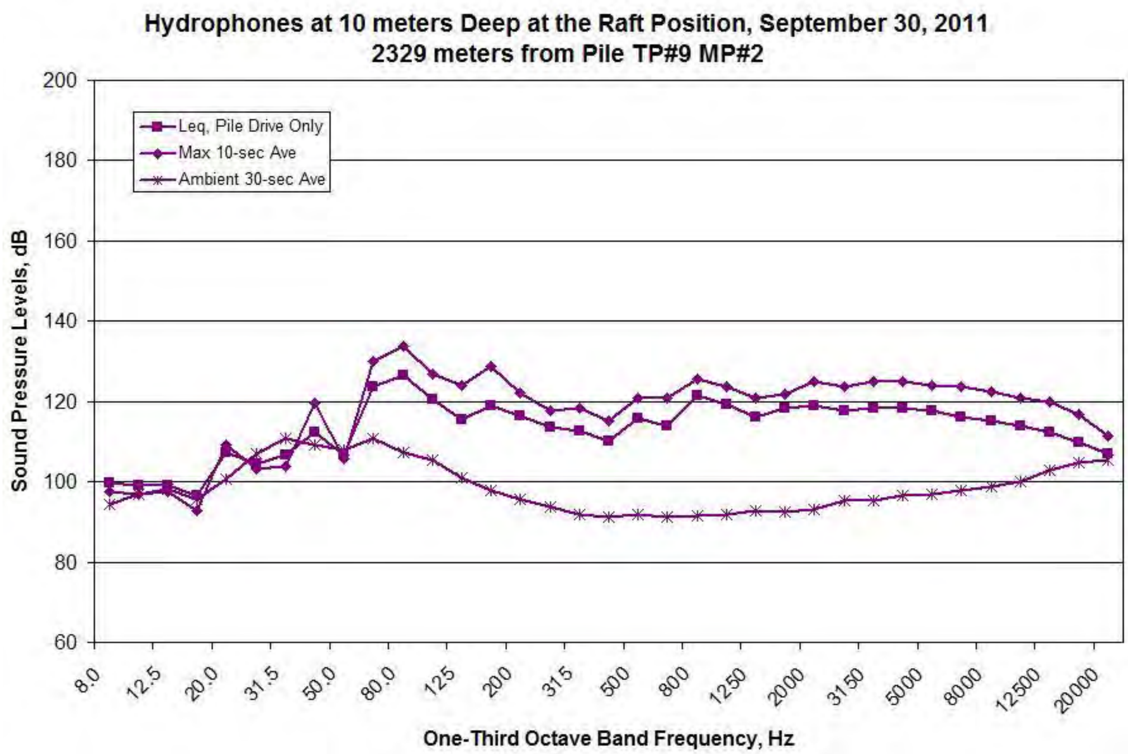

Figure A545. Spectral Data Measured at the RFT Location during TP#9 MP#2, 11:33-11:39, Measured at Depths of 10 meters on September 30, 2011

TP#5 (Vibratory Removal)

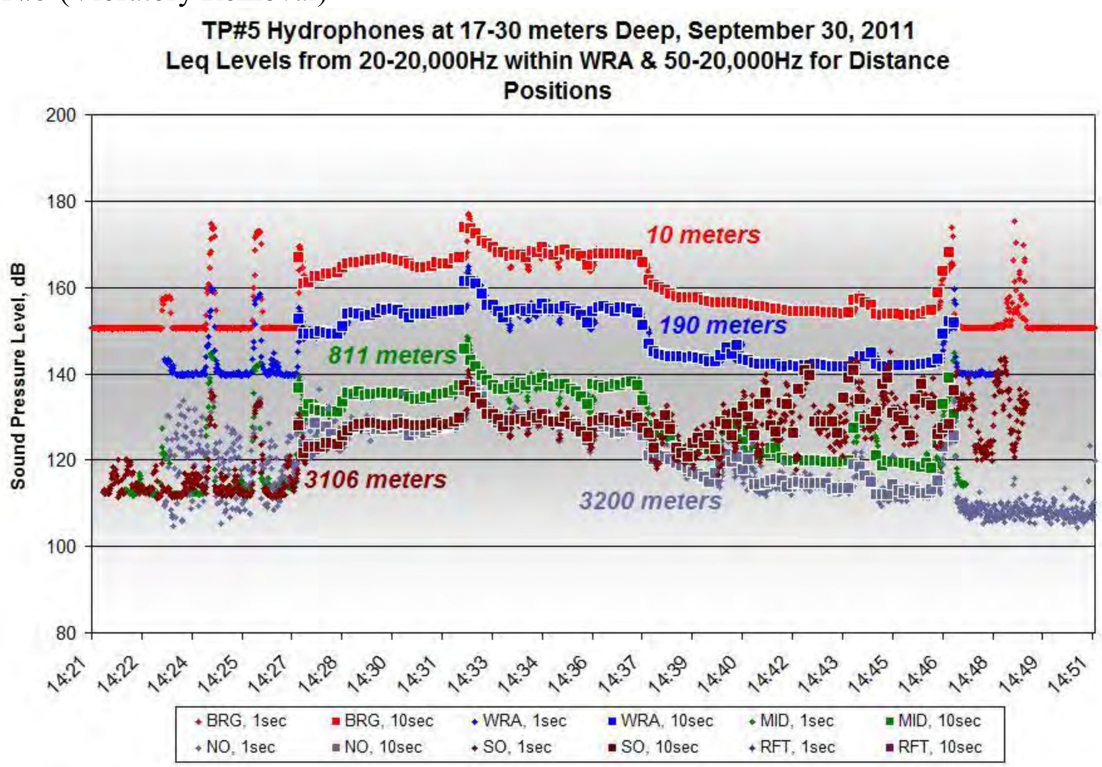

Figure A546. One-second and 10-second Average Data for TP#5, 14:28-14:47, Measured at Depths of 17-30 meters on September 30, 2011

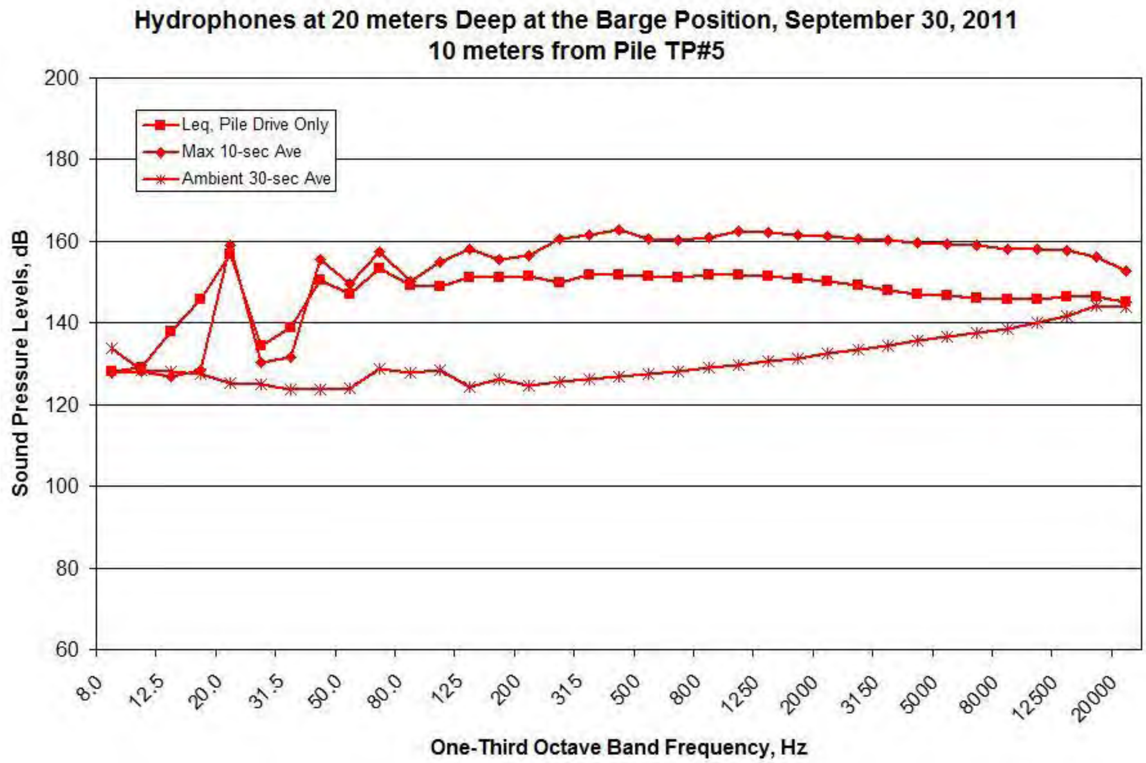

Figure A547. Spectral Data Measured at the BRG Location during TP#5, 14:28-14:47, Measured at Depths of 20 meters on September 30, 2011

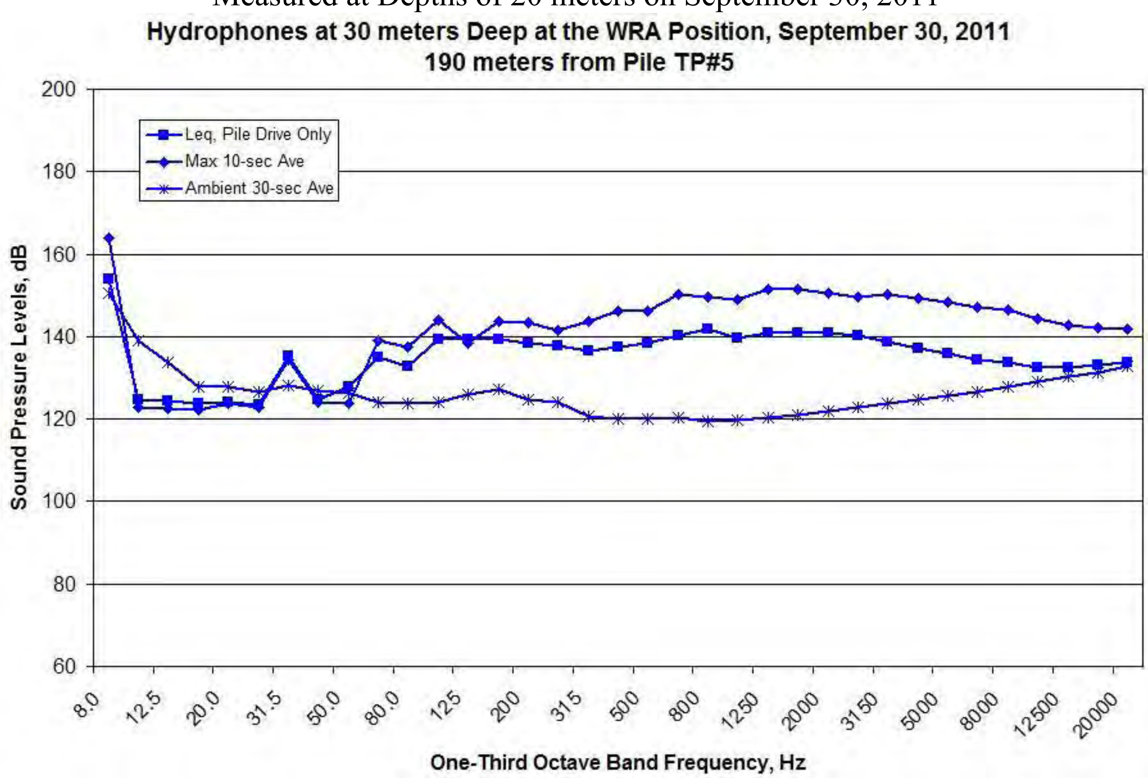

Figure A548. Spectral Data Measured at the WRA Location during TP#5, 14:28-14:47, Measured at Depths of 30 meters on September 30, 2011

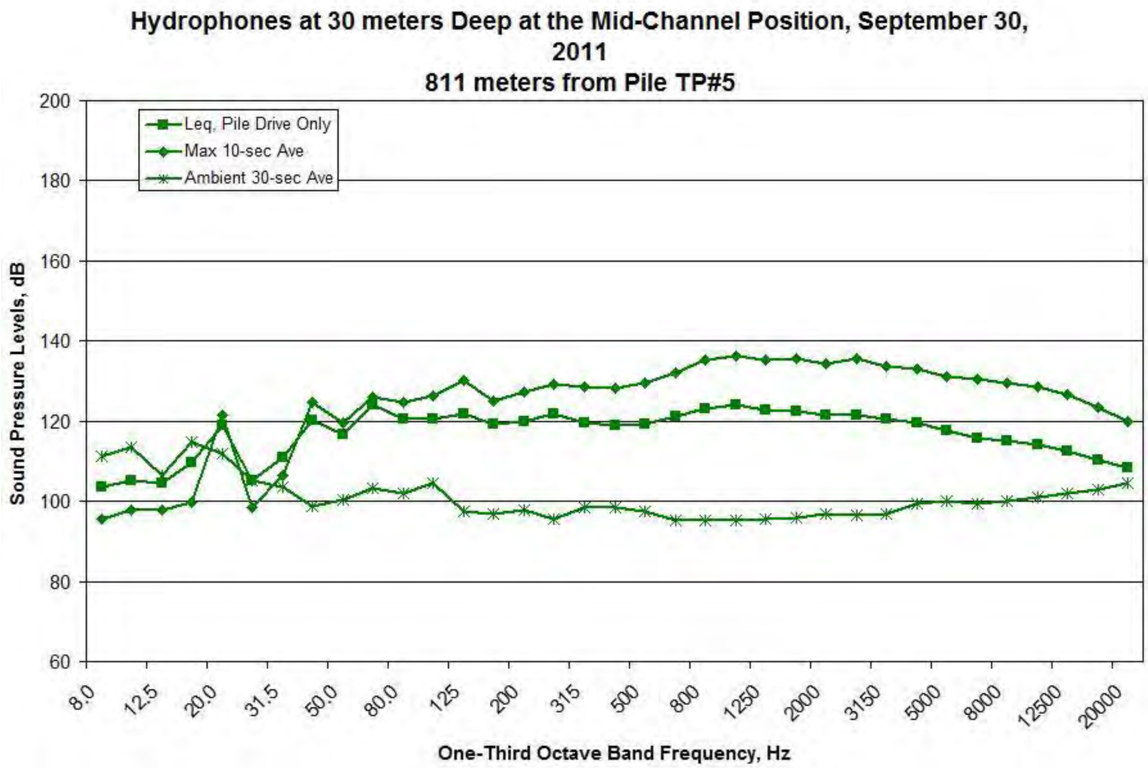

Figure A549. Spectral Data Measured at the MID Location during TP#5, 14:28-14:47, Measured at Depths of 30 meters on September 30, 2011

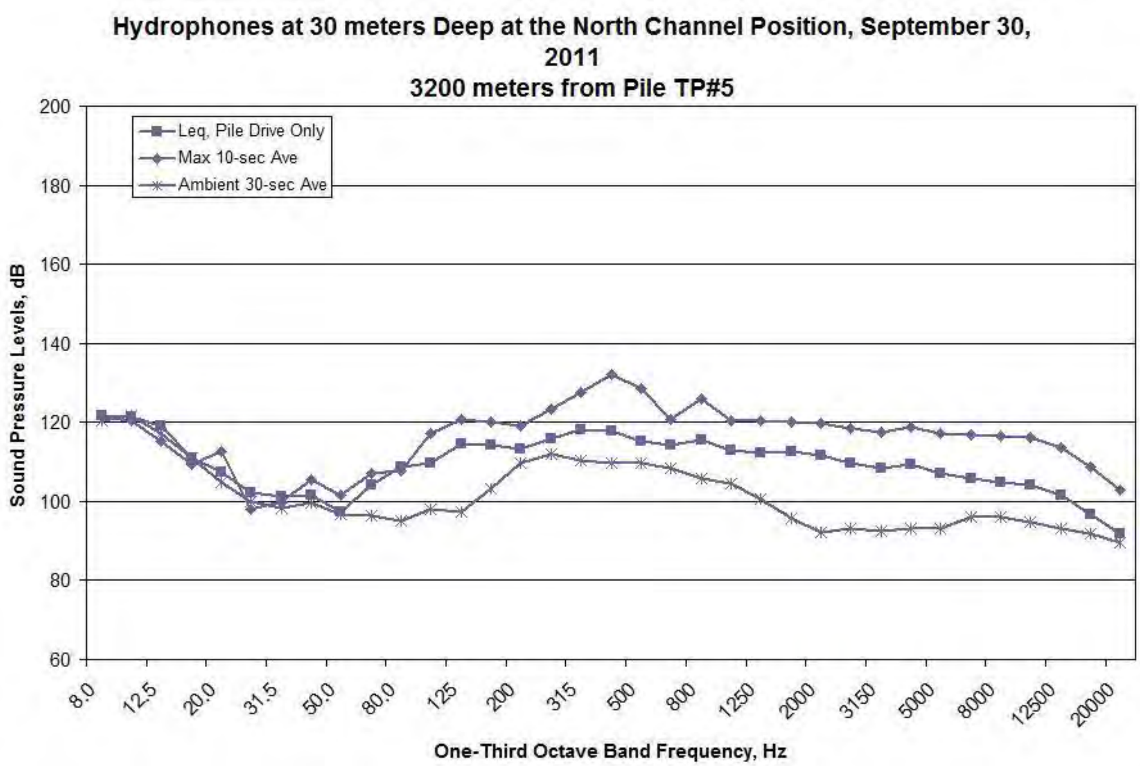

Figure A550. Spectral Data Measured at the NO Location during TP#5, 14:28-14:47, Measured at Depths of 30 meters on September 30, 2011

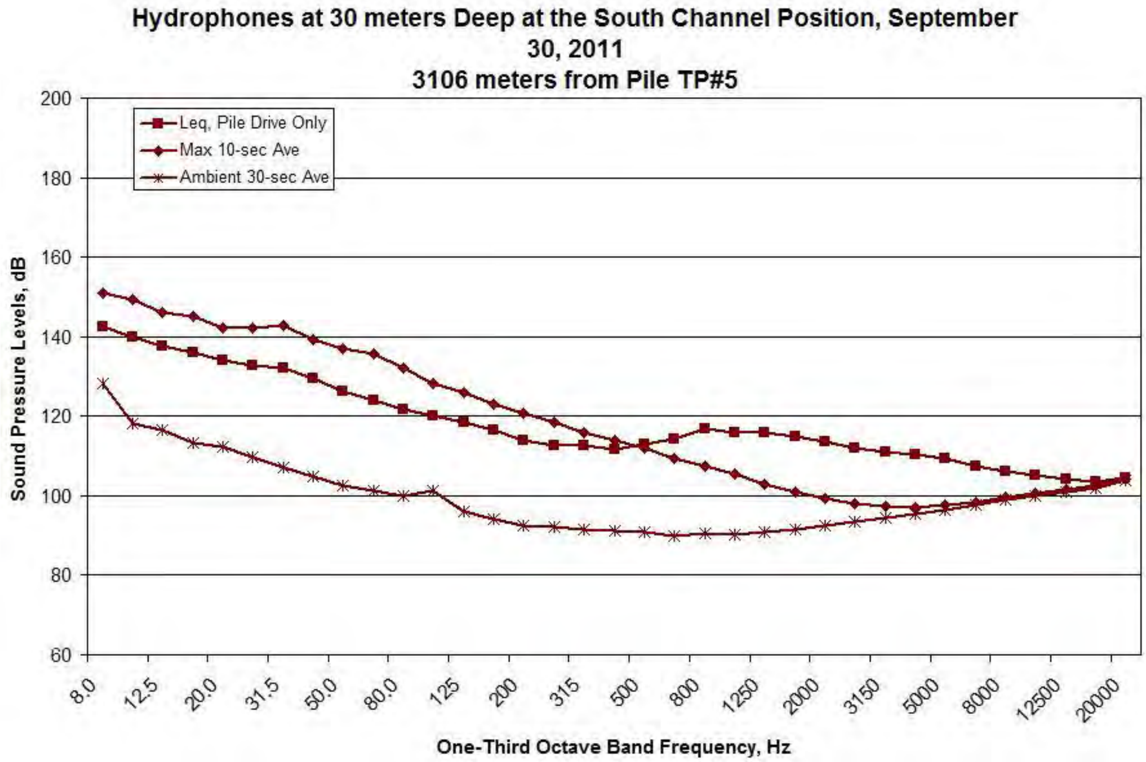

Figure A551. Spectral Data Measured at the SO Location during TP#5, 14:28-14:47, Measured at Depths of 30 meters on September 30, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A552. Spectral Data Measured at the RFT Location during TP#5, 14:28-14:47, Measured at Depths of 17 meters on September 30, 2011

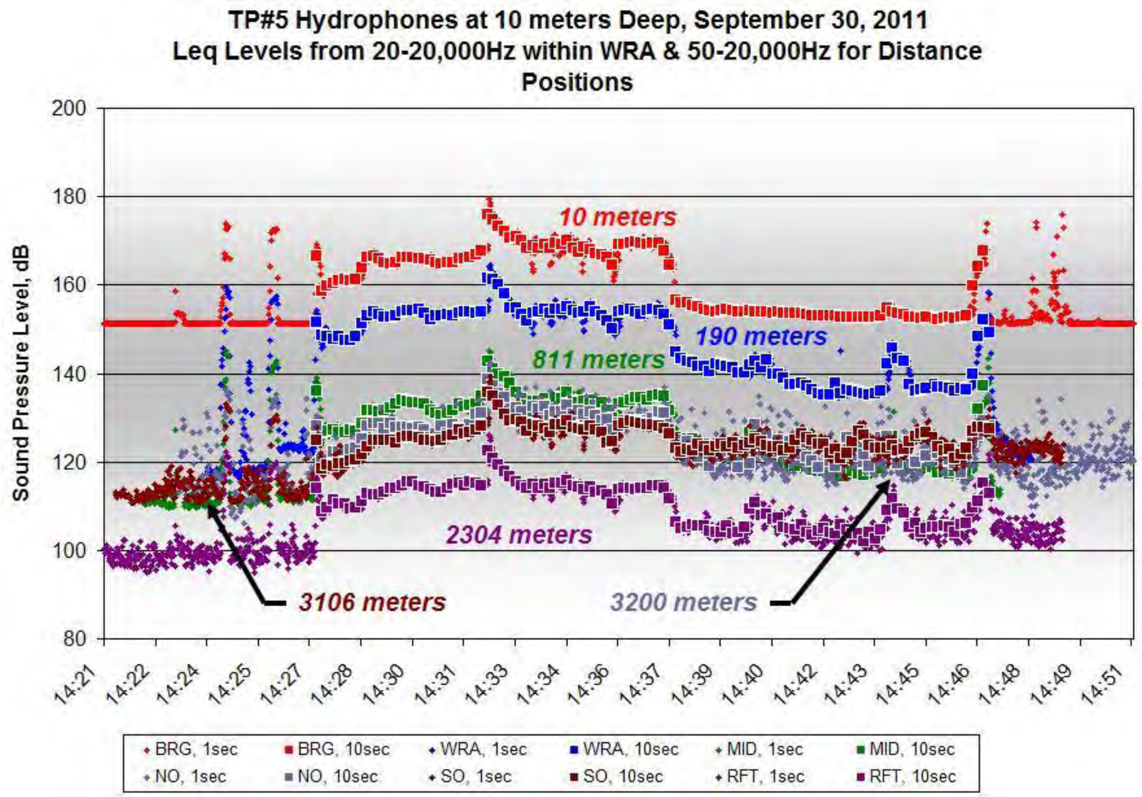

Figure A553. One-second and 10-second Average Data for TP#5, 14:28-14:47, Measured at Depths of 10 meters on September 30, 2011

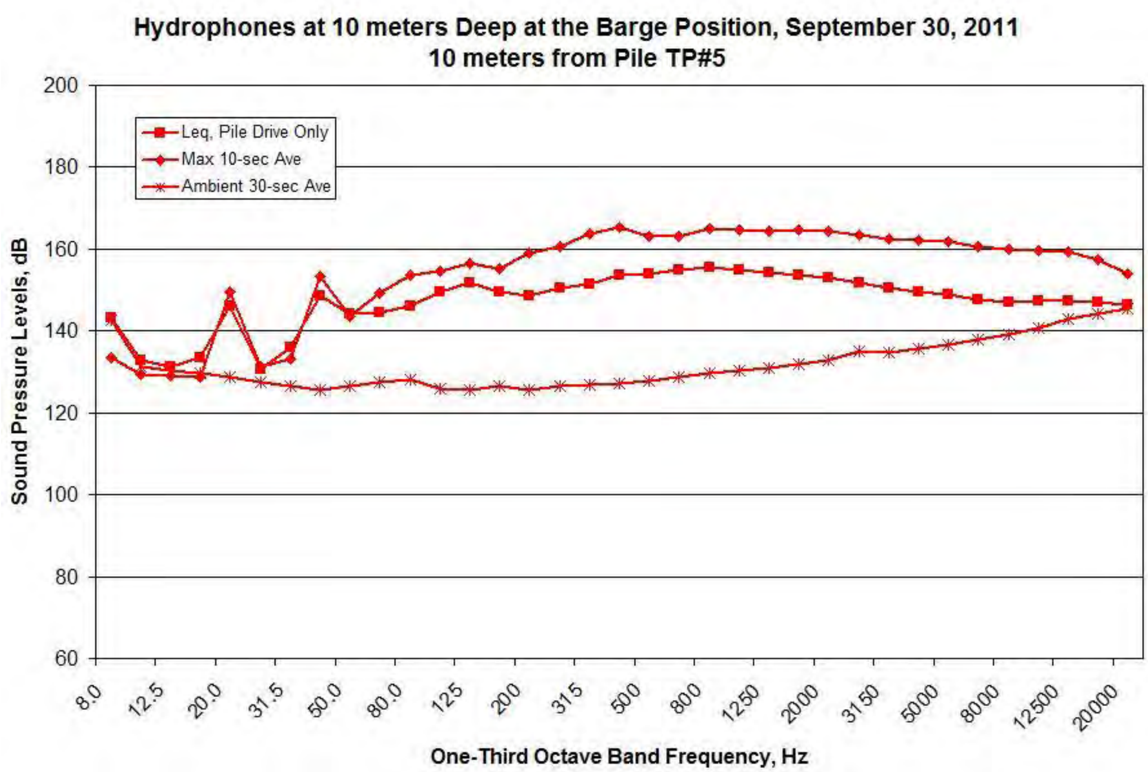

Figure A554. Spectral Data Measured at the BRG Location during TP#5, 14:28-14:47, Measured at Depths of 10 meters on September 30, 2011

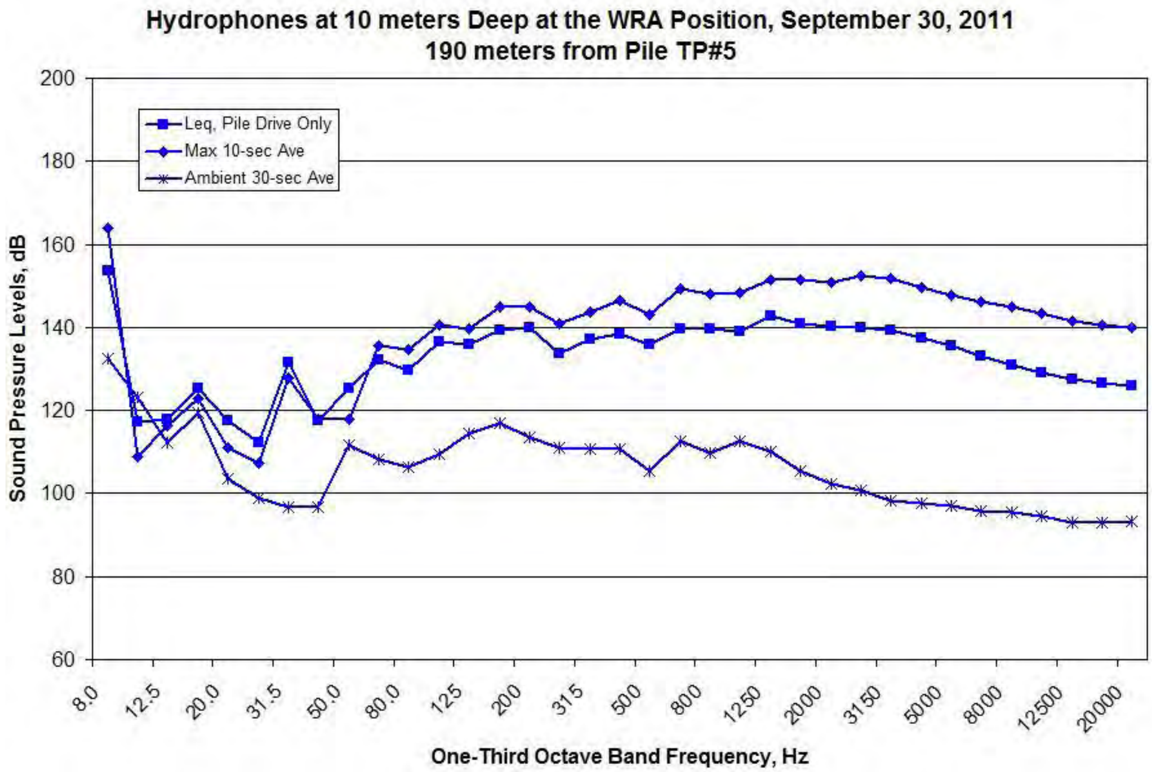

Figure A555. Spectral Data Measured at the WRA Location during TP#5, 14:28-14:47, Measured at Depths of 10 meters on September 30, 2011

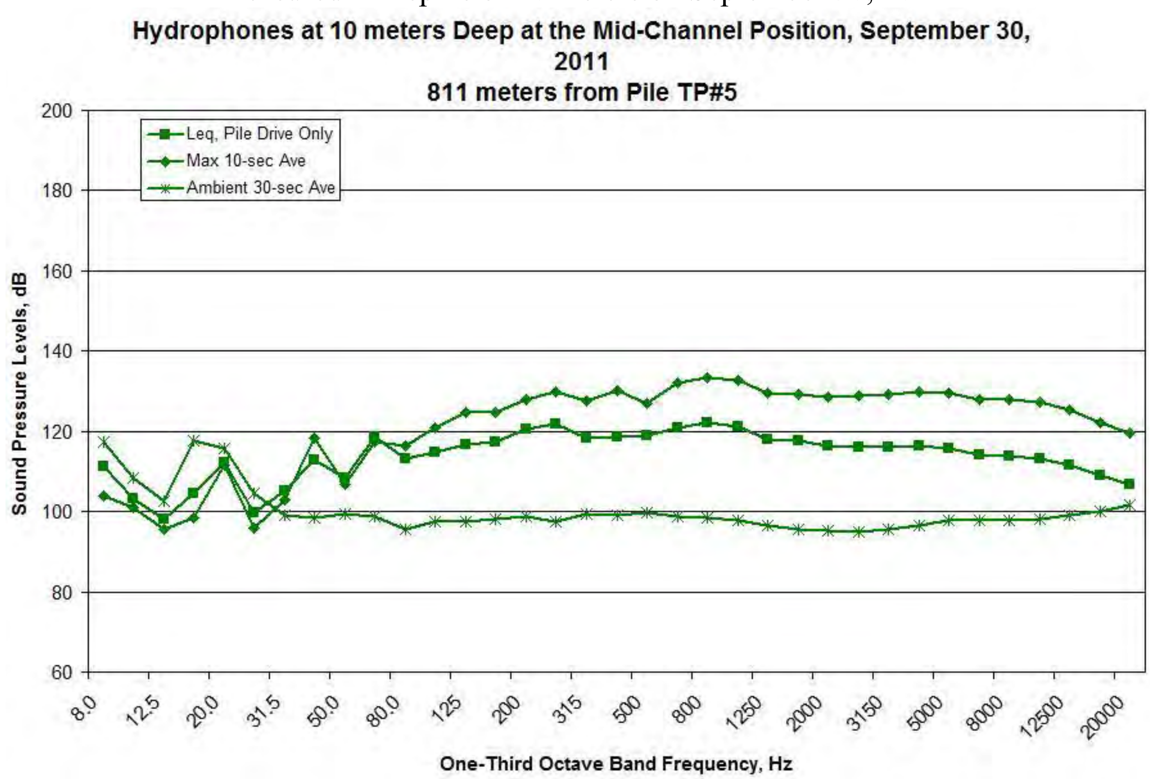

Figure A556. Spectral Data Measured at the MID Location during TP#5, 14:28-14:47, Measured at Depths of 10 meters on September 30, 2011

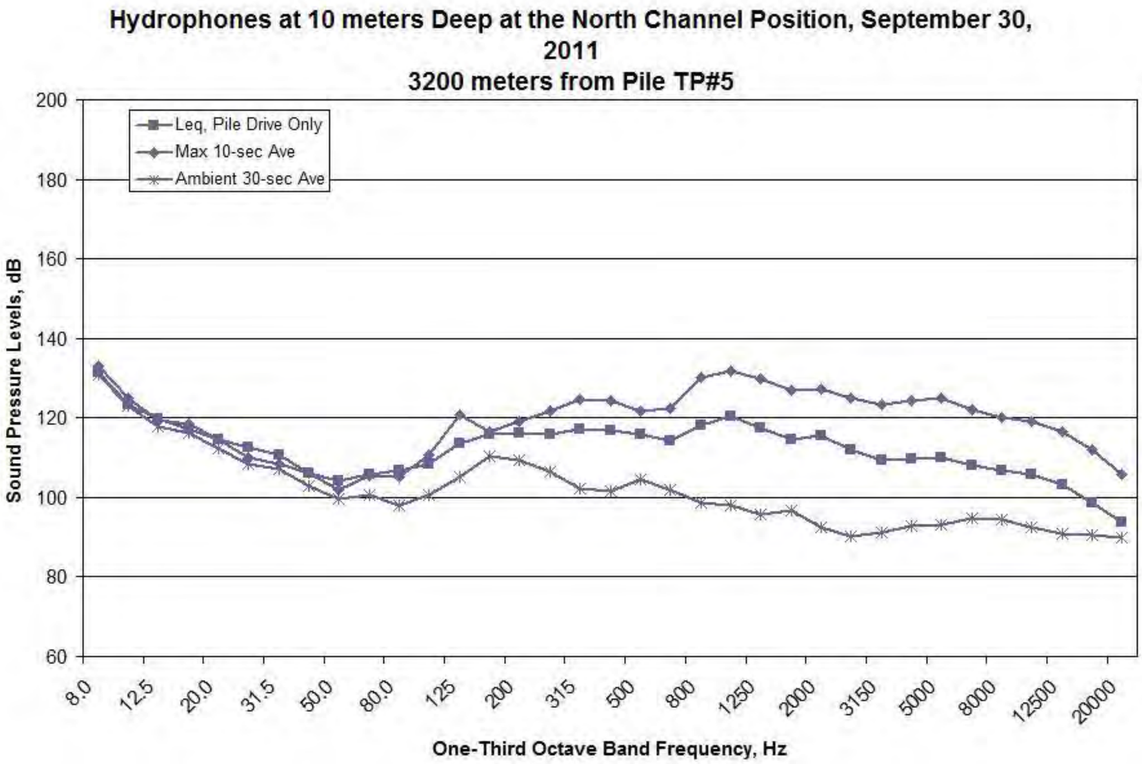

Figure A557. Spectral Data Measured at the NO Location during TP#5, 14:28-14:47, Measured at Depths of 10 meters on September 30, 2011

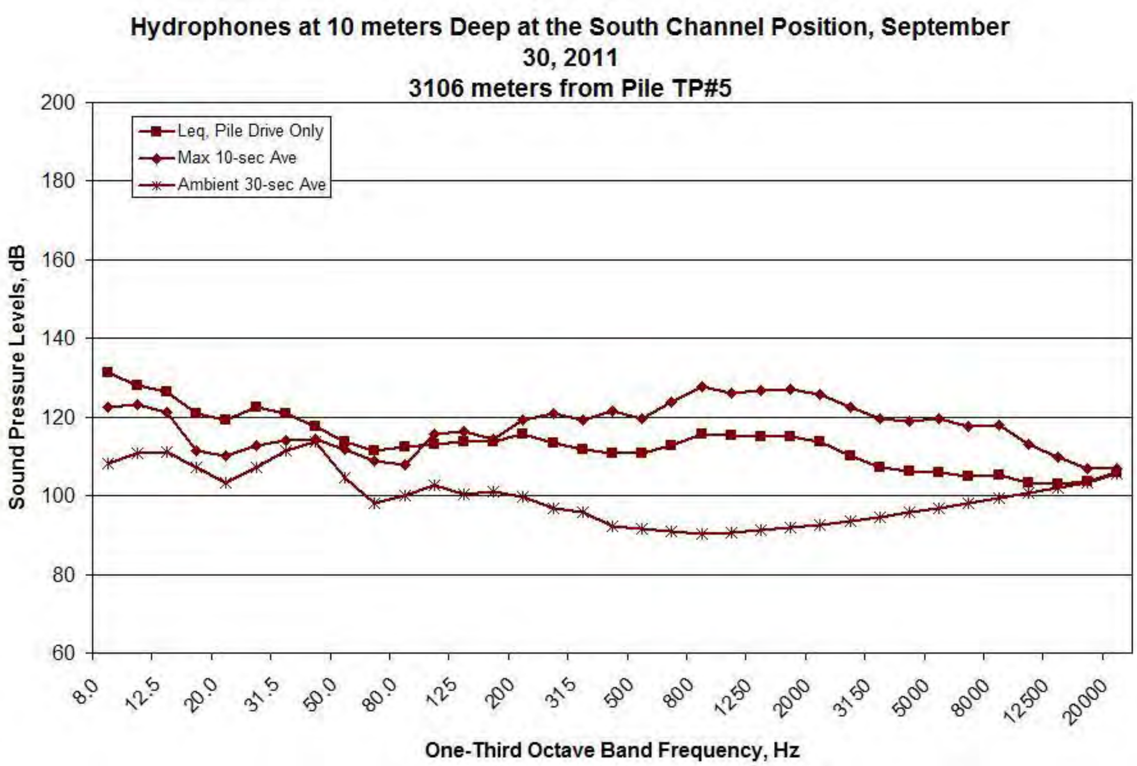

Figure A558. Spectral Data Measured at the SO Location during TP#5, 14:28-14:47, Measured at Depths of 10 meters on September 30, 2011

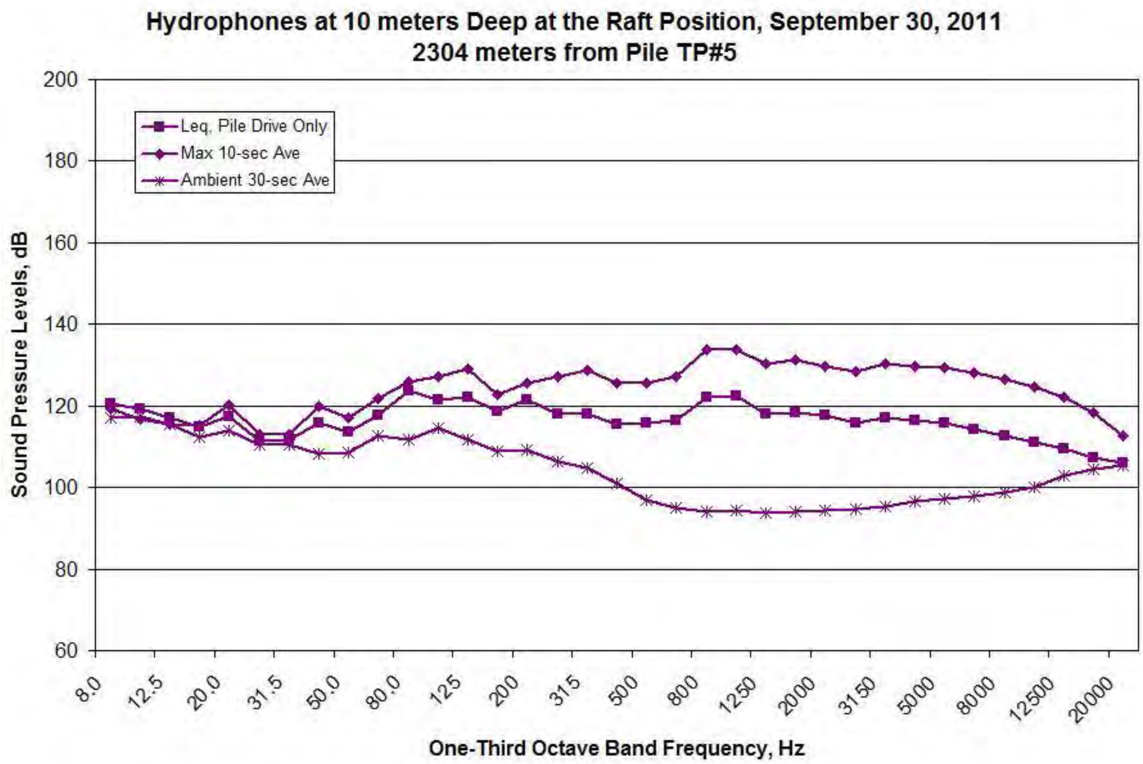

Figure A559. Spectral Data Measured at the RFT Location during TP#5, 14:28-14:47, Measured at Depths of 10 meters on September 30, 2011

TP#9 MP#3 (Vibratory Installation)

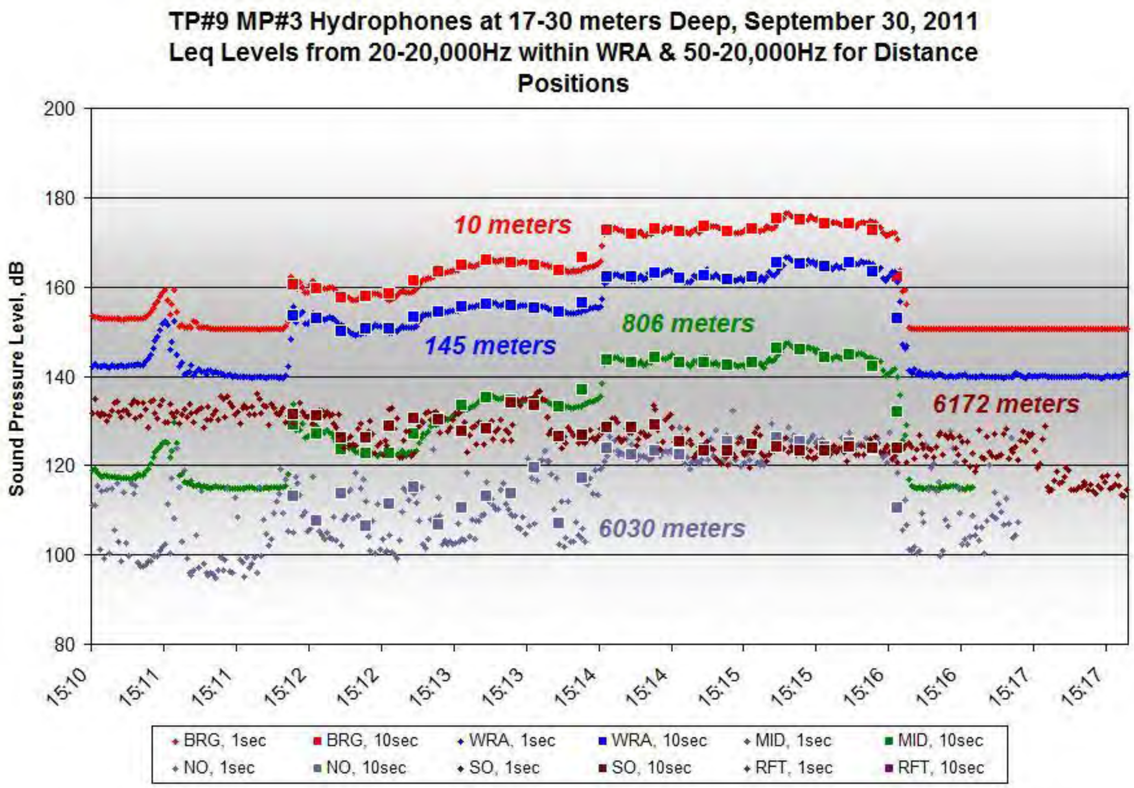

Figure A560. One-second and 10-second Average Data for TP#9 MP#3, 15:12-15:19, Measured at Depths of 17-30 meters on September 30, 2011

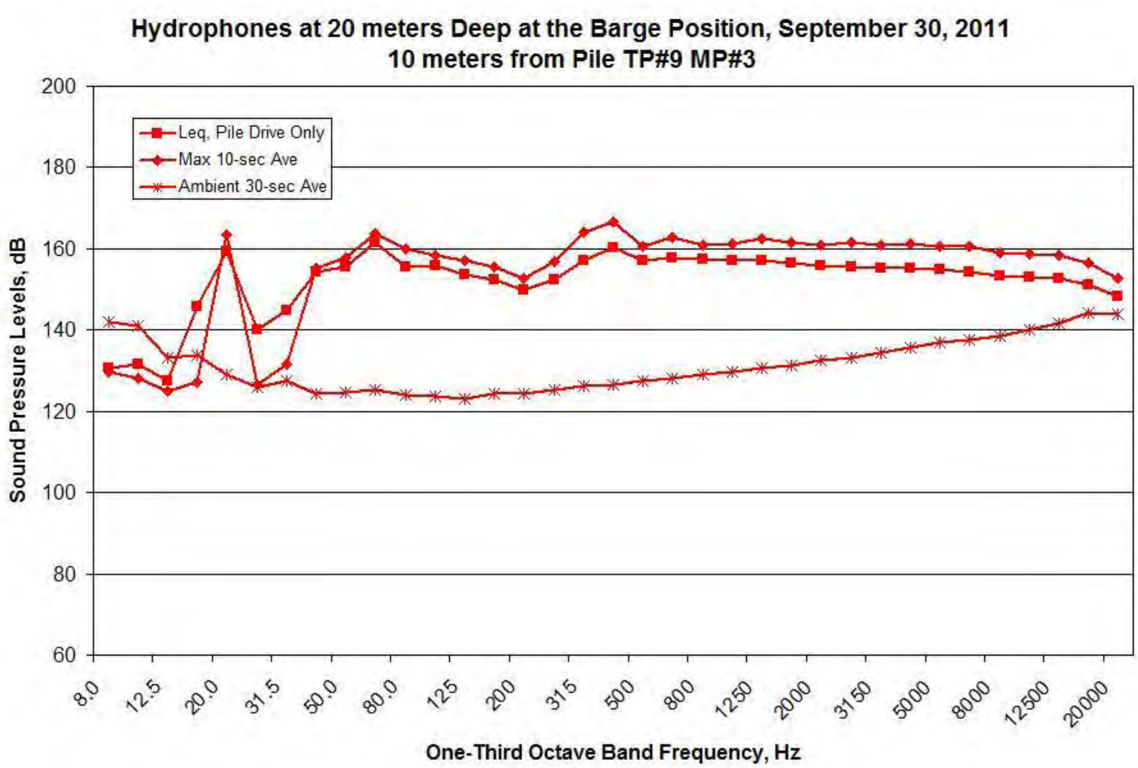

Figure A561. Spectral Data Measured at the BRG Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 20 meters on September 30, 2011

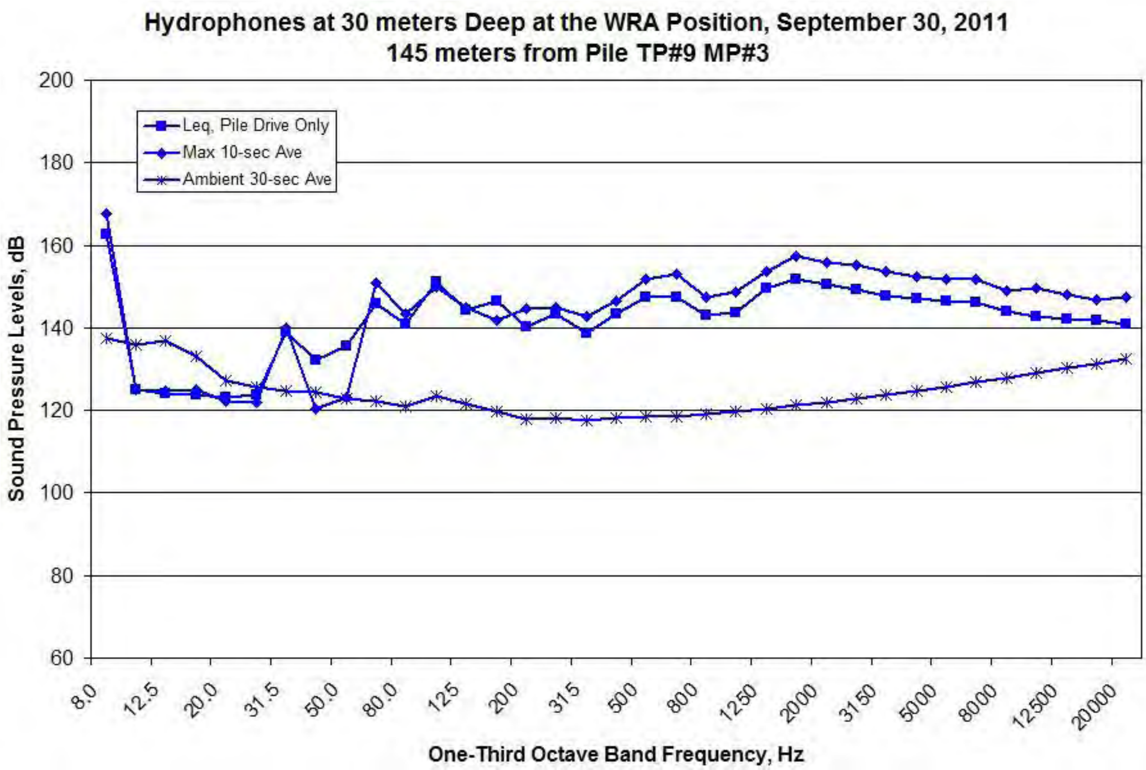

Figure A562. Spectral Data Measured at the WRA Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 30 meters on September 30, 2011

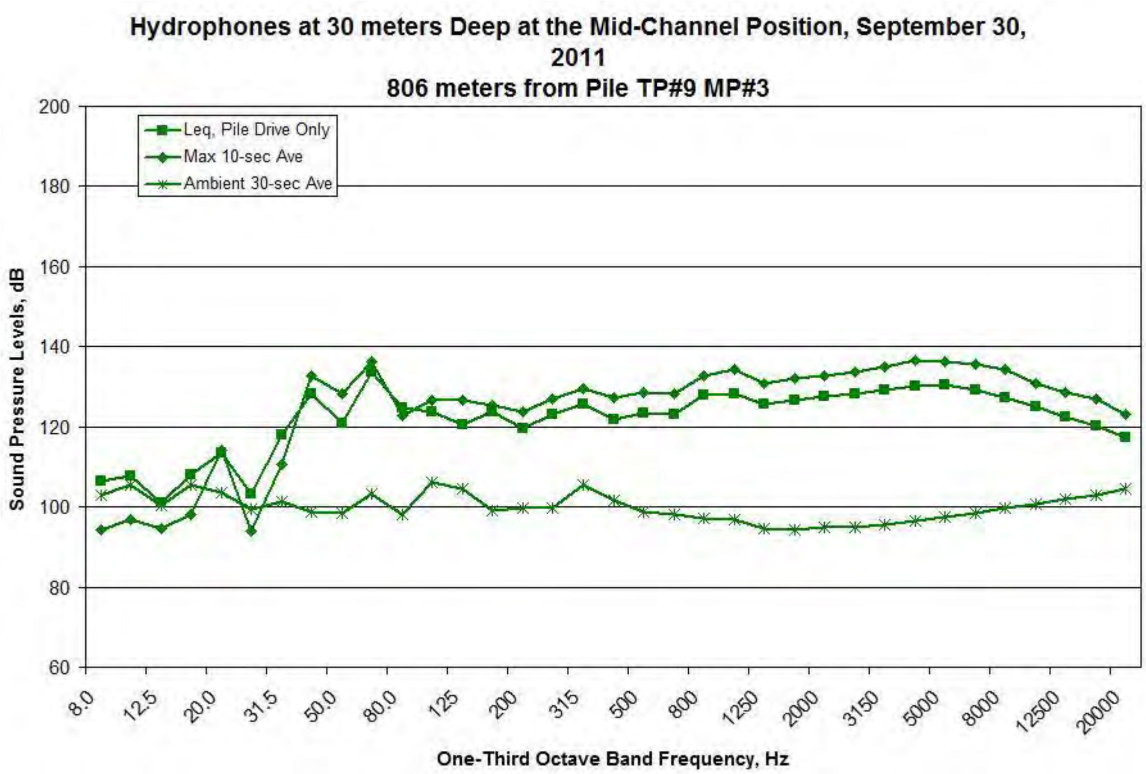

Figure A563. Spectral Data Measured at the MID Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 30 meters on September 30, 2011

NO DATA AVAILABLE – TOO MUCH NOISE

Figure A564. Spectral Data Measured at the NO Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 30 meters on September 30, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A565. Spectral Data Measured at the SO Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 30 meters on September 30, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A566. Spectral Data Measured at the RFT Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 17 meters on September 30, 2011

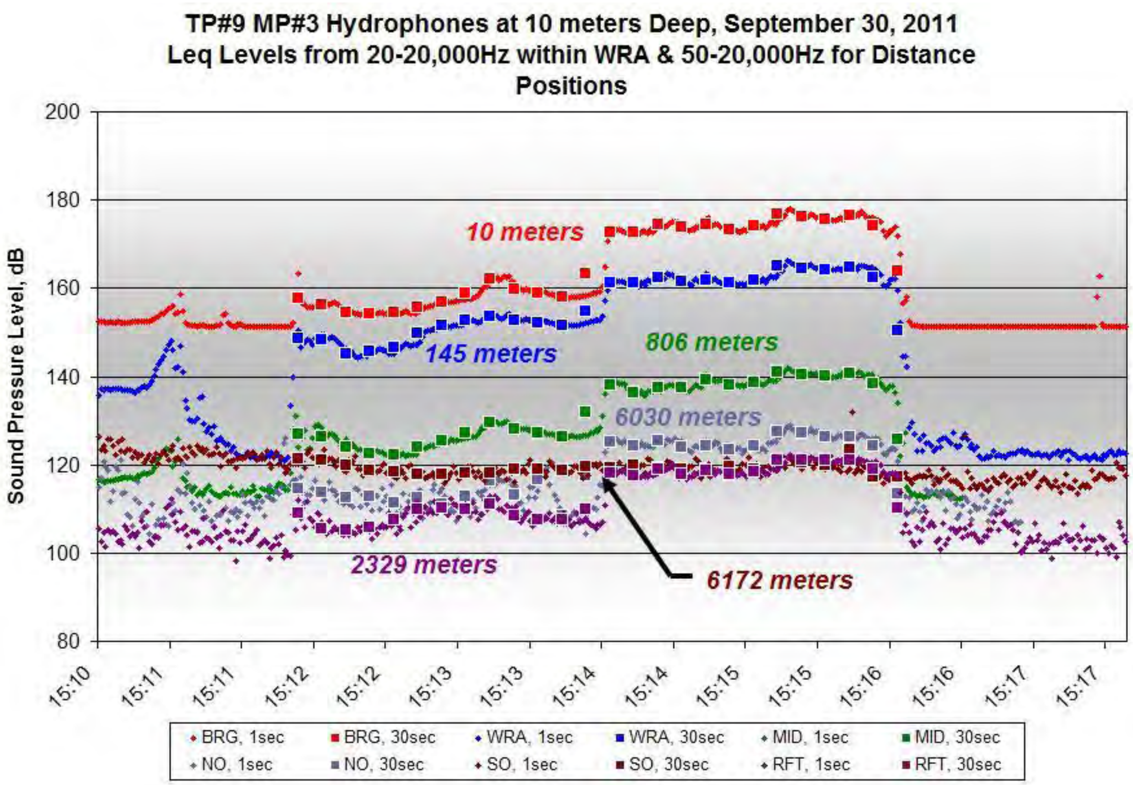

Figure A567. One-second and 10-second Average Data for TP#9 MP#3, 15:12-15:19, Measured at Depths of 10 meters on September 30, 2011

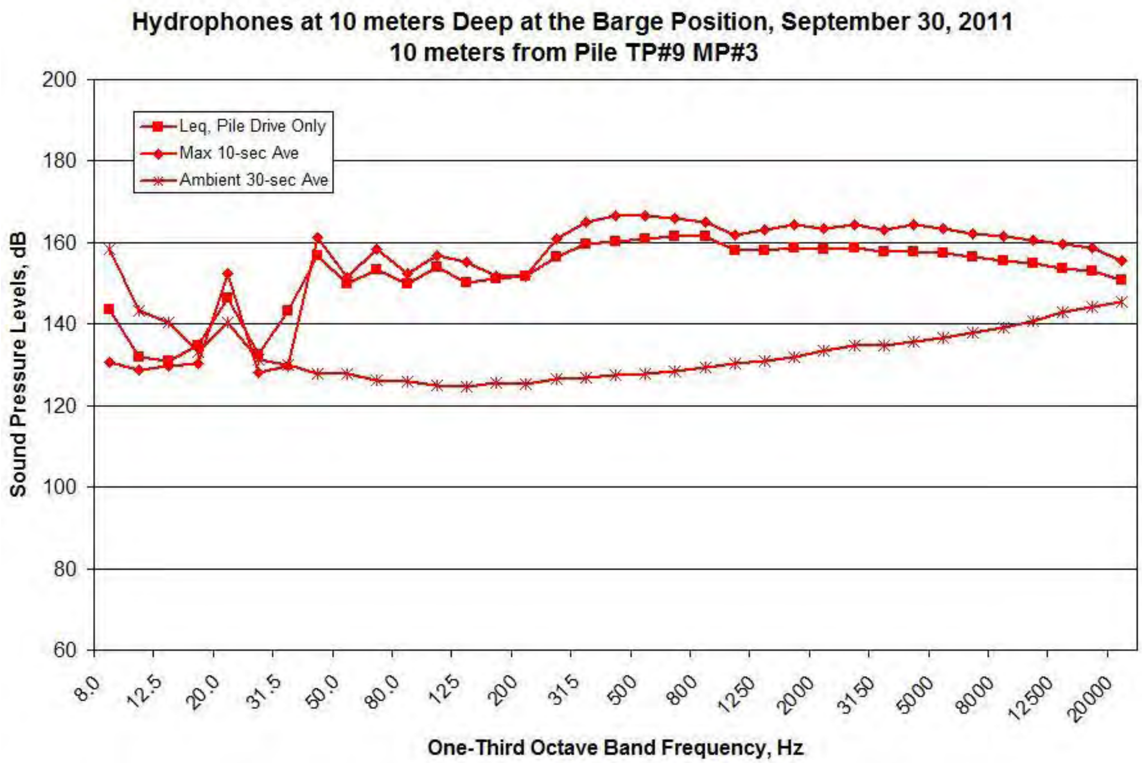

Figure A568. Spectral Data Measured at the BRG Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 10 meters on September 30, 2011

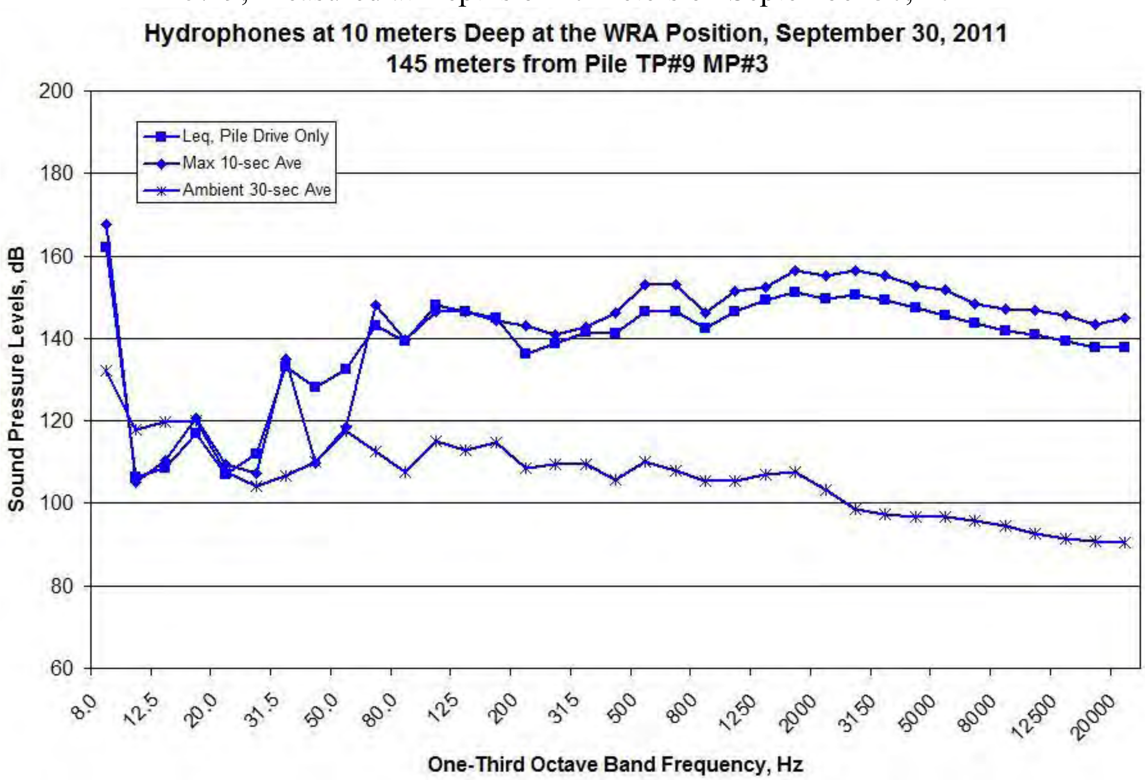

Figure A569. Spectral Data Measured at the WRA Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 10 meters on September 30, 2011

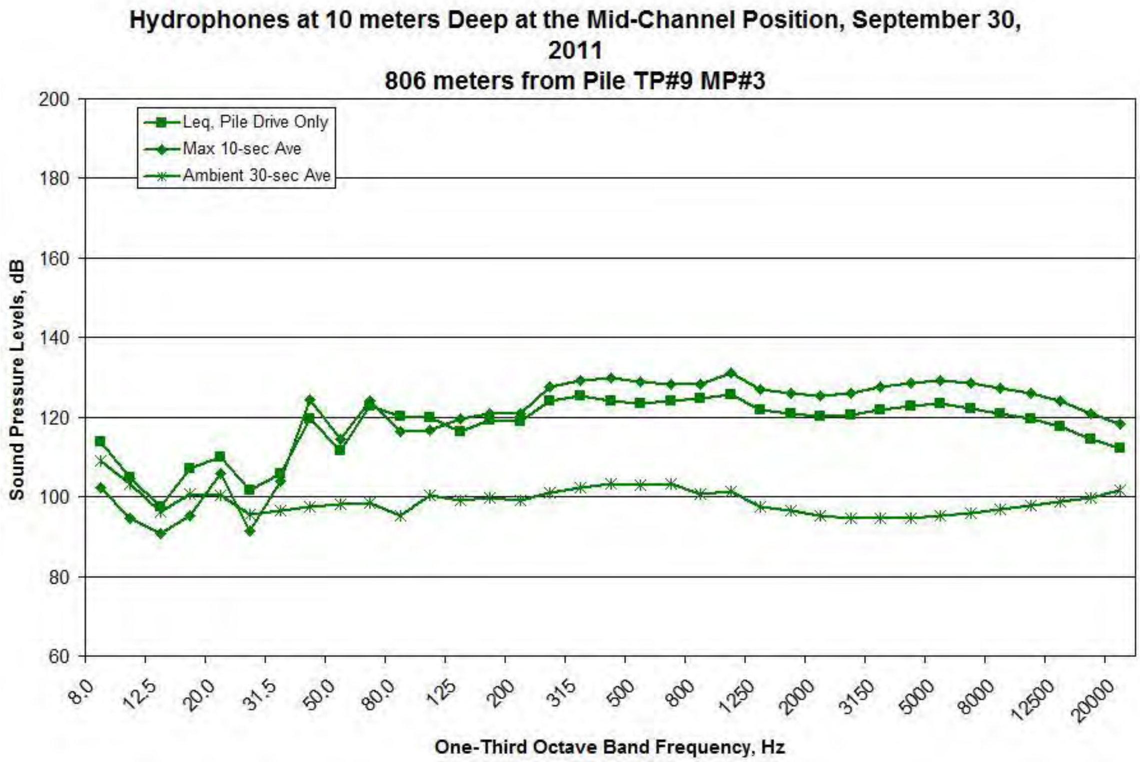

Figure A570. Spectral Data Measured at the MID Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 10 meters on September 30, 2011

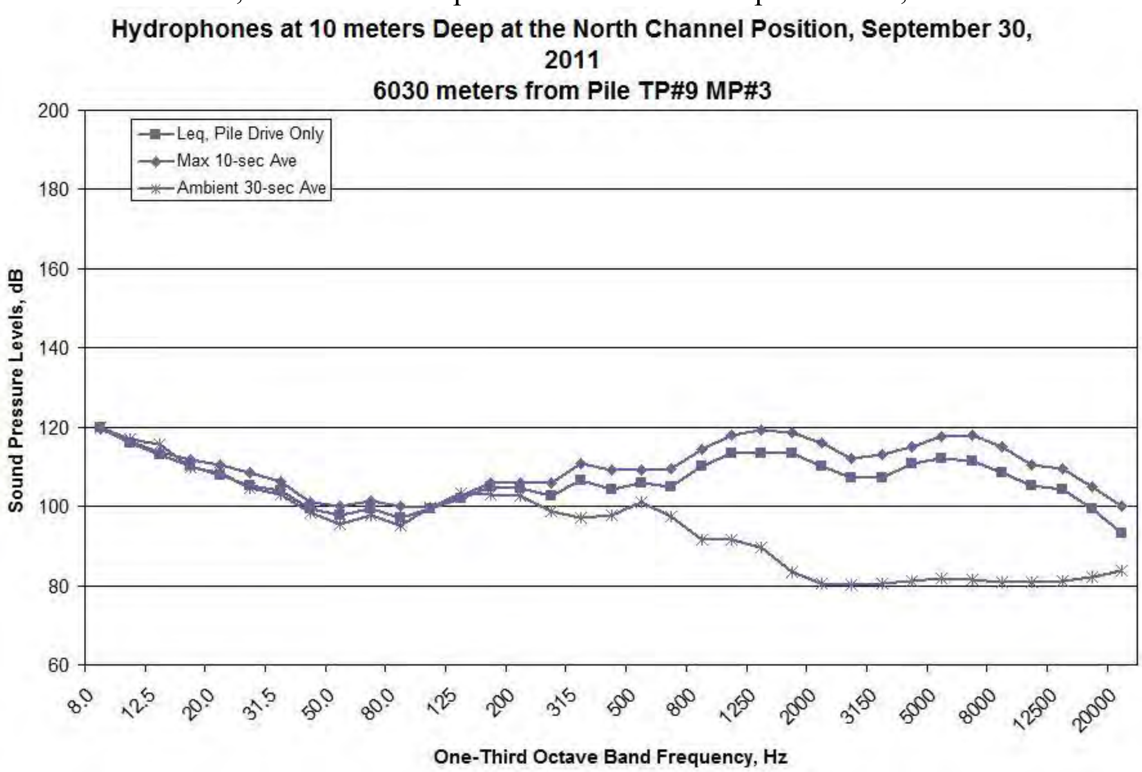

Figure A571. Spectral Data Measured at the NO Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 10 meters on September 30, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A572. Spectral Data Measured at the SO Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 10 meters on September 30, 2011

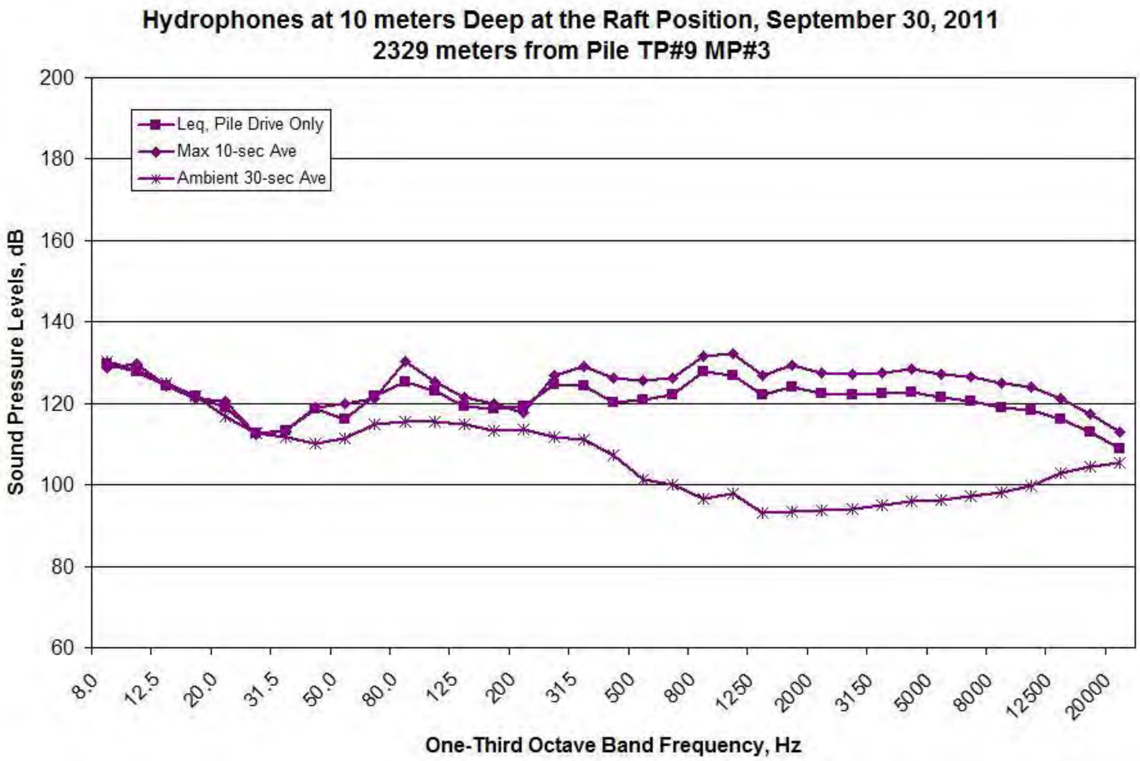

Figure A573. Spectral Data Measured at the RFT Location during TP#9 MP#3, 15:12-15:19, Measured at Depths of 10 meters on September 30, 2011

10/3/2011 – TP#6 (Vibratory Removal)

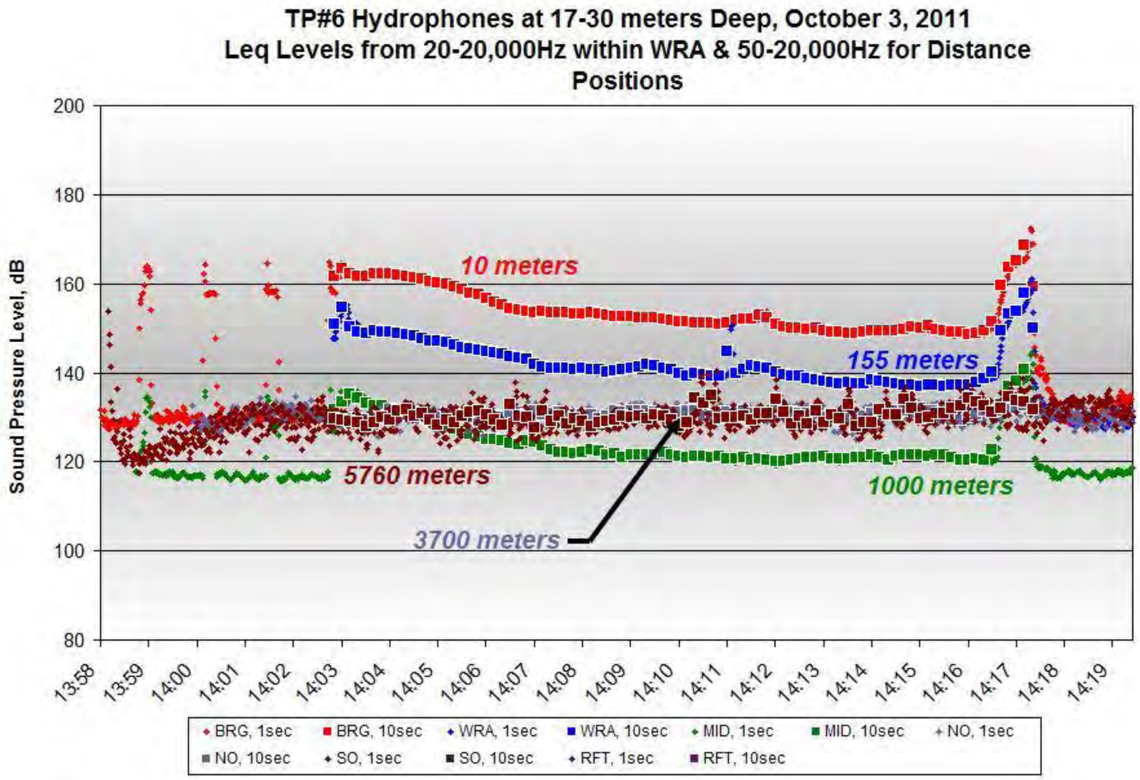

Figure A574. One-second and 10-second Average Data for TP#6, 14:02-14:17, Measured at Depths of 17-30 meters on October 3, 2011

NO SPECTRA DATA AVAILABLE

Figure A575. Spectral Data Measured at the BRG Location during TP#6, 14:02-14:17, Measured at Depths of 20 meters on October 3, 2011

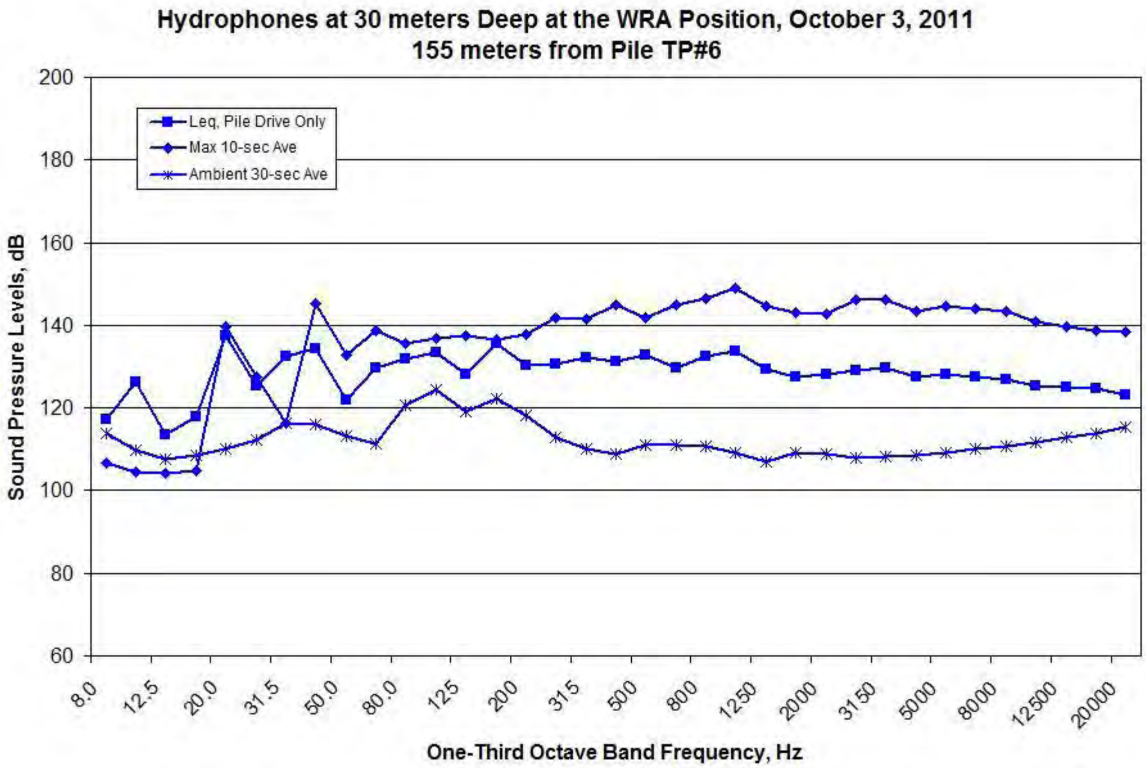

Figure A576. Spectral Data Measured at the WRA Location during TP#6, 14:02-14:17, Measured at Depths of 30 meters on October 3, 2011

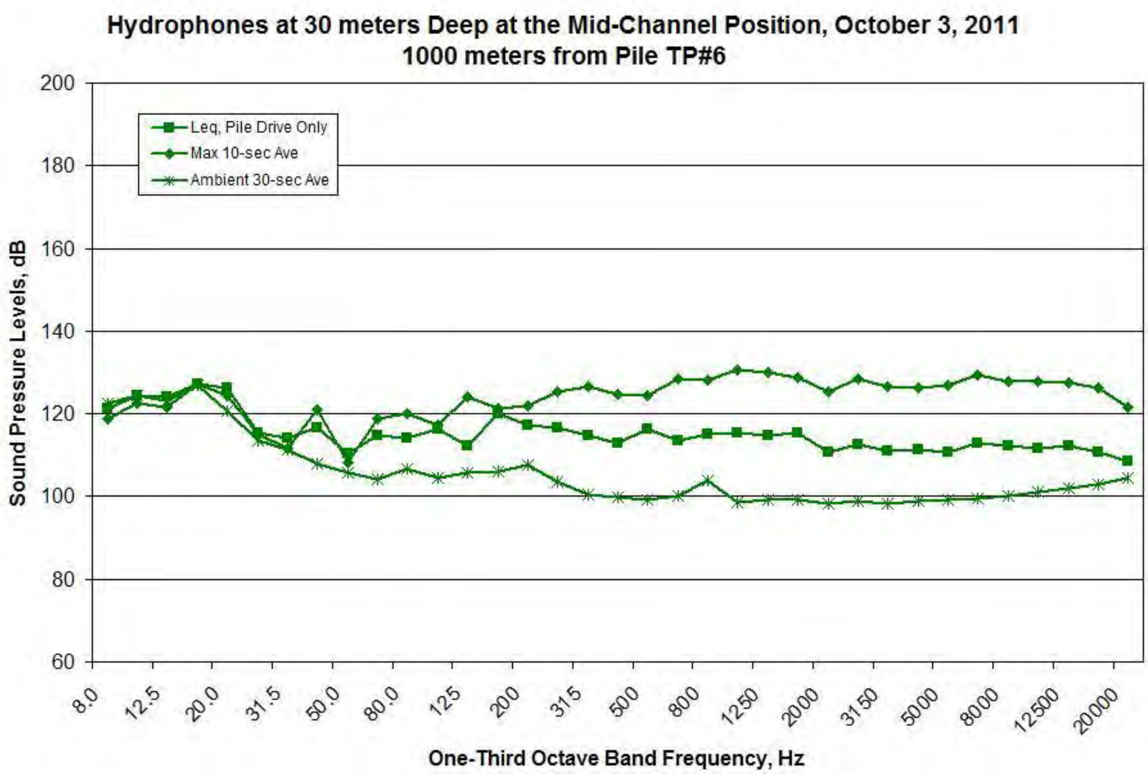

Figure A577. Spectral Data Measured at the MID Location during TP#6, 14:02-14:17, Measured at Depths of 30 meters on October 3, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A578. Spectral Data Measured at the NO Location during TP#6, 14:02-14:17, Measured at Depths of 30 meters on October 3, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A579. Spectral Data Measured at the SO Location during TP#6, 14:02-14:17, Measured at Depths of 30 meters on October 3, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A580. Spectral Data Measured at the RFT Location during TP#6, 14:02-14:17, Measured at Depths of 17 meters on October 3, 2011

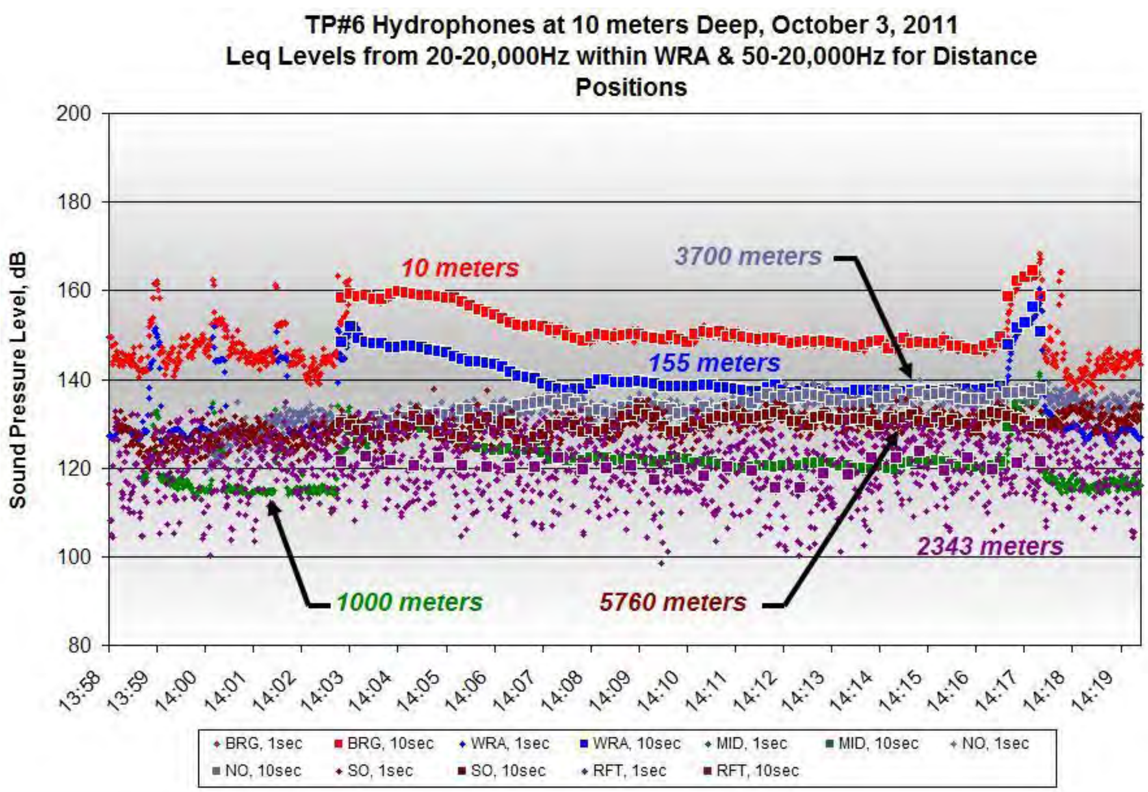

Figure A581. One-second and 10-second Average Data for TP#6, 14:02-14:17, Measured at Depths of 10 meters on October 3, 2011

NO SPECTRA DATA AVAILABLE

Figure A582. Spectral Data Measured at the BRG Location during TP#6, 14:02-14:17, Measured at Depths of 10 meters on October 3, 2011

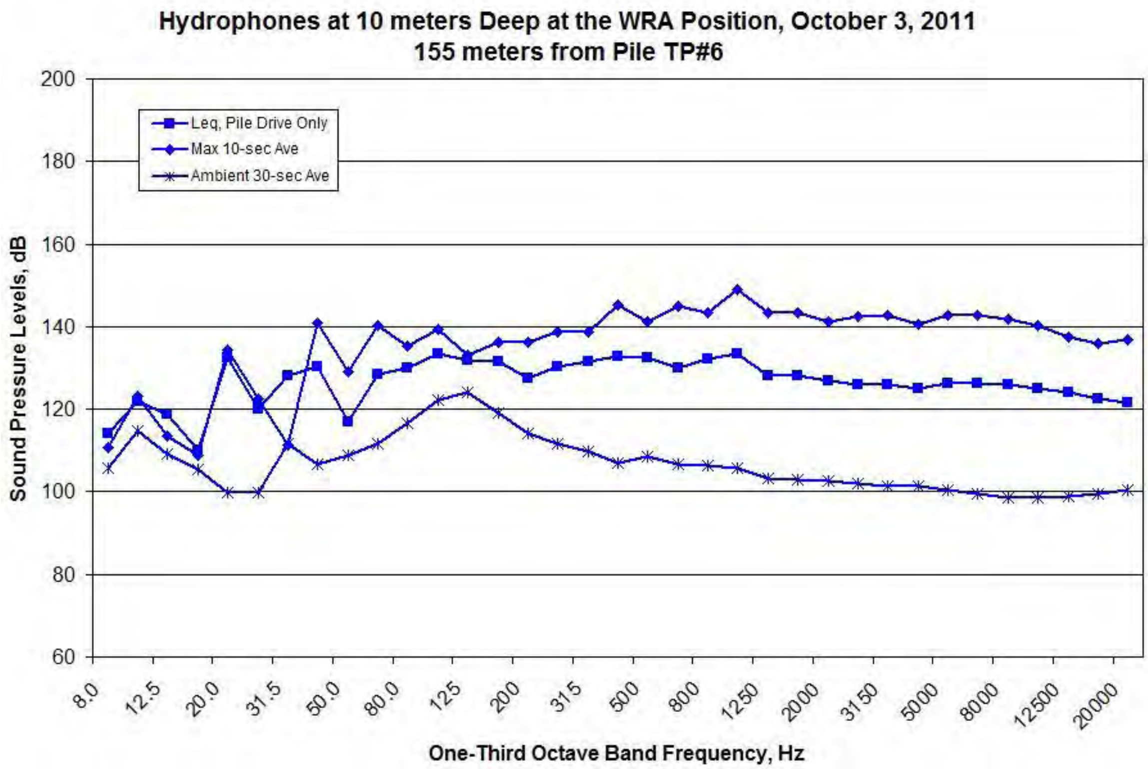

Figure A583. Spectral Data Measured at the WRA Location during TP#6, 14:02-14:17, Measured at Depths of 10 meters on October 3, 2011

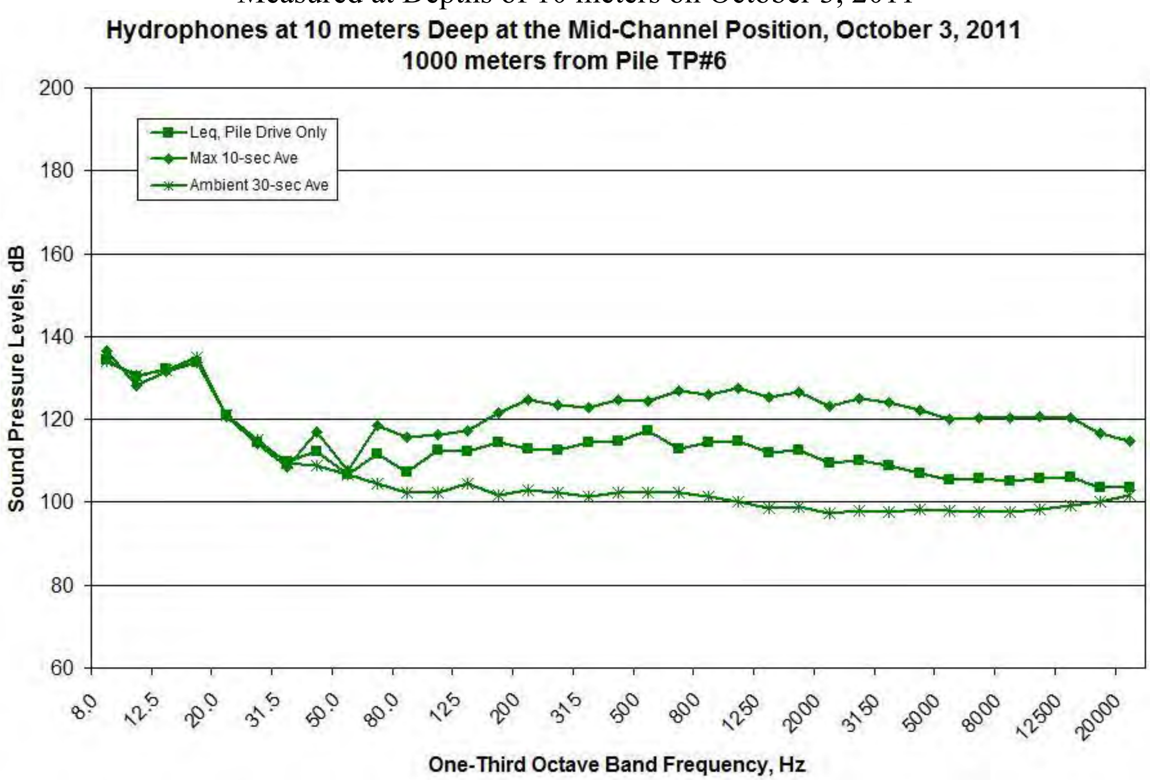

Figure A584. Spectral Data Measured at the MID Location during TP#6, 14:02-14:17, Measured at Depths of 10 meters on October 3, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A585. Spectral Data Measured at the NO Location during TP#6, 14:02-14:17, Measured at Depths of 10 meters on October 3, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A586. Spectral Data Measured at the SO Location during TP#6, 14:02-14:17, Measured at Depths of 10 meters on October 3, 2011

NO DATA AVAILABLE – TOO MUCH NOISE

Figure A587. Spectral Data Measured at the RFT Location during TP#6, 14:02-14:17, Measured at Depths of 10 meters on October 3, 2011

TP#4 (Vibratory Removal)

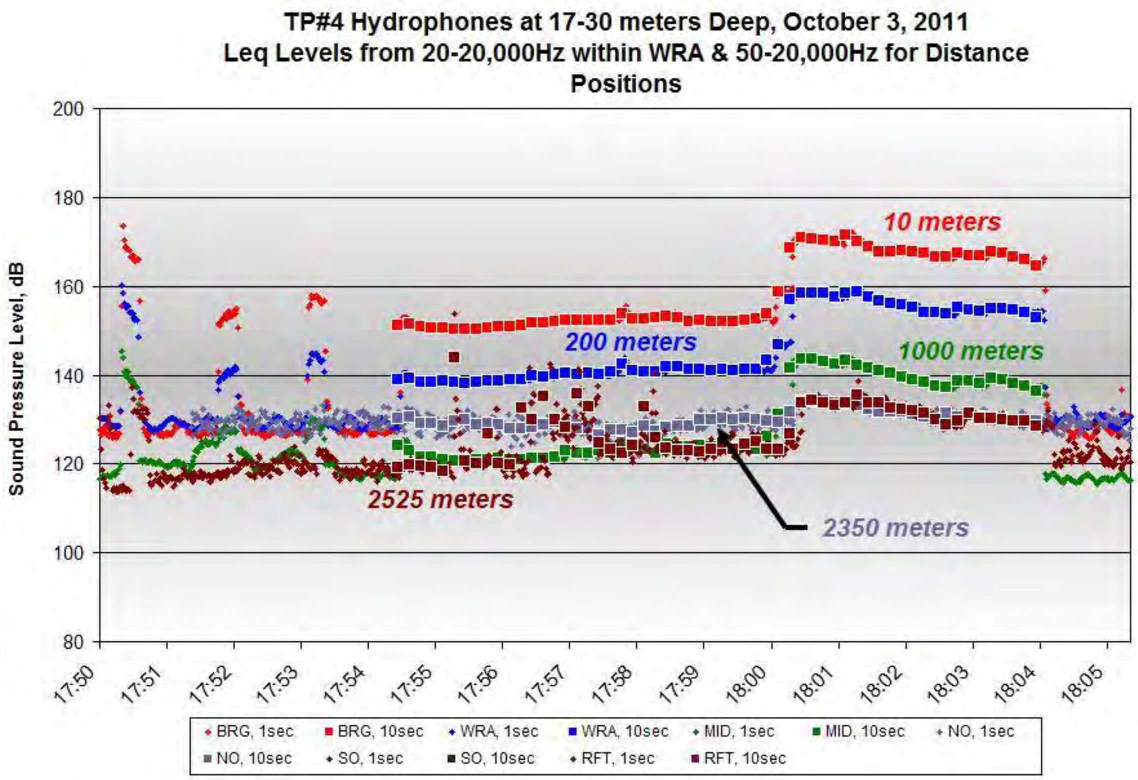

Figure A588. One-second and 10-second Average Data for TP#4, 17:54-18:04, Measured at Depths of 17-30 meters on October 3, 2011

NO SPECTRA DATA AVAILABLE

Figure A589. Spectral Data Measured at the BRG Location during TP#4, 17:54-18:04, Measured at Depths of 20 meters on October 3, 2011

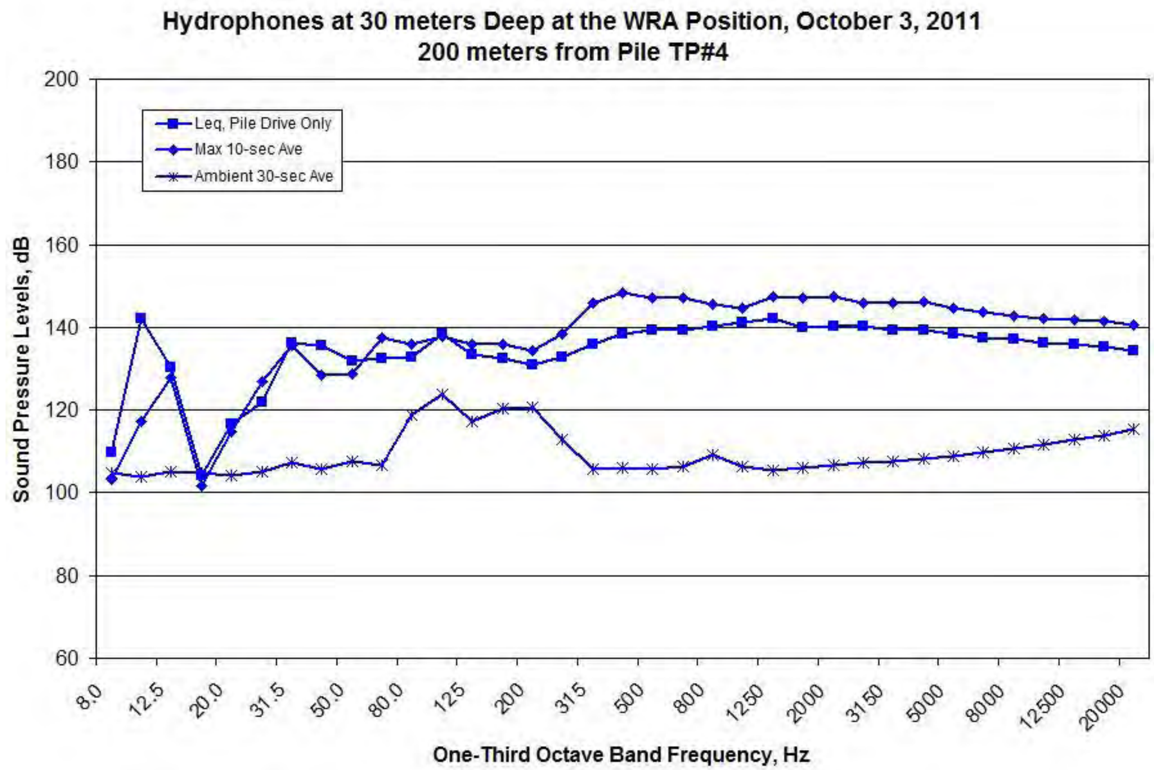

Figure A590. Spectral Data Measured at the WRA Location during TP#4, 17:54-18:04, Measured at Depths of 30 meters on October 3, 2011

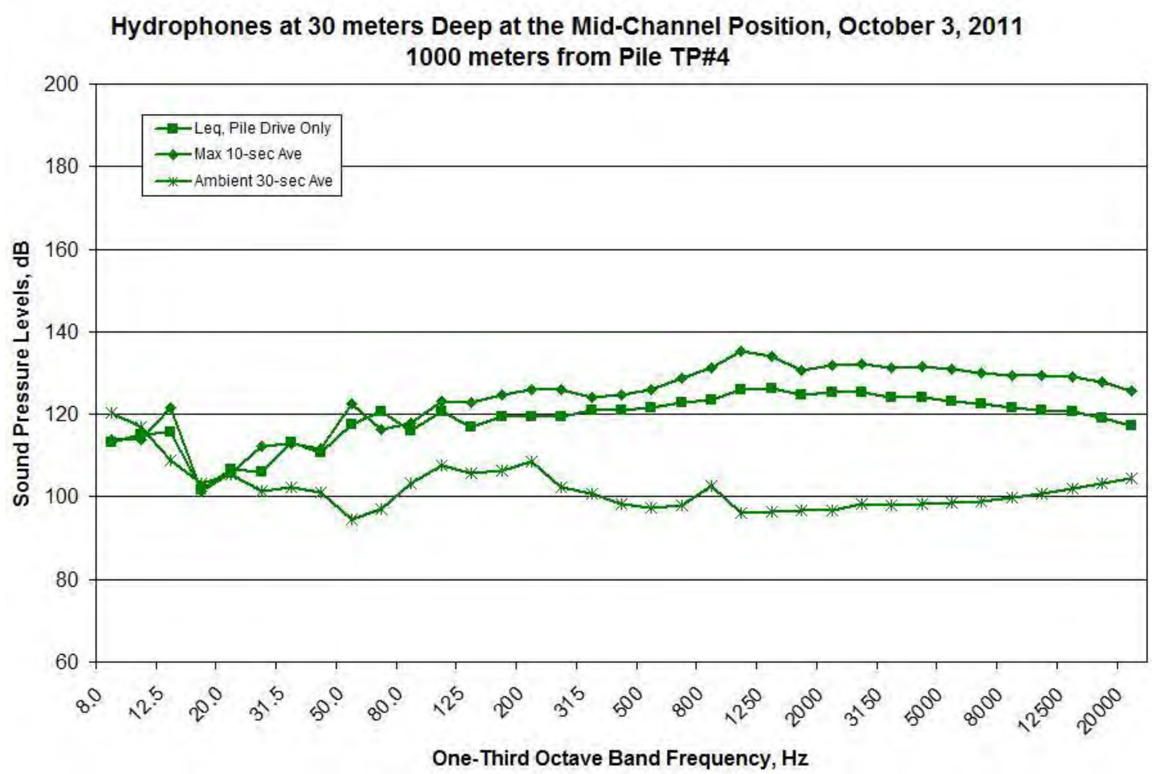

Figure A591. Spectral Data Measured at the MID Location during TP#4, 17:54-18:04, Measured at Depths of 30 meters on October 3, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A592. Spectral Data Measured at the NO Location during TP#4, 17:54-18:04, Measured at Depths of 30 meters on October 3, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A593. Spectral Data Measured at the SO Location during TP#4, 17:54-18:04, Measured at Depths of 30 meters on October 3, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A594. Spectral Data Measured at the RFT Location during TP#4, 17:54-18:04, Measured at Depths of 17 meters on October 3, 2011

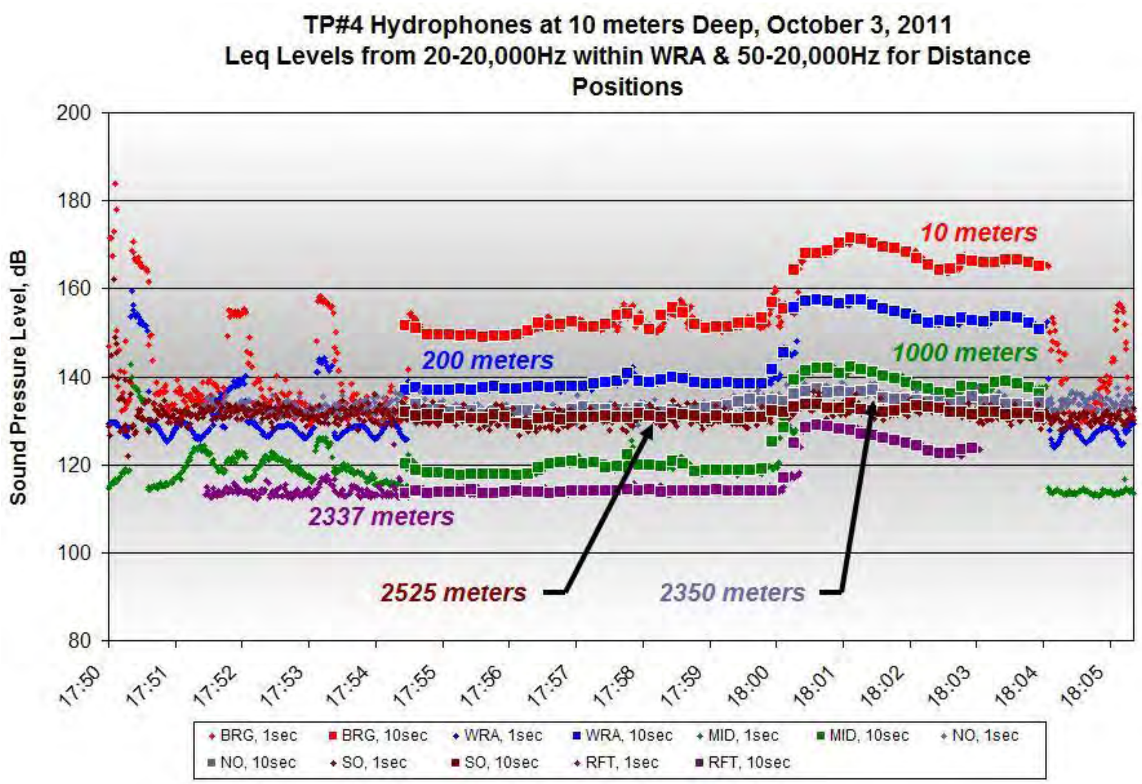

Figure A595. One-second and 10-second Average Data for TP#4, 17:54-18:04, Measured at Depths of 10 meters on October 3, 2011

NO SPECTRA DATA AVAILABLE

Figure A596. Spectral Data Measured at the BRG Location during TP#4, 17:54-18:04, Measured at Depths of 10 meters on October 3, 2011

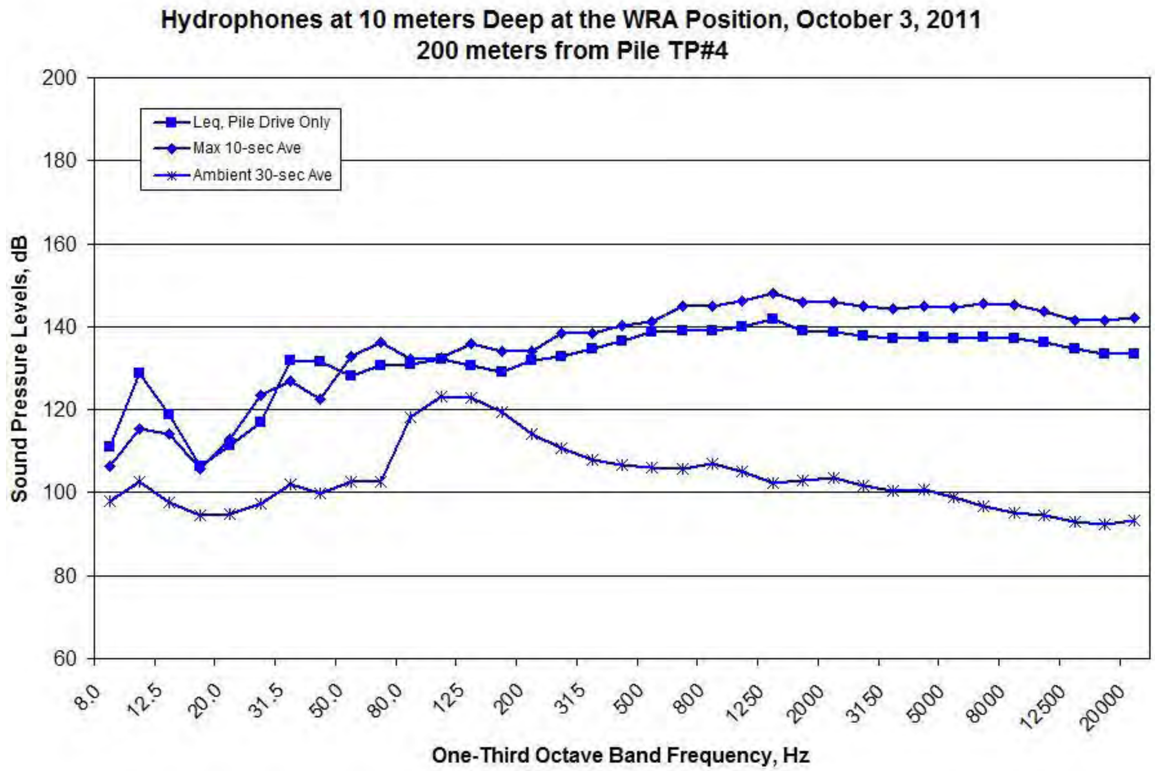

Figure A597. Spectral Data Measured at the WRA Location during TP#4, 17:54-18:04, Measured at Depths of 10 meters on October 3, 2011

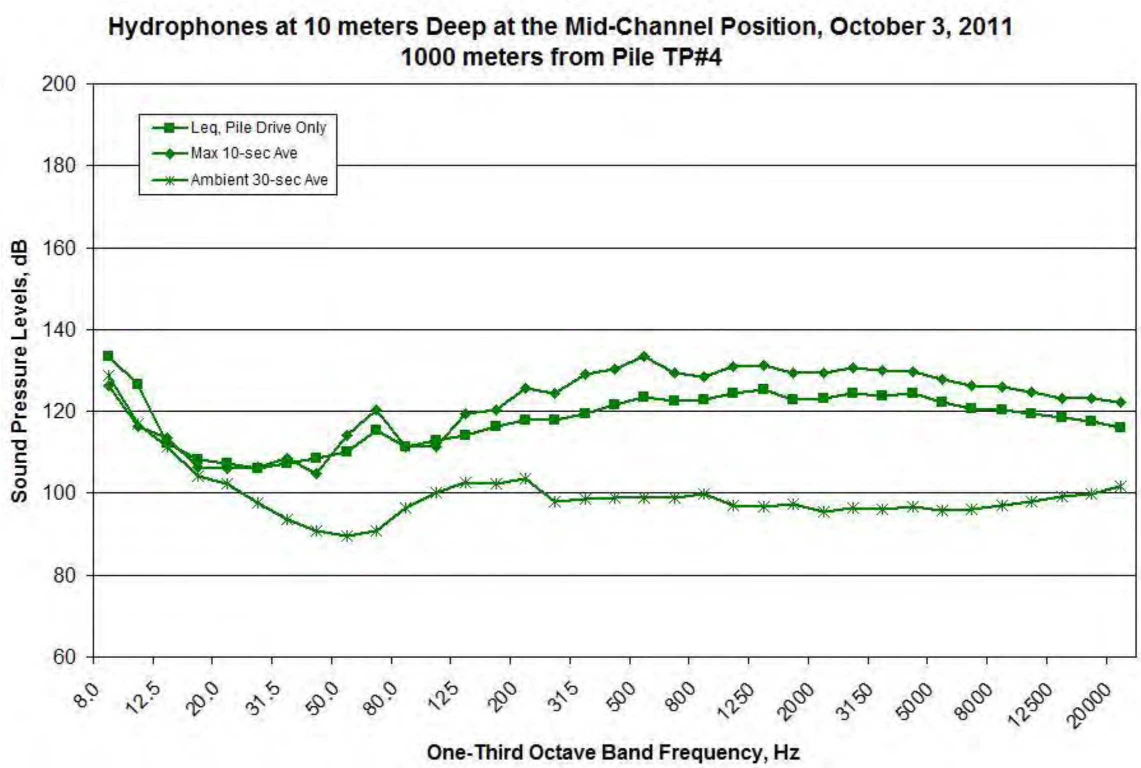

Figure A598. Spectral Data Measured at the MID Location during TP#4, 17:54-18:04, Measured at Depths of 10 meters on October 3, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A599. Spectral Data Measured at the NO Location during TP#4, 17:54-18:04, Measured at Depths of 10 meters on October 3, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A600. Spectral Data Measured at the SO Location during TP#4, 17:54-18:04, Measured at Depths of 10 meters on October 3, 2011

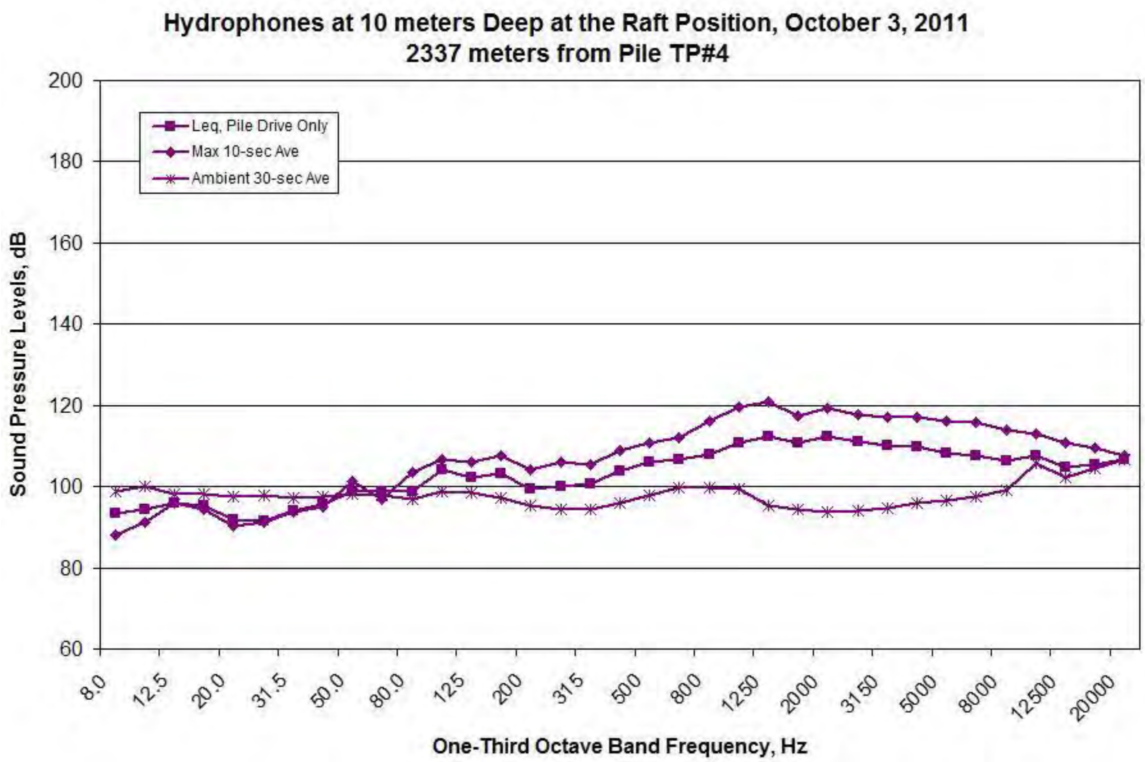

Figure A601. Spectral Data Measured at the RFT Location during TP#4, 17:54-18:04, Measured at Depths of 10 meters on October 3, 2011

10/4/2011 – TP#4 (Vibratory Removal)

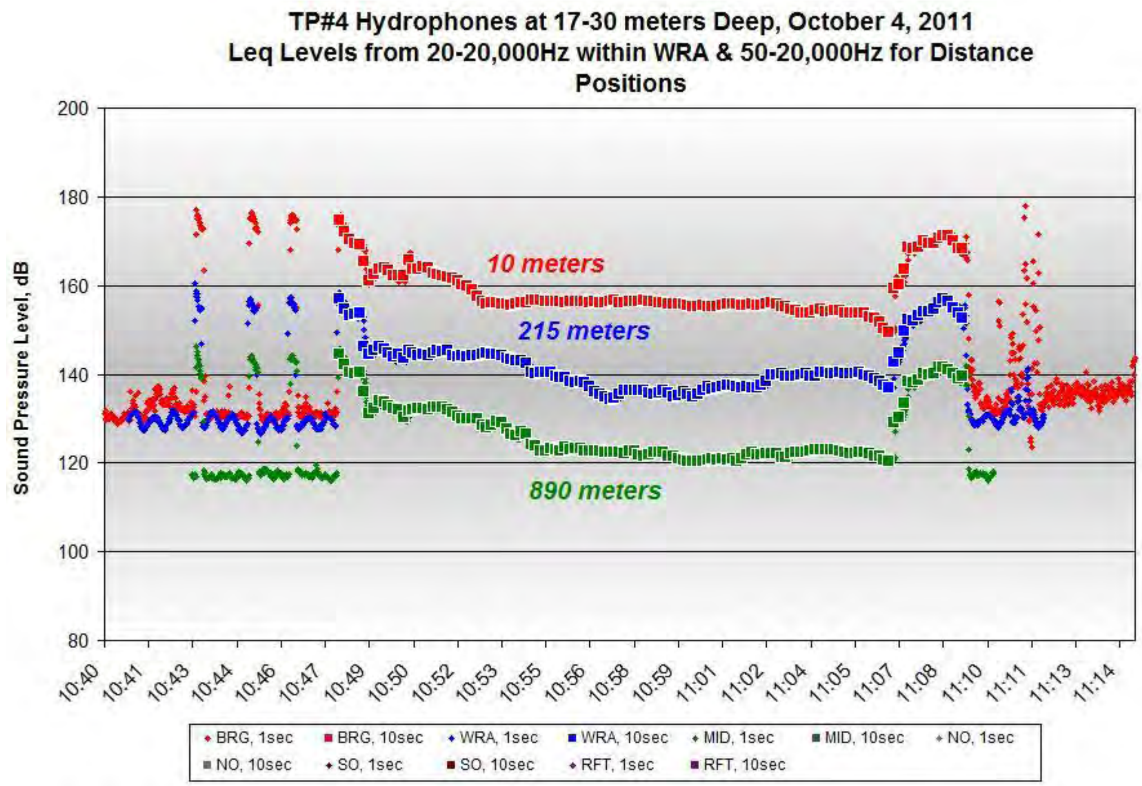

Figure A602. One-second and 10-second Average Data for TP#4, 10:45-11:07, Measured at Depths of 17-30 meters on October 4, 2011

NO SPECTRA DATA AVAILABLE

Figure A603. Spectral Data Measured at the BRG Location during TP#4, 10:45-11:07, Measured at Depths of 20 meters on October 4, 2011

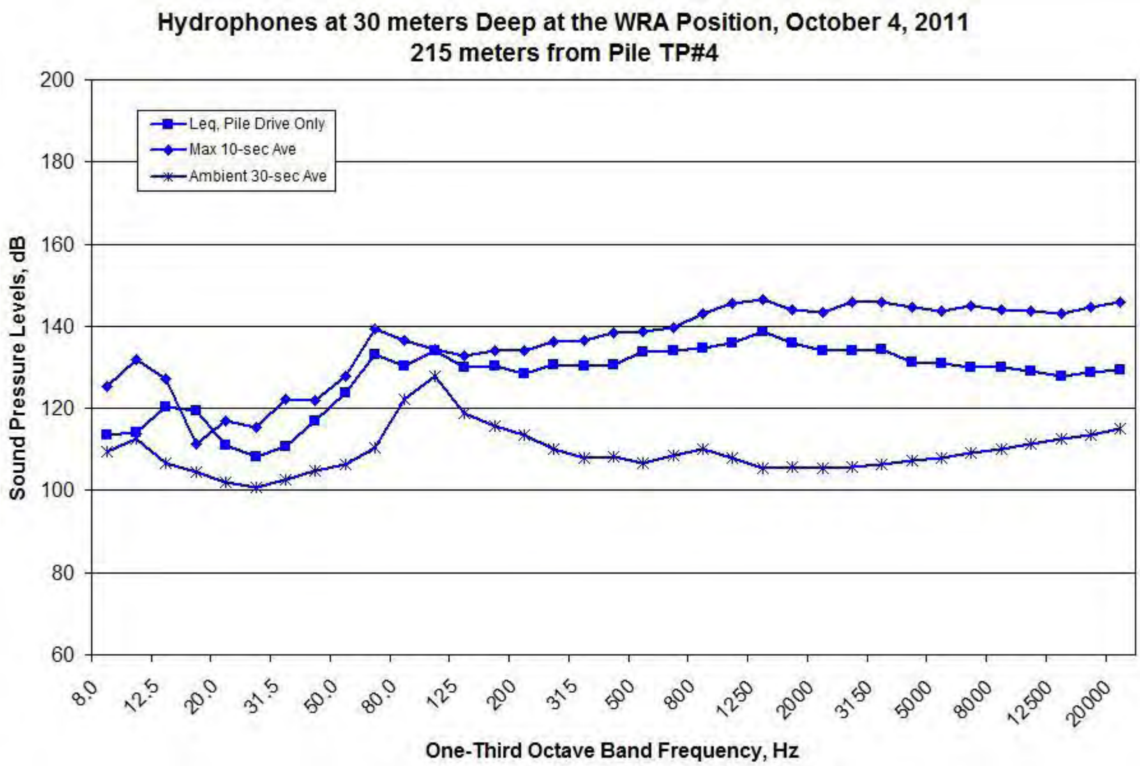

Figure A604. Spectral Data Measured at the WRA Location during TP#4, 10:45-11:07, Measured at Depths of 30 meters on October 4, 2011

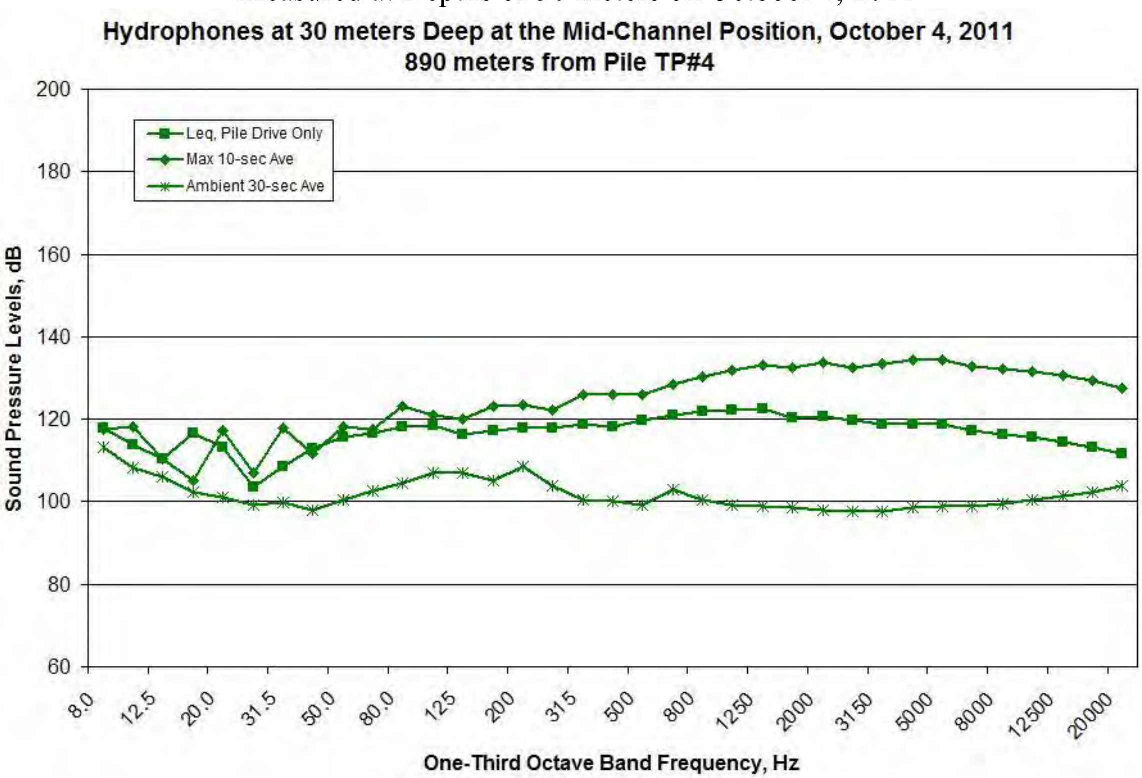

Figure A605. Spectral Data Measured at the MID Location during TP#4, 10:45-11:07, Measured at Depths of 30 meters on October 4, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A606. Spectral Data Measured at the RFT Location during TP#4, 10:45-11:07, Measured at Depths of 17 meters on October 4, 2011

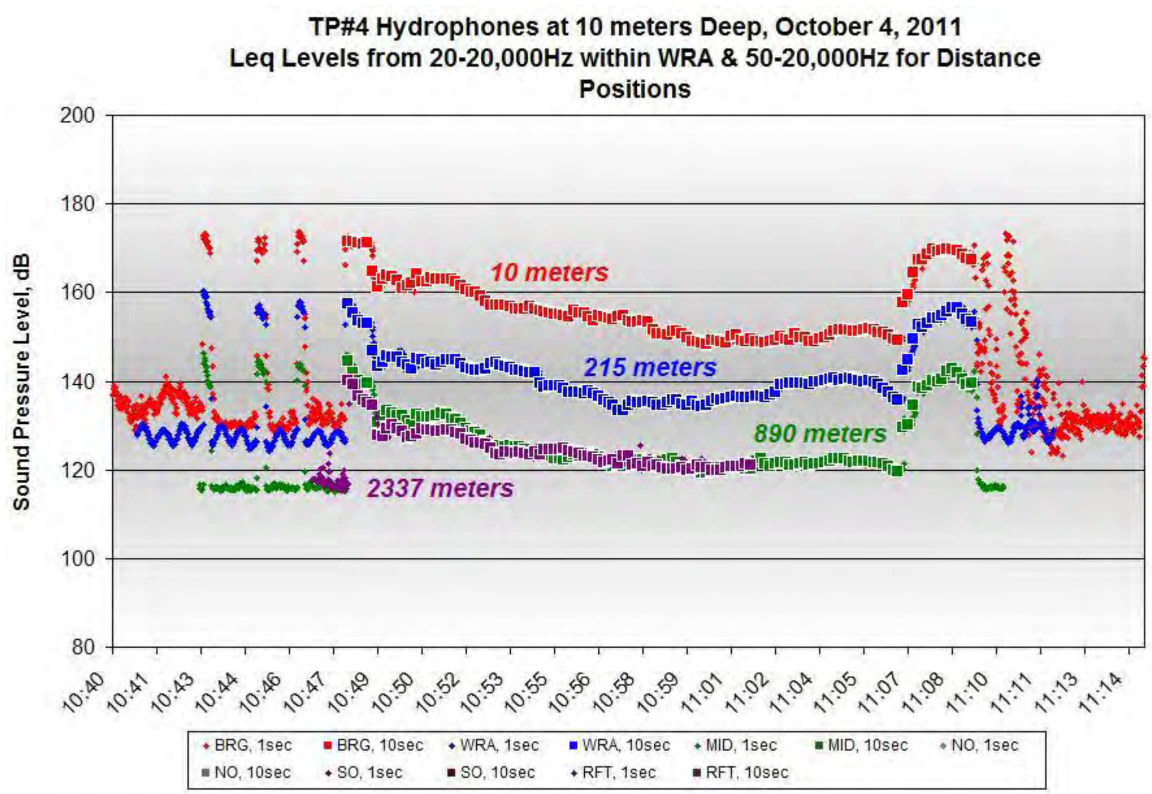

Figure A607. One-second and 10-second Average Data for TP#4, 10:45-11:07, Measured at Depths of 10 meters on October 4, 2011

NO SPECTRA DATA AVAILABLE

Figure A608. Spectral Data Measured at the BRG Location during TP#4, 10:45-11:07, Measured at Depths of 10 meters on October 4, 2011

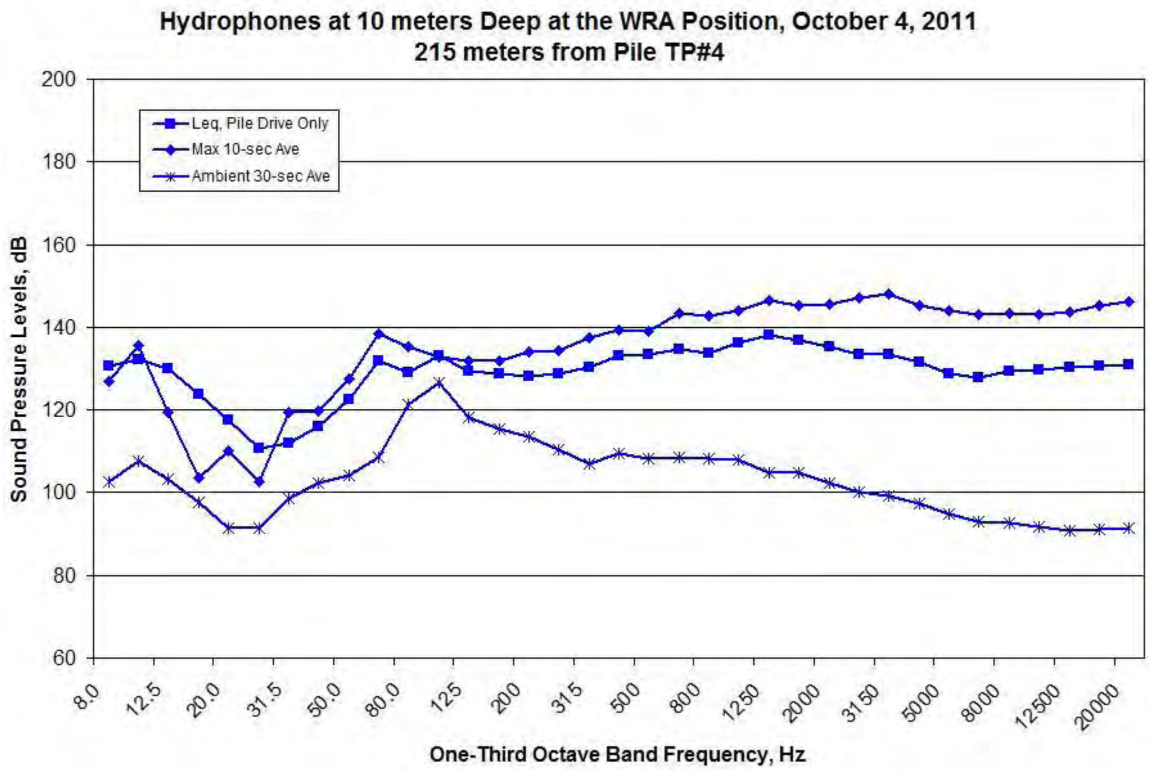

Figure A609. Spectral Data Measured at the WRA Location during TP#4, 10:45-11:07, Measured at Depths of 10 meters on October 4, 2011

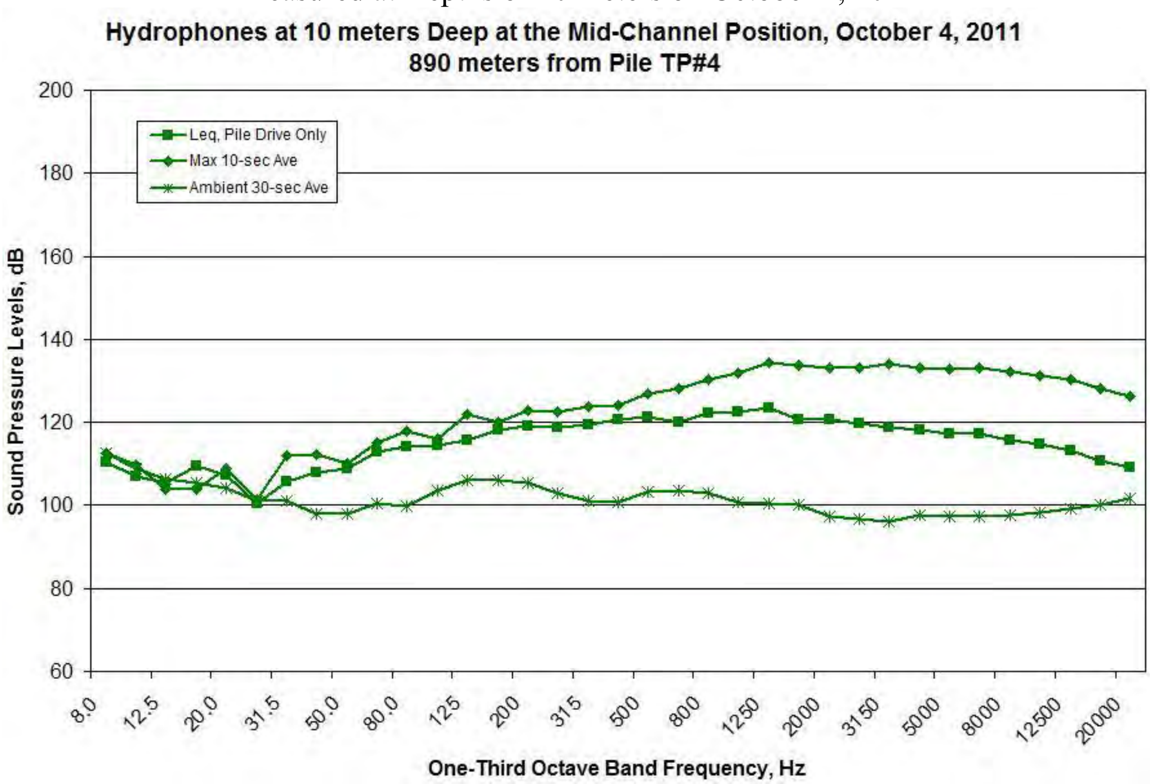

Figure A610. Spectral Data Measured at the MID Location during TP#4, 10:45-11:07, Measured at Depths of 10 meters on October 4, 2011

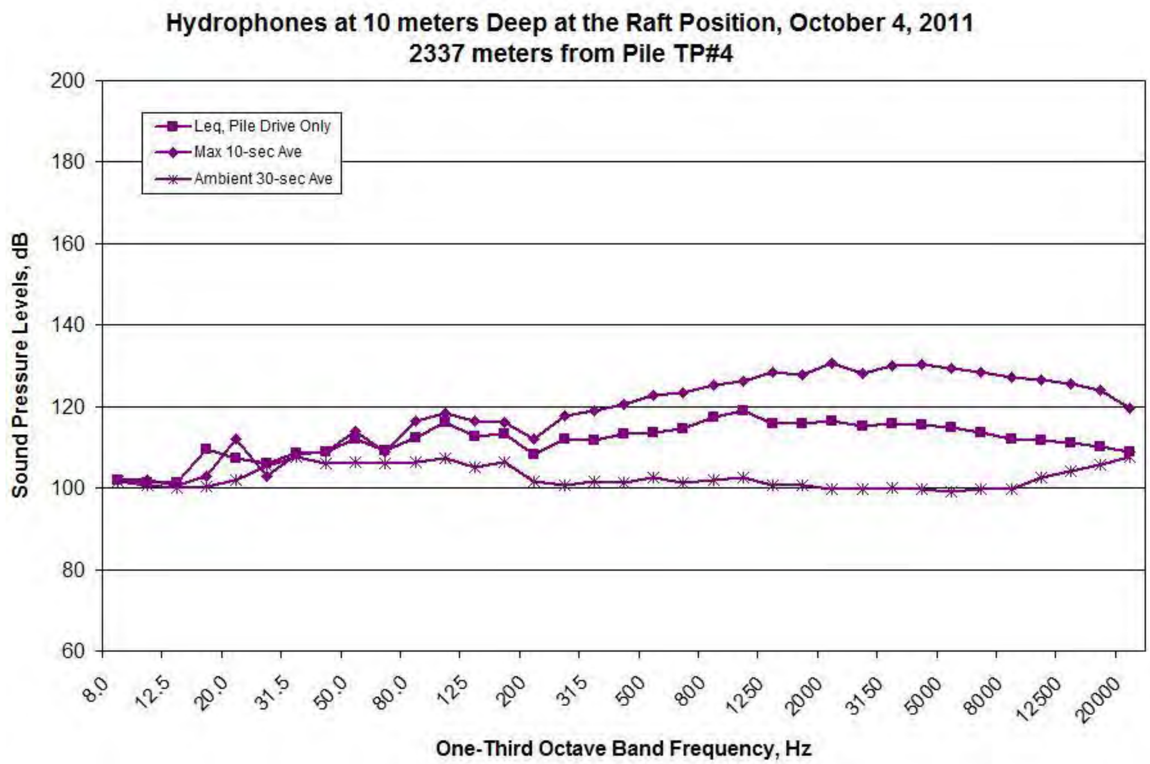

Figure A611. Spectral Data Measured at the RFT Location during TP#4, 10:45-11:07, Measured at Depths of 10 meters on October 4, 2011

TTP#1 (Vibratory Installation & Removal)

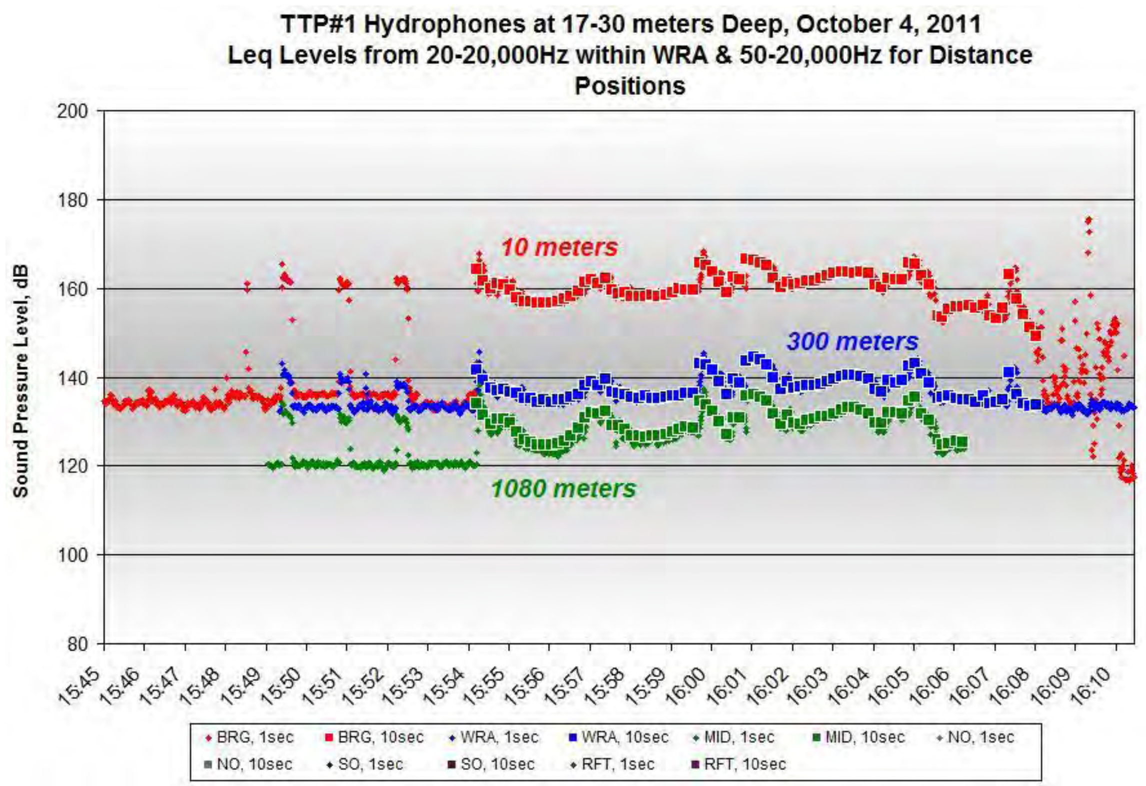

Figure A612. One-second and 10-second Average Data for TTP#1, 15:54-16:08, Measured at Depths of 17-30 meters on October 4, 2011

NO SPECTRA DATA AVAILABLE

Figure A613. Spectral Data Measured at the BRG Location during TTP#1, 15:54-16:08, Measured at Depths of 20 meters on October 4, 2011

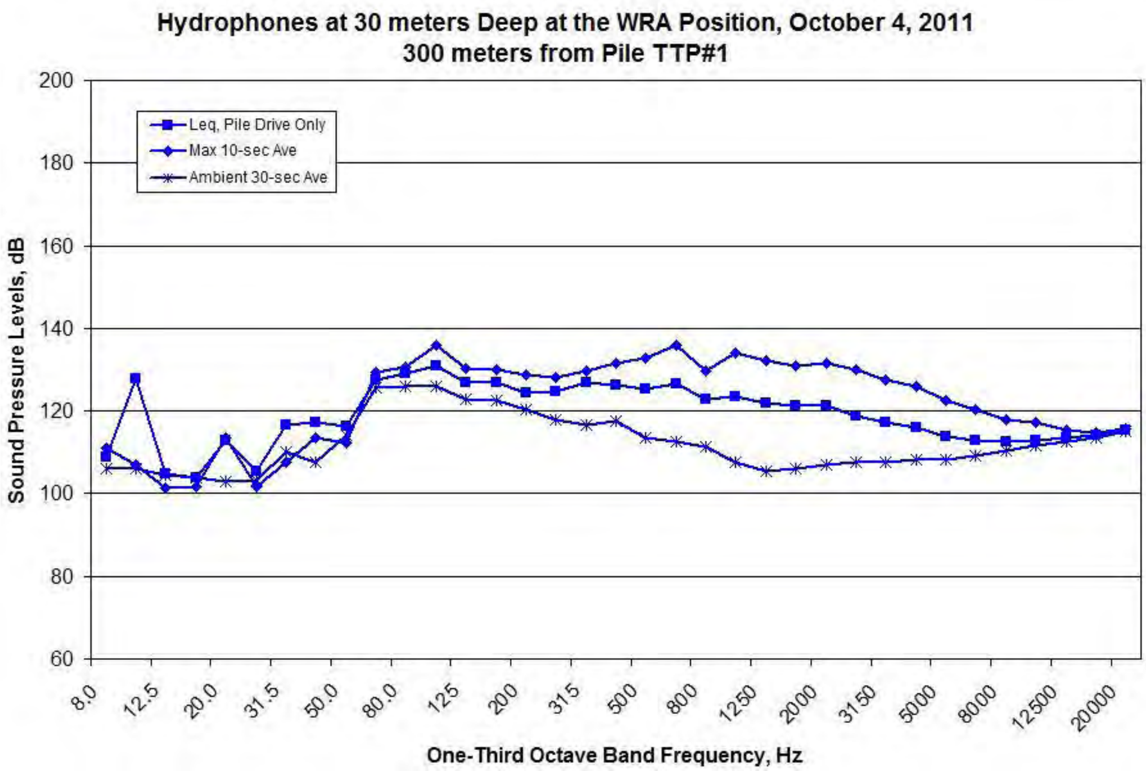

Figure A614. Spectral Data Measured at the WRA Location during TTP#1, 15:54-16:08, Measured at Depths of 30 meters on October 4, 2011

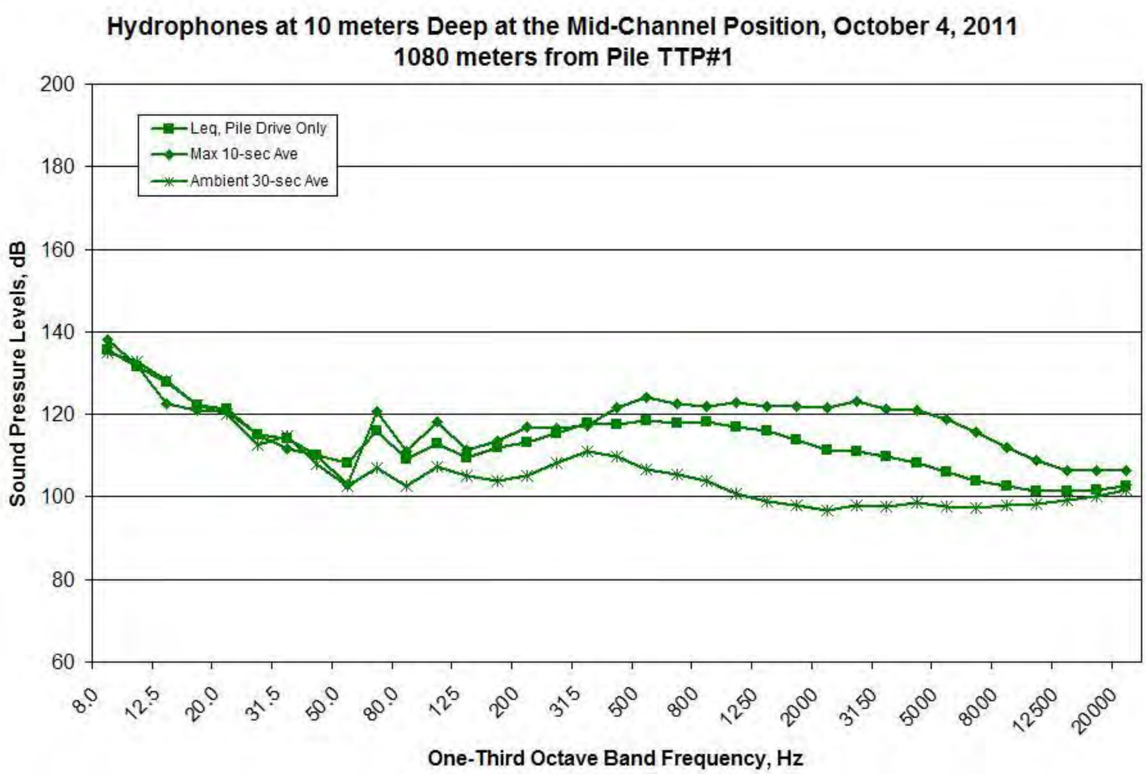

Figure A615. Spectral Data Measured at the MID Location during TTP#1, 15:54-16:08, Measured at Depths of 30 meters on October 4, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A616. Spectral Data Measured at the RFT Location during TTP#1, 15:54-16:08, Measured at Depths of 17 meters on October 4, 2011

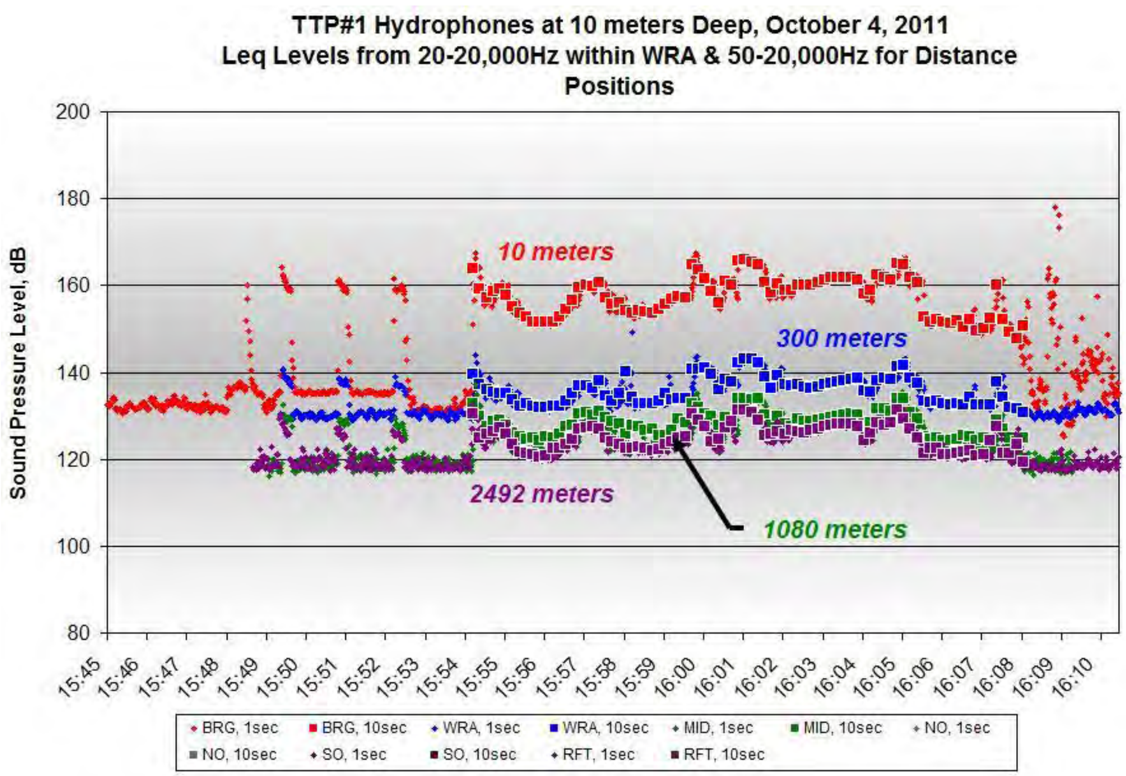

Figure A617. One-second and 10-second Average Data for TTP#1, 15:54-16:08, Measured at Depths of 10 meters on October 4, 2011

NO SPECTRA DATA AVAILABLE

Figure A618. Spectral Data Measured at the BRG Location during TTP#1, 15:54-16:08, Measured at Depths of 10 meters on October 4, 2011

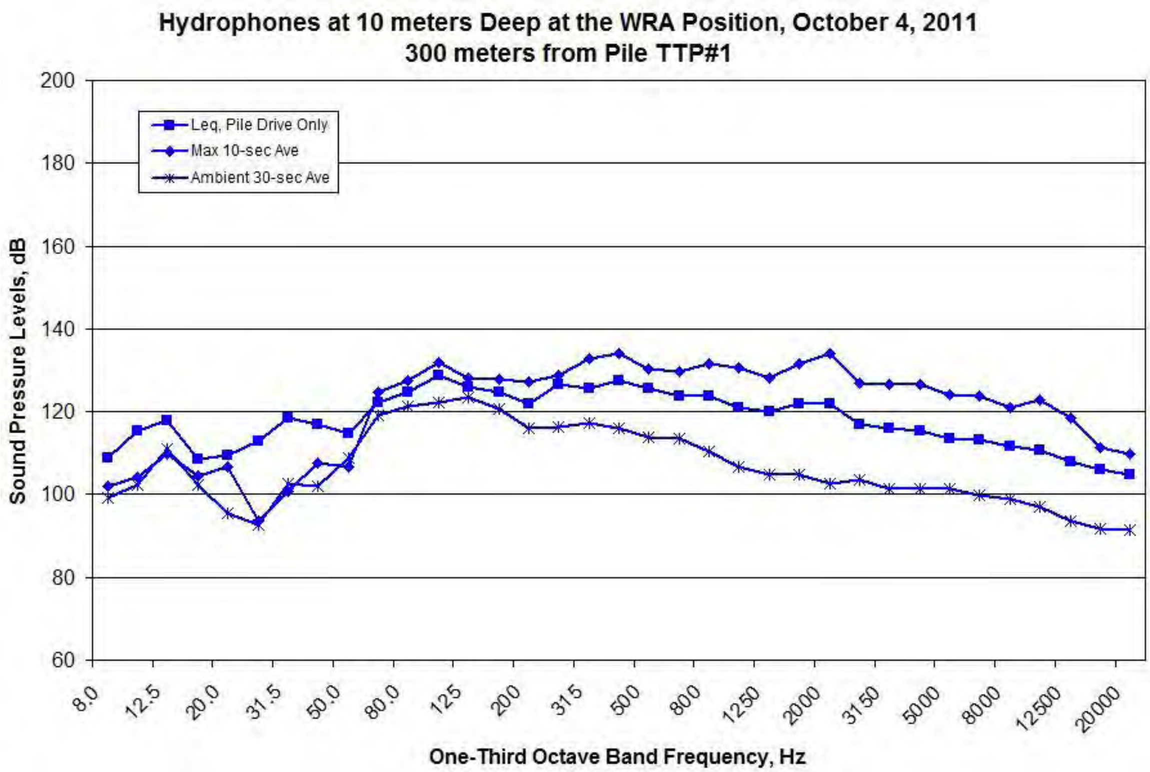

Figure A619. Spectral Data Measured at the WRA Location during TTP#1, 15:54-16:08, Measured at Depths of 10 meters on October 4, 2011

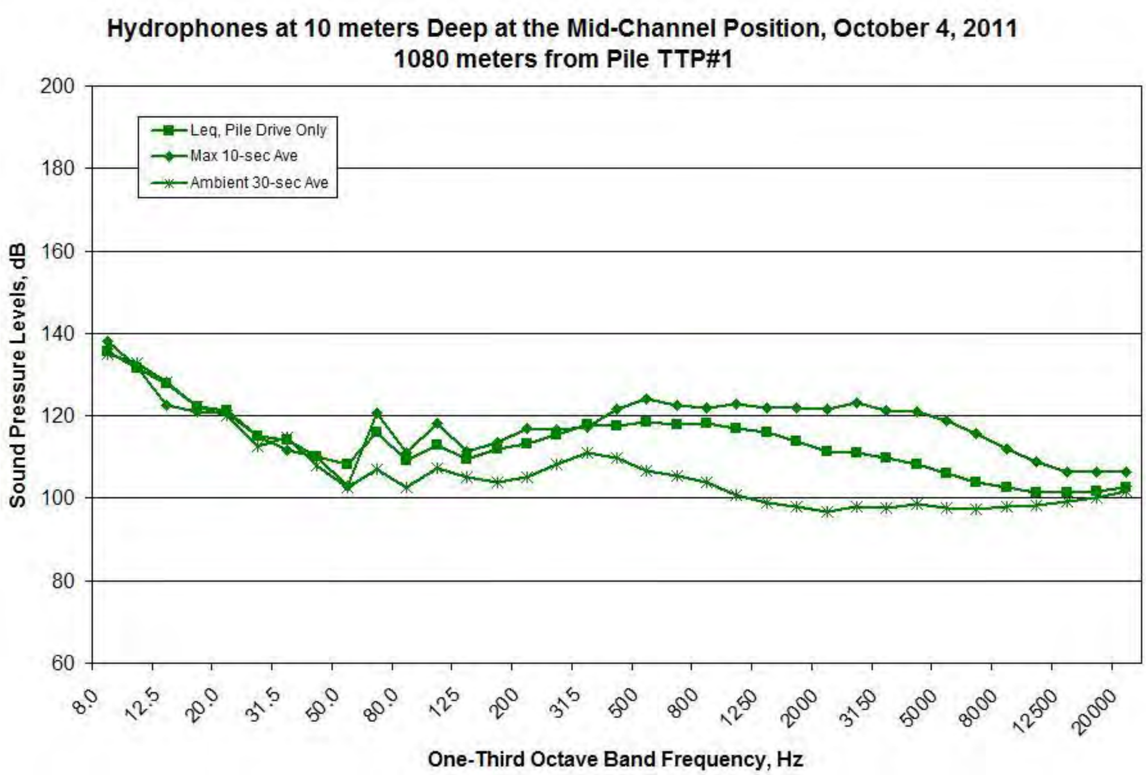

Figure A620. Spectral Data Measured at the MID Location during TTP#1, 15:54-16:08, Measured at Depths of 10 meters on October 4, 2011

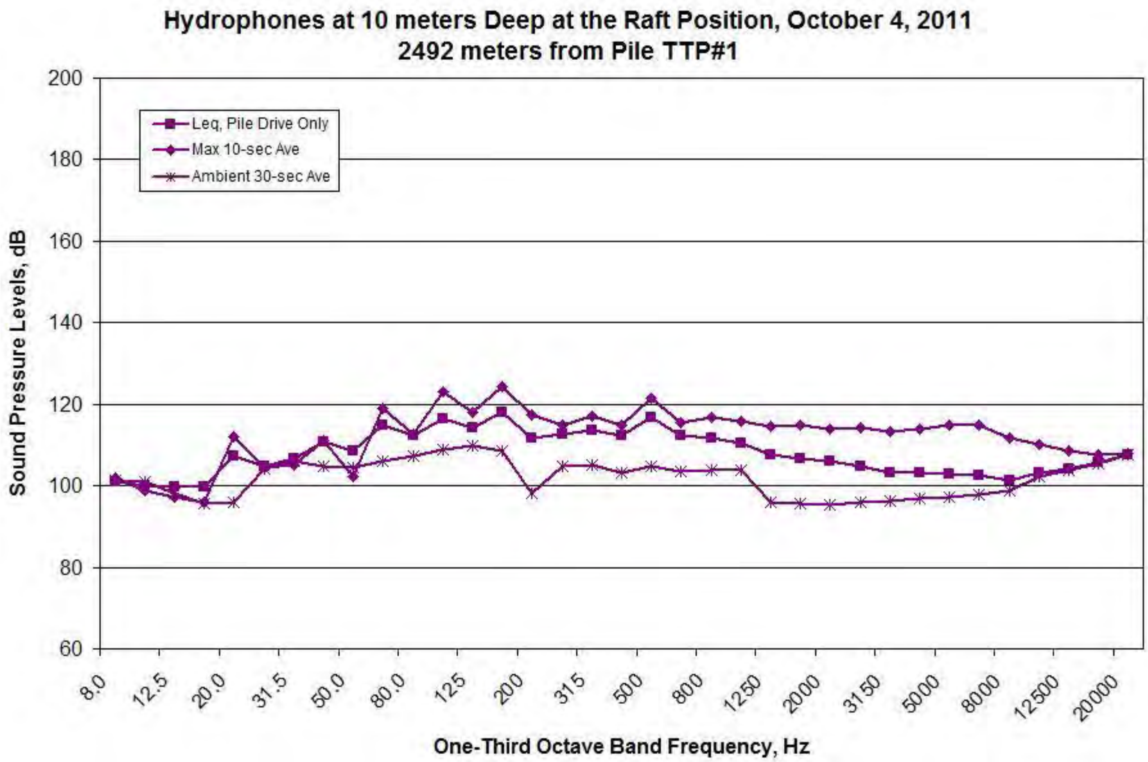

Figure A621. Spectral Data Measured at the RFT Location during TTP#1, 15:54-16:08, Measured at Depths of 10 meters on October 4, 2011

10/5/2011 – TP#1 (Vibratory Installation)

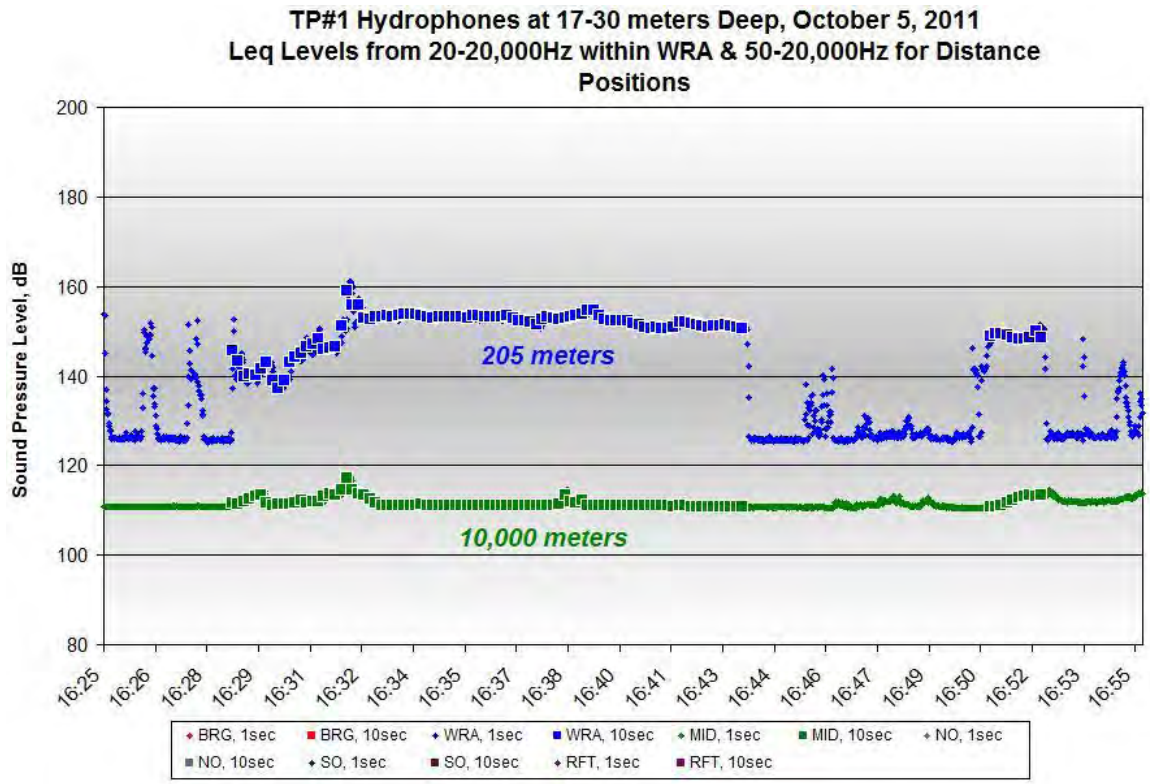

Figure A622. One-second and 10-second Average Data for TP#1, 16:28-16:52, Measured at Depths of 17-30 meters on October 5, 2011

DATA NOT USABLE

Figure A623. Spectral Data Measured at the BRG Location during TP#1, 16:28-16:52, Measured at Depths of 20 meters on October 5, 2011

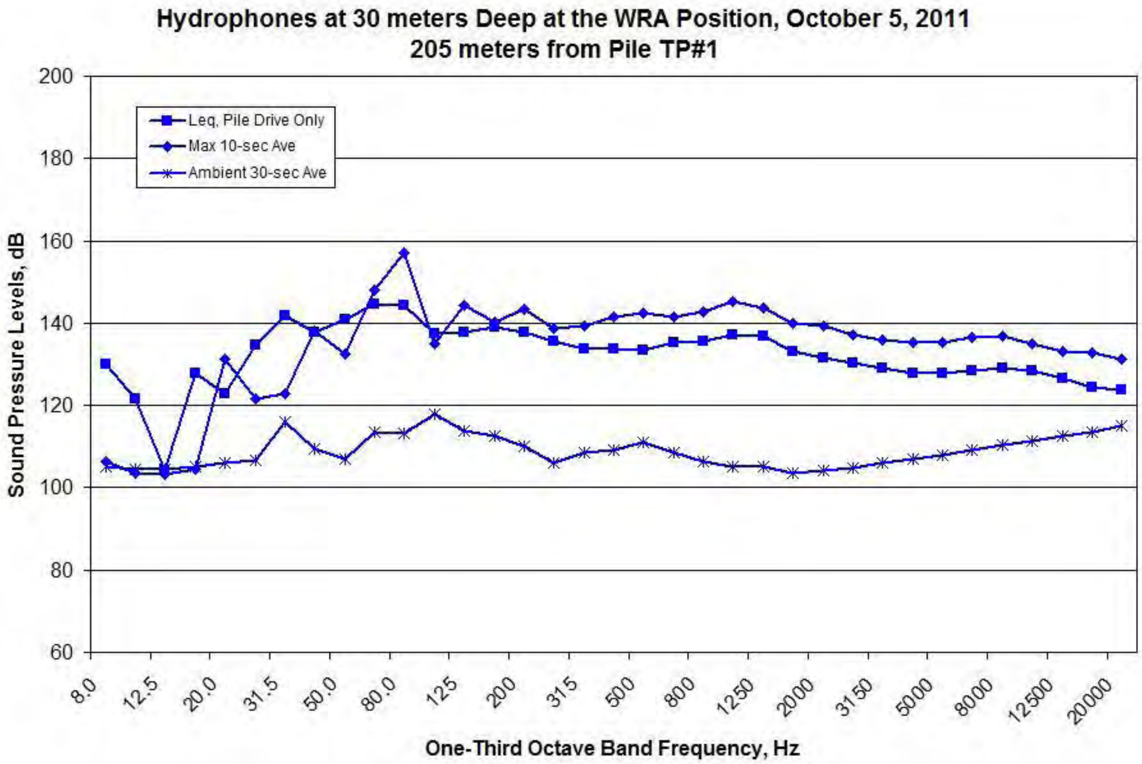

Figure A624. Spectral Data Measured at the WRA Location during TP#1, 16:28-16:52, Measured at Depths of 30 meters on October 5, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A625. Spectral Data Measured at the MID Location during TP#1, 16:28-16:52, Measured at Depths of 30 meters on October 5, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A626. Spectral Data Measured at the RFT Location during TP#1, 16:28-16:52, Measured at Depths of 17 meters on October 5, 2011

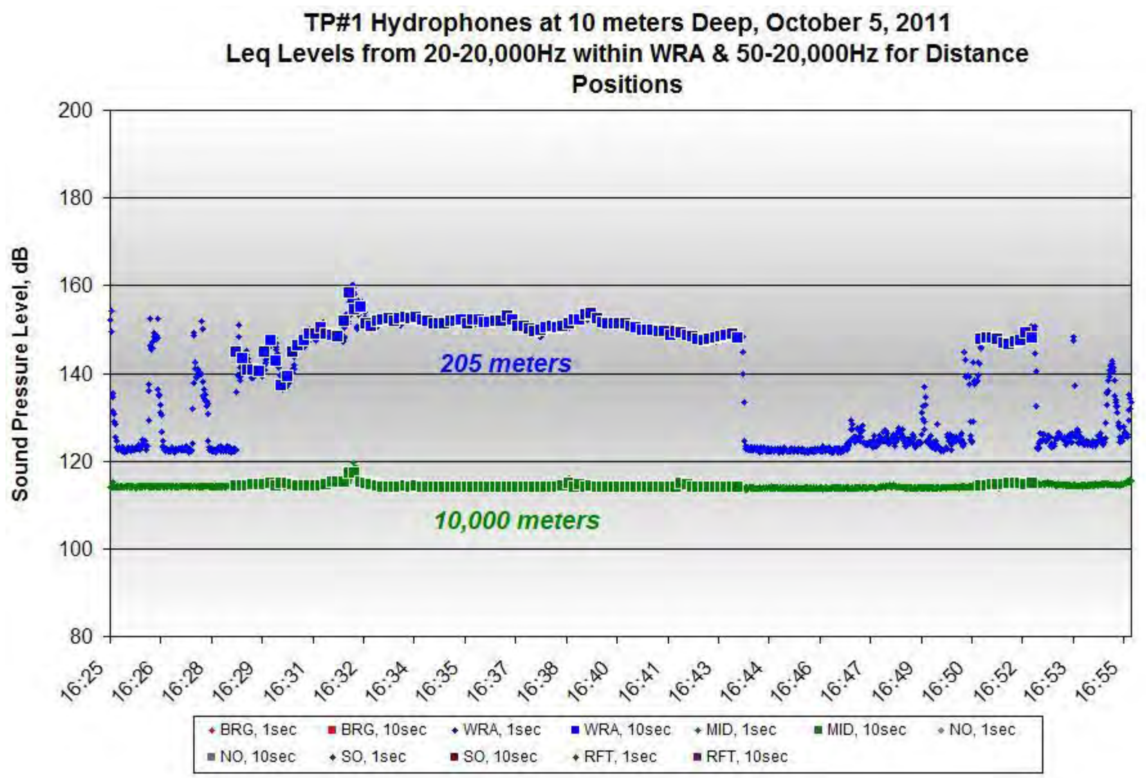

Figure A627. One-second and 10-second Average Data for TP#1, 16:28-16:52, Measured at Depths of 10 meters on October 5, 2011

DATA NOT USABLE

Figure A628. Spectral Data Measured at the BRG Location during TP#1, 16:28-16:52, Measured at Depths of 10 meters on October 5, 2011

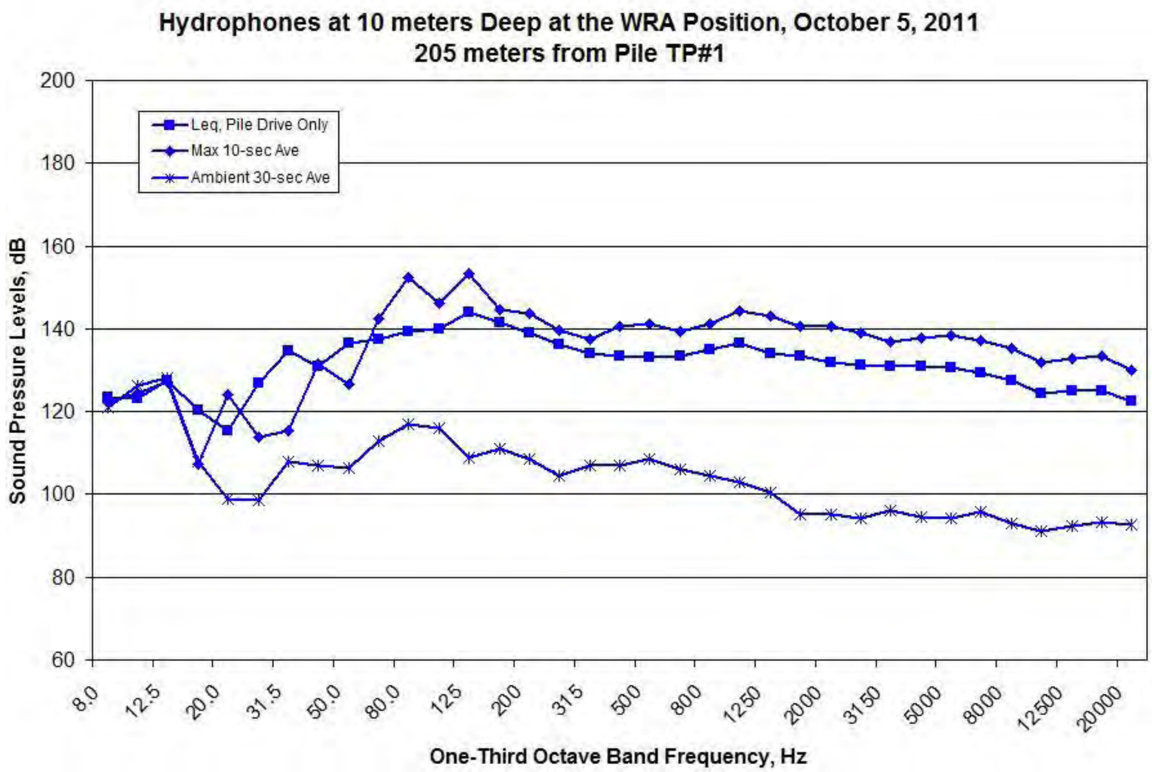

Figure A629. Spectral Data Measured at the WRA Location during TP#1, 16:28-16:52, Measured at Depths of 10 meters on October 5, 2011

PILE DRIVING NOT DISCERNIBLE

Figure A630. Spectral Data Measured at the MID Location during TP#1, 16:28-16:52, Measured at Depths of 10 meters on October 5, 2011

DATA NOT USABLE

Figure A631. Spectral Data Measured at the RFT Location during TP#1, 16:28-16:52, Measured at Depths of 10 meters on October 5, 2011

10/8/2011 – TP#1 (Vibratory Removal)

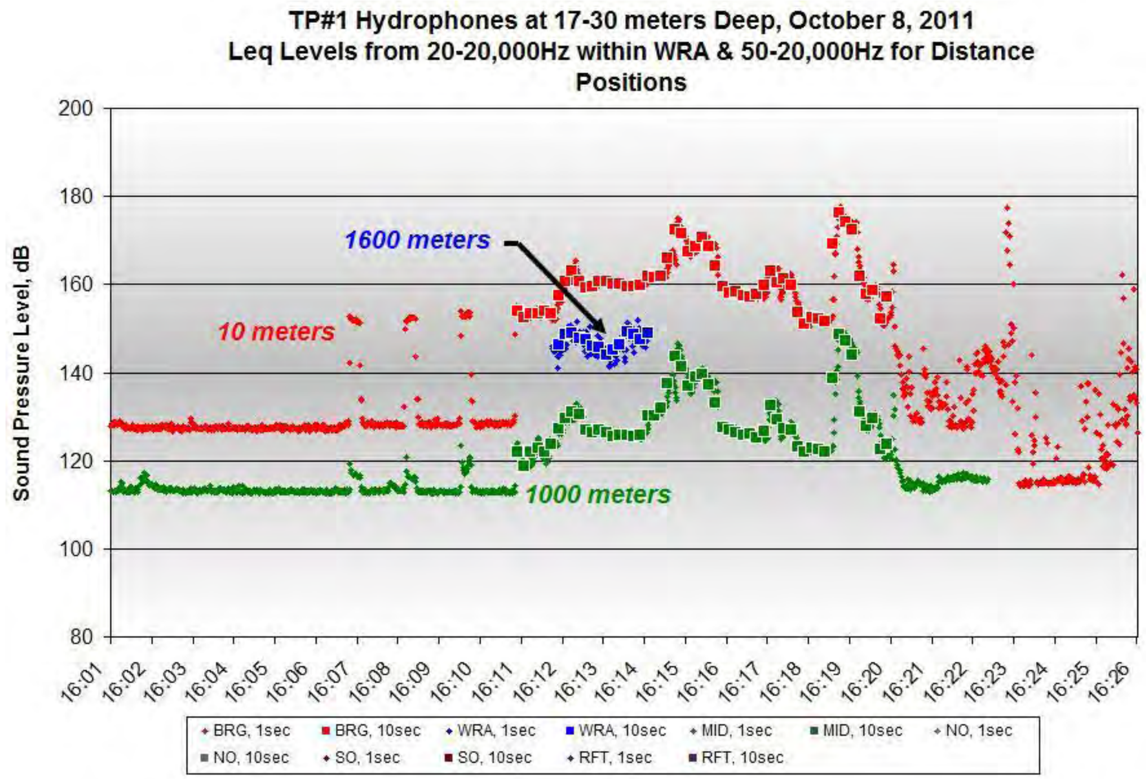

Figure A632. One-second and 10-second Average Data for TP#1, 16:10-16:20, Measured at Depths of 17-30 meters on October 8, 2011

NO SPECTRA DATA AVAILABLE

Figure A633. Spectral Data Measured at the BRG Location during TP#1, 16:10-16:20, Measured at Depths of 20 meters on October 8, 2011

NO DATA AVAILABLE DUE TO RECORDER TURNING OFF DURING TESTING

Figure A634. Spectral Data Measured at the WRA Location during TP#1, 16:10-16:20, Measured at Depths of 30 meters on October 8, 2011

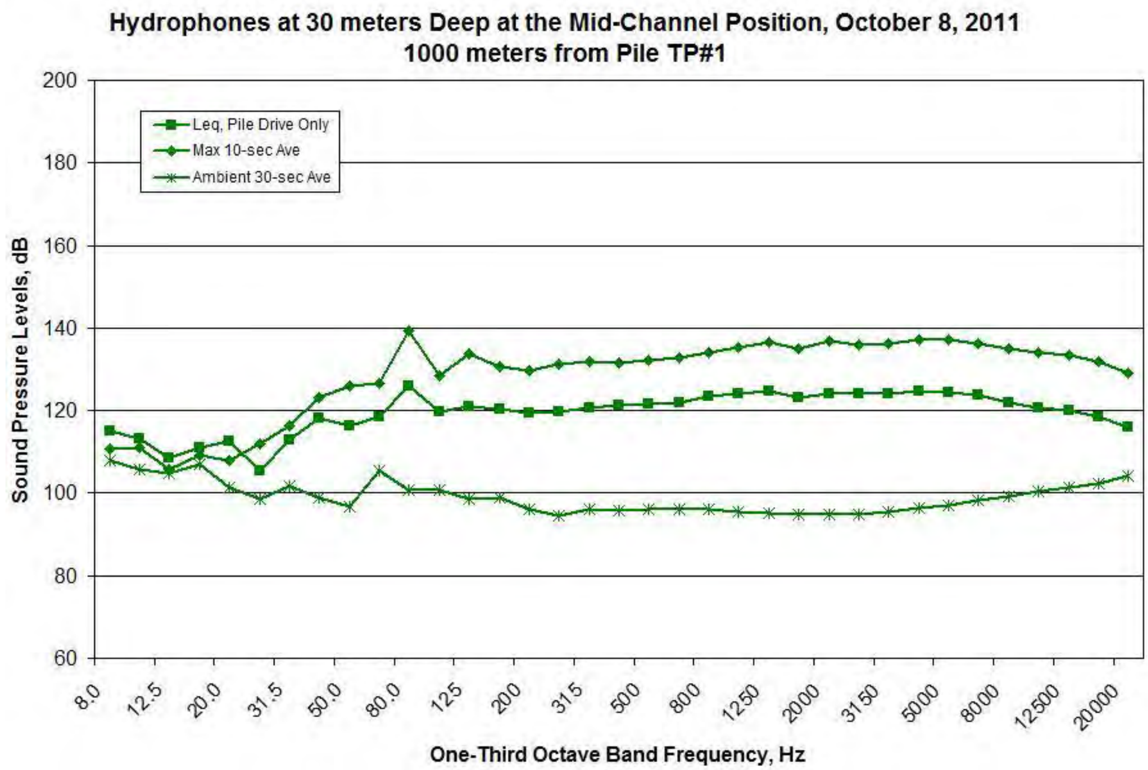

Figure A635. Spectral Data Measured at the MID Location during TP#1, 16:10-16:20, Measured at Depths of 30 meters on October 8, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A636. Spectral Data Measured at the RFT Location during TP#1, 16:10-16:20, Measured at Depths of 17 meters on October 8, 2011

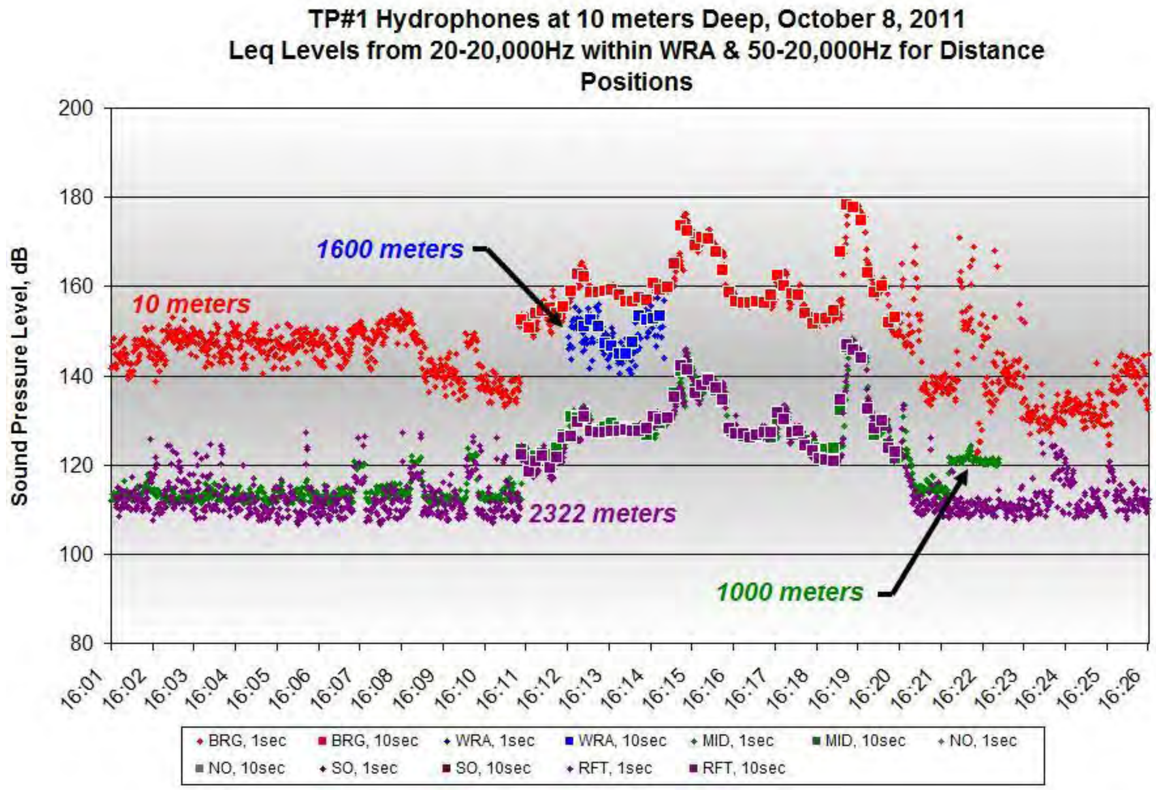

Figure A637. One-second and 10-second Average Data for TP#1, 16:10-16:20, Measured at Depths of 10 meters on October 8, 2011

NO SPECTRA DATA AVAILABLE

Figure A638. Spectral Data Measured at the BRG Location during TP#1, 16:10-16:20, Measured at Depths of 10 meters on October 8, 2011

NO DATA AVAILABLE DUE TO RECORDER TURNING OFF DURING TESTING

Figure A639. Spectral Data Measured at the WRA Location during TP#1, 16:10-16:20, Measured at Depths of 10 meters on October 8, 2011

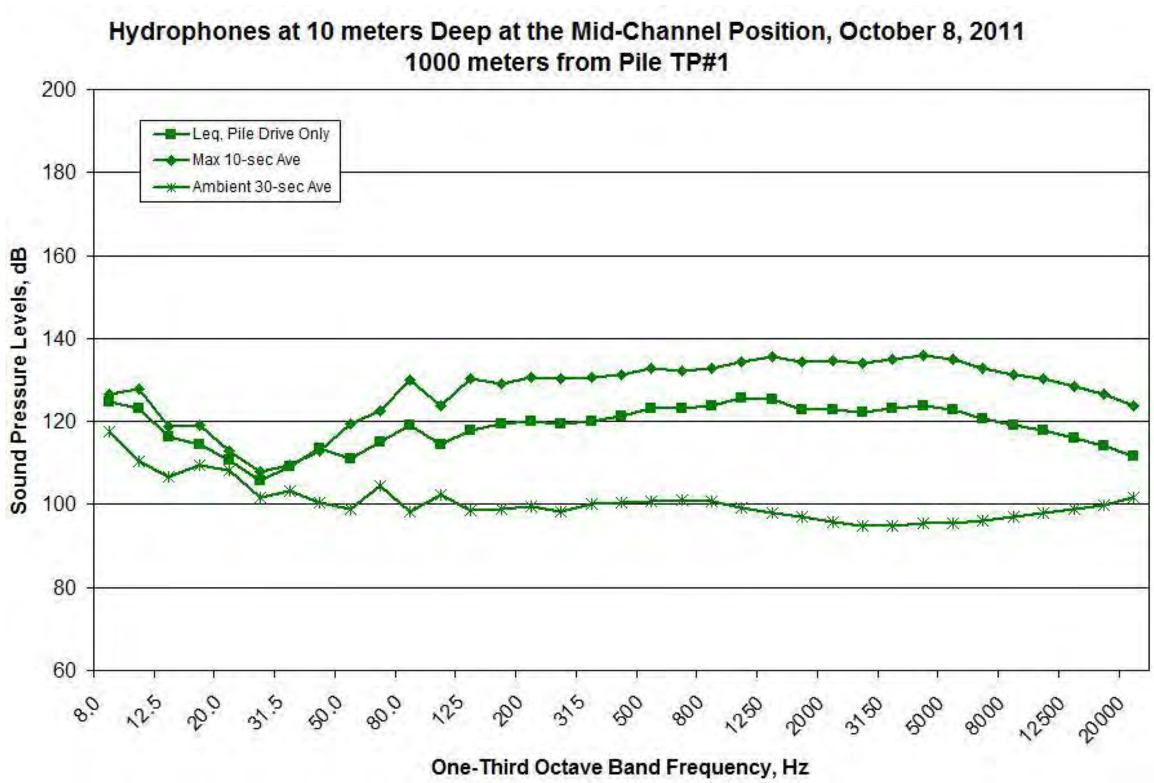

Figure A640. Spectral Data Measured at the MID Location during TP#1, 16:10-16:20, Measured at Depths of 10 meters on October 8, 2011

NO SPECTRA DATA AVAILABLE

Figure A641. Spectral Data Measured at the RFT Location during TP#1, 16:10-16:20, Measured at Depths of 10 meters on October 8, 2011

10/17/2011 – TP#3 MP#3 (Vibratory Removal)

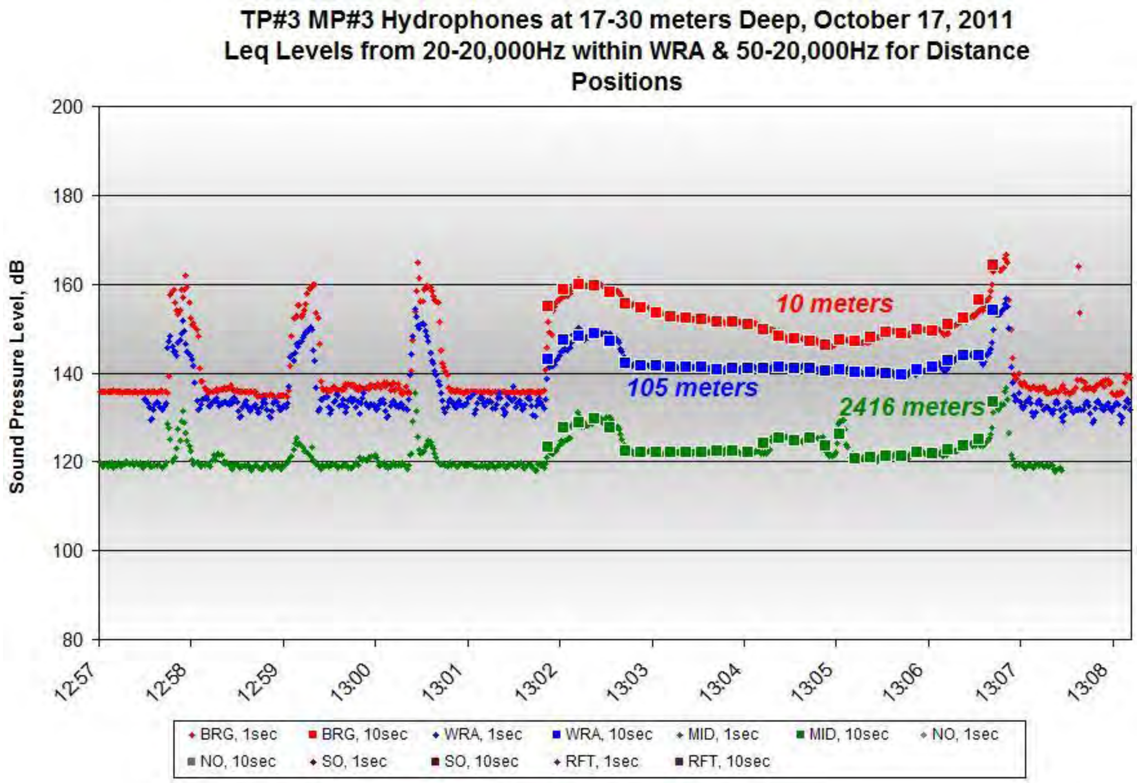

Figure A642. One-second and 10-second Average Data for TP#3 MP#3, 12:58-13:07, Measured at Depths of 17-30 meters on October 17, 2011

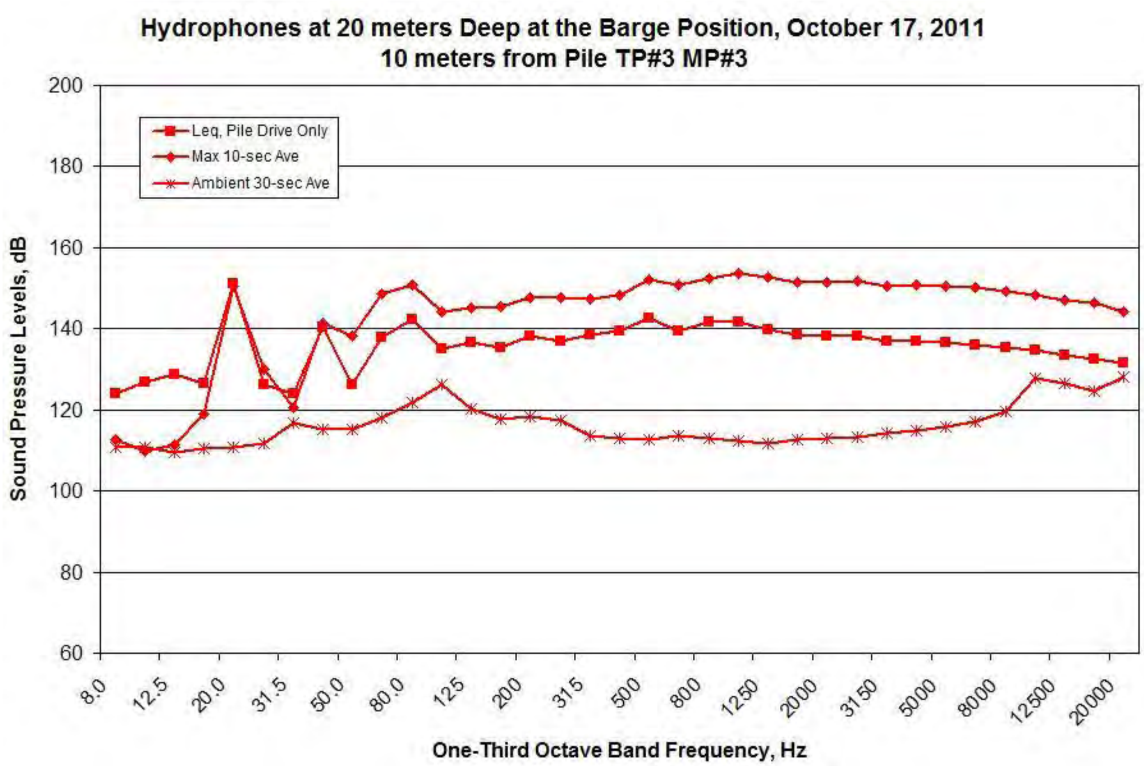

Figure A643. Spectral Data Measured at the BRG Location during TP#3 MP#3, 12:58-13:07, Measured at Depths of 20 meters on October 17, 2011

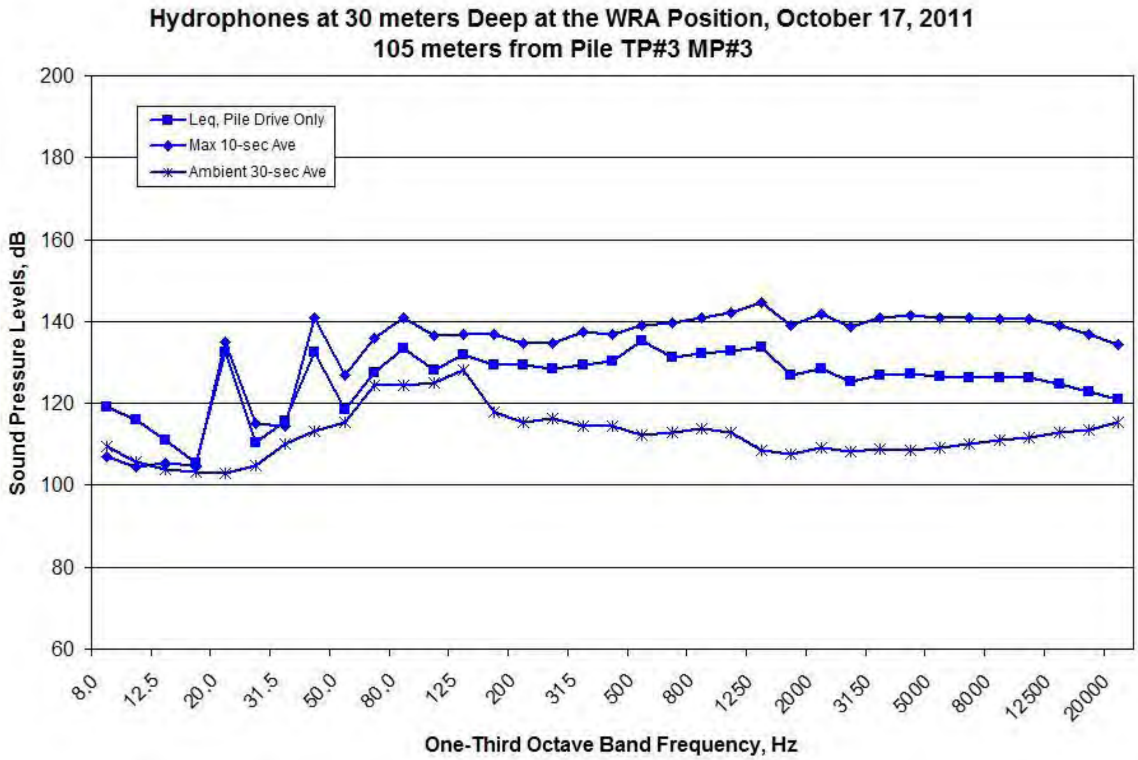

Figure A644. Spectral Data Measured at the WRA Location during TP#3 MP#3, 12:58-13:07, Measured at Depths of 30 meters on October 17, 2011

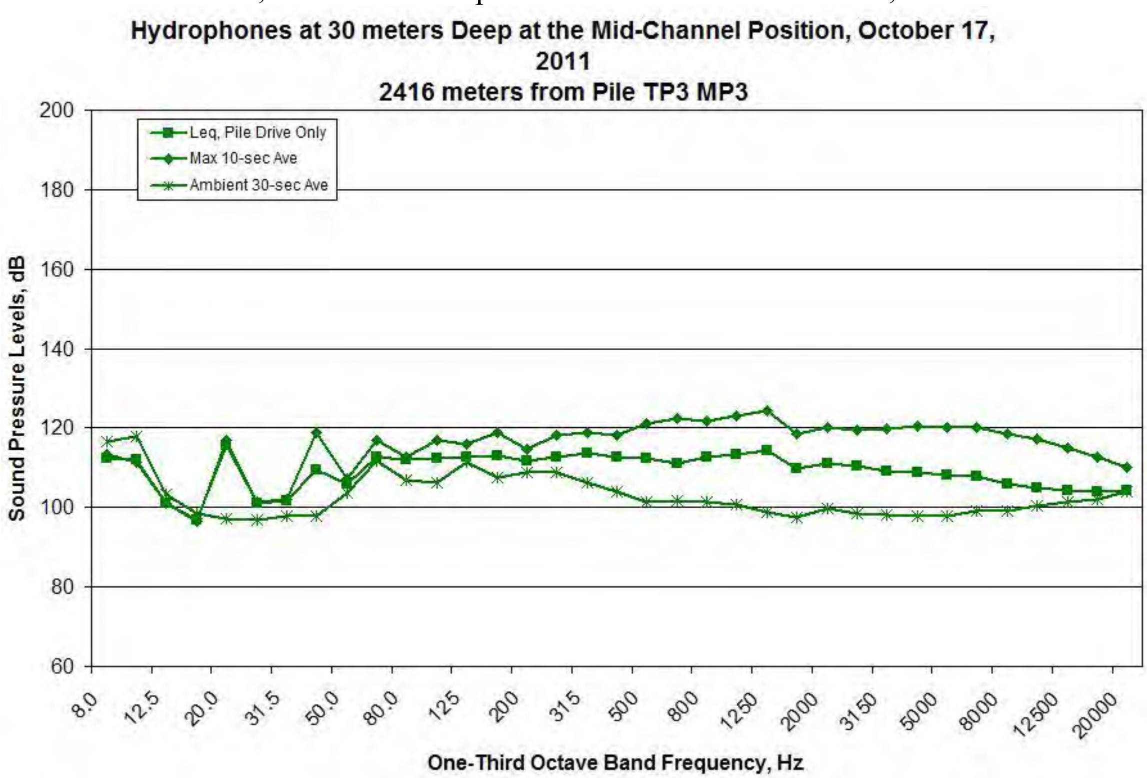

Figure A645. Spectral Data Measured at the MID Location during TP#3 MP#3, 12:58-13:07, Measured at Depths of 30 meters on October 17, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A646. Spectral Data Measured at the RFT Location during TP#3 MP#3, 12:58-13:07, Measured at Depths of 17 meters on October 17, 2011

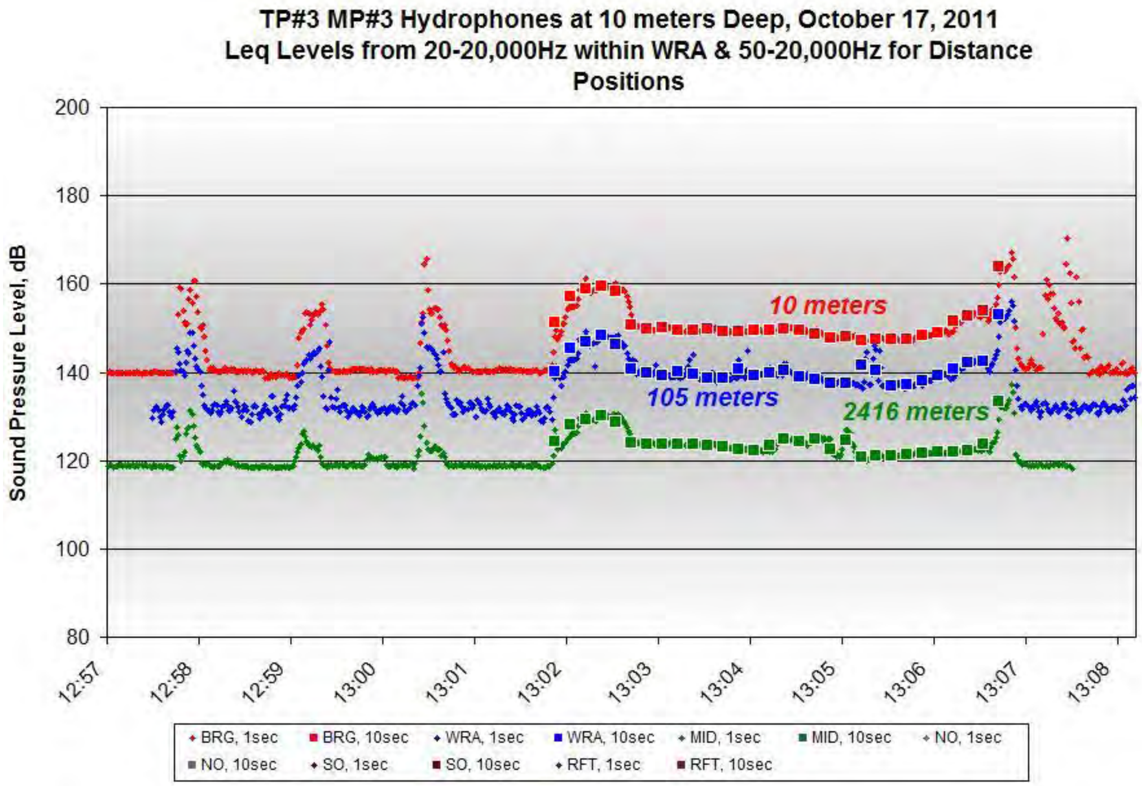

Figure A647. One-second and 10-second Average Data for TP#3 MP#3, 12:58-13:07, Measured at Depths of 10 meters on October 17, 2011

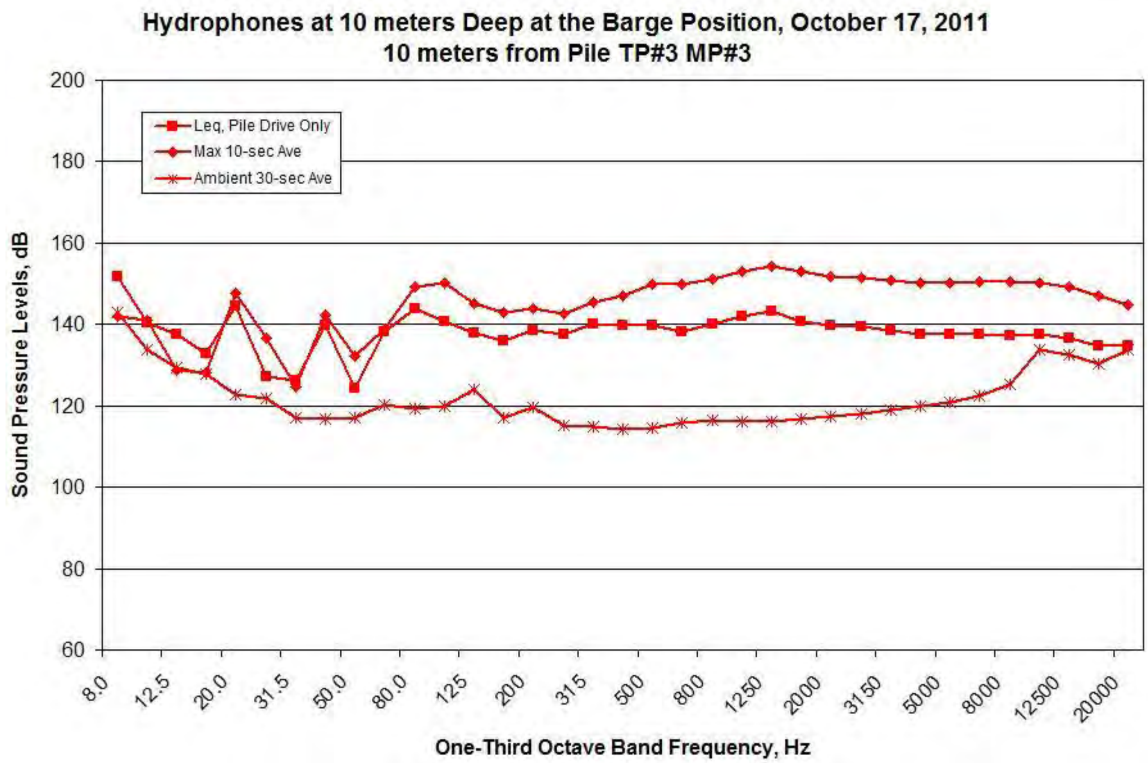

Figure A648. Spectral Data Measured at the BRG Location during TP#3 MP#3, 12:58-13:07, Measured at Depths of 10 meters on October 17, 2011

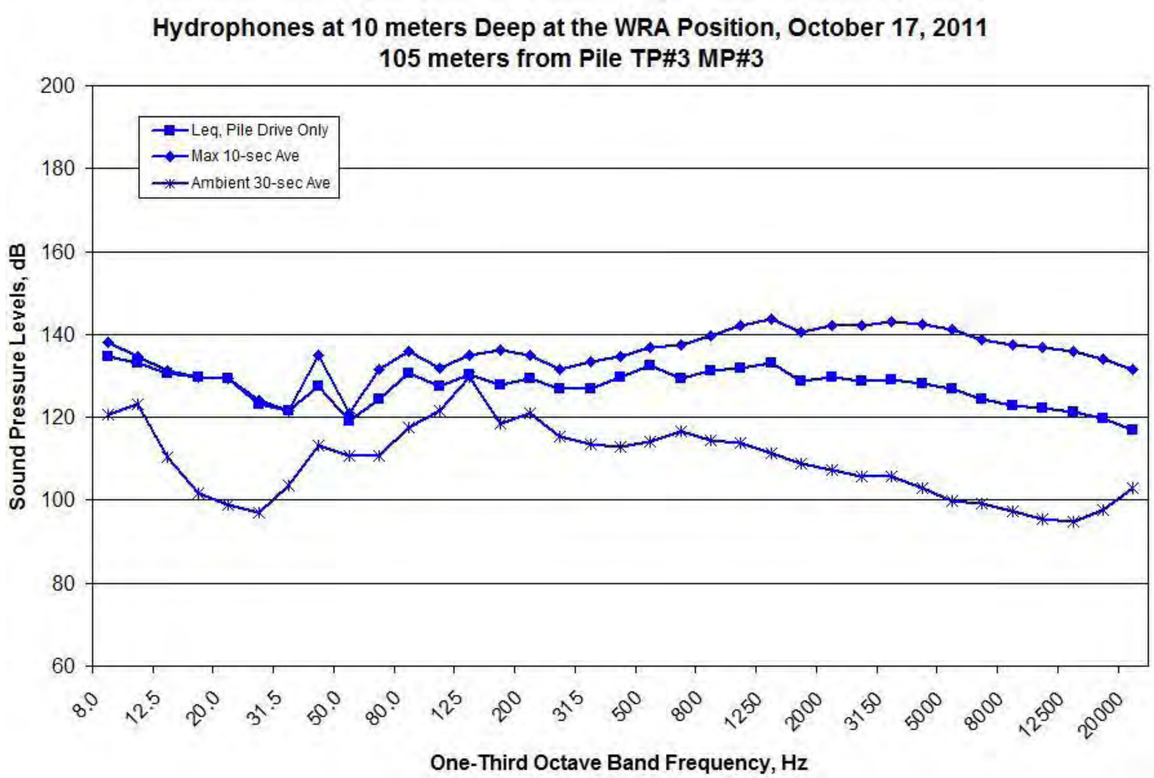

Figure A649. Spectral Data Measured at the WRA Location during TP#3 MP#3, 12:58-13:07, Measured at Depths of 10 meters on October 17, 2011

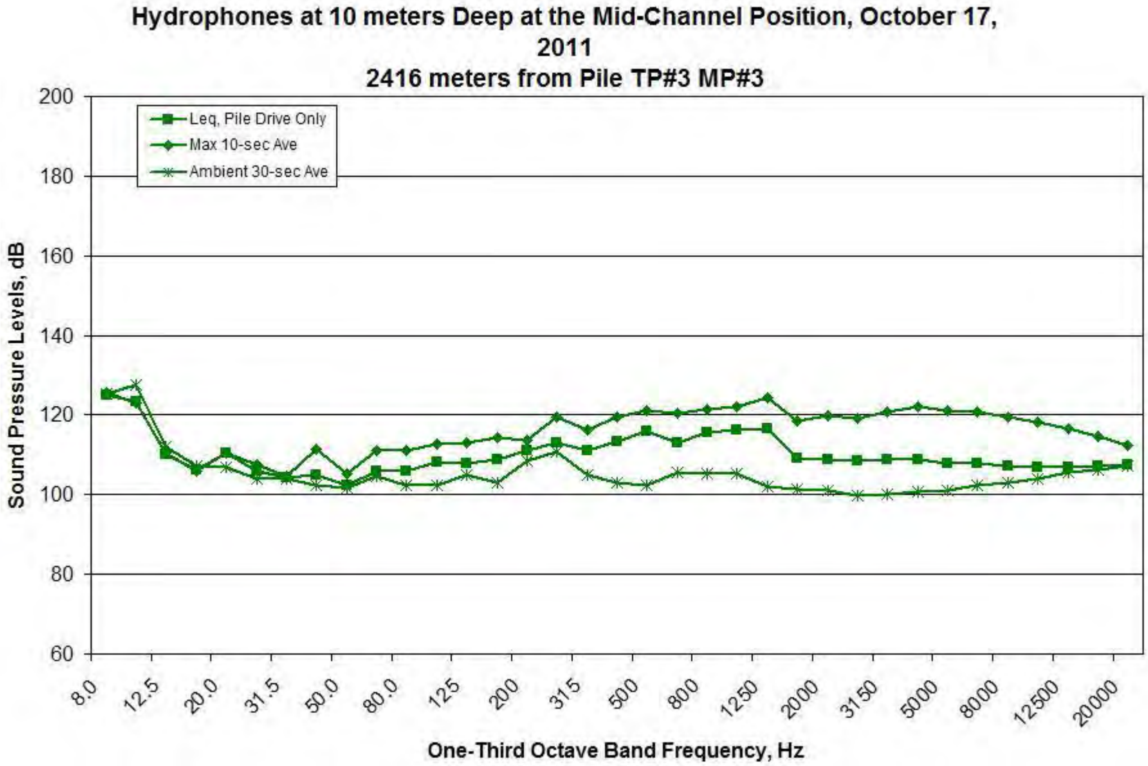

Figure A650. Spectral Data Measured at the MID Location during TP#3 MP#3, 12:58-13:07, Measured at Depths of 10 meters on October 17, 2011

NO DATA AVAILABLE DUE TO POOR ENVIRONMENTAL CONDITIONS

Figure A651. Spectral Data Measured at the RFT Location during TP#3 MP#3, 12:58-13:07, Measured at Depths of 10 meters on October 17, 2011

TP#3 MP#2 (Vibratory Removal)

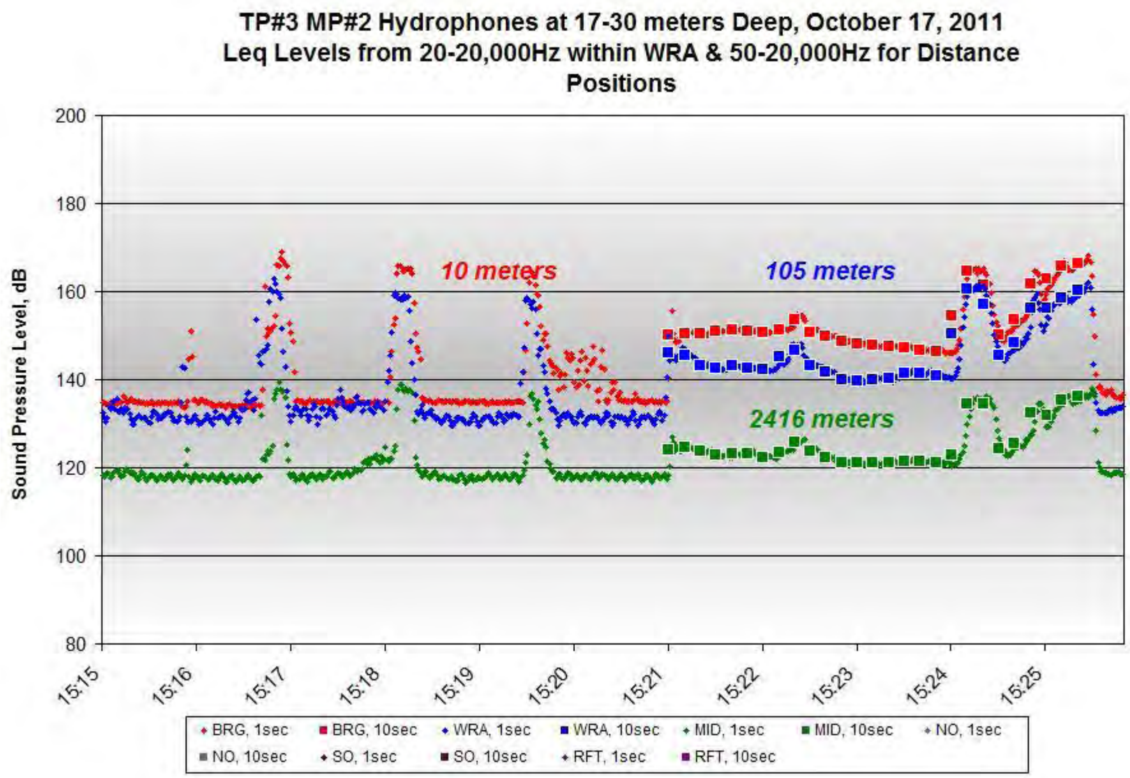

Figure A652. One-second and 10-second Average Data for TP#3 MP#2, 15:16-15:25, Measured at Depths of 17-30 meters on October 17, 2011

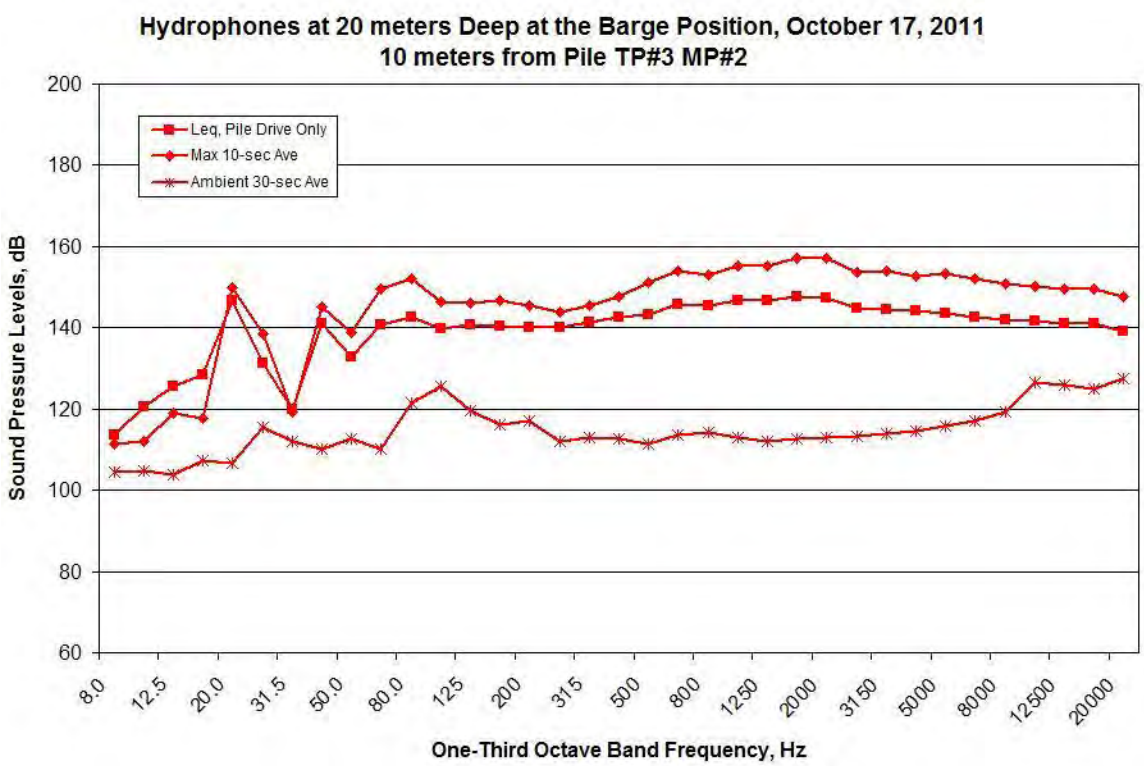

Figure A653. Spectral Data Measured at the BRG Location during TP#3 MP#2, 15:16-15:25, Measured at Depths of 20 meters on October 17, 2011

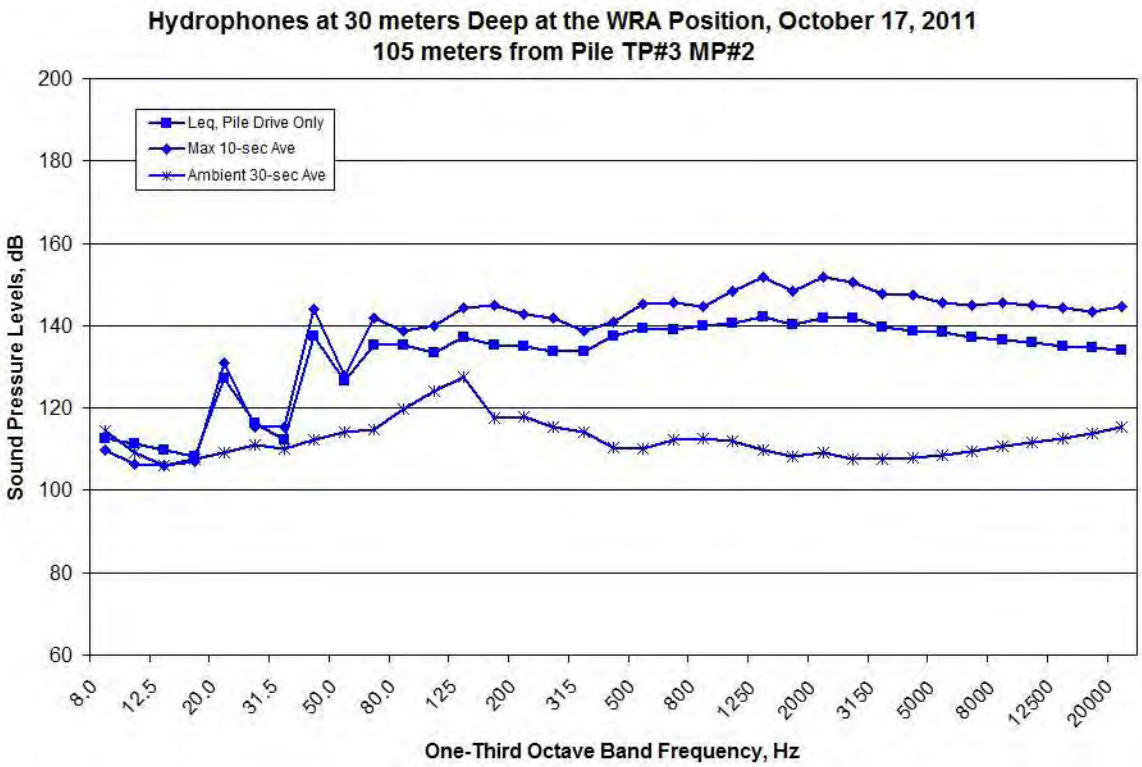

Figure A654. Spectral Data Measured at the WRA Location during TP#3 MP#2, 15:16-15:25, Measured at Depths of 30 meters on October 17, 2011

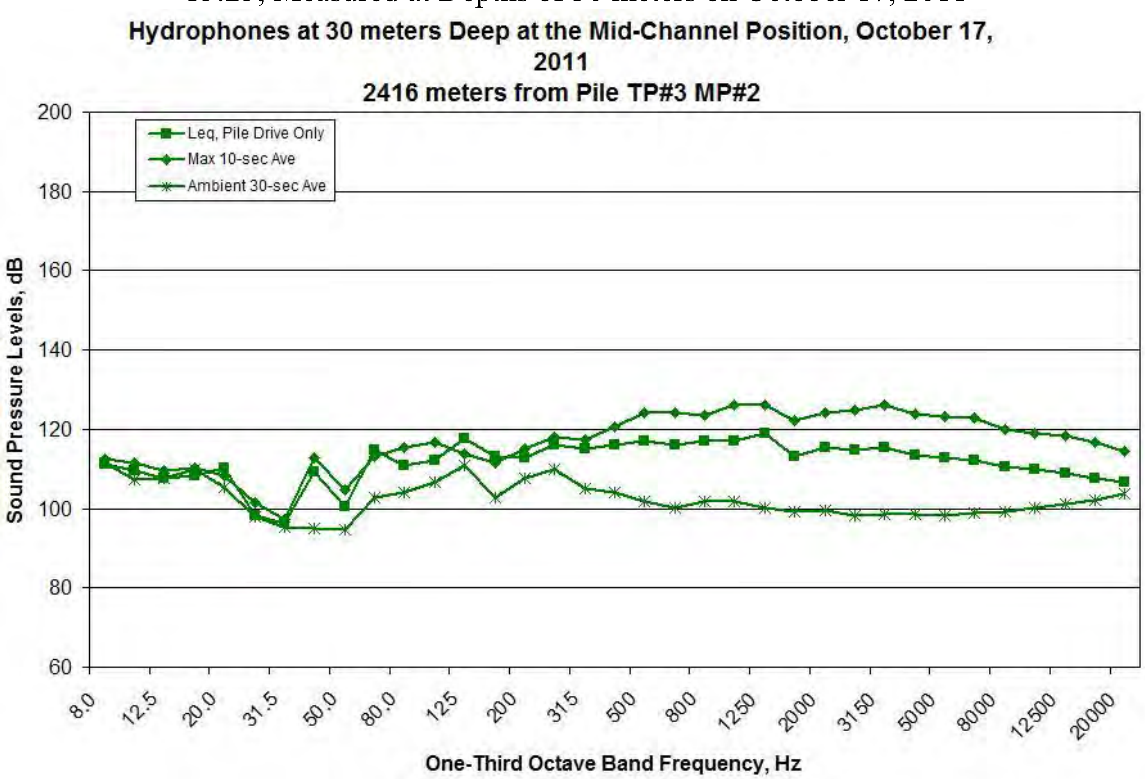

Figure A655. Spectral Data Measured at the MID Location during TP#3 MP#2, 15:16-15:25, Measured at Depths of 30 meters on October 17, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A656. Spectral Data Measured at the RFT Location during TP#3 MP#2, 15:16-15:25, Measured at Depths of 17 meters on October 17, 2011

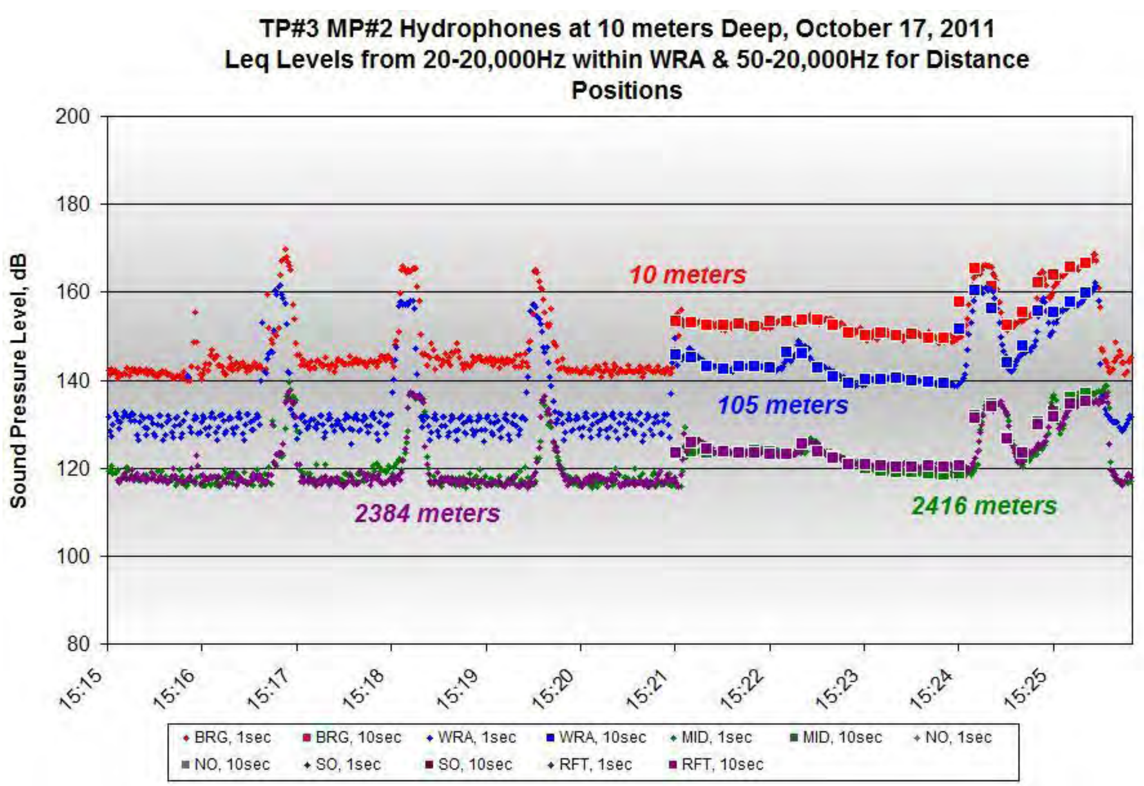

Figure A657. One-second and 10-second Average Data for TP#3 MP#2, 15:16-15:25, Measured at Depths of 10 meters on October 17, 2011

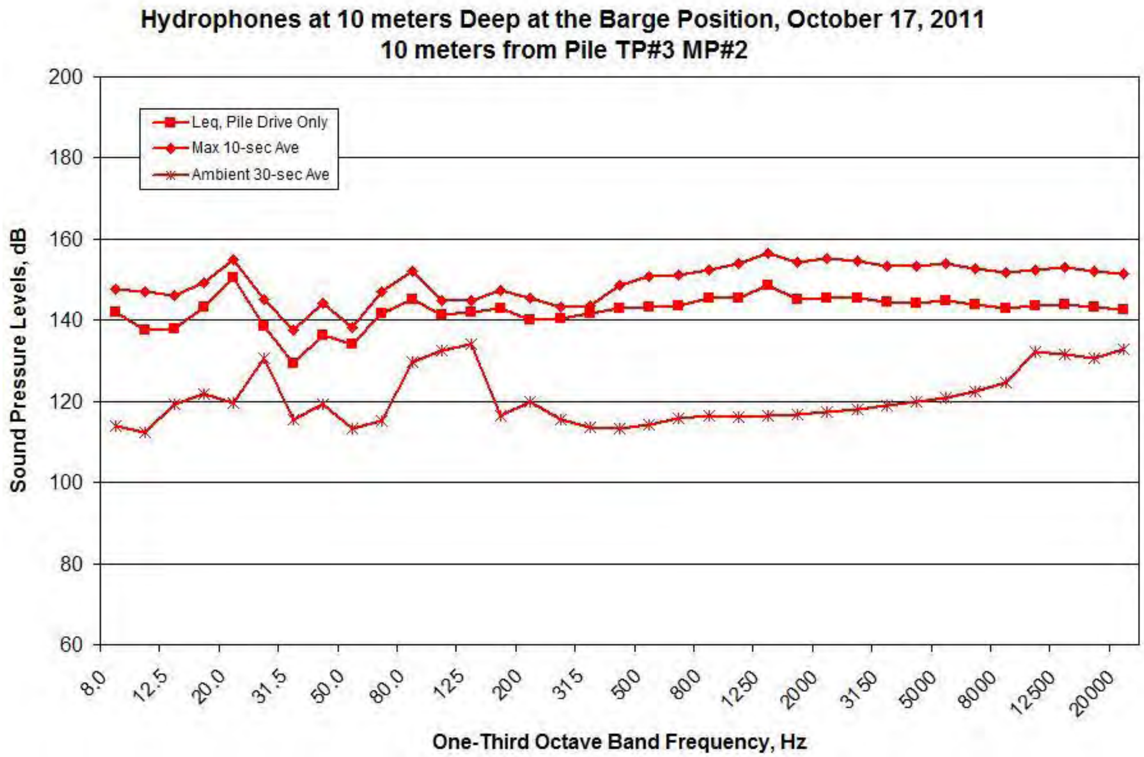

Figure A658. Spectral Data Measured at the BRG Location during TP#3 MP#2, 15:16-15:25, Measured at Depths of 10 meters on October 17, 2011

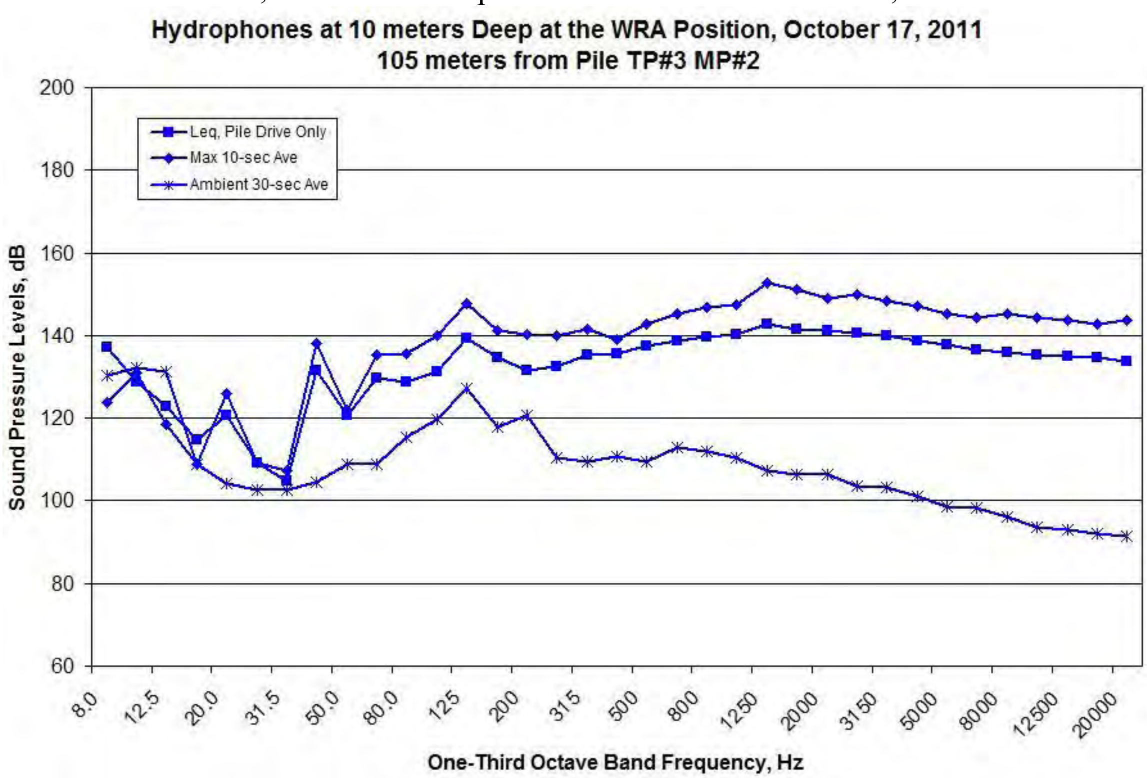

Figure A659. Spectral Data Measured at the WRA Location during TP#3 MP#2, 15:16-15:25, Measured at Depths of 10 meters on October 17, 2011

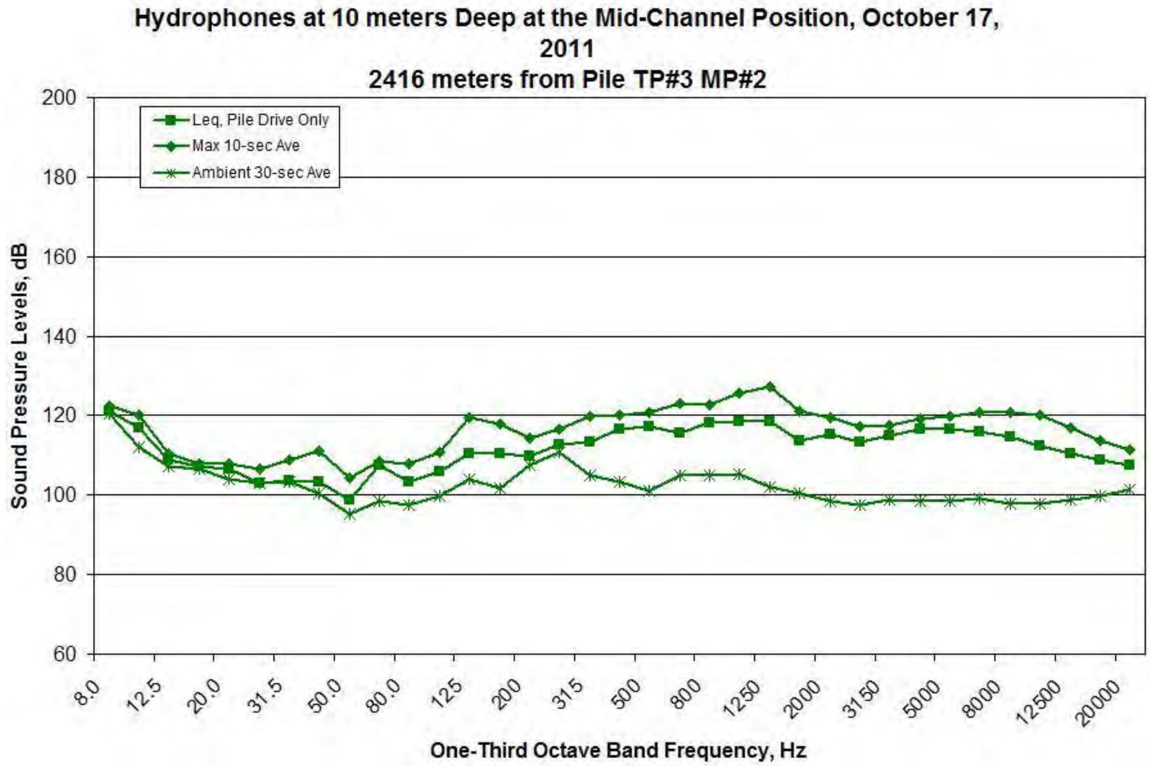

Figure A660. Spectral Data Measured at the MID Location during TP#3 MP#2, 15:16-15:25, Measured at Depths of 10 meters on October 17, 2011

NO SPECTRA DATA AVAILABLE

Figure A661. Spectral Data Measured at the RFT Location during TP#3 MP#2, 15:16-15:25, Measured at Depths of 10 meters on October 17, 2011

TP#3 (Vibratory Removal)

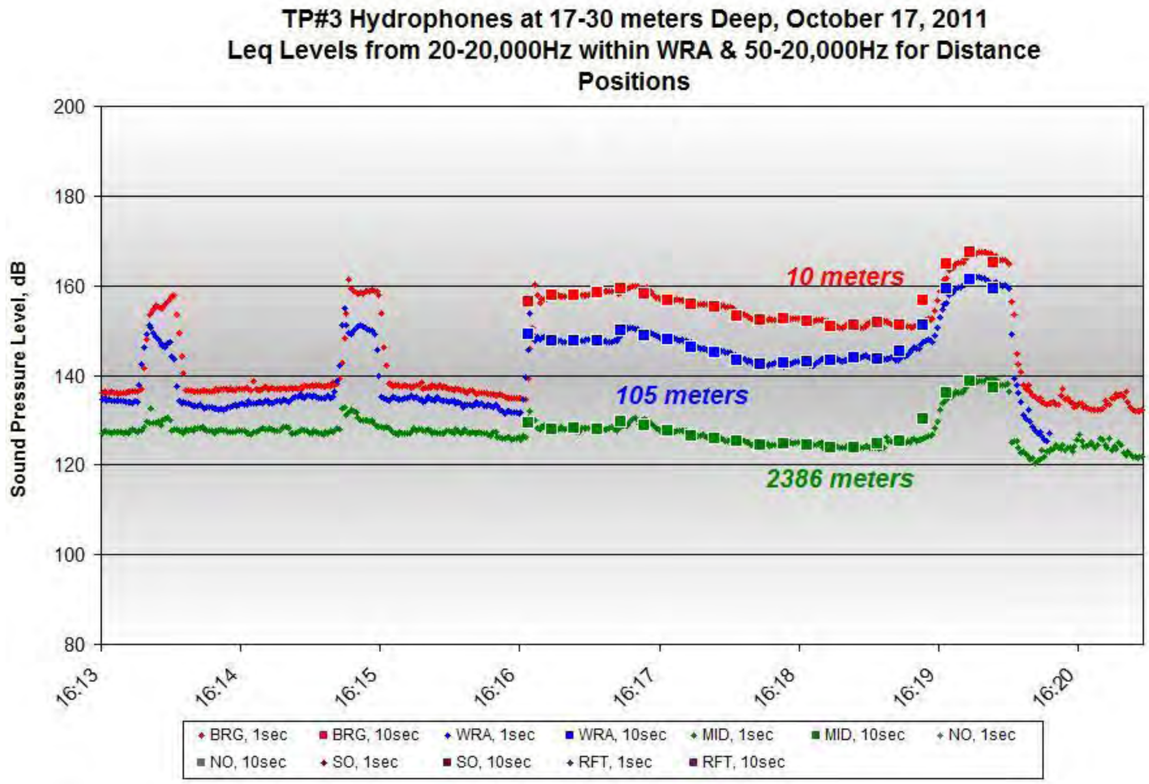

Figure A662. One-second and 10-second Average Data for TP#3, 16:13-16:20, Measured at Depths of 17-30 meters on October 17, 2011

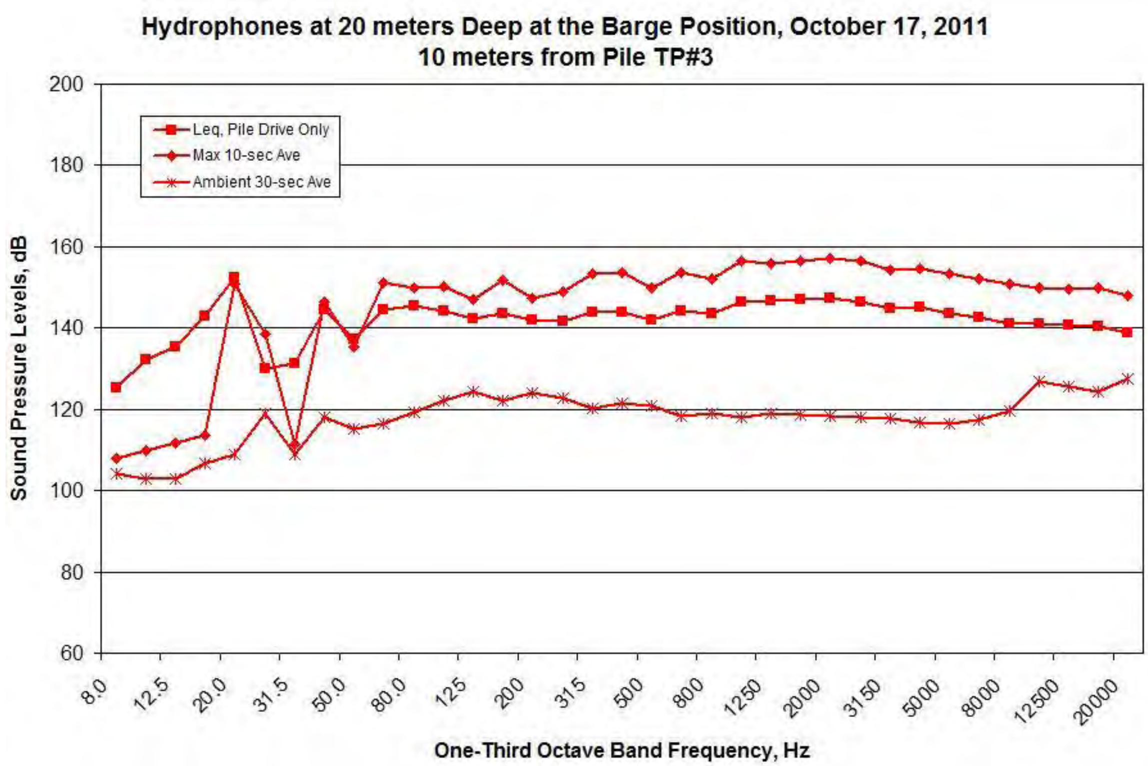

Figure A663. Spectral Data Measured at the BRG Location during TP#3, 16:13-16:20, Measured at Depths of 20 meters on October 17, 2011

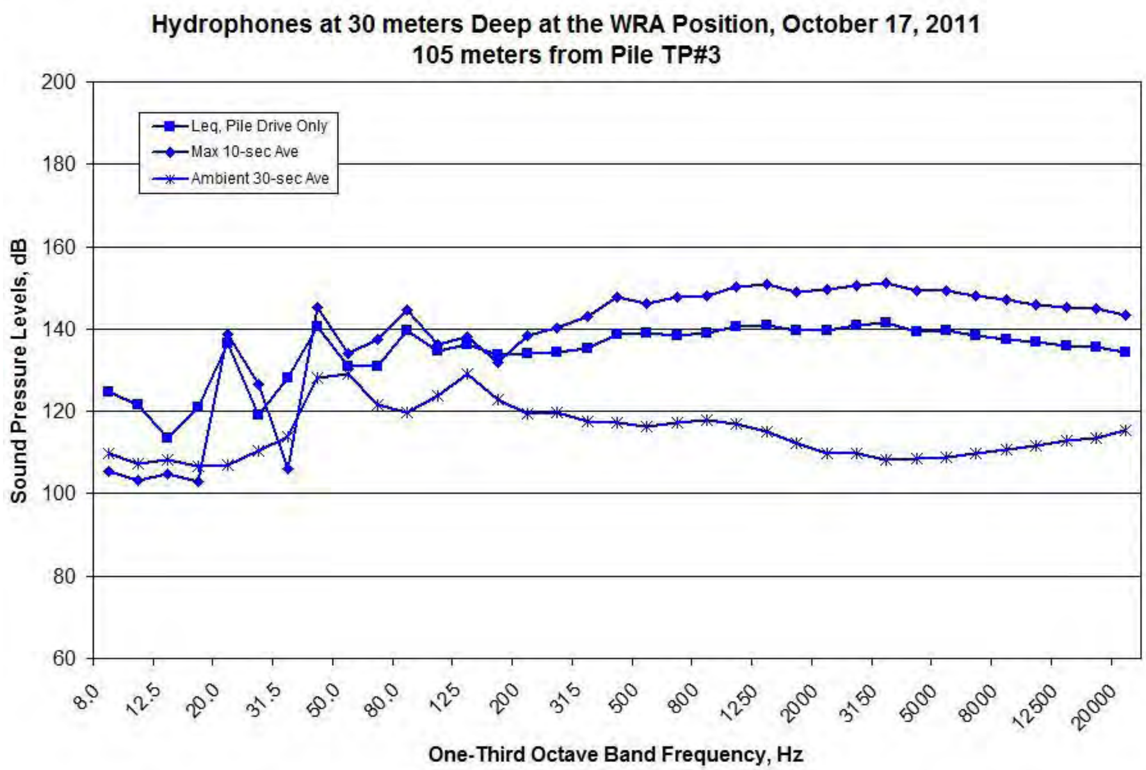

Figure A664. Spectral Data Measured at the WRA Location during TP#3, 16:13-16:20, Measured at Depths of 30 meters on October 17, 2011

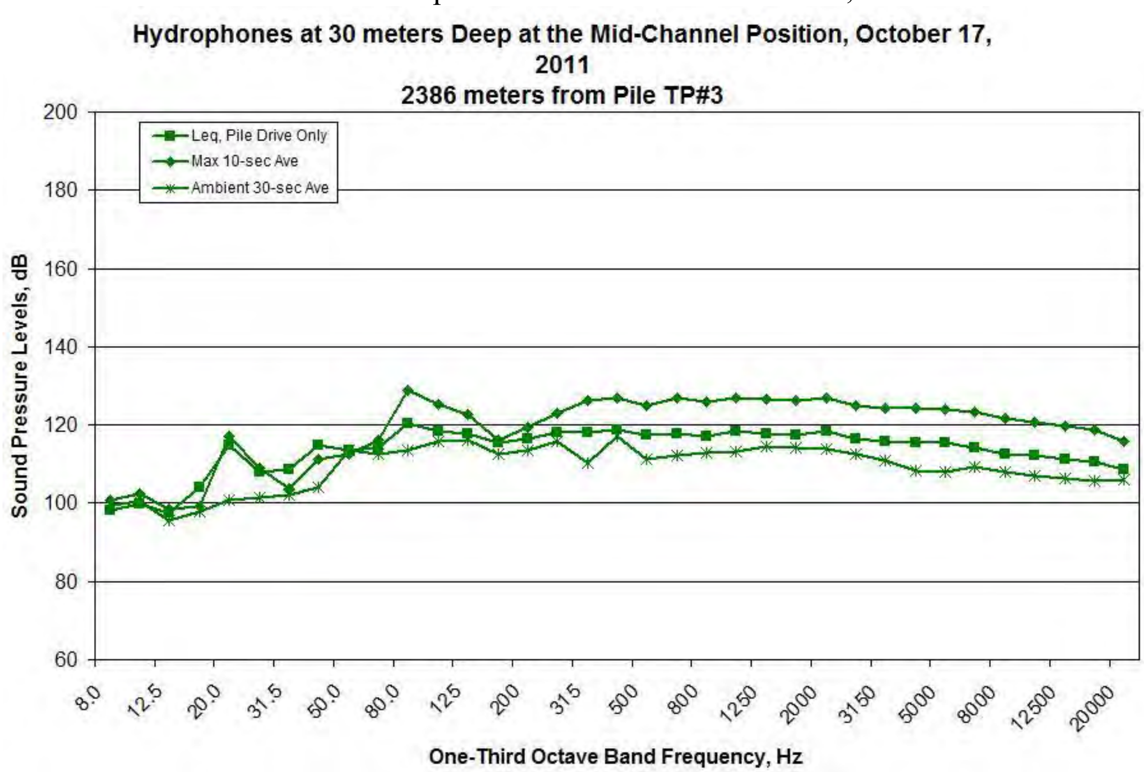

Figure A665. Spectral Data Measured at the MID Location during TP#3, 16:13-16:20, Measured at Depths of 30 meters on October 17, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure A666. Spectral Data Measured at the RFT Location during TP#3, 16:13-16:20, Measured at Depths of 17 meters on October 17, 2011

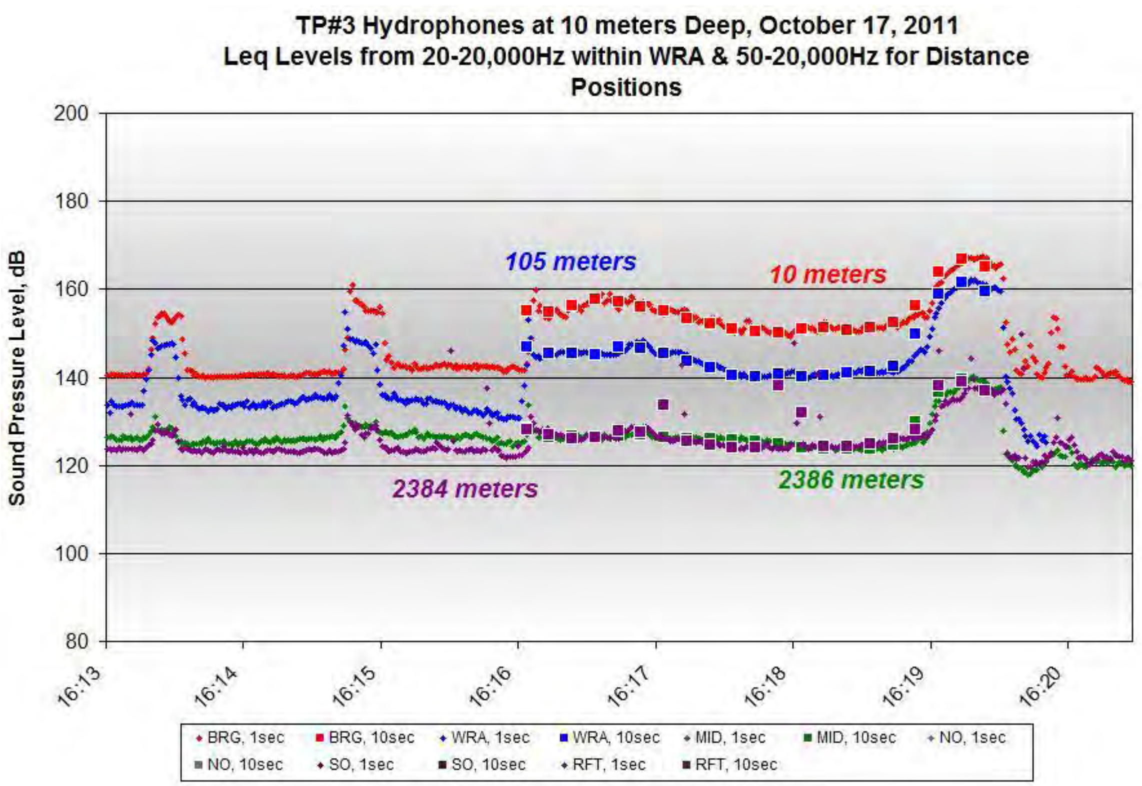

Figure A667. One-second and 10-second Average Data for TP#3, 16:13-16:20, Measured at Depths of 10 meters on October 17, 2011

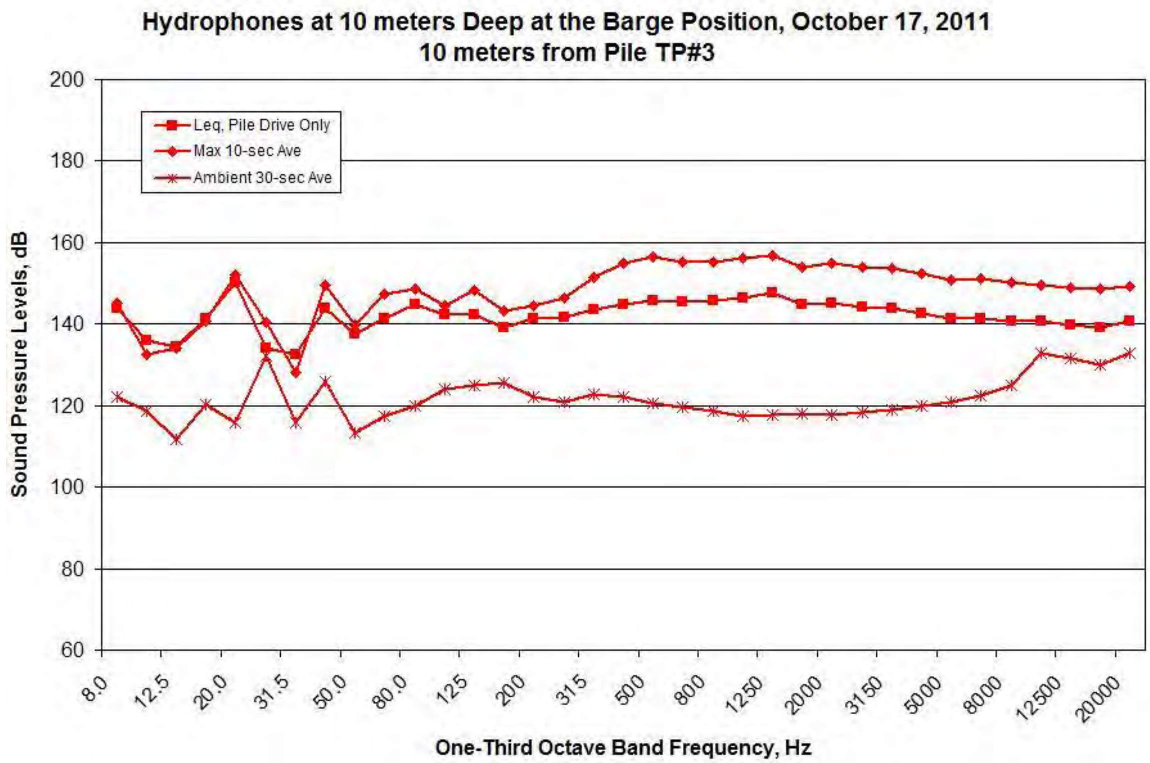

Figure A668. Spectral Data Measured at the BRG Location during TP#3, 16:13-16:20, Measured at Depths of 10 meters on October 17, 2011

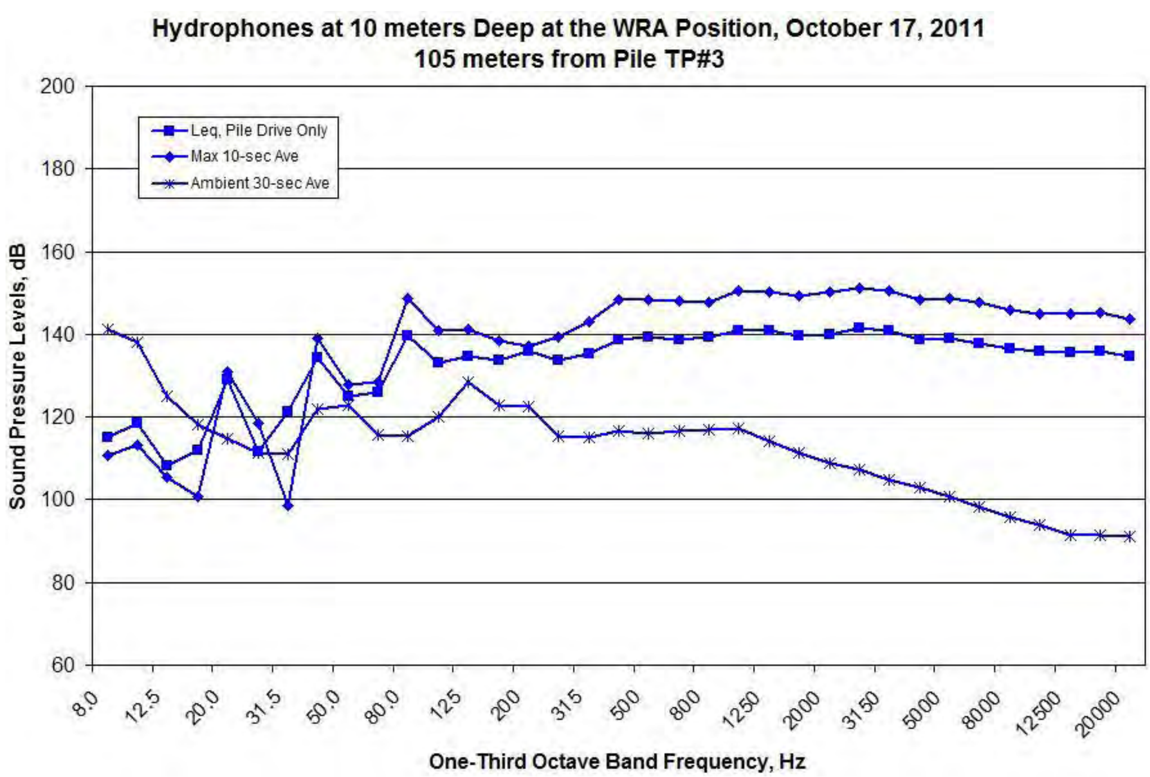

Figure A669. Spectral Data Measured at the WRA Location during TP#3, 16:13-16:20, Measured at Depths of 10 meters on October 17, 2011

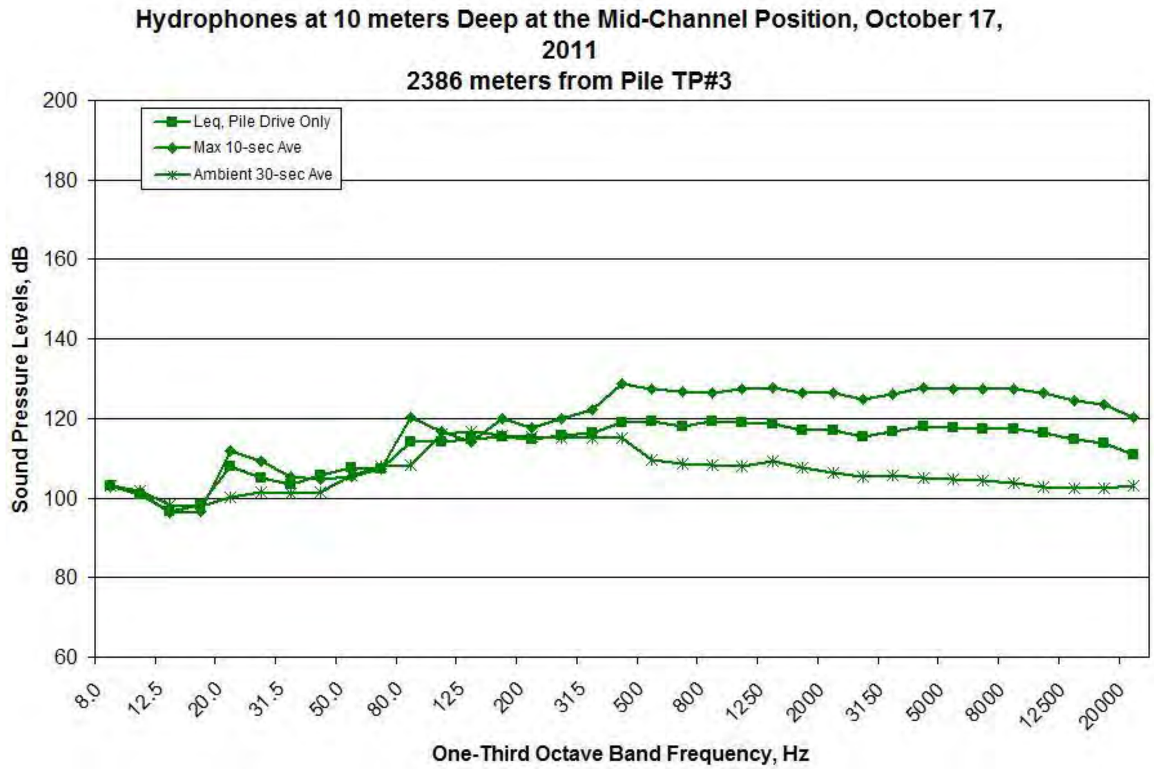

Figure A670. Spectral Data Measured at the MID Location during TP#3, 16:13-16:20, Measured at Depths of 10 meters on October 17, 2011

NO SPECTRA DATA AVAILABLE

Figure A671. Spectral Data Measured at the RFT Location during TP#3, 16:13-16:20, Measured at Depths of 10 meters on October 17, 2011

10/18/2011 – TP#3 RP#3 (Vibratory Removal)

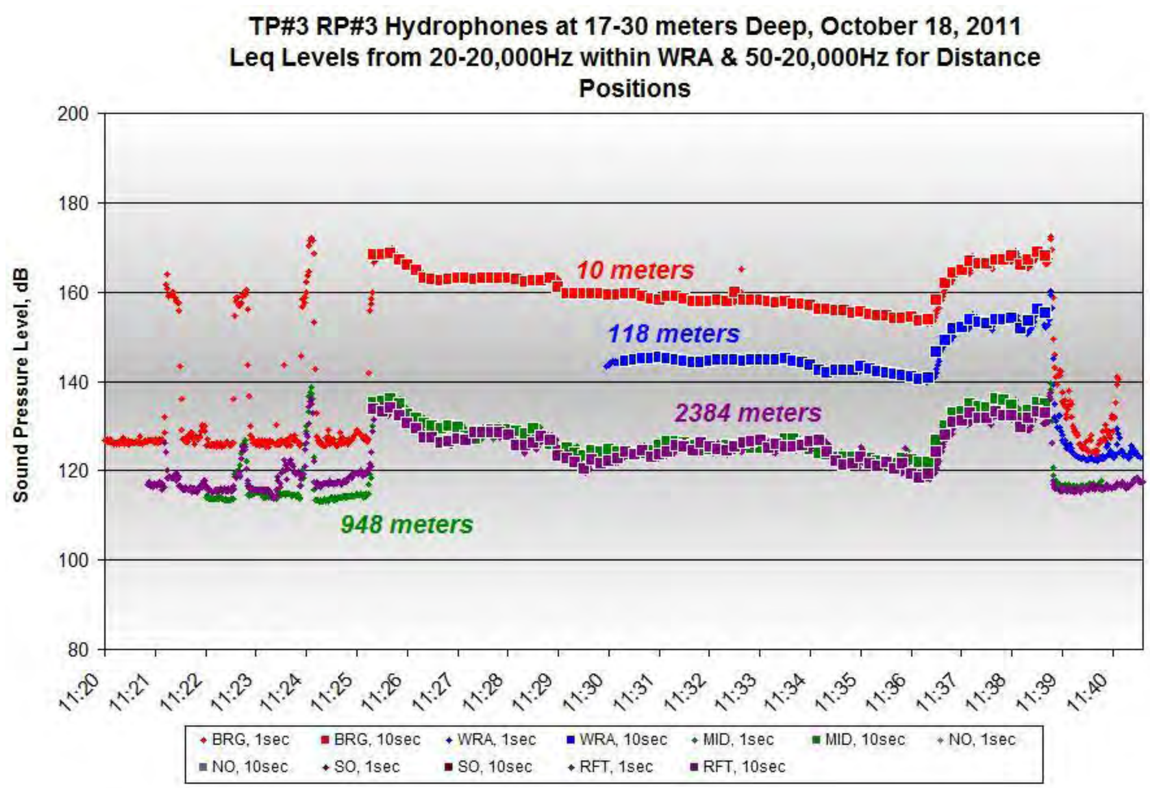

Figure A672. One-second and 10-second Average Data for TP#3 RP#3, 11:21-11:30, Measured at Depths of 17-30 meters on October 18, 2011

NO SPECTRA DATA AVAILABLE

Figure A673. Spectral Data Measured at the BRG Location during TP#3 RP#3, 11:21-11:30, Measured at Depths of 20 meters on October 18, 2011

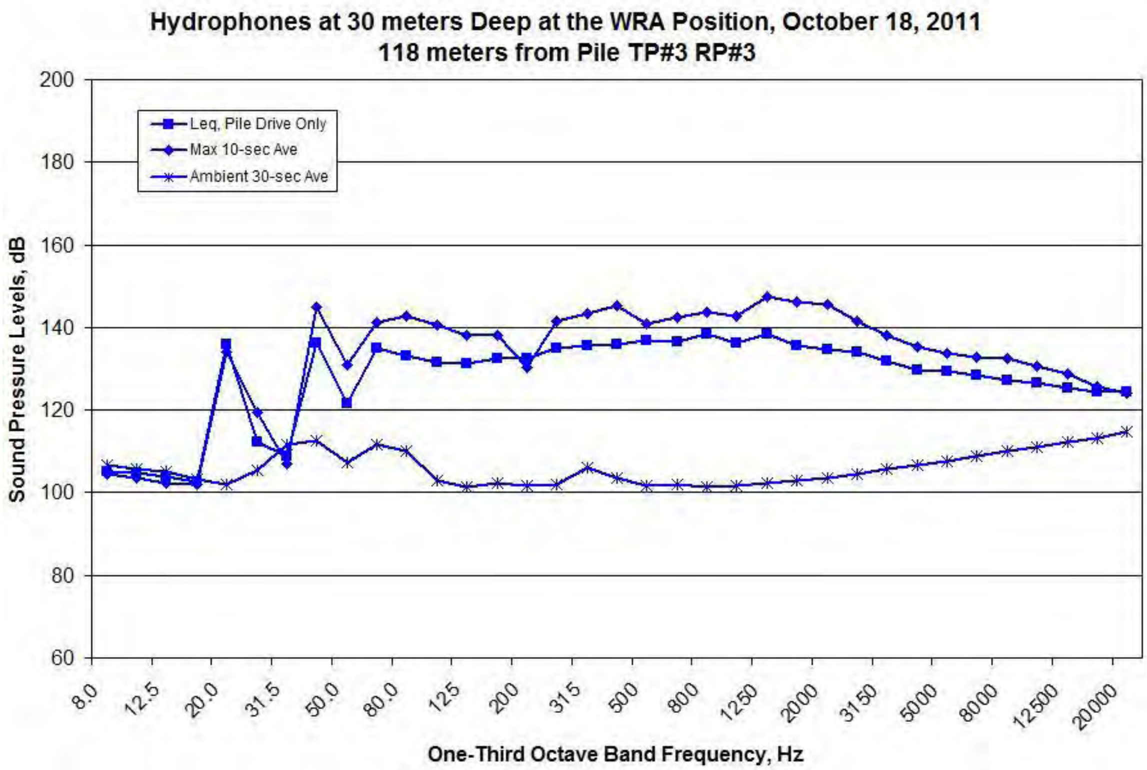

Figure A674. Spectral Data Measured at the WRA Location during TP#3 RP#3, 11:21-11:30, Measured at Depths of 30 meters on October 18, 2011

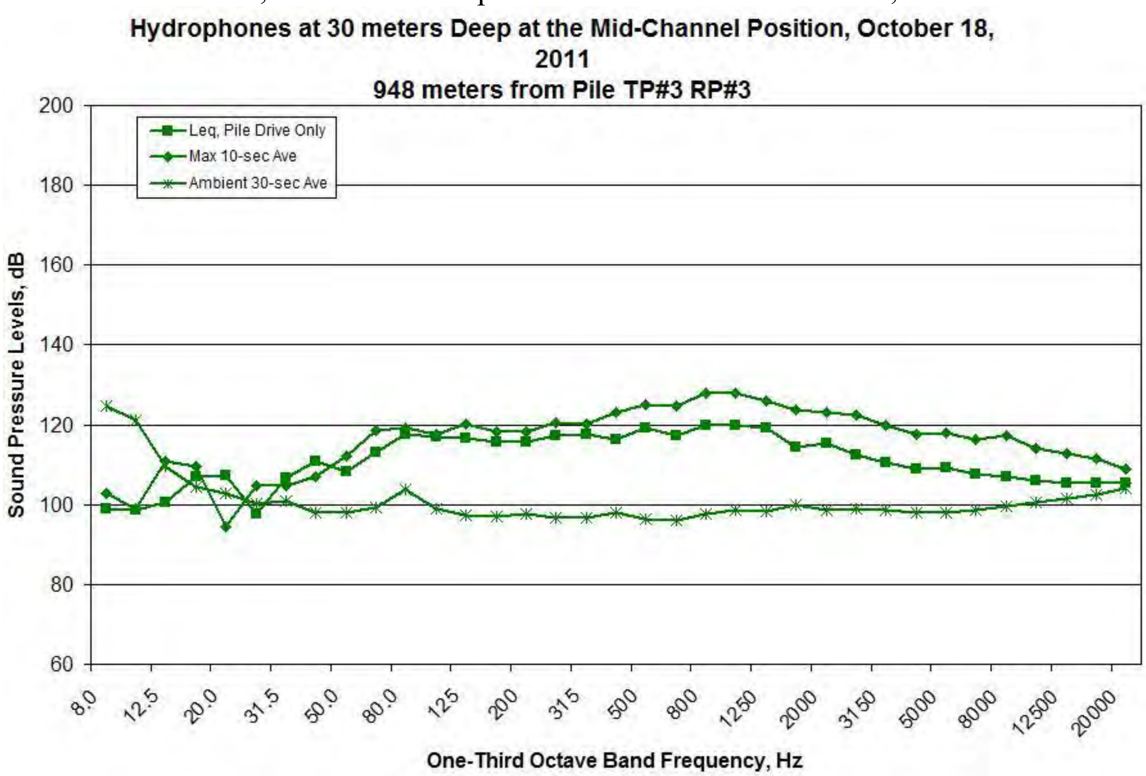

Figure A675. Spectral Data Measured at the MID Location during TP#3 RP#3, 11:21-11:30, Measured at Depths of 30 meters on October 18, 2011

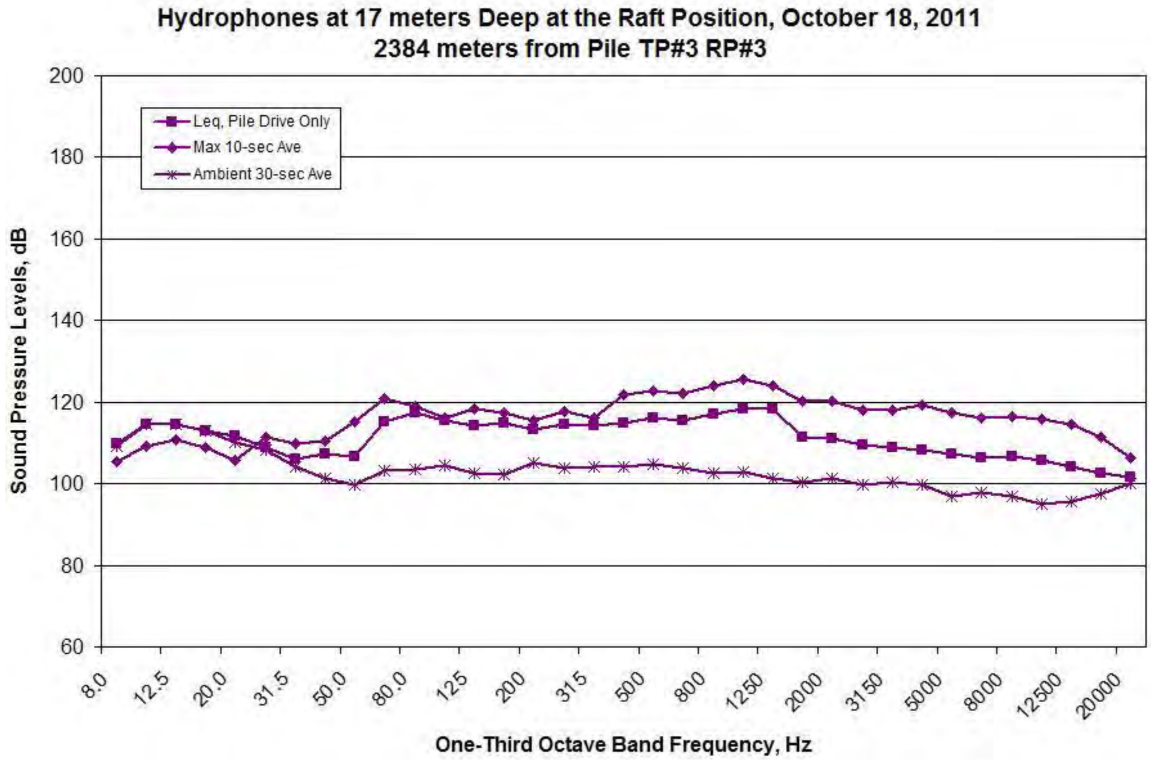

Figure A676. Spectral Data Measured at the RFT Location during TP#3 RP#3, 11:21-11:30, Measured at Depths of 17 meters on October 18, 2011

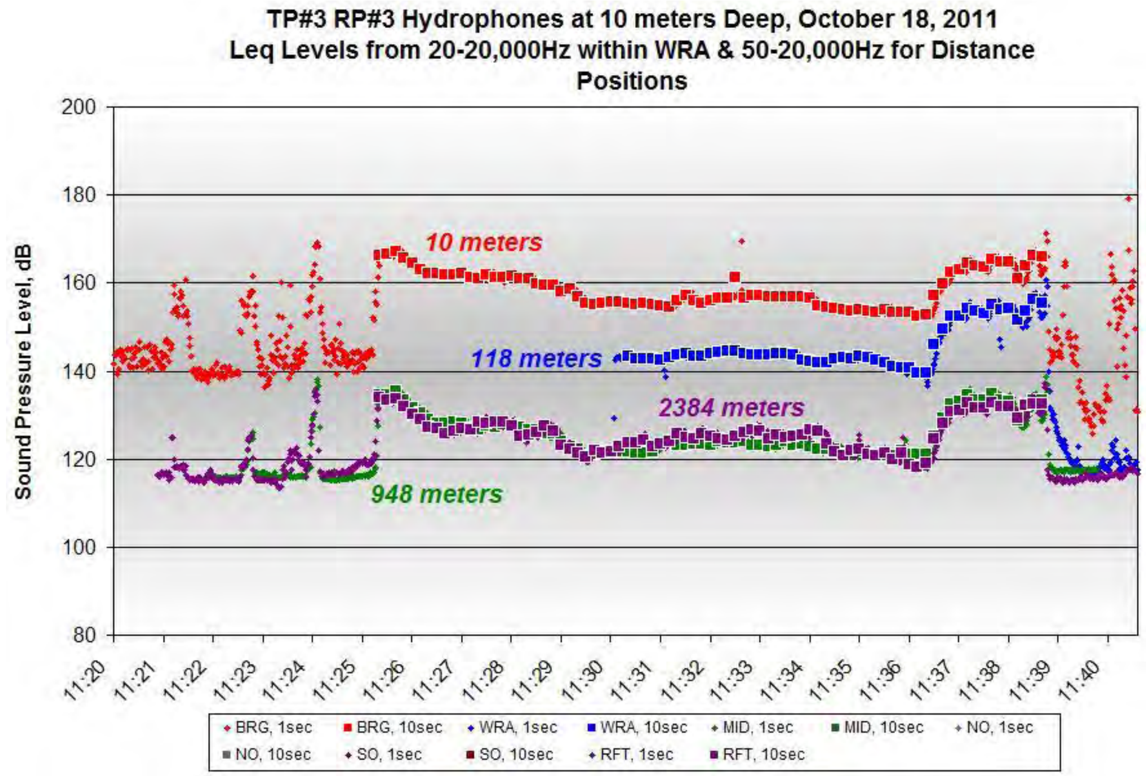

Figure A677. One-second and 10-second Average Data for TP#3 RP#3, 11:21-11:30, Measured at Depths of 10 meters on October 18, 2011

NO SPECTRA DATA AVAILABLE

Figure A678. Spectral Data Measured at the BRG Location during TP#3 RP#3, 11:21-11:30, Measured at Depths of 10 meters on October 18, 2011

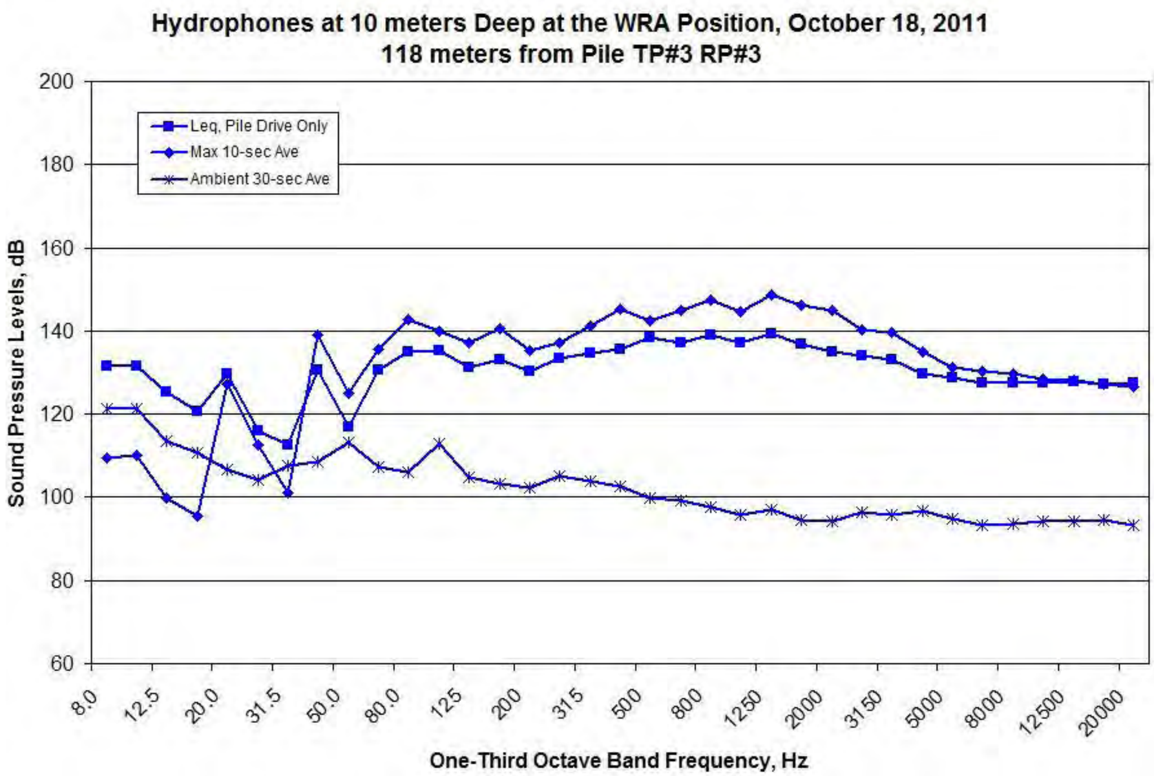

Figure A679. Spectral Data Measured at the WRA Location during TP#3 RP#3, 11:21-11:30, Measured at Depths of 10 meters on October 18, 2011

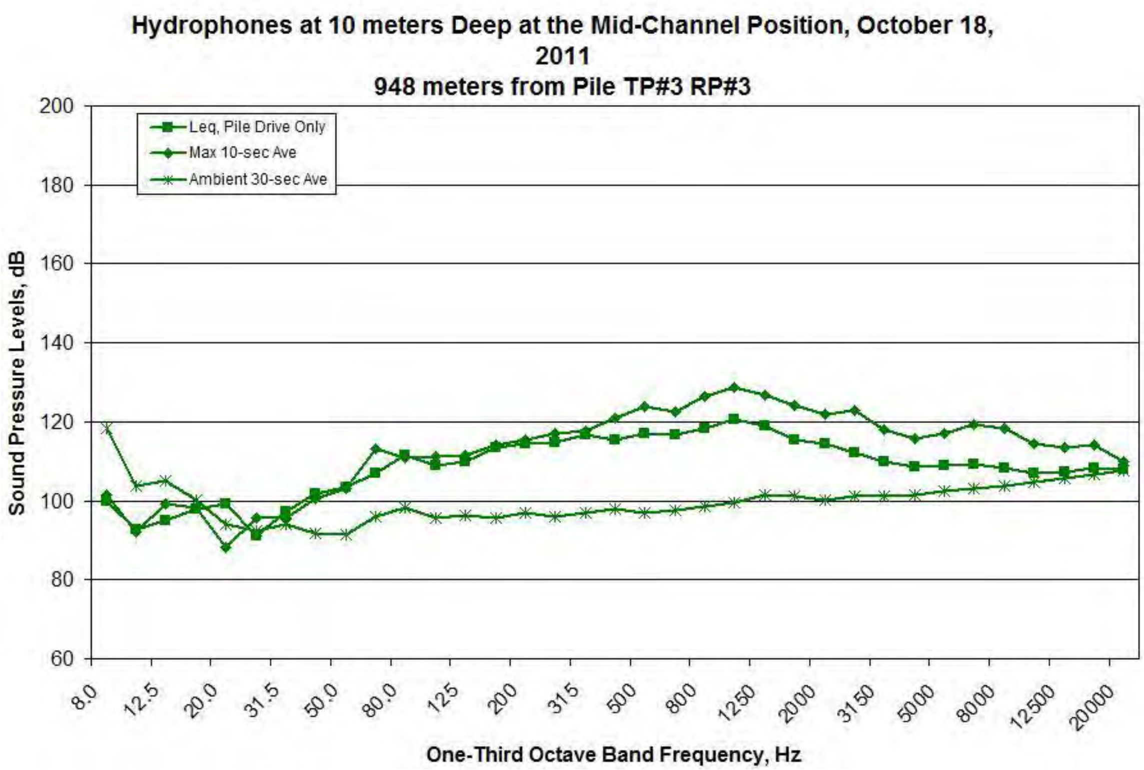

Figure A680. Spectral Data Measured at the MID Location during TP#3 RP#3, 11:21-11:30, Measured at Depths of 10 meters on October 18, 2011

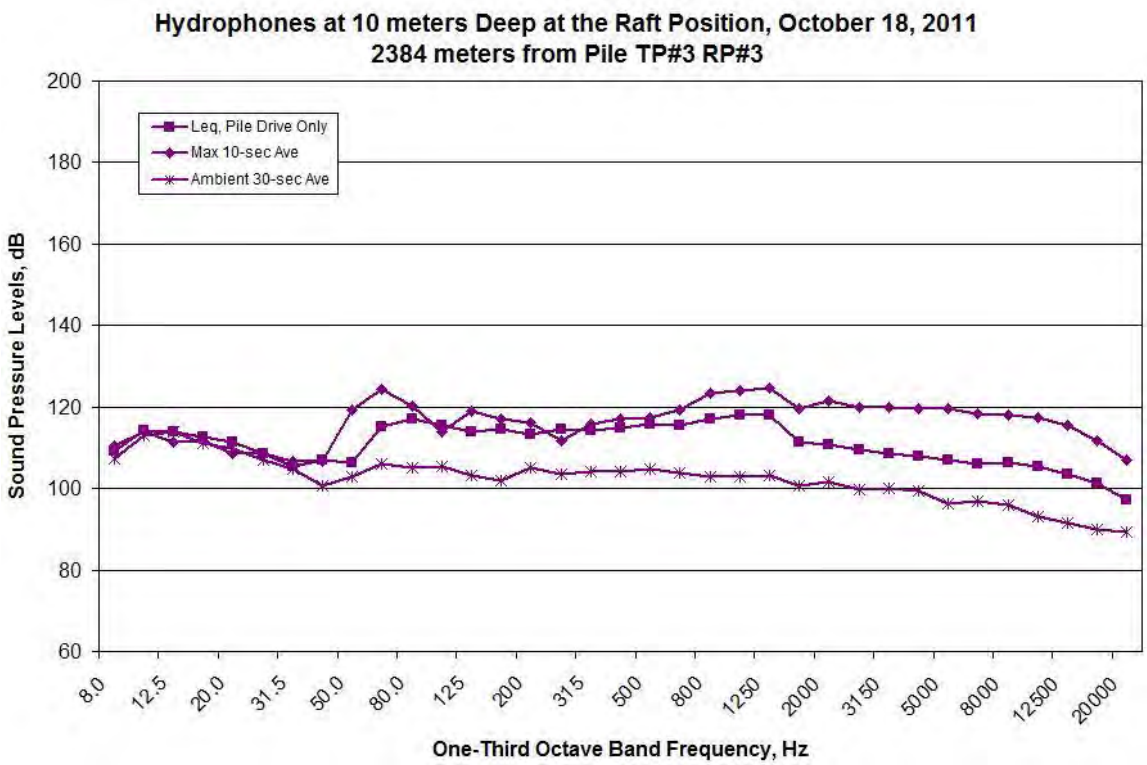

Figure A681. Spectral Data Measured at the RFT Location during TP#3 RP#3, 11:21-11:30, Measured at Depths of 10 meters on October 18, 2011

TP#3 RP#1 (Vibratory Removal)

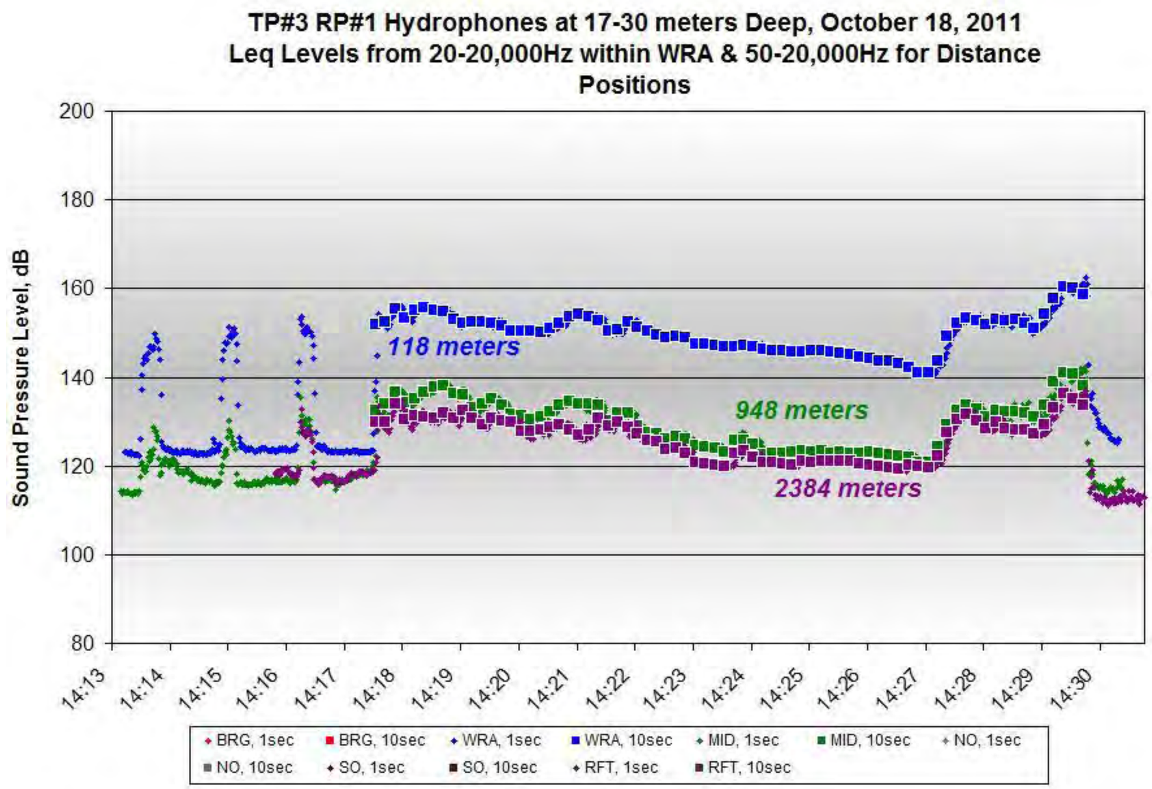

Figure A682. One-second and 10-second Average Data for TP#3 RP#1, 13:13-13:31, Measured at Depths of 17-30 meters on October 18, 2011

DATA NOT USABLE

Figure A683. Spectral Data Measured at the BRG Location during TP#3 RP#1, 13:13-13:31, Measured at Depths of 20 meters on October 18, 2011

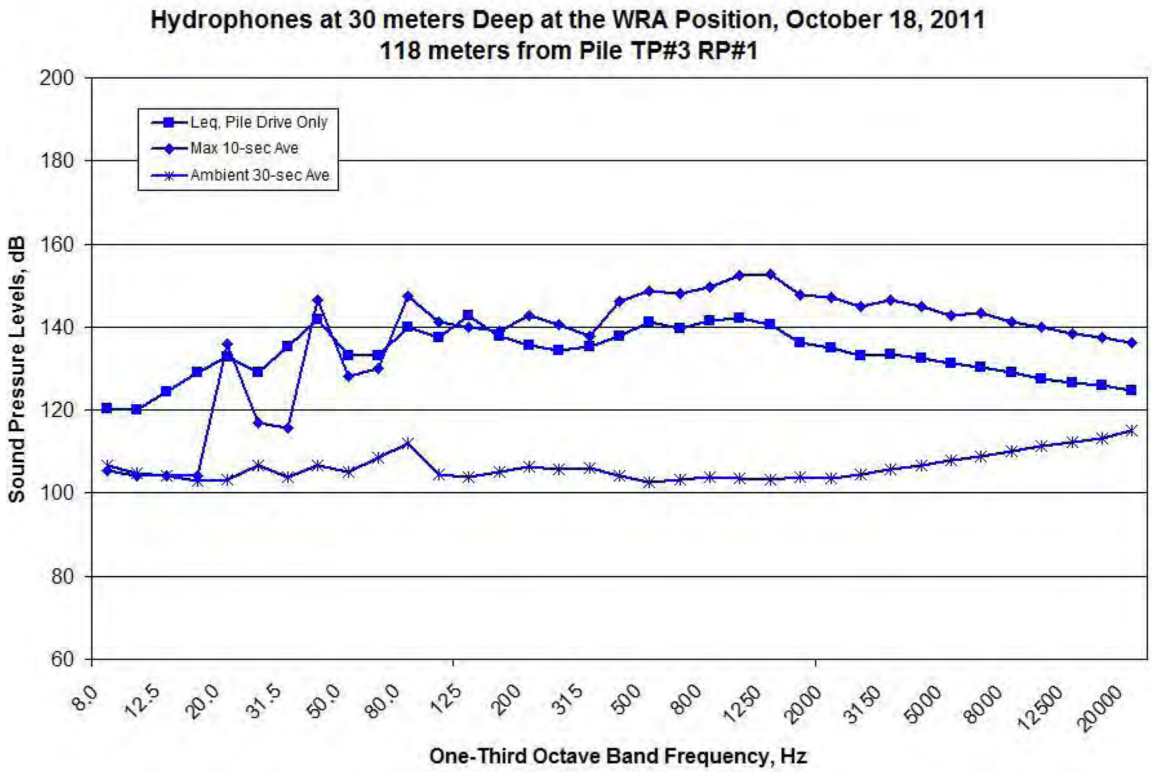

Figure A684. Spectral Data Measured at the WRA Location during TP#3 RP#1, 13:13-13:31, Measured at Depths of 30 meters on October 18, 2011

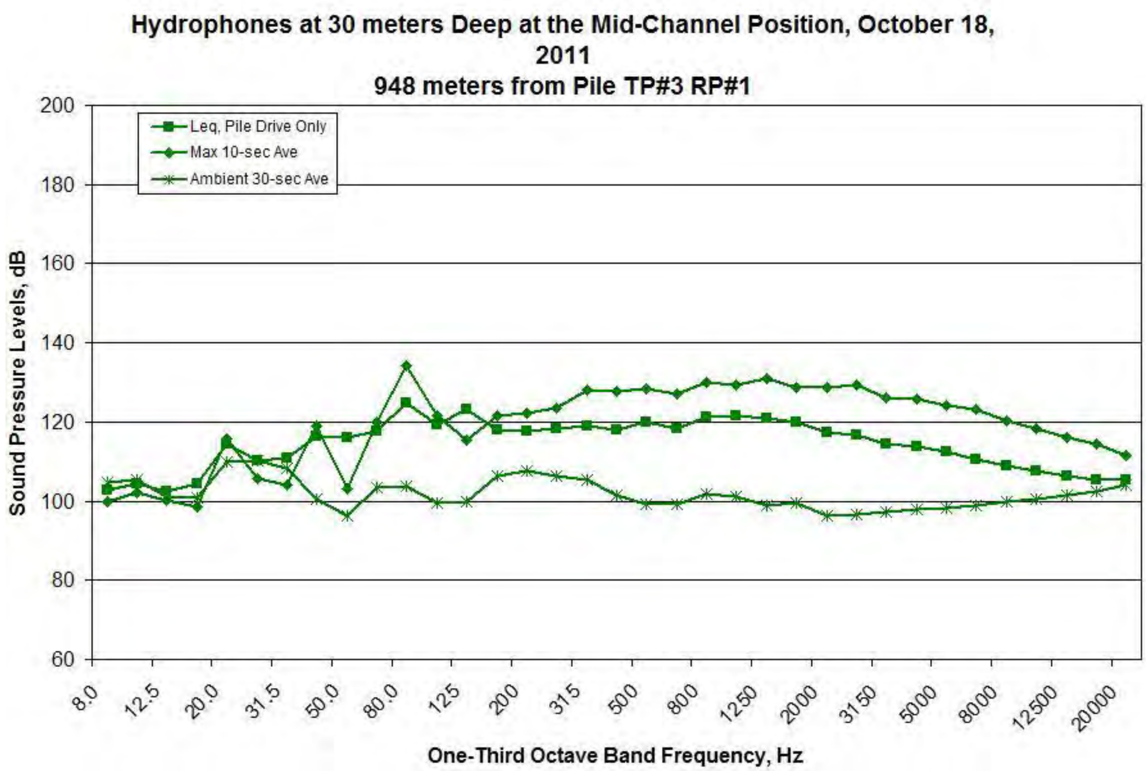

Figure A685. Spectral Data Measured at the MID Location during TP#3 RP#1, 13:13-13:31, Measured at Depths of 30 meters on October 18, 2011

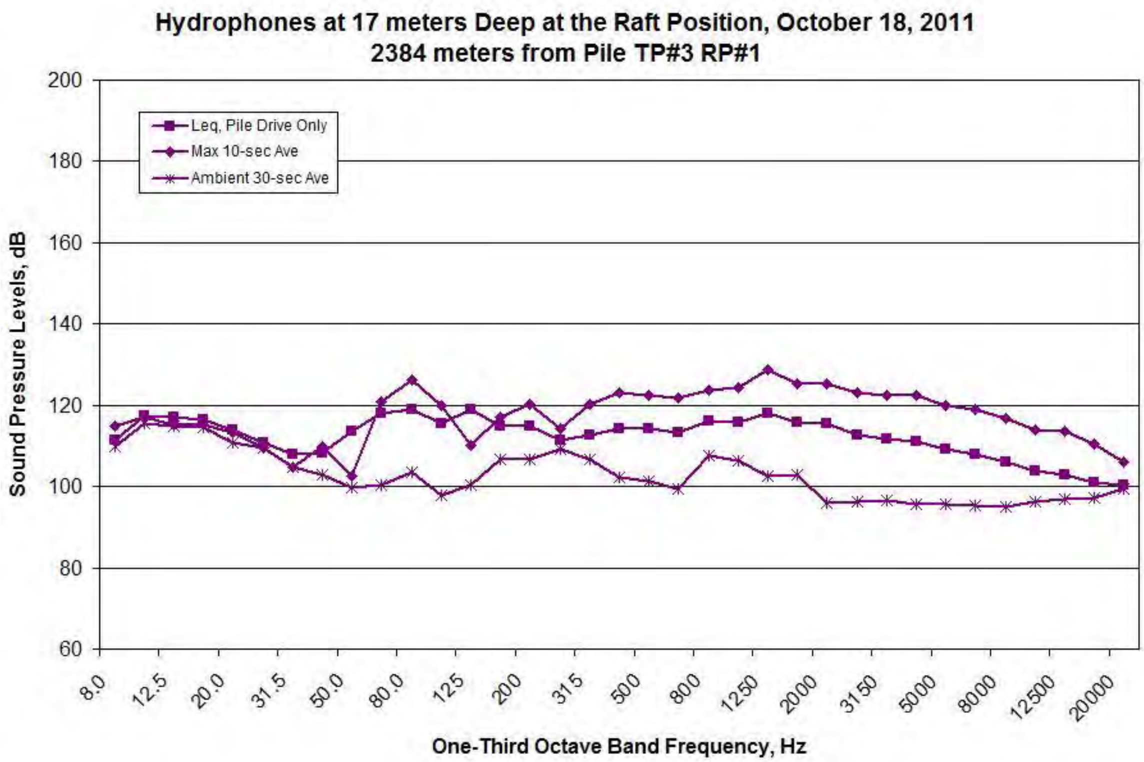

Figure A686. Spectral Data Measured at the RFT Location during TP#3 RP#1, 13:13-13:31, Measured at Depths of 17 meters on October 18, 2011

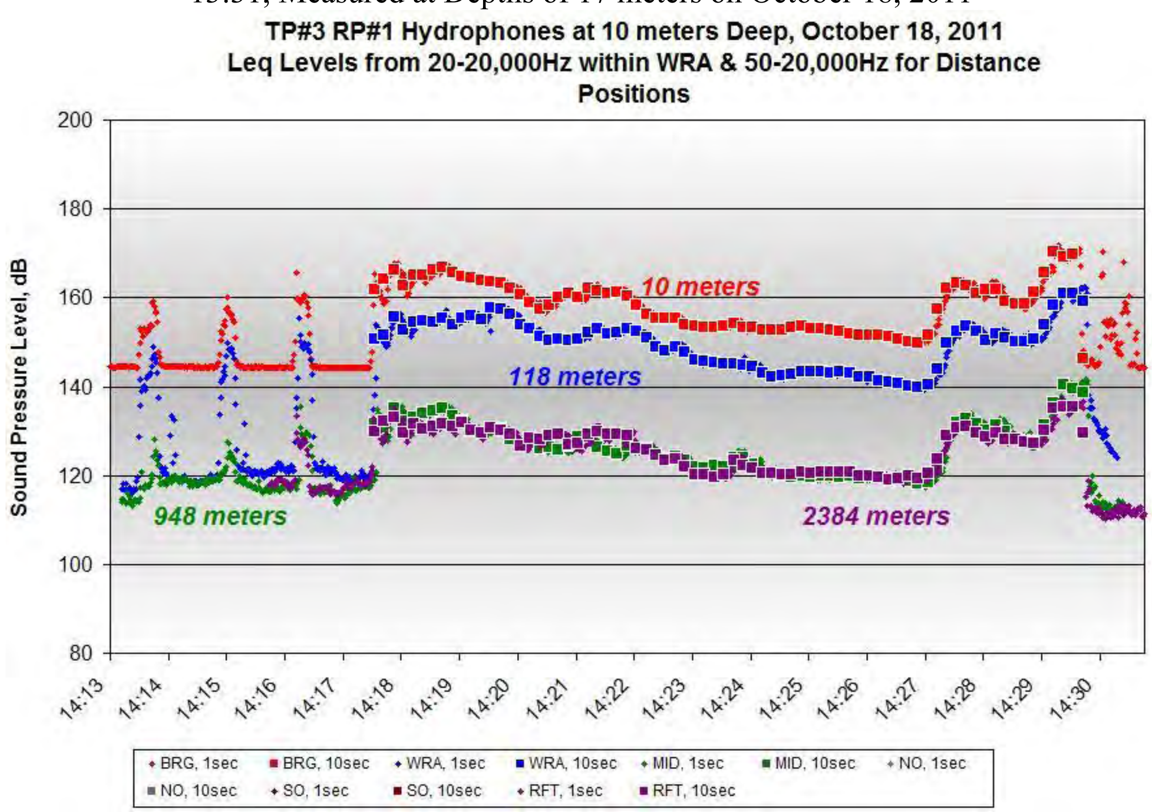

Figure A689. One-second and 10-second Average Data for TP#3 RP#1, 13:13-13:31, Measured at Depths of 10 meters on October 18, 2011

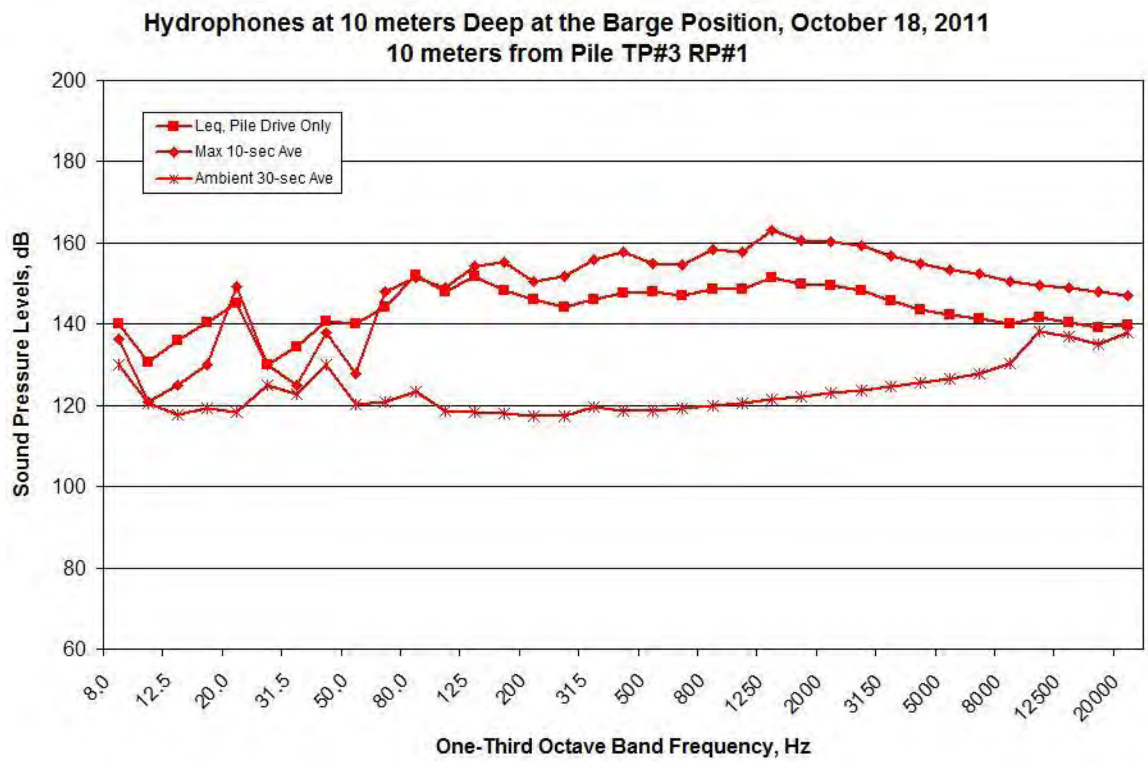

Figure A690. Spectral Data Measured at the BRG Location during TP#3 RP#1, 13:13-13:31, Measured at Depths of 10 meters on October 18, 2011

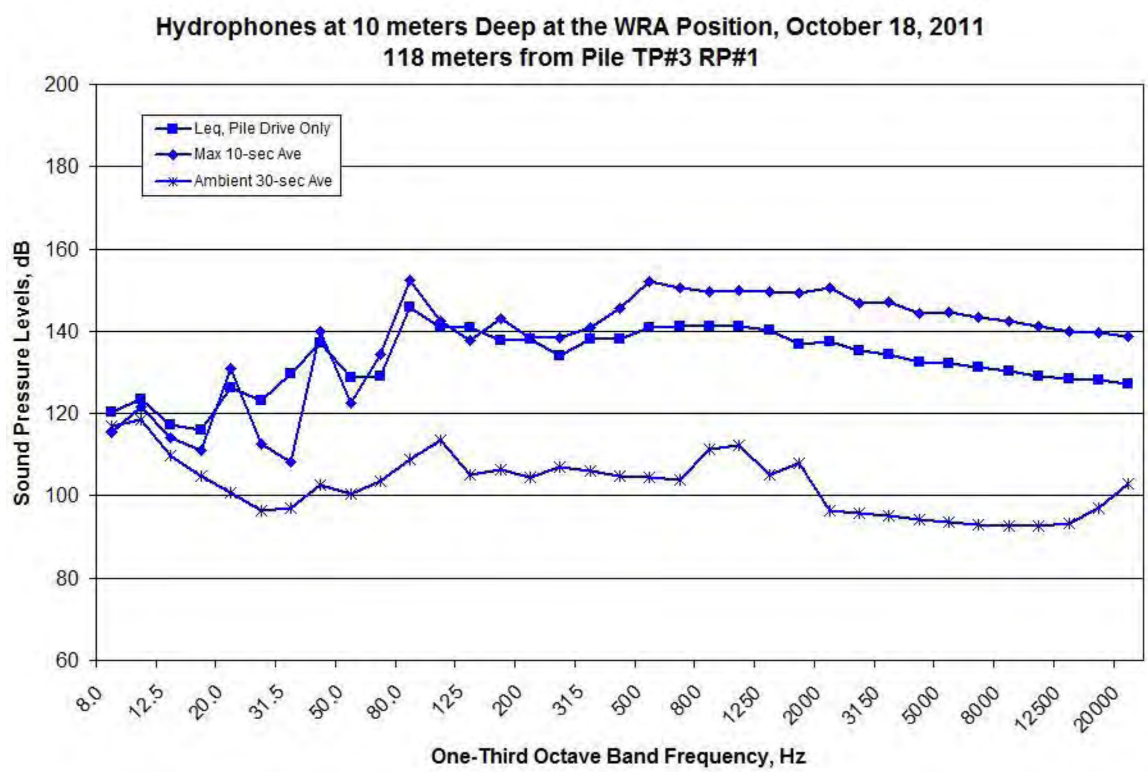

Figure A691. Spectral Data Measured at the WRA Location during TP#3 RP#1, 13:13-13:31, Measured at Depths of 10 meters on October 18, 2011

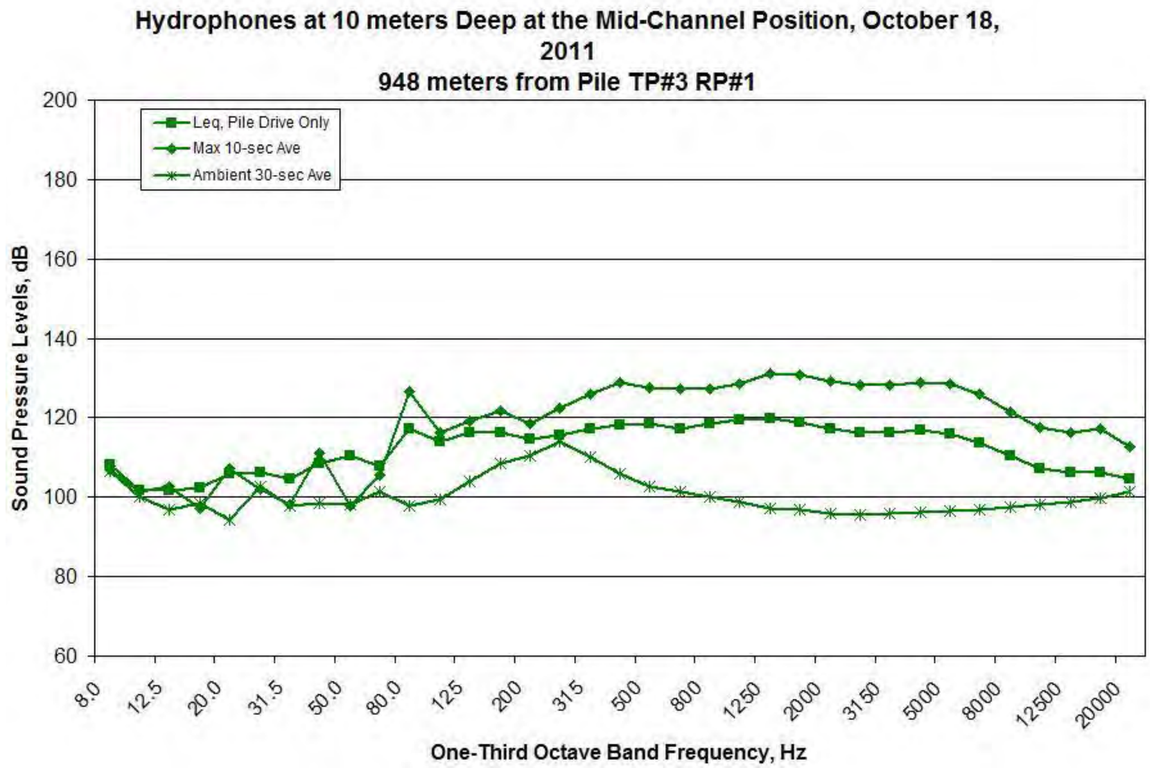

Figure A692. Spectral Data Measured at the MID Location during TP#3 RP#1, 13:13-13:31, Measured at Depths of 10 meters on October 18, 2011

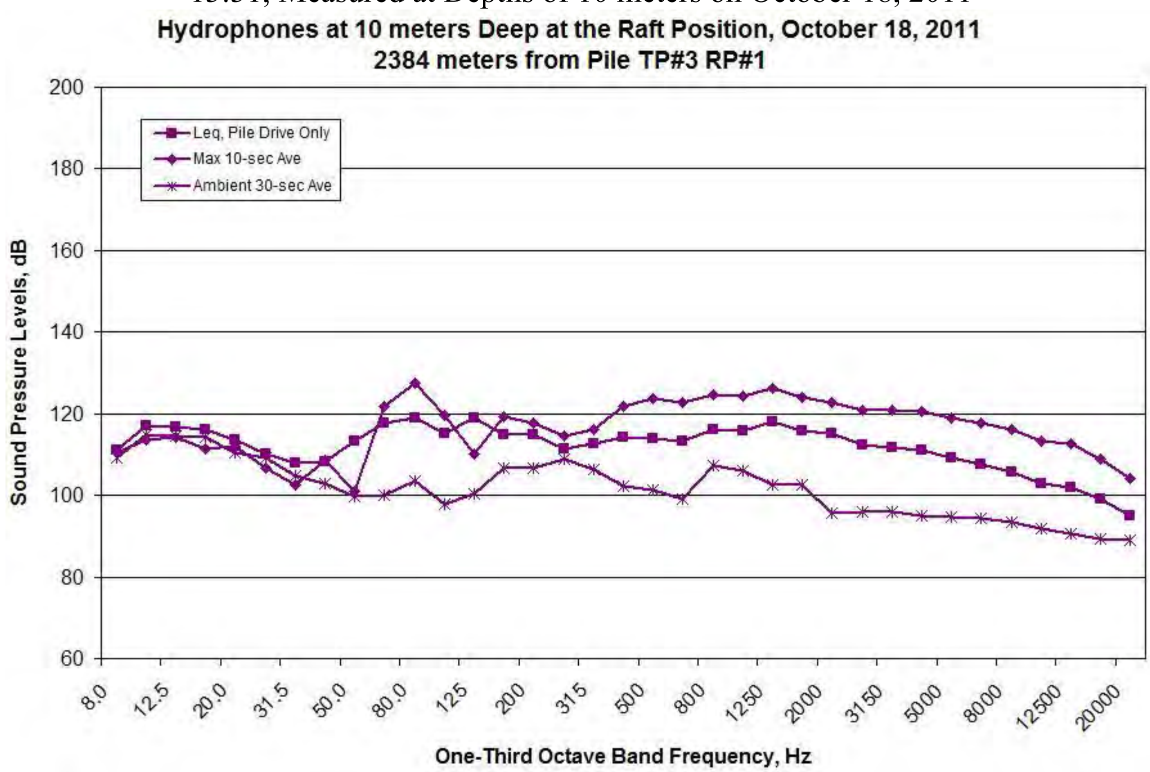

Figure A693. Spectral Data Measured at the RFT Location during TP#3 RP#1, 13:13-13:31, Measured at Depths of 10 meters on October 18, 2011

TP#3 RP#2 (Vibratory Removal)

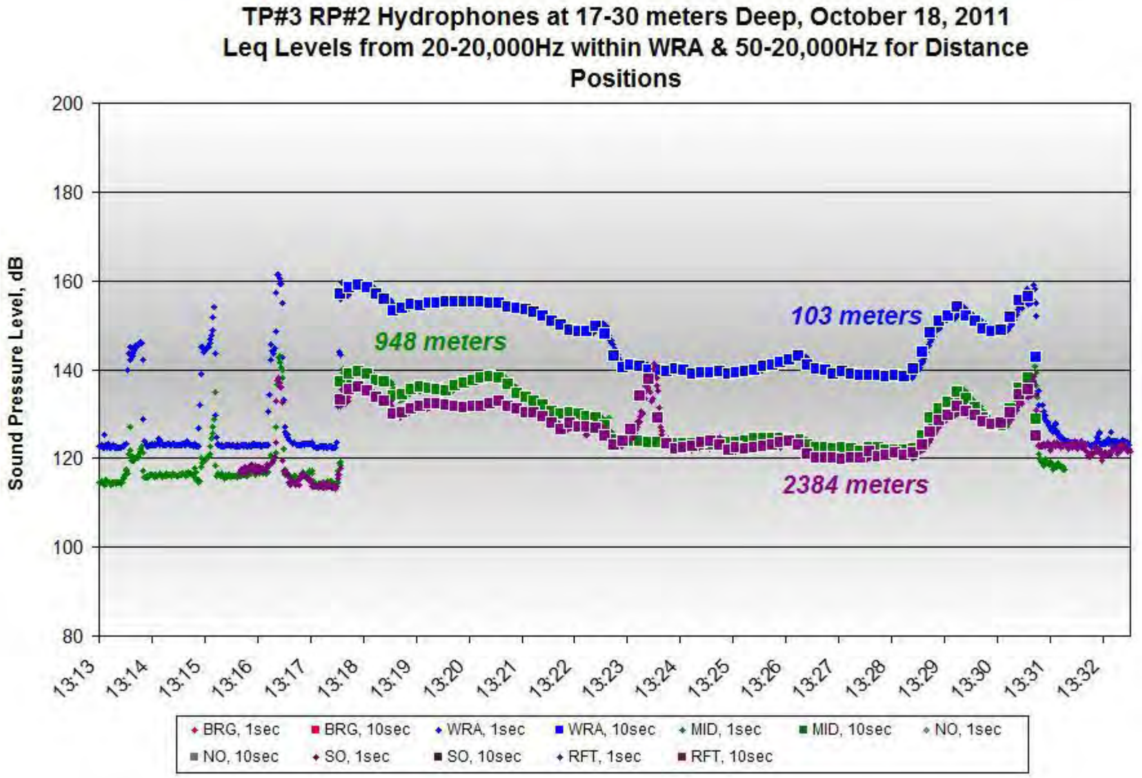

Figure A694. One-second and 10-second Average Data for TP#3 RP#2, 14:13-14:30, Measured at Depths of 17-30 meters on October 18, 2011

DATA NOT USABLE

Figure A695. Spectral Data Measured at the BRG Location during TP#3 RP#2, 14:13-14:30, Measured at Depths of 20 meters on October 18, 2011

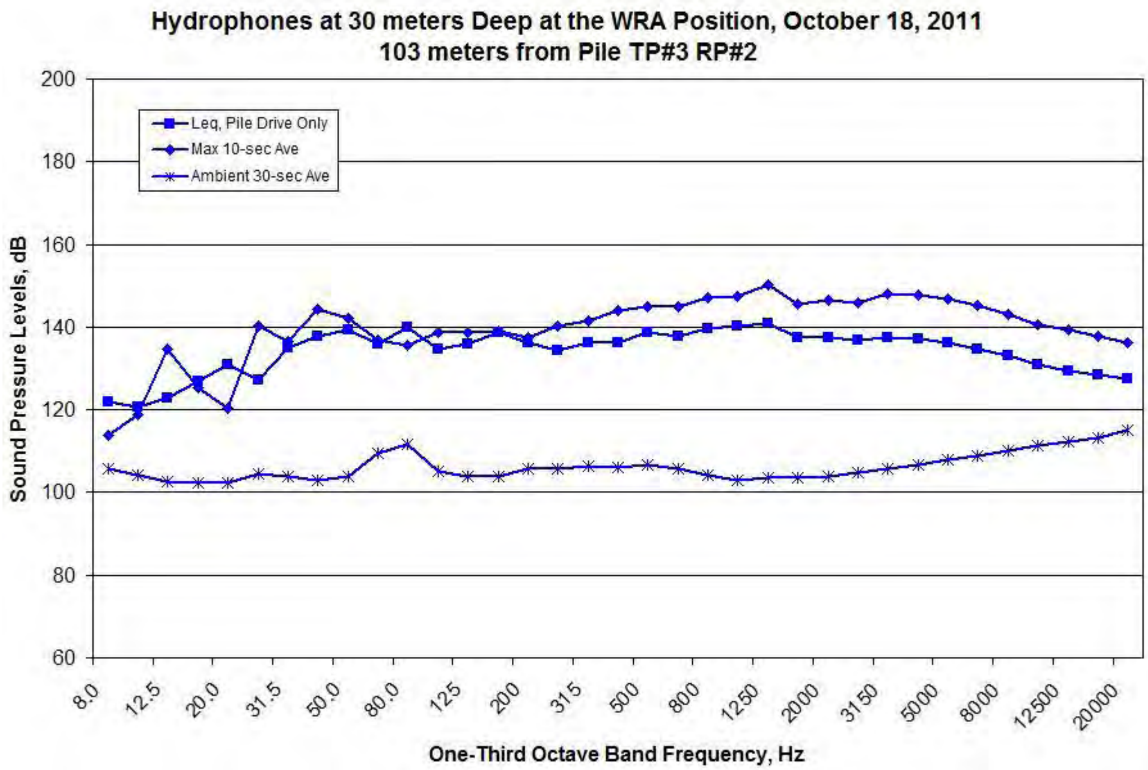

Figure A696. Spectral Data Measured at the WRA Location during TP#3 RP#2, 14:13-14:30, Measured at Depths of 30 meters on October 18, 2011

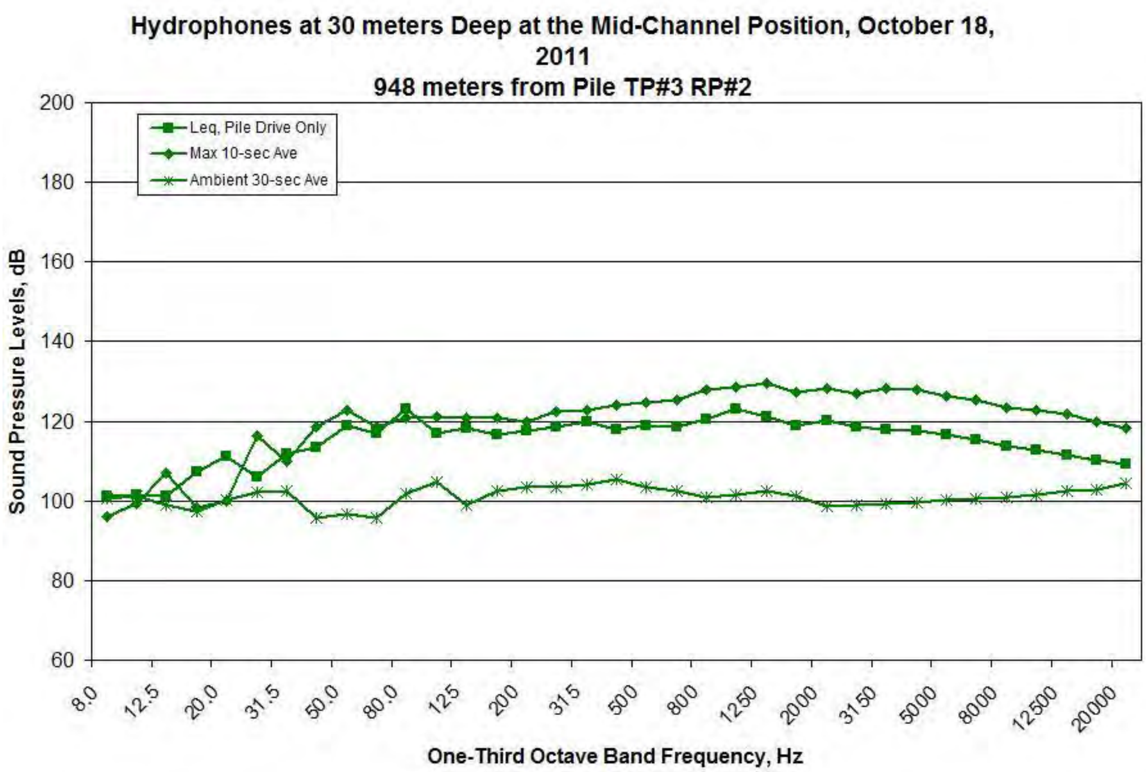

Figure A697. Spectral Data Measured at the MID Location during TP#3 RP#2, 14:13-14:30, Measured at Depths of 30 meters on October 18, 2011

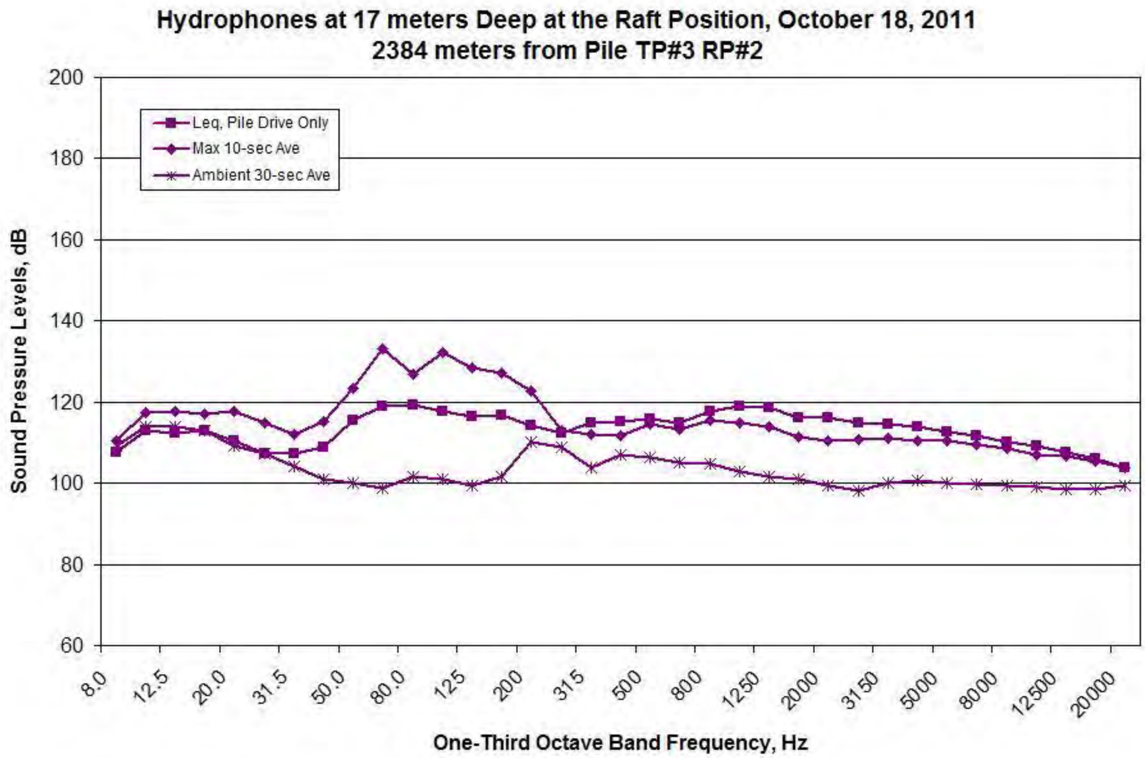

Figure A697. Spectral Data Measured at the RFT Location during TP#3 RP#2, 14:13-14:30, Measured at Depths of 17 meters on October 18, 2011

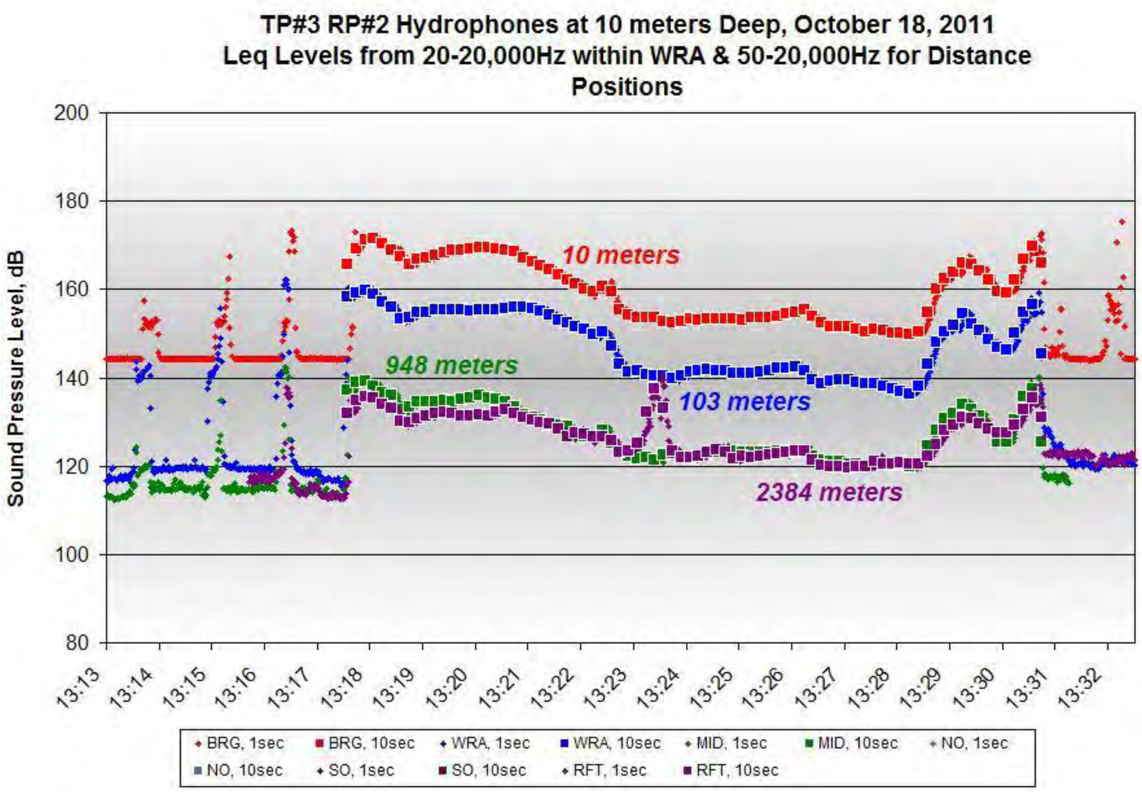

Figure A698. One-second and 10-second Average Data for TP#3 RP#2, 14:13-14:30, Measured at Depths of 10 meters on October 18, 2011

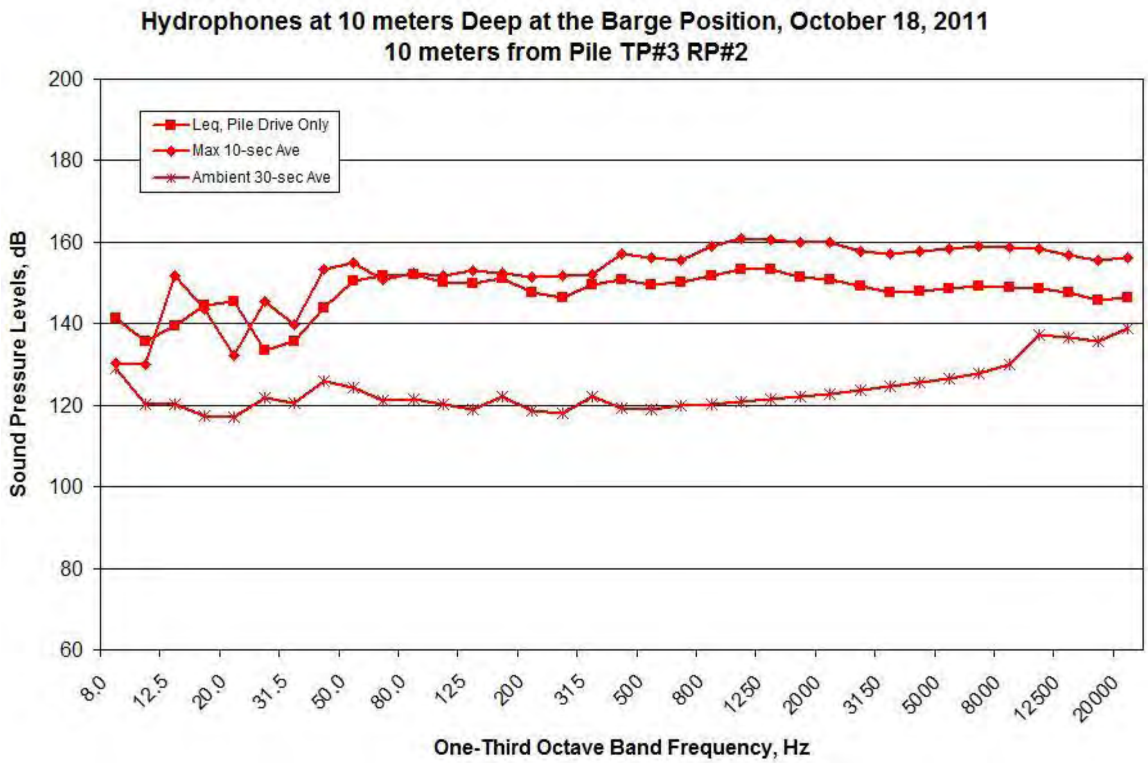

Figure A699. Spectral Data Measured at the BRG Location during TP#3 RP#2, 14:13-14:30, Measured at Depths of 10 meters on October 18, 2011

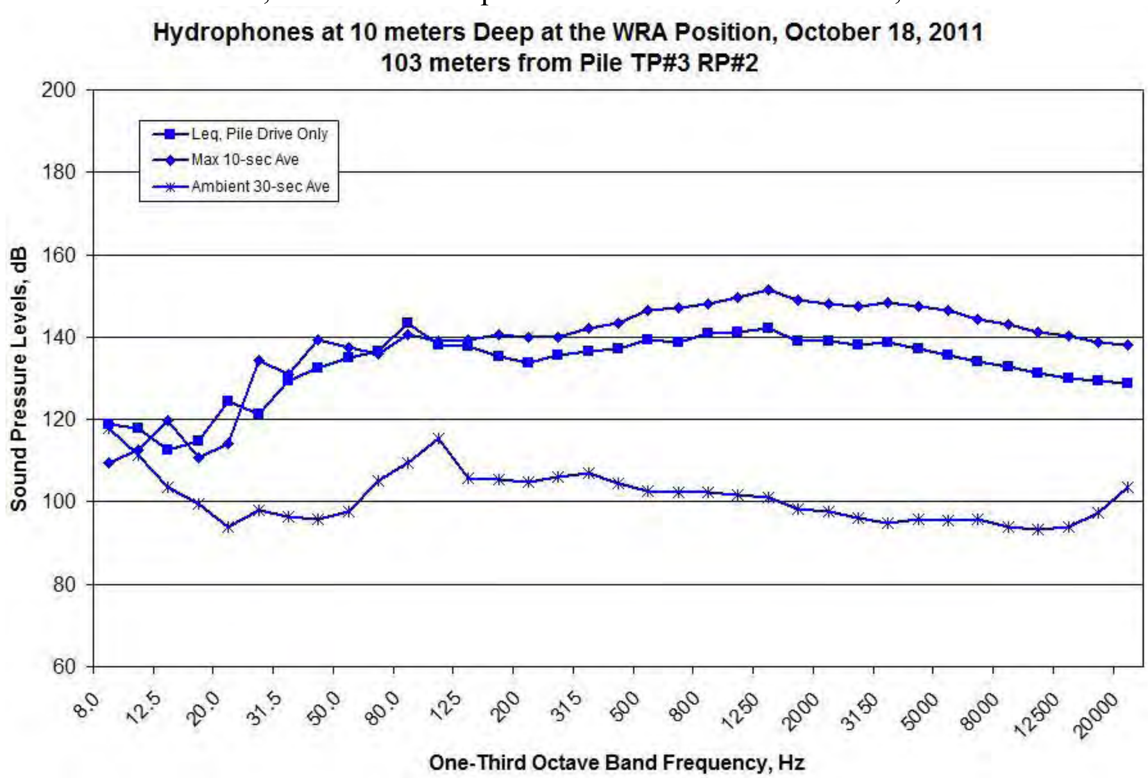

Figure A700. Spectral Data Measured at the WRA Location during TP#3 RP#2, 14:13-14:30, Measured at Depths of 10 meters on October 18, 2011

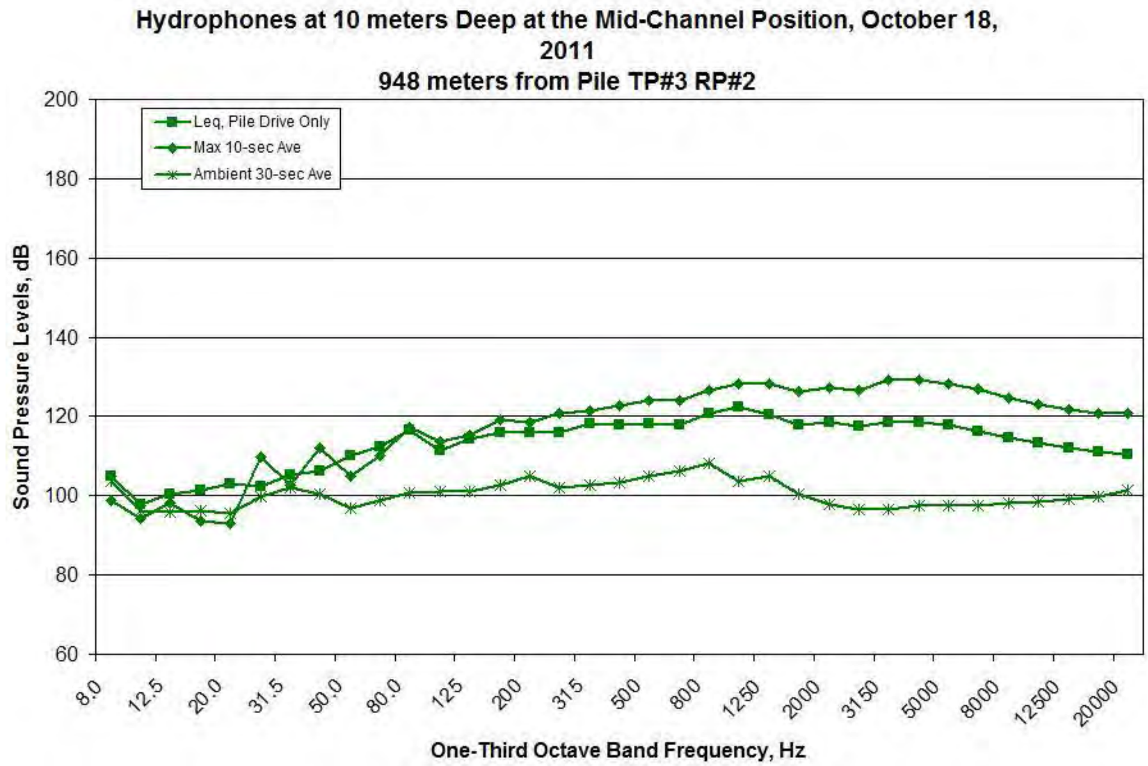

Figure A701. Spectral Data Measured at the MID Location during TP#3 RP#2, 14:13-14:30, Measured at Depths of 10 meters on October 18, 2011

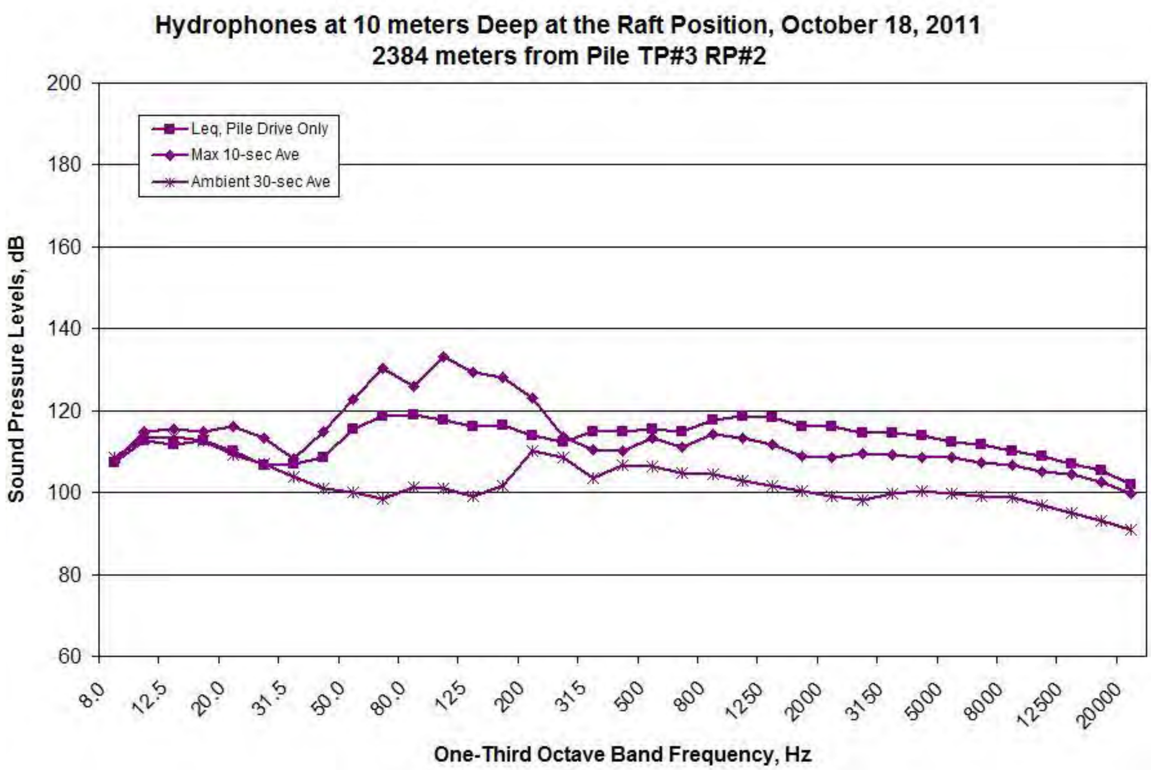

Figure A702. Spectral Data Measured at the RFT Location during TP#3 RP#2, 14:13-14:30, Measured at Depths of 10 meters on October 18, 2011

TP#3 MP#1 (Vibratory Removal)

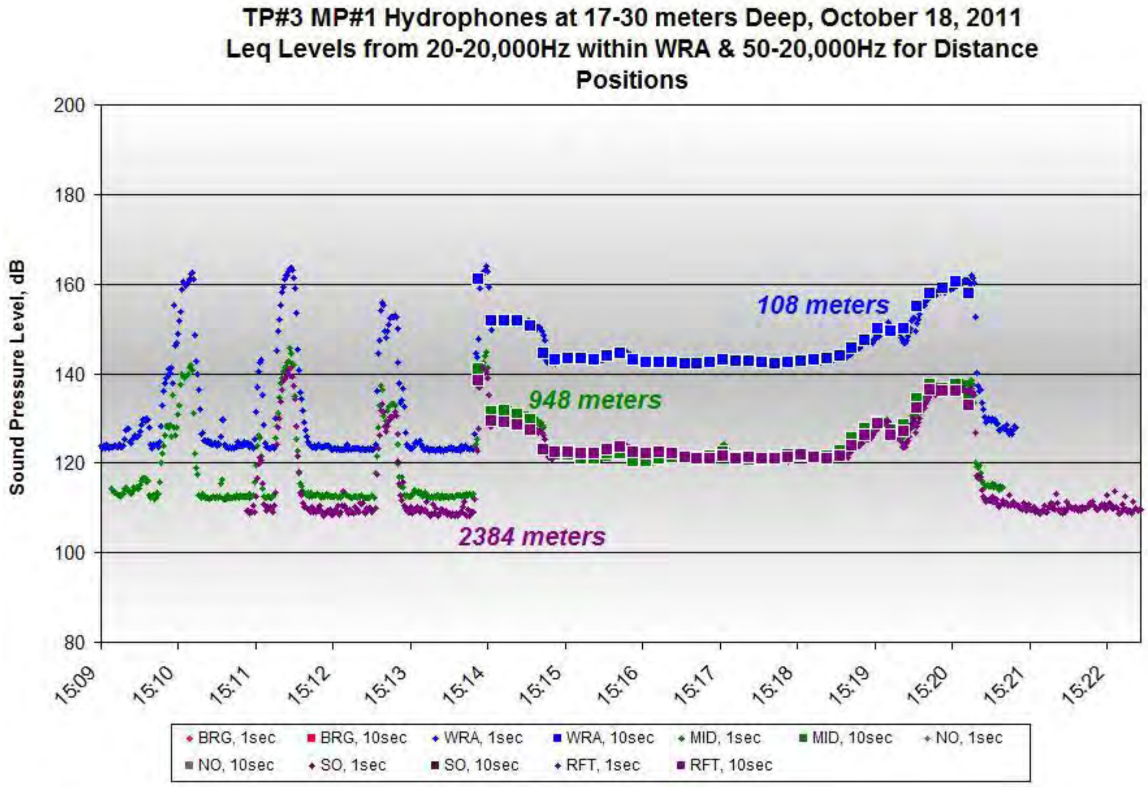

Figure A703. One-second and 10-second Average Data for TP#3 MP#1, 15:09-15:21, Measured at Depths of 17-30 meters on October 18, 2011

DATA NOT USABLE

Figure A704. Spectral Data Measured at the BRG Location during TP#3 MP#1, 15:09-15:21, Measured at Depths of 20 meters on October 18, 2011

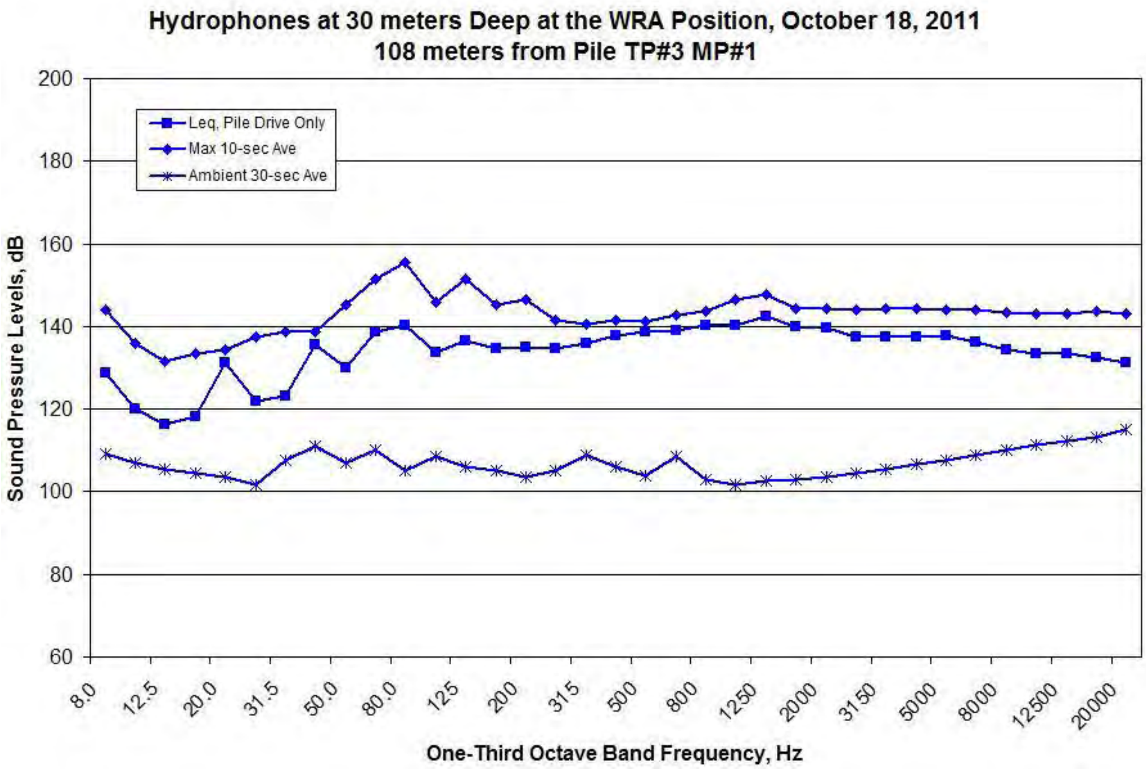

Figure A705. Spectral Data Measured at the WRA Location during TP#3 MP#1, 15:09-15:21, Measured at Depths of 30 meters on October 18, 2011

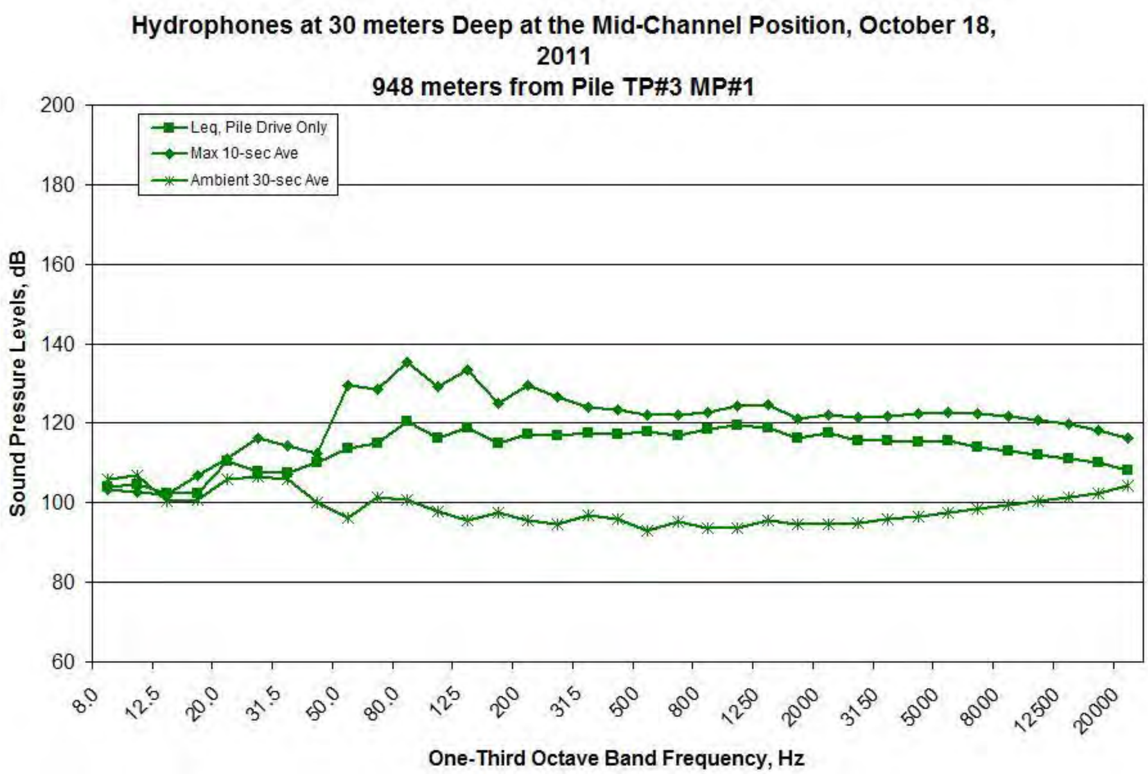

Figure A706. Spectral Data Measured at the MID Location during TP#3 MP#1, 15:09-15:21, Measured at Depths of 30 meters on October 18, 2011

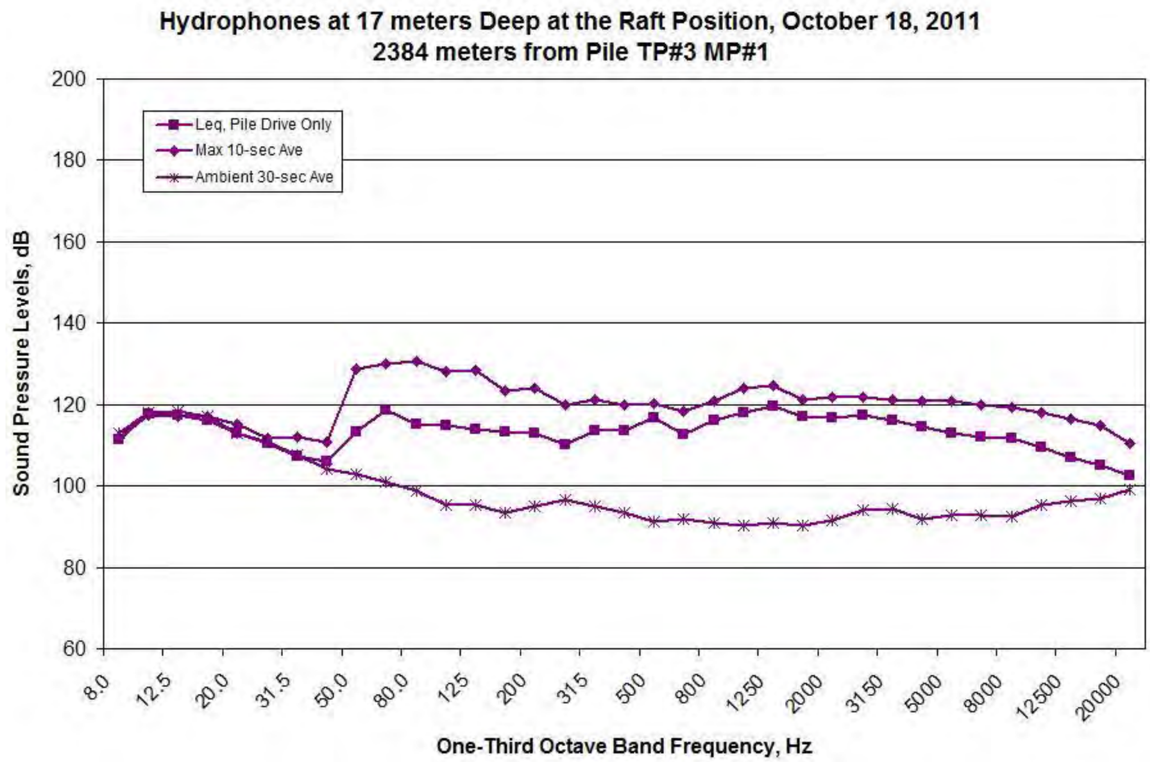

Figure A707. Spectral Data Measured at the RFT Location during TP#3 MP#1, 15:09-15:21, Measured at Depths of 17 meters on October 18, 2011

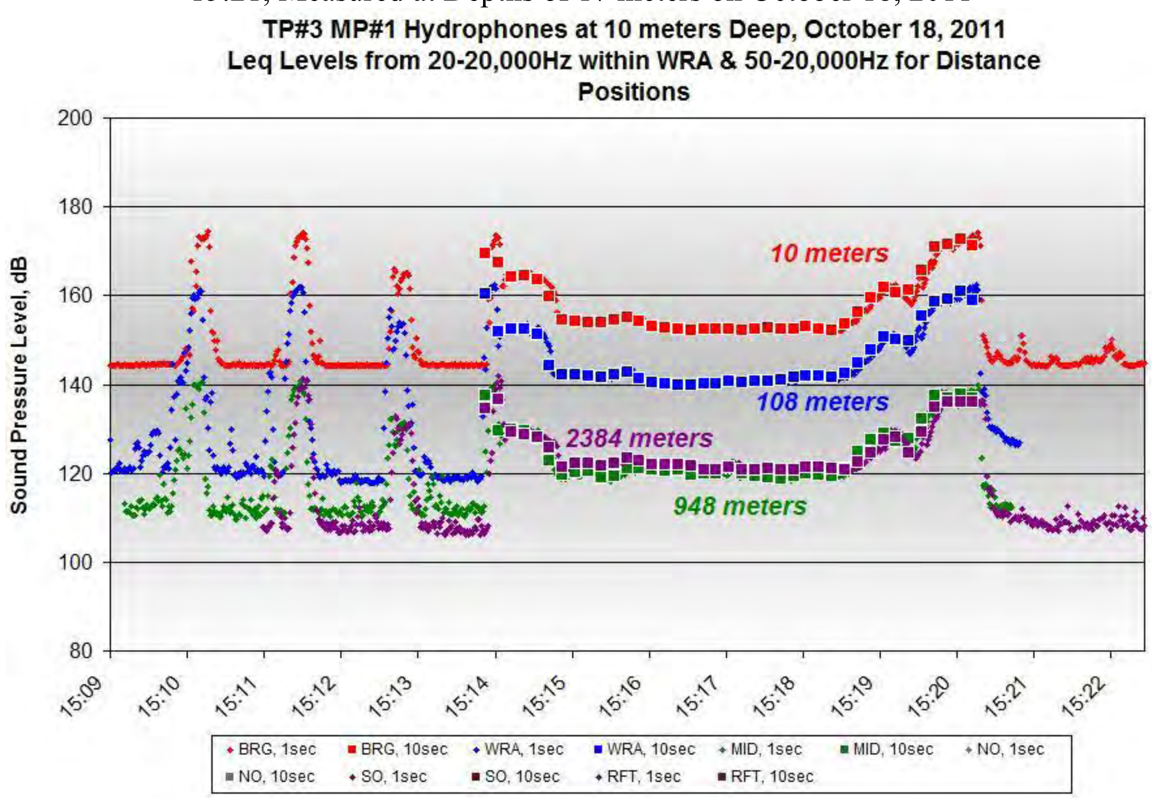

Figure A708. One-second and 10-second Average Data for TP#3 MP#1, 15:09-15:21, Measured at Depths of 10 meters on October 18, 2011

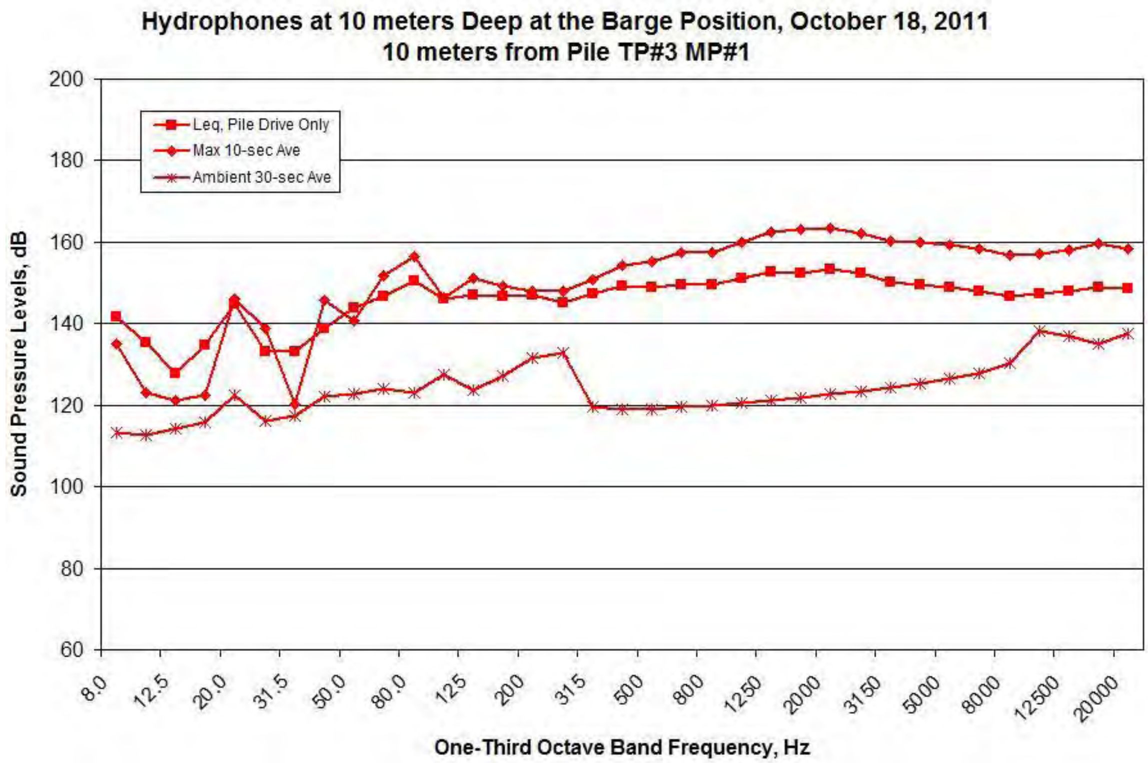

Figure A709. Spectral Data Measured at the BRG Location during TP#3 MP#1, 15:09-15:21, Measured at Depths of 10 meters on October 18, 2011

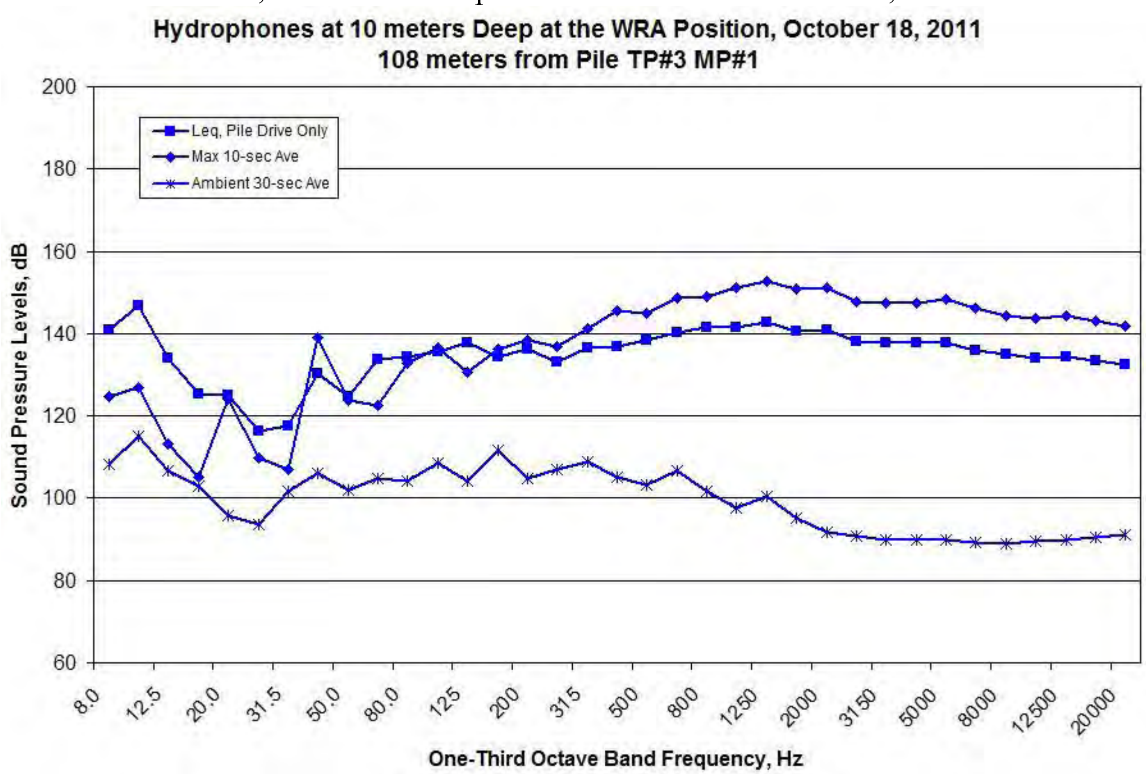

Figure A710. Spectral Data Measured at the WRA Location during TP#3 MP#1, 15:09-15:21, Measured at Depths of 10 meters on October 18, 2011

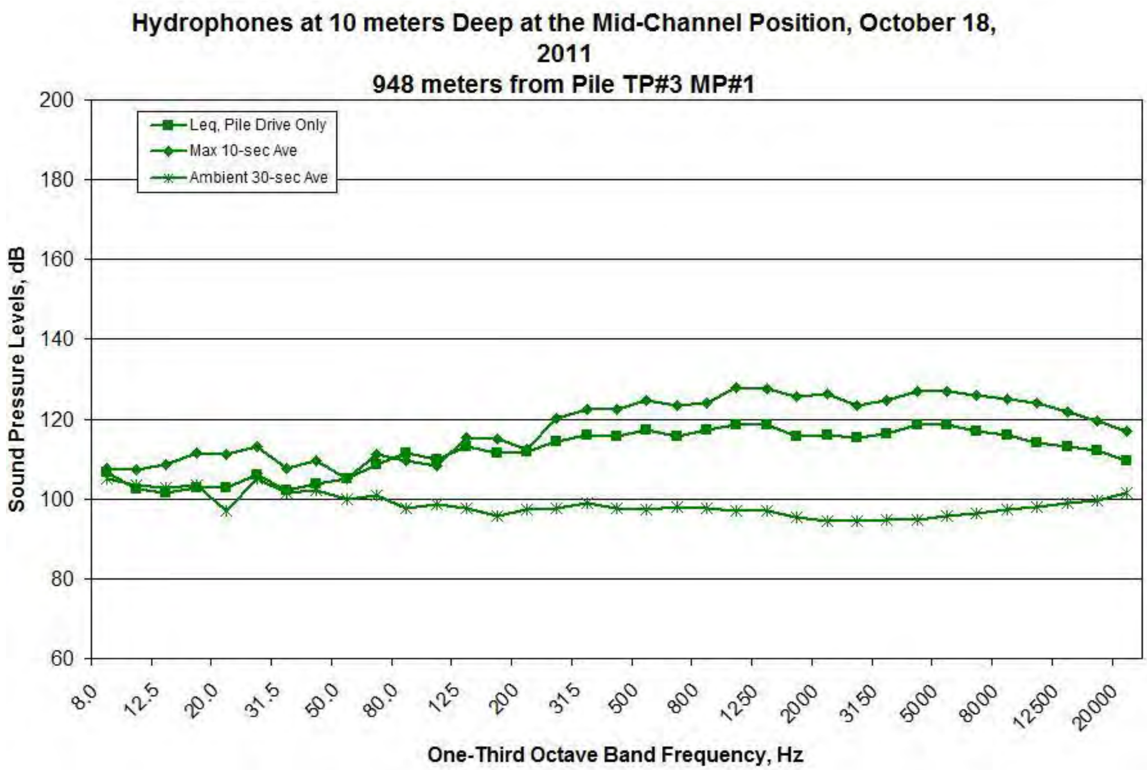

Figure A711. Spectral Data Measured at the MID Location during TP#3 MP#1, 15:09-15:21, Measured at Depths of 10 meters on October 18, 2011

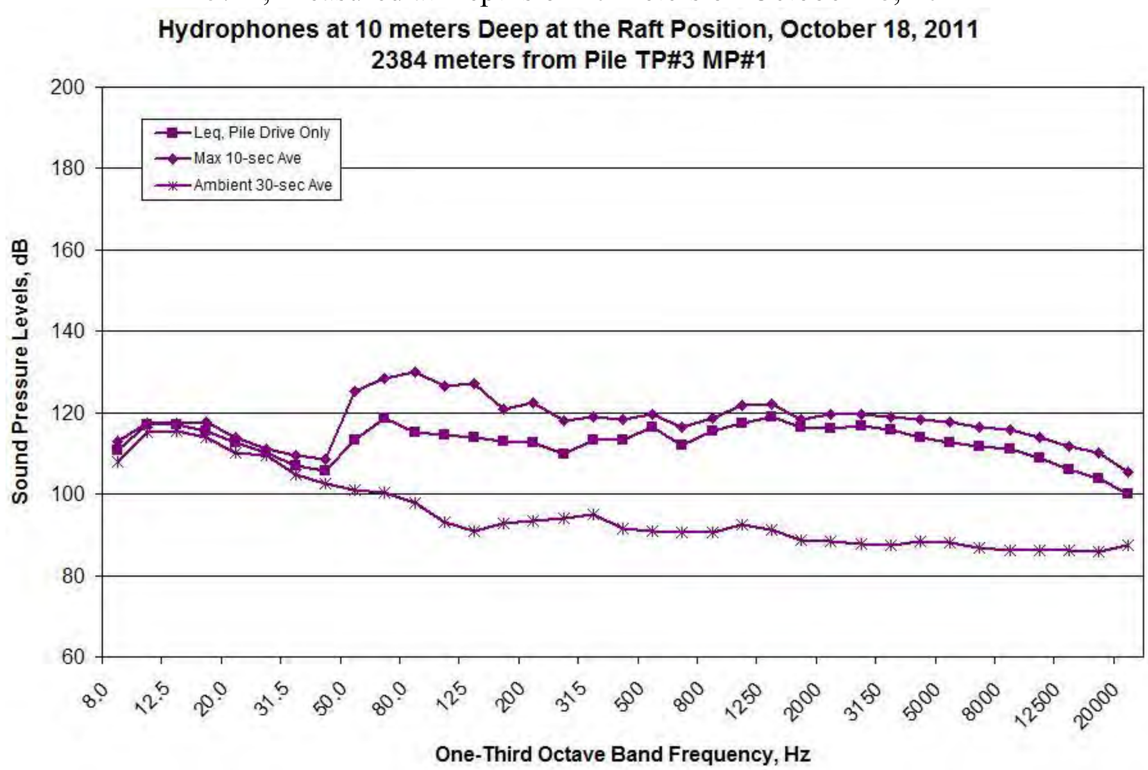

Figure A712. Spectral Data Measured at the RFT Location during TP#3 MP#1, 15:09-15:21, Measured at Depths of 10 meters on October 18, 2011

10/19/2011 – TP#9 MP#2, 8:36-8:37 (Vibratory Removal)

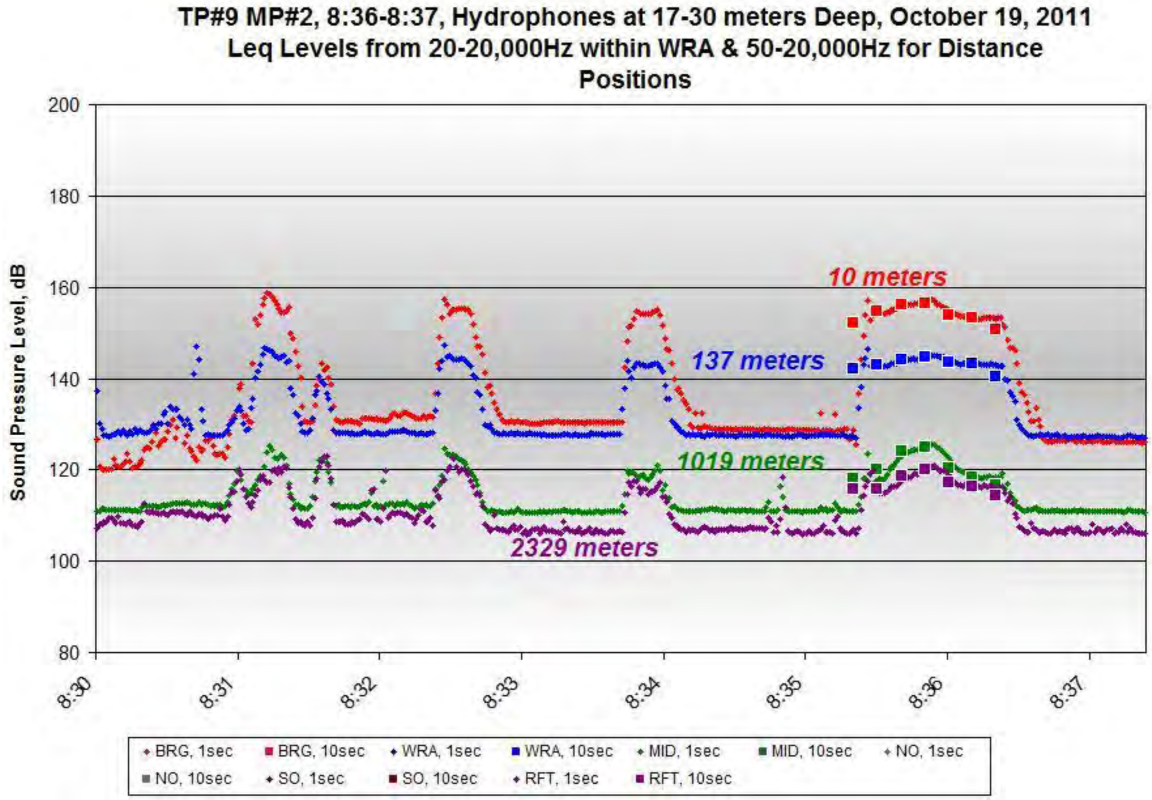

Figure A713. One-second and 10-second Average Data for TP#9 MP#2, 8:36-8:37, Measured at Depths of 17-30 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A714. Spectral Data Measured at the BRG Location during TP#9 MP#2, 8:36-8:37, Measured at Depths of 20 meters on October 19, 2011

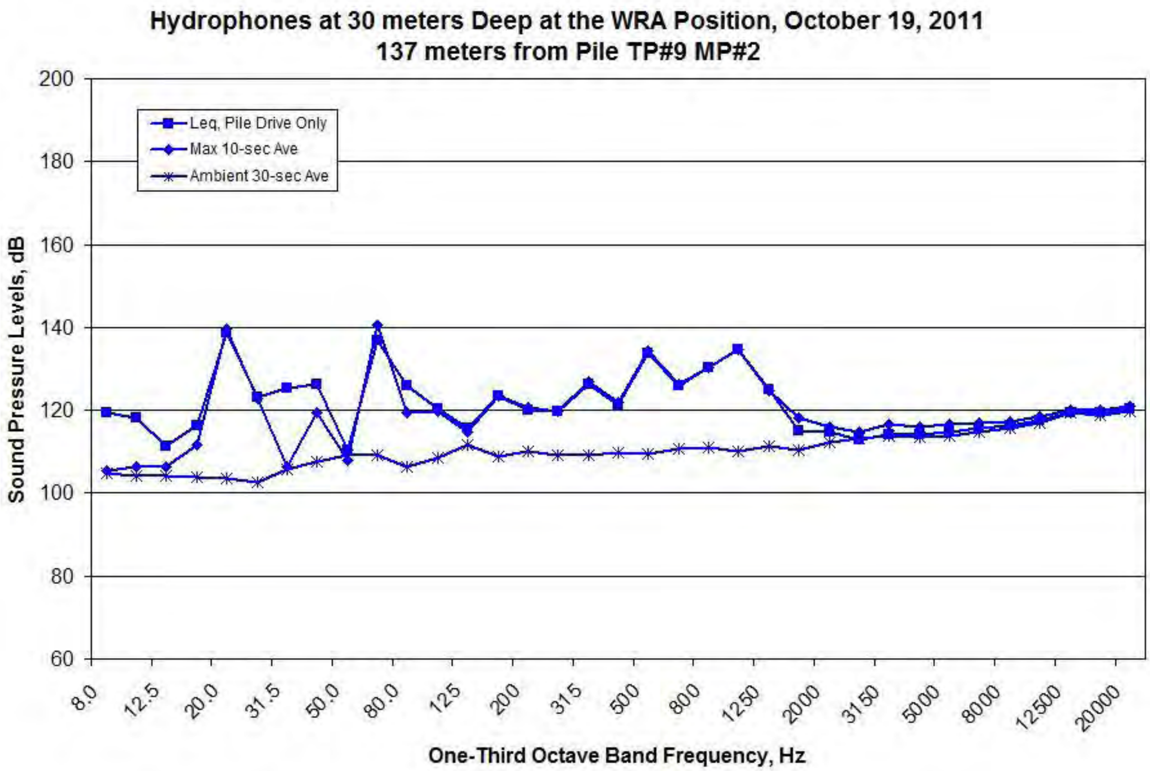

Figure A715. Spectral Data Measured at the WRA Location during TP#9 MP#2, 8:36-8:37, Measured at Depths of 30 meters on October 19, 2011

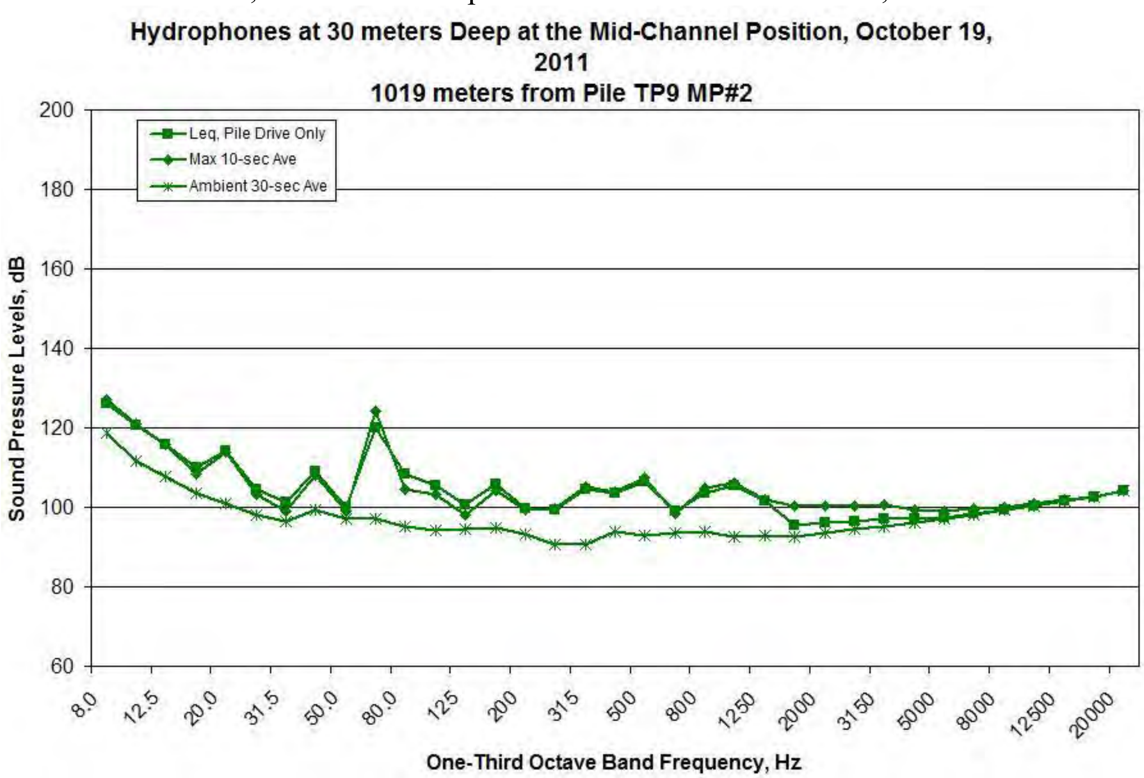

Figure A716. Spectral Data Measured at the MID Location during TP#9 MP#2, 8:36-8:37, Measured at Depths of 30 meters on October 19, 2011

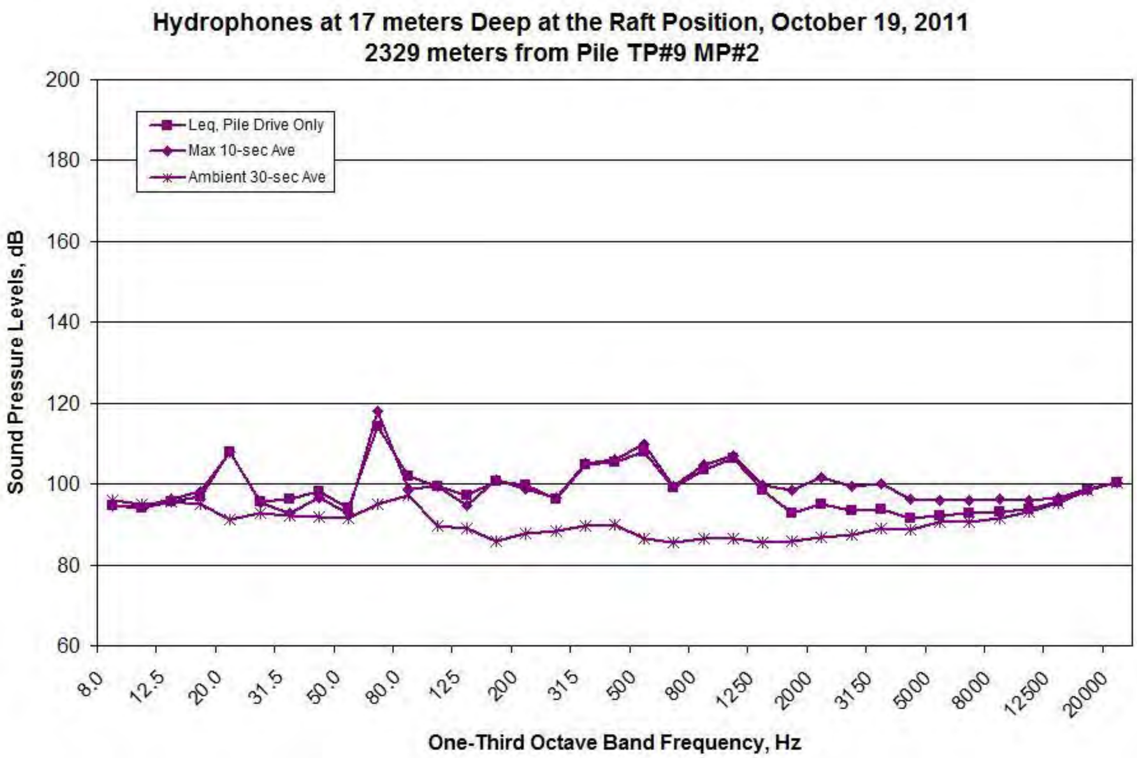

Figure A717. Spectral Data Measured at the RFT Location during TP#9 MP#2, 8:36-8:37, Measured at Depths of 17 meters on October 19, 2011

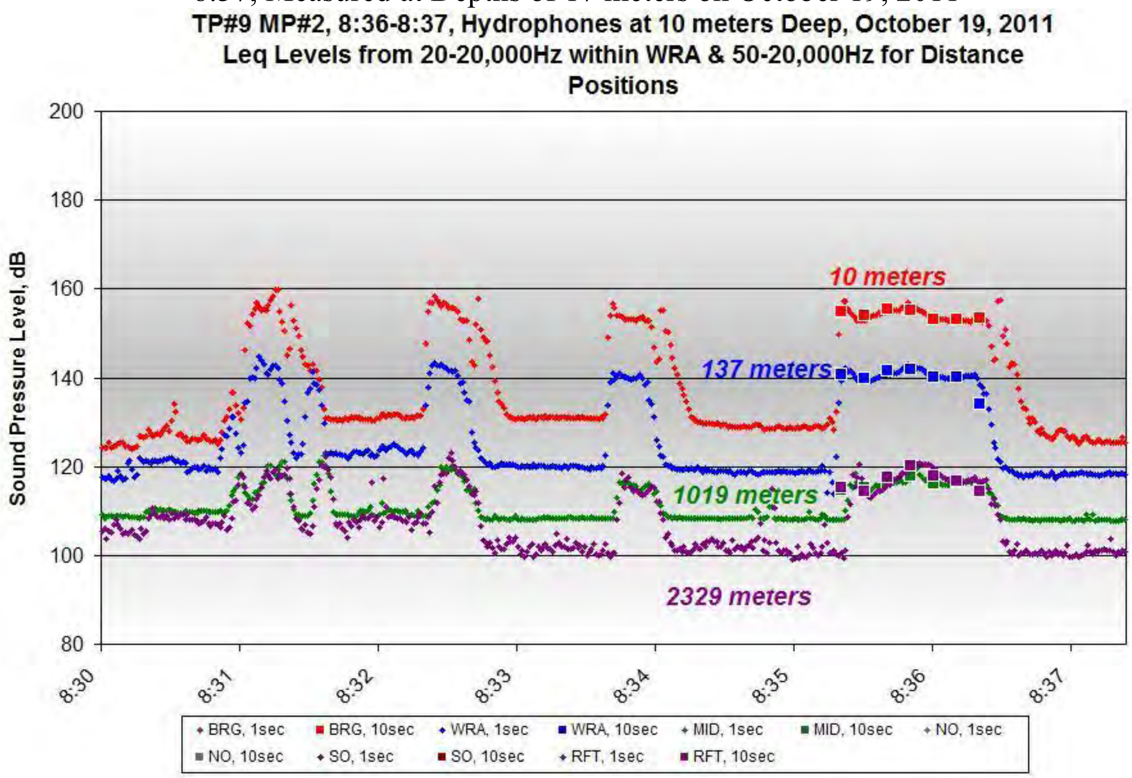

Figure A718. One-second and 10-second Average Data for TP#9 MP#2, 8:36-8:37, Measured at Depths of 10 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A719. Spectral Data Measured at the BRG Location during TP#9 MP#2, 8:36-8:37, Measured at Depths of 10 meters on October 19, 2011

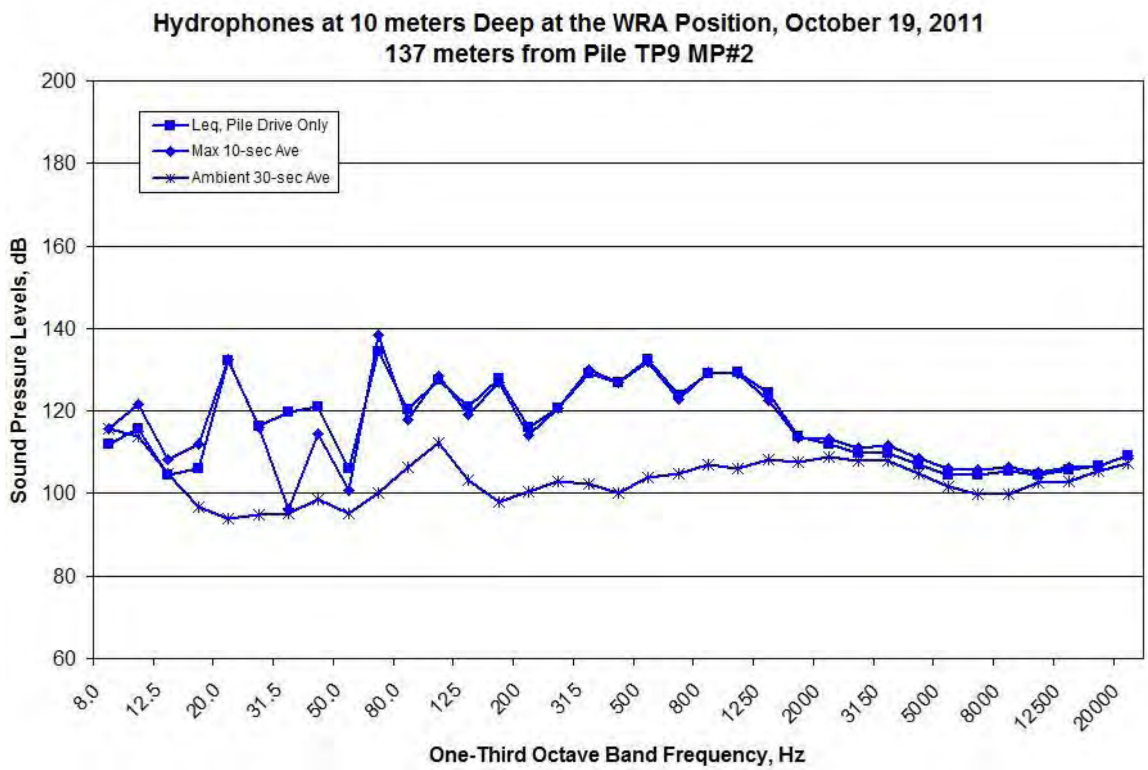

Figure A720. Spectral Data Measured at the WRA Location during TP#9 MP#2, 8:36-8:37, Measured at Depths of 10 meters on October 19, 2011

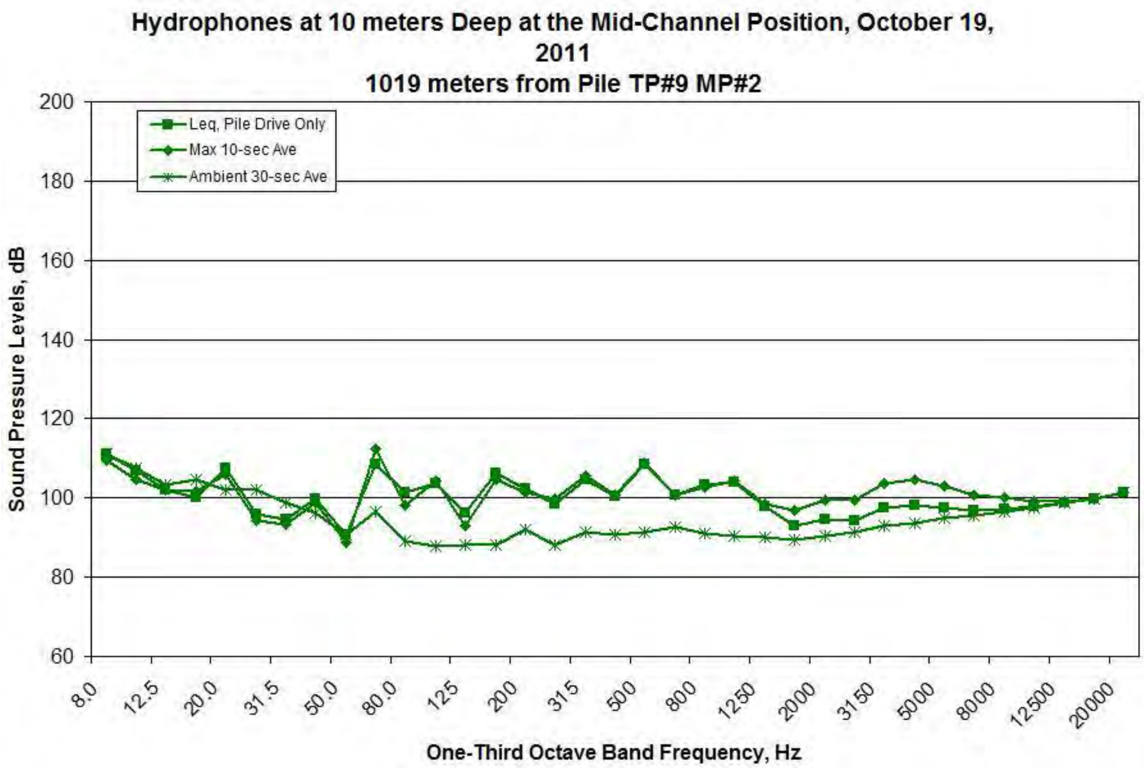

Figure A721. Spectral Data Measured at the MID Location during TP#9 MP#2, 8:36-8:37, Measured at Depths of 10 meters on October 19, 2011

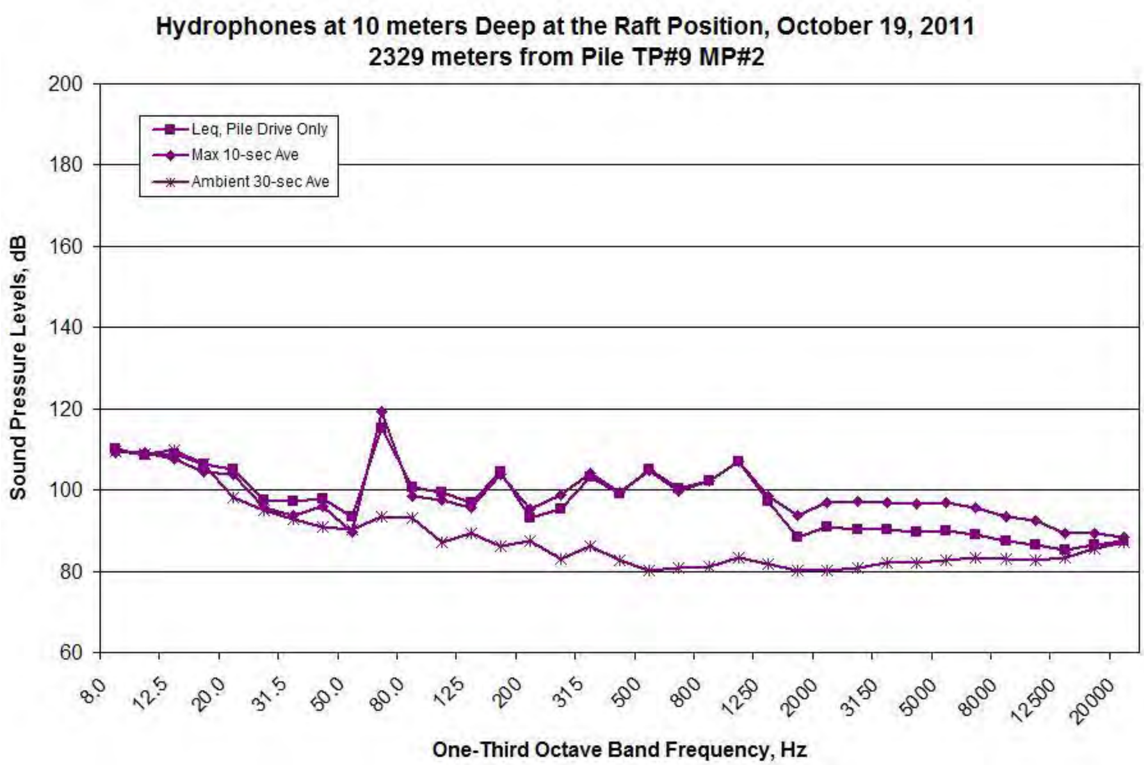

Figure A722. Spectral Data Measured at the RFT Location during TP#9 MP#2, 8:36-8:37, Measured at Depths of 10 meters on October 19, 2011

TP#9 MP#2, 10:26-10:56 (Vibratory Removal)

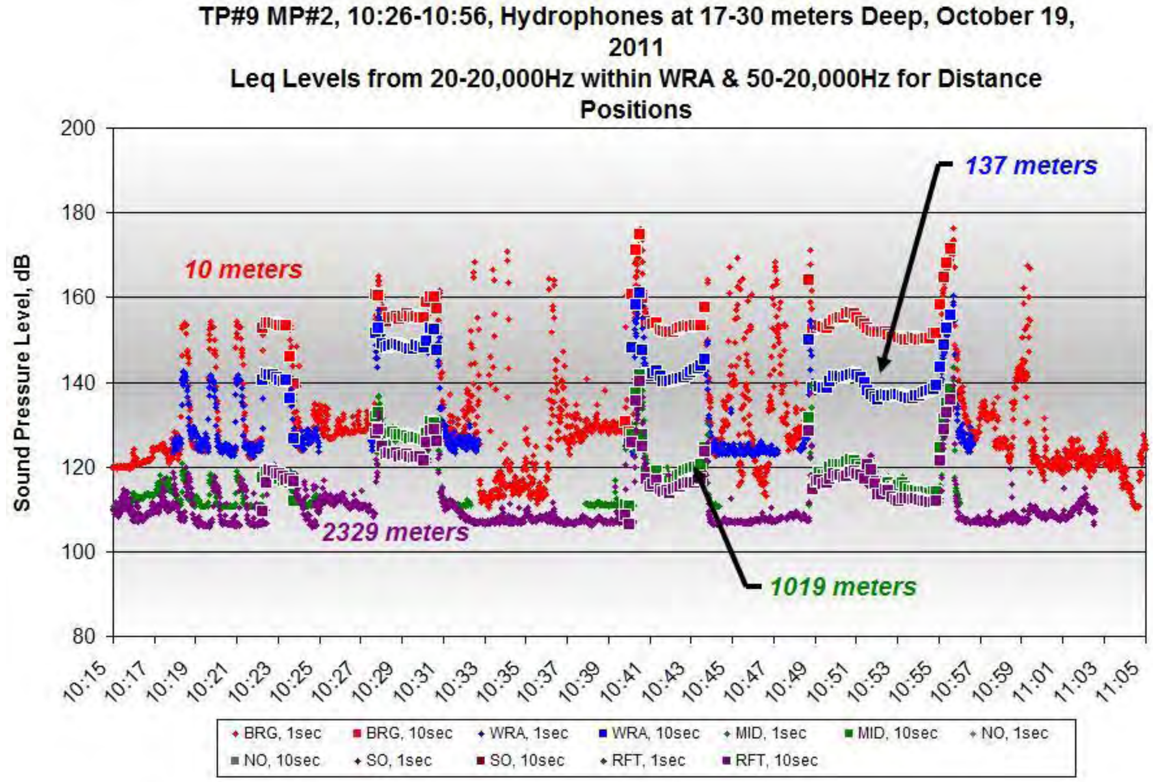

Figure A723. One-second and 10-second Average Data for TP#9 MP#2, 10:26-10:56, Measured at Depths of 17-30 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A724. Spectral Data Measured at the BRG Location during TP#9 MP#2, 10:26-10:56, Measured at Depths of 20 meters on October 19, 2011

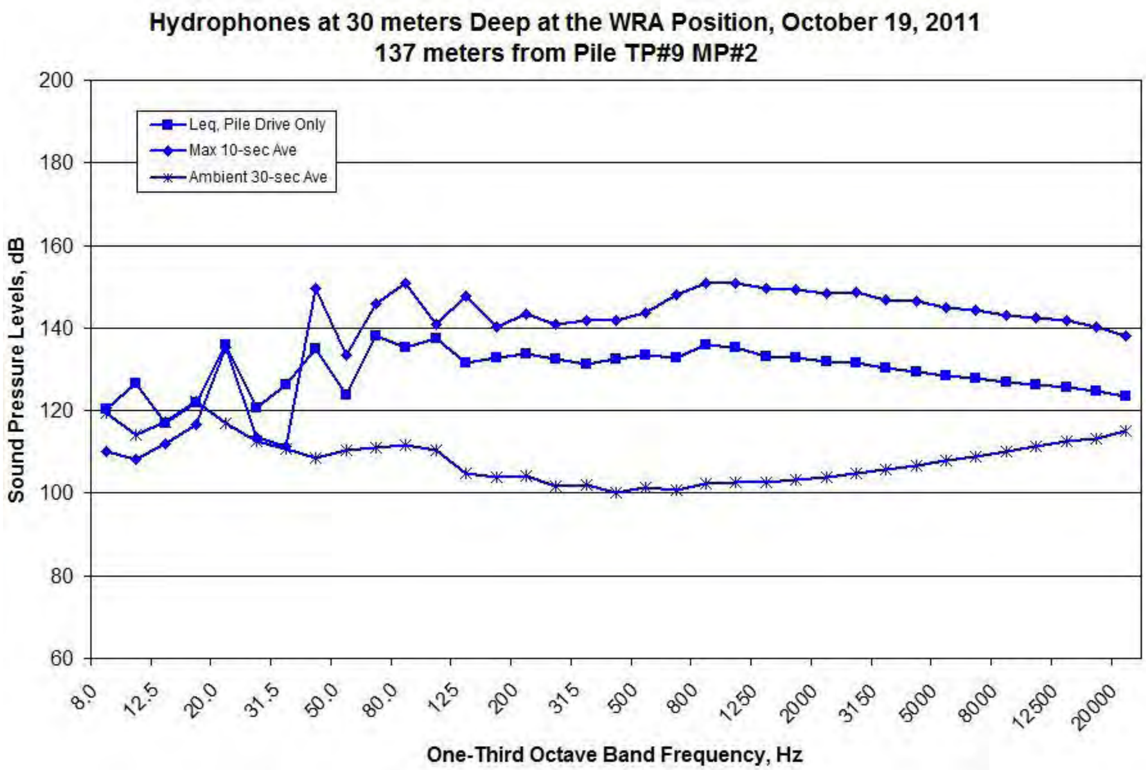

Figure A725. Spectral Data Measured at the WRA Location during TP#9 MP#2, 10:26-10:56, Measured at Depths of 30 meters on October 19, 2011

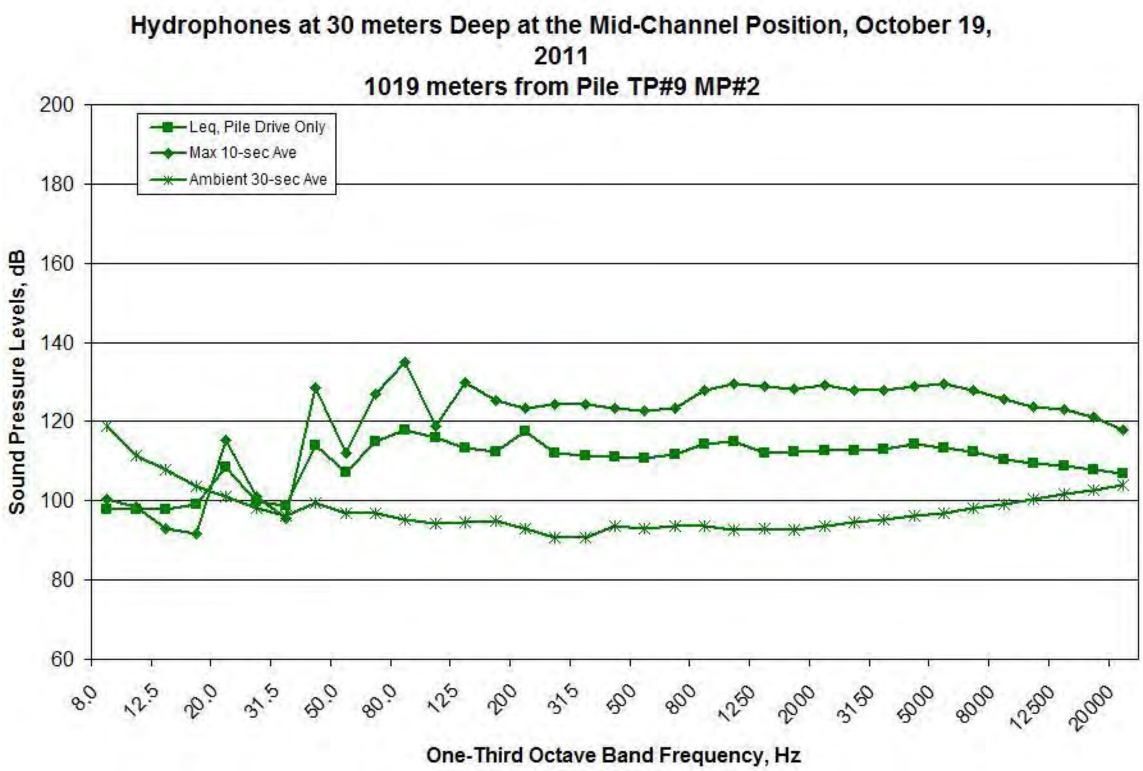

Figure A726. Spectral Data Measured at the MID Location during TP#9 MP#2, 10:26-10:56, Measured at Depths of 30 meters on October 19, 2011

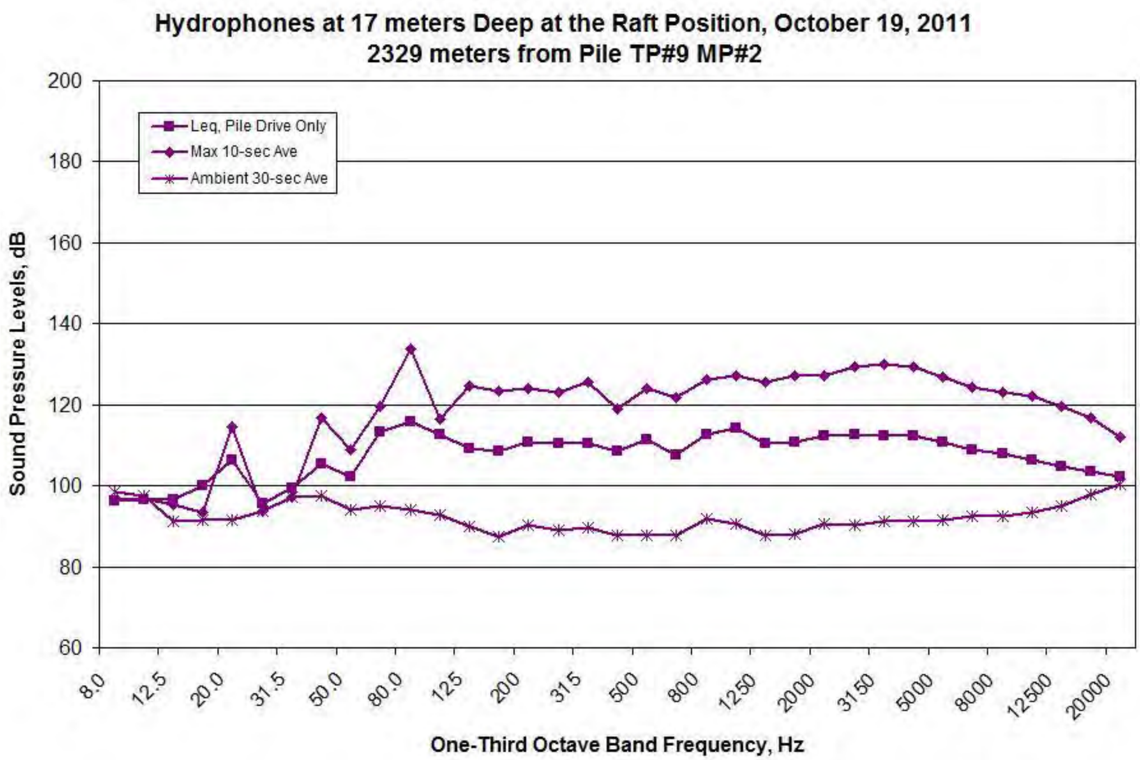

Figure A727. Spectral Data Measured at the RFT Location during TP#9 MP#2, 10:26-10:56, Measured at Depths of 17 meters on October 19, 2011

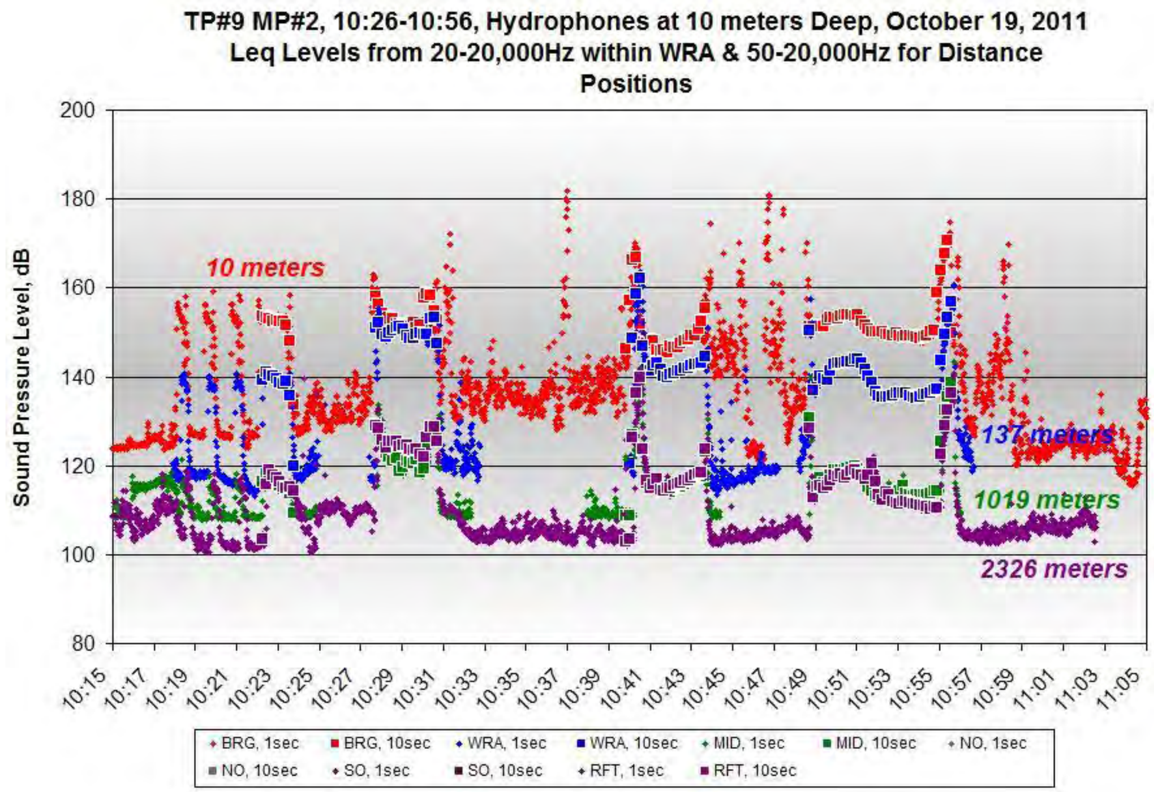

Figure A728. One-second and 10-second Average Data for TP#9 MP#2, 10:26-10:56, Measured at Depths of 10 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A729. Spectral Data Measured at the BRG Location during TP#9 MP#2, 10:26-10:56, Measured at Depths of 10 meters on October 19, 2011

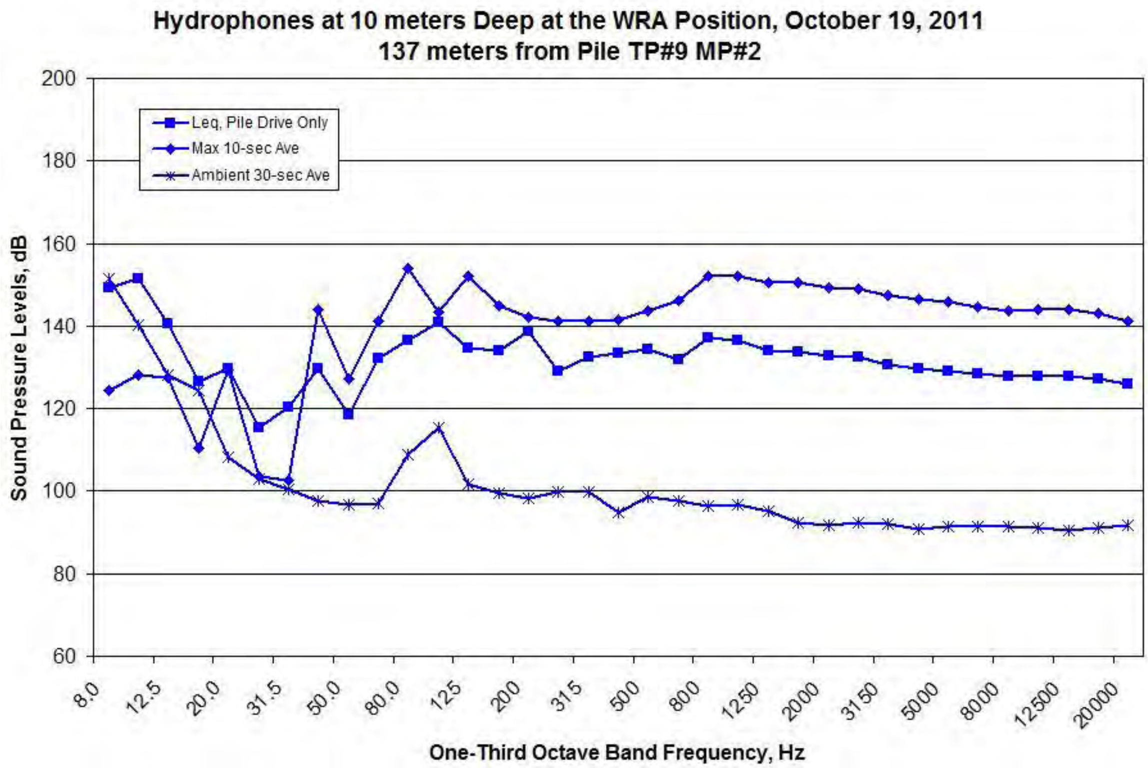

Figure A730. Spectral Data Measured at the WRA Location during TP#9 MP#2, 10:26-10:56, Measured at Depths of 10 meters on October 19, 2011

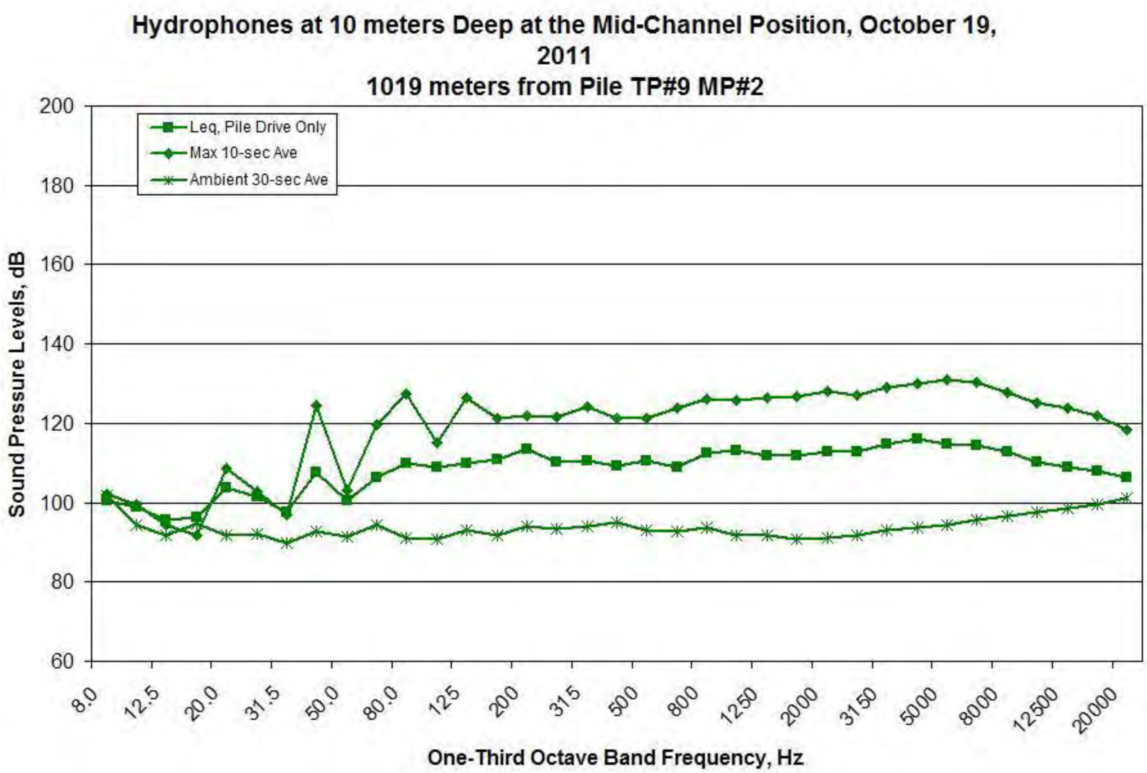

Figure A731. Spectral Data Measured at the MID Location during TP#9 MP#2, 10:26-10:56, Measured at Depths of 10 meters on October 19, 2011

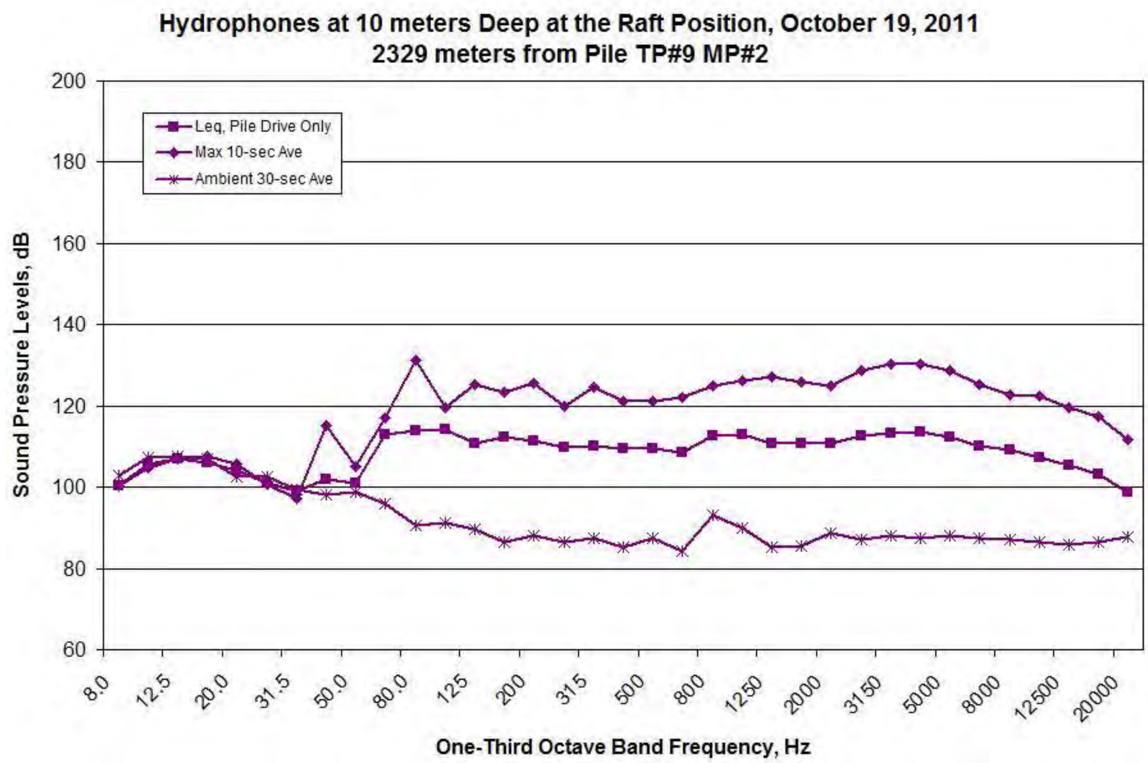

Figure A732. Spectral Data Measured at the RFT Location during TP#9 MP#2, 10:26-10:56, Measured at Depths of 10 meters on October 19, 2011

TP#9 MP#3 (Vibratory Removal)

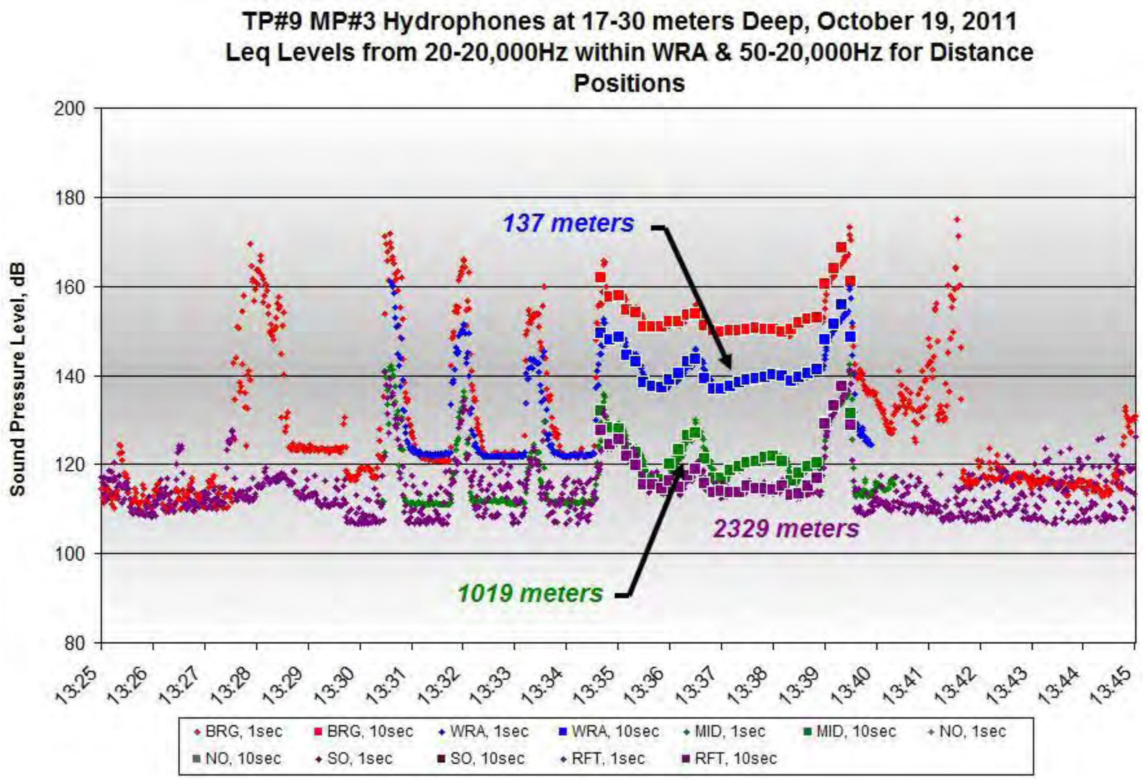

Figure A733. One-second and 10-second Average Data for TP#9 MP#3, 13:35-13:40, Measured at Depths of 17-30 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A734. Spectral Data Measured at the BRG Location during TP#9 MP#3, 13:35-13:40, Measured at Depths of 20 meters on October 19, 2011

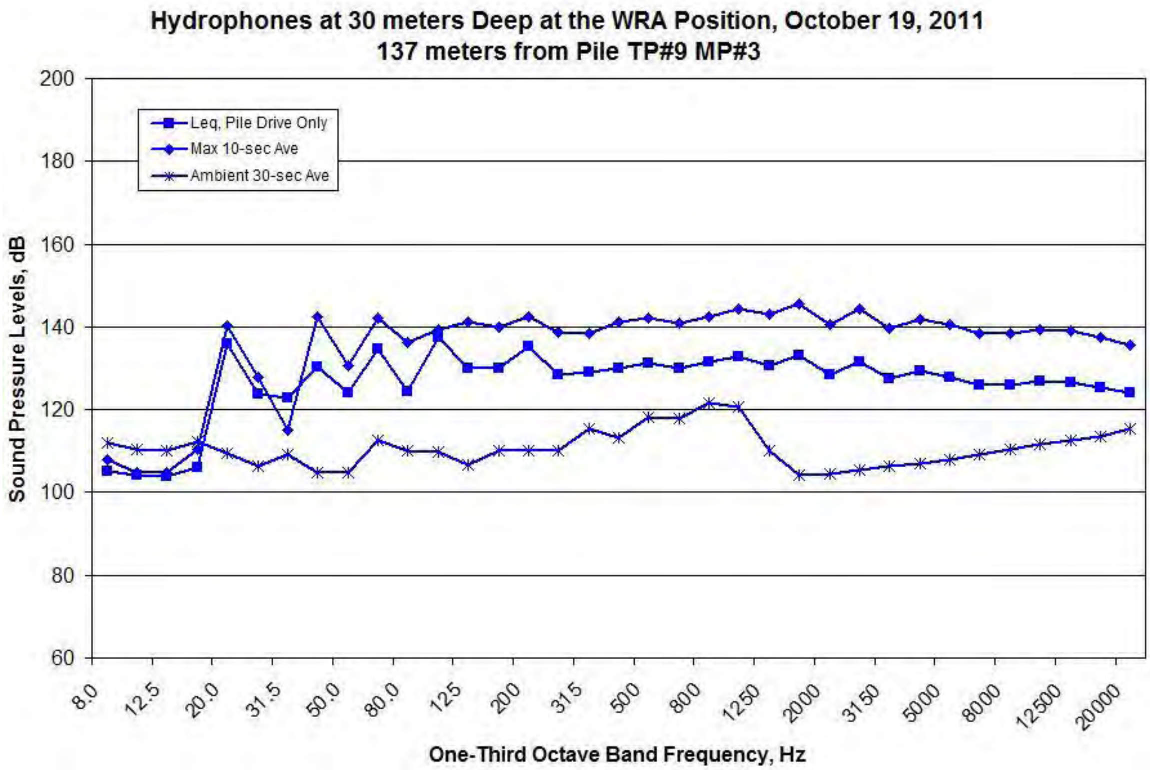

Figure A735. Spectral Data Measured at the WRA Location during TP#9 MP#3, 13:35-13:40, Measured at Depths of 30 meters on October 19, 2011

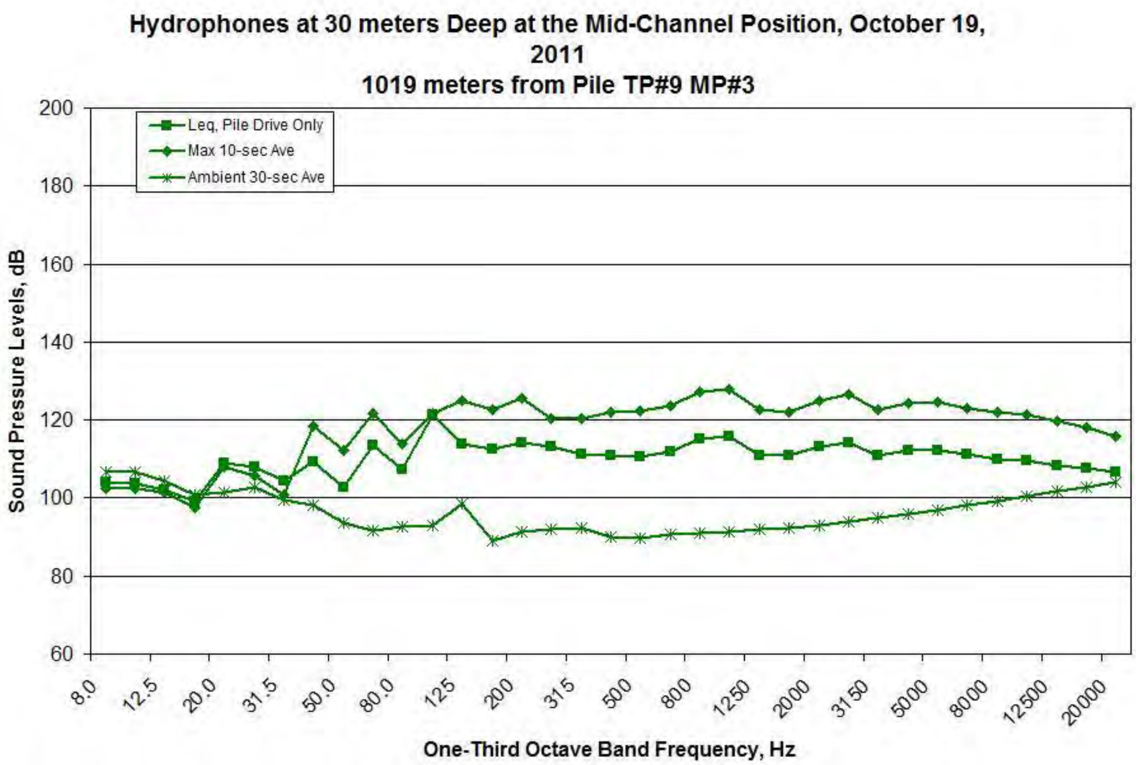

Figure A736. Spectral Data Measured at the MID Location during TP#9 MP#3, 13:35-13:40, Measured at Depths of 30 meters on October 19, 2011

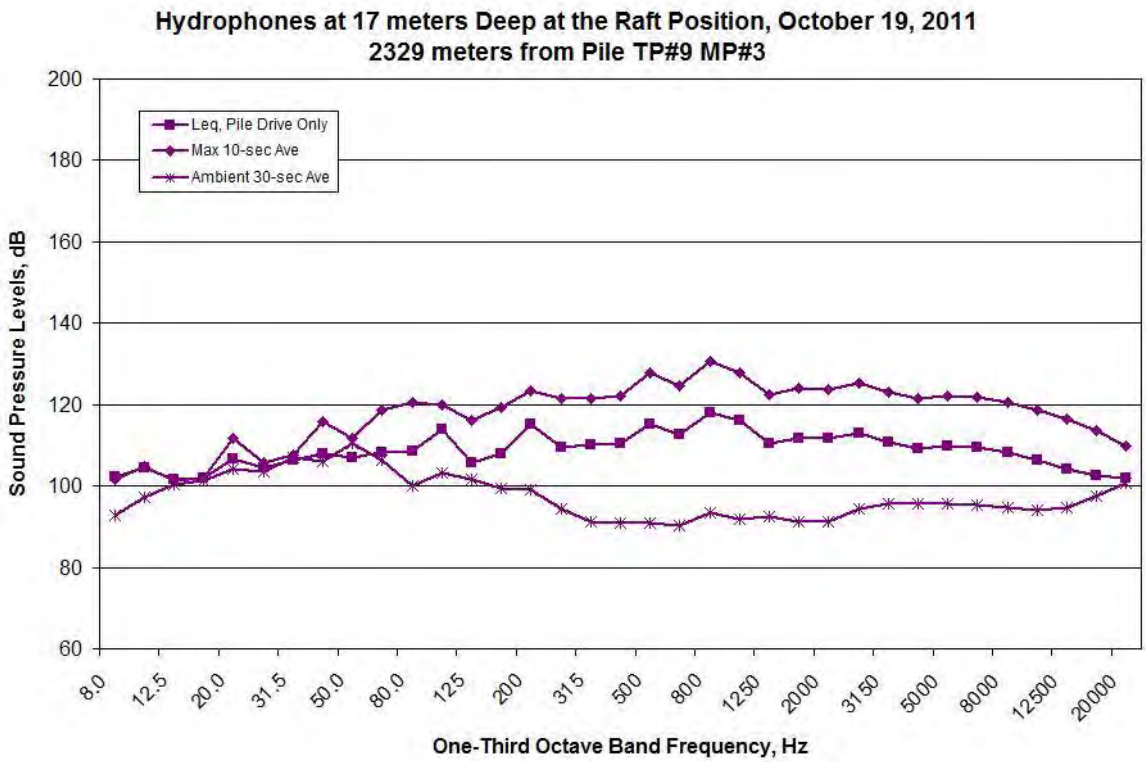

Figure A737. Spectral Data Measured at the RFT Location during TP#9 MP#3, 13:35-13:40, Measured at Depths of 17 meters on October 19, 2011

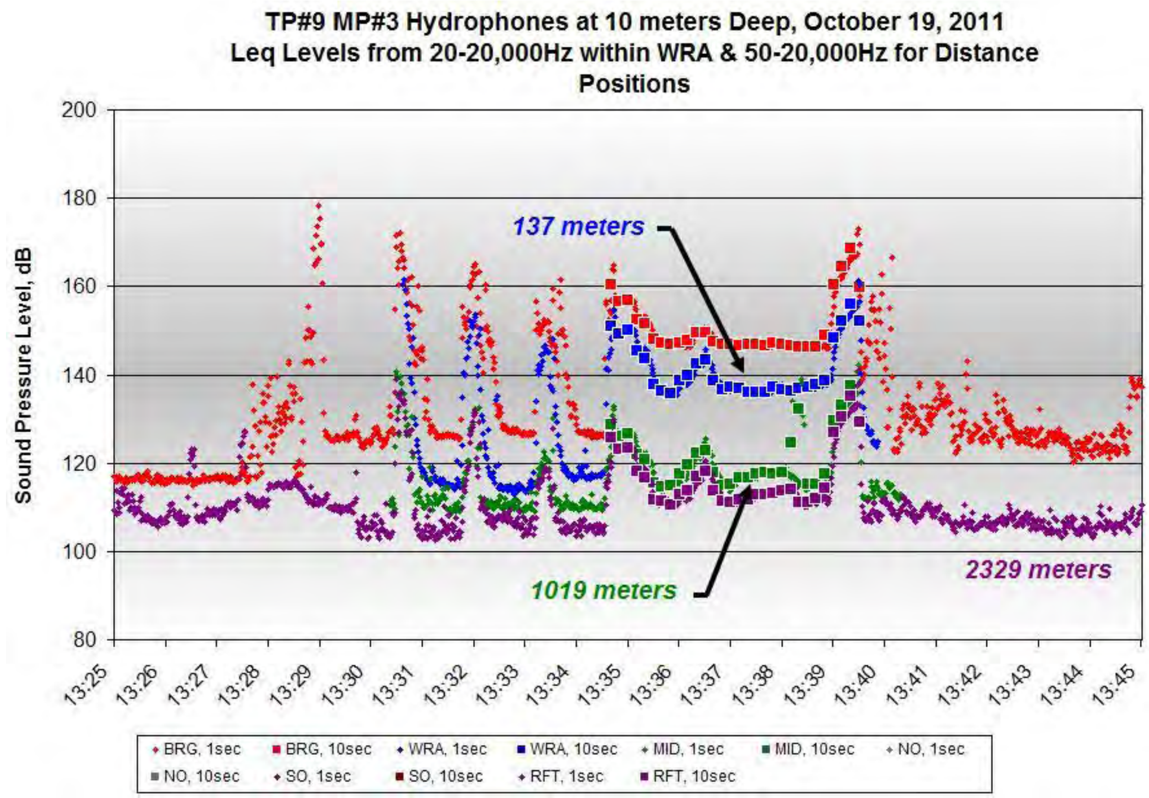

Figure A738. One-second and 10-second Average Data for TP#9 MP#3, 13:35-13:40, Measured at Depths of 10 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A739. Spectral Data Measured at the BRG Location during TP#9 MP#3, 13:35-13:40, Measured at Depths of 10 meters on October 19, 2011

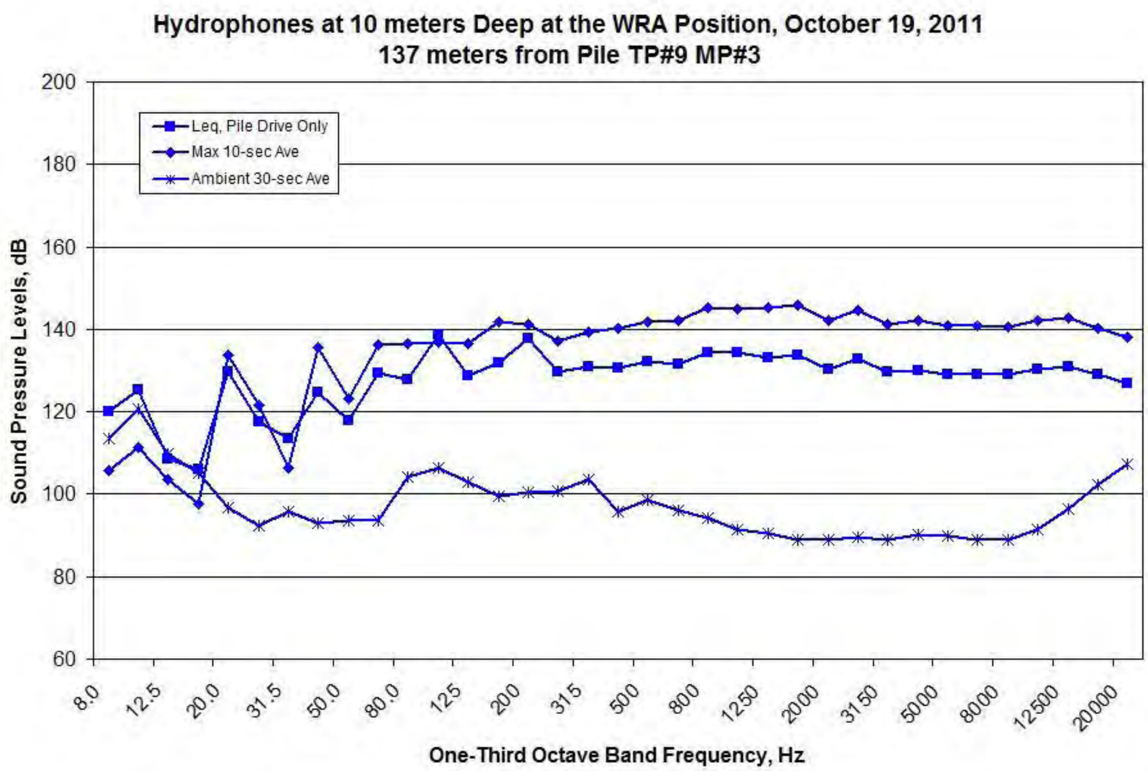

Figure A740. Spectral Data Measured at the WRA Location during TP#9 MP#3, 13:35-13:40, Measured at Depths of 10 meters on October 19, 2011

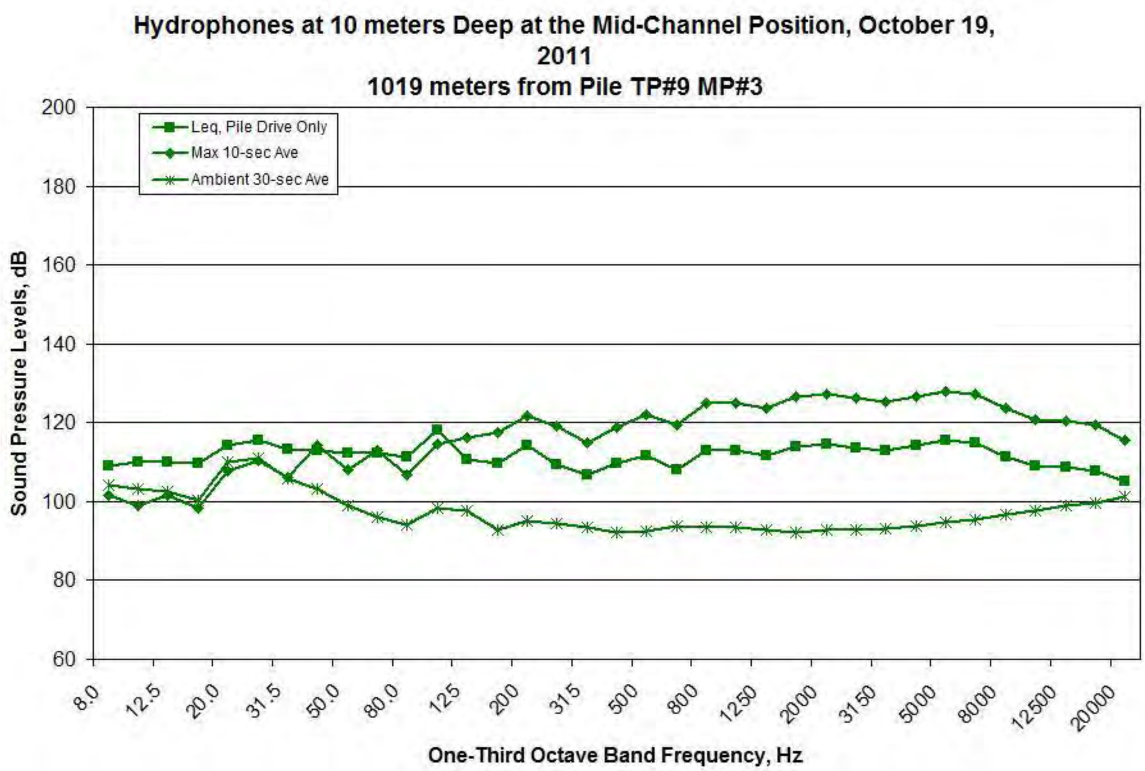

Figure A741. Spectral Data Measured at the MID Location during TP#9 MP#3, 13:35-13:40, Measured at Depths of 10 meters on October 19, 2011

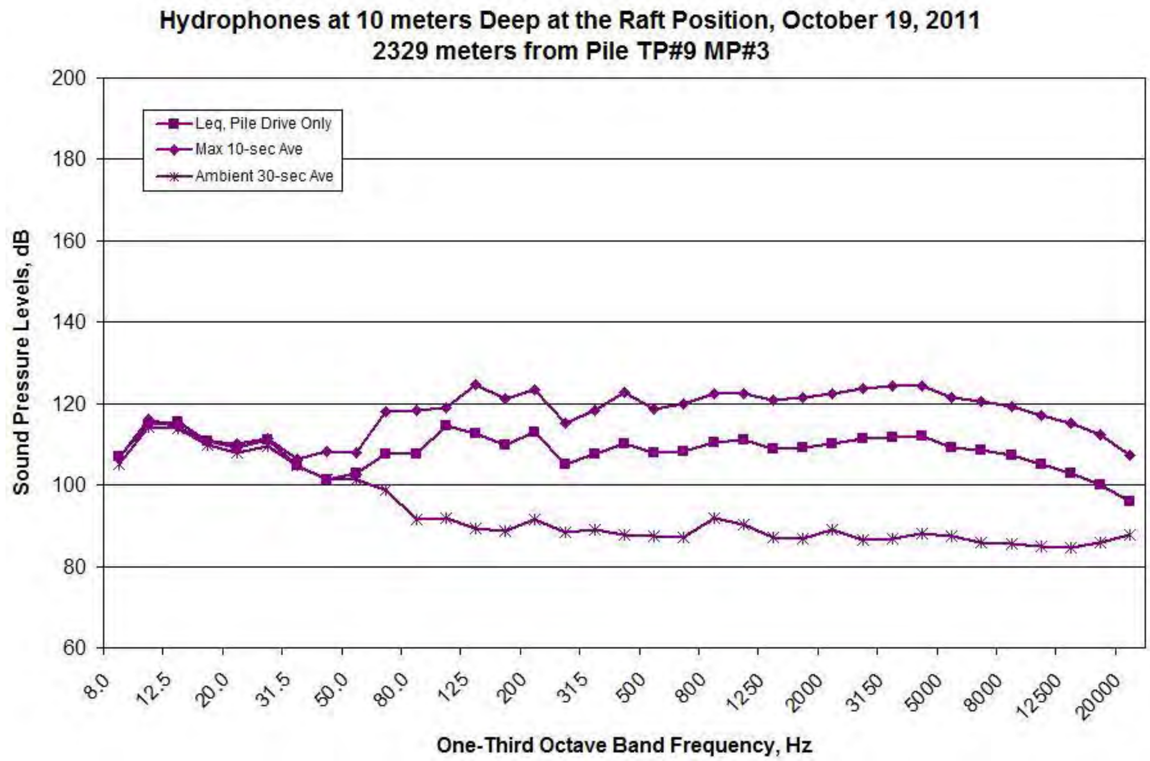

Figure A742. Spectral Data Measured at the RFT Location during TP#9 MP#3, 13:35-13:40, Measured at Depths of 10 meters on October 19, 2011

TP#9 MP#1 (Vibratory Removal)

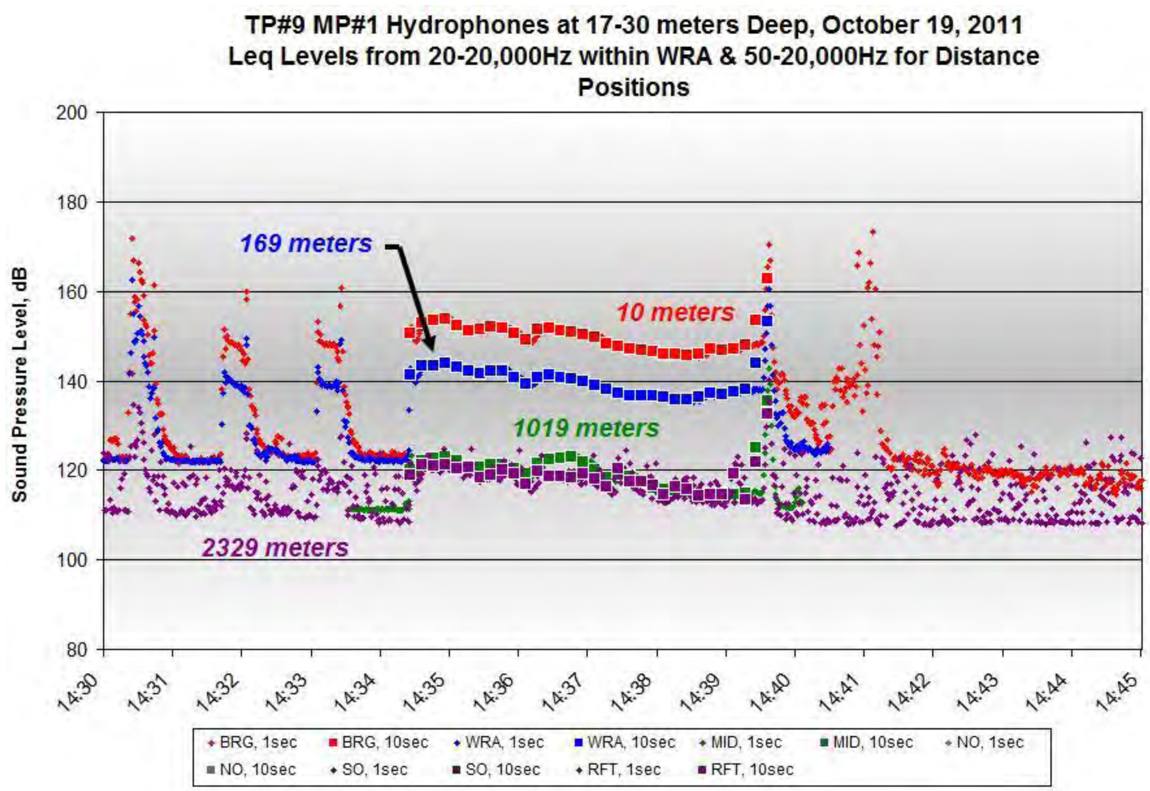

Figure A743. One-second and 10-second Average Data for TP#9 MP#1, 14:34-14:40, Measured at Depths of 17-30 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A744. Spectral Data Measured at the BRG Location during TP#9 MP#1, 14:34-14:40, Measured at Depths of 20 meters on October 19, 2011

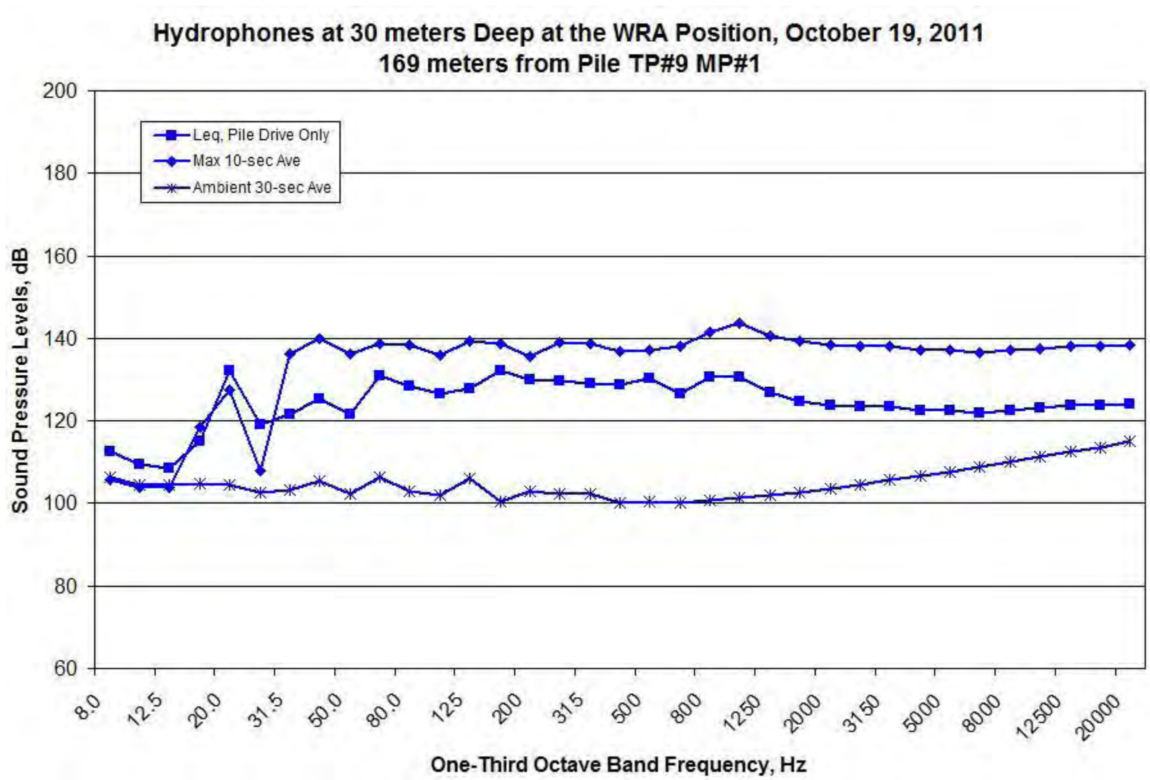

Figure A745. Spectral Data Measured at the WRA Location during TP#9 MP#1, 14:34-14:40, Measured at Depths of 30 meters on October 19, 2011

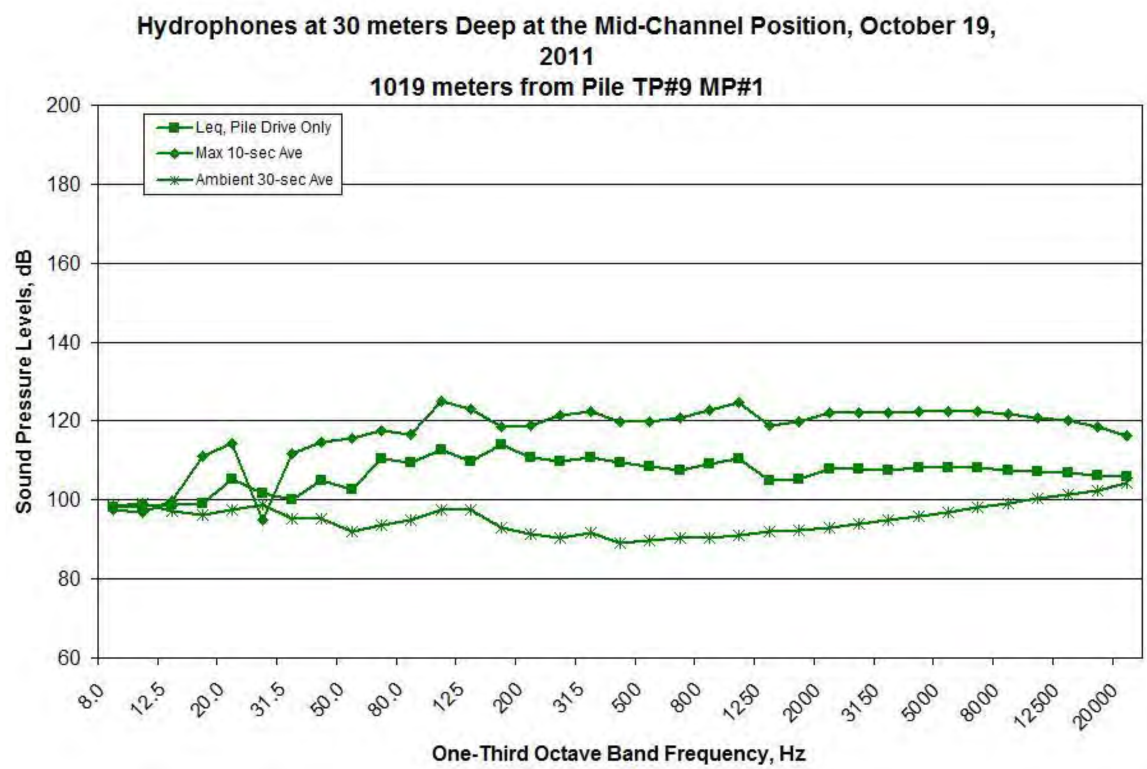

Figure A746. Spectral Data Measured at the MID Location during TP#9 MP#1, 14:34-14:40, Measured at Depths of 30 meters on October 19, 2011

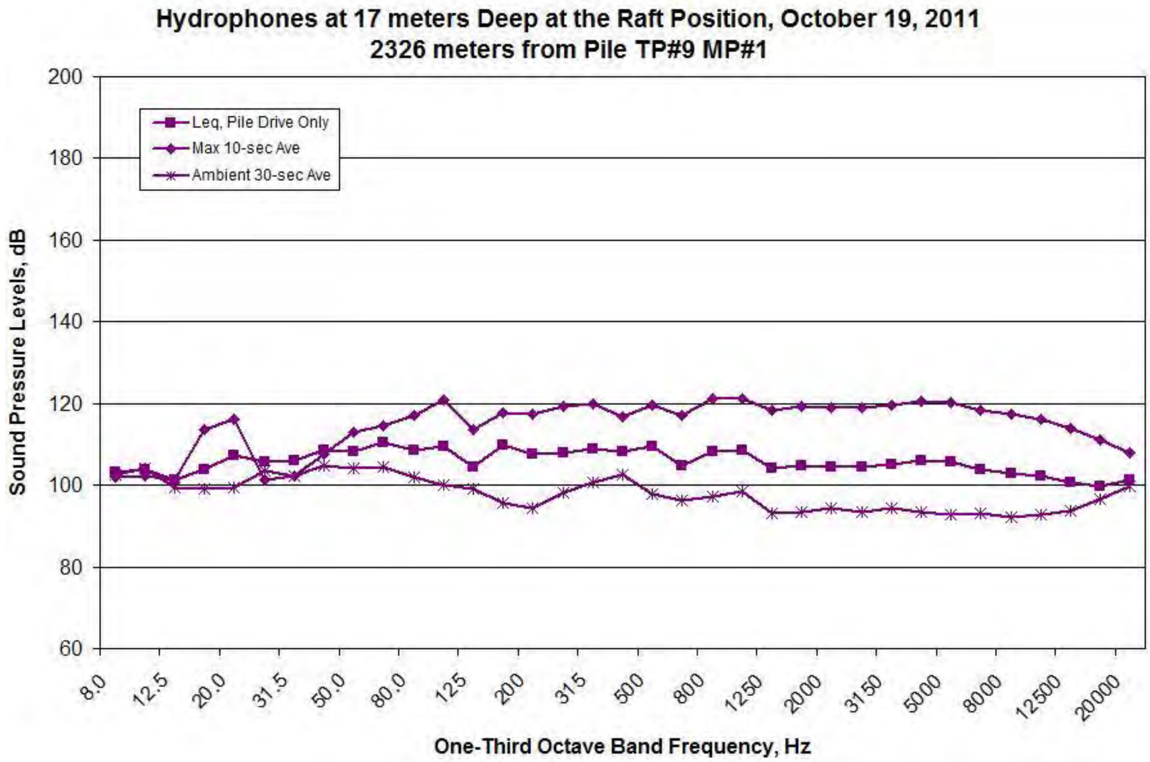

Figure A747. Spectral Data Measured at the RFT Location during TP#9 MP#1, 14:34-14:40, Measured at Depths of 17 meters on October 19, 2011

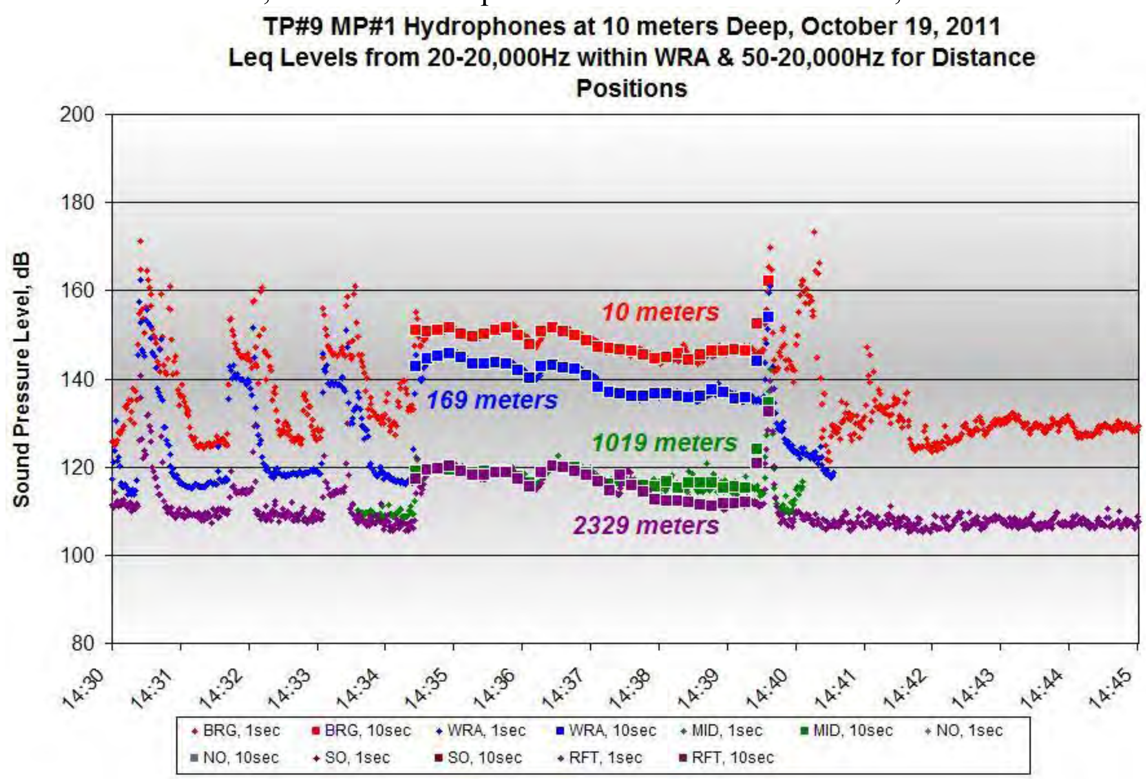

Figure A748. One-second and 10-second Average Data for TP#9 MP#1, 14:34-14:40, Measured at Depths of 10 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A749. Spectral Data Measured at the BRG Location during TP#9 MP#1, 14:34-14:40, Measured at Depths of 10 meters on October 19, 2011

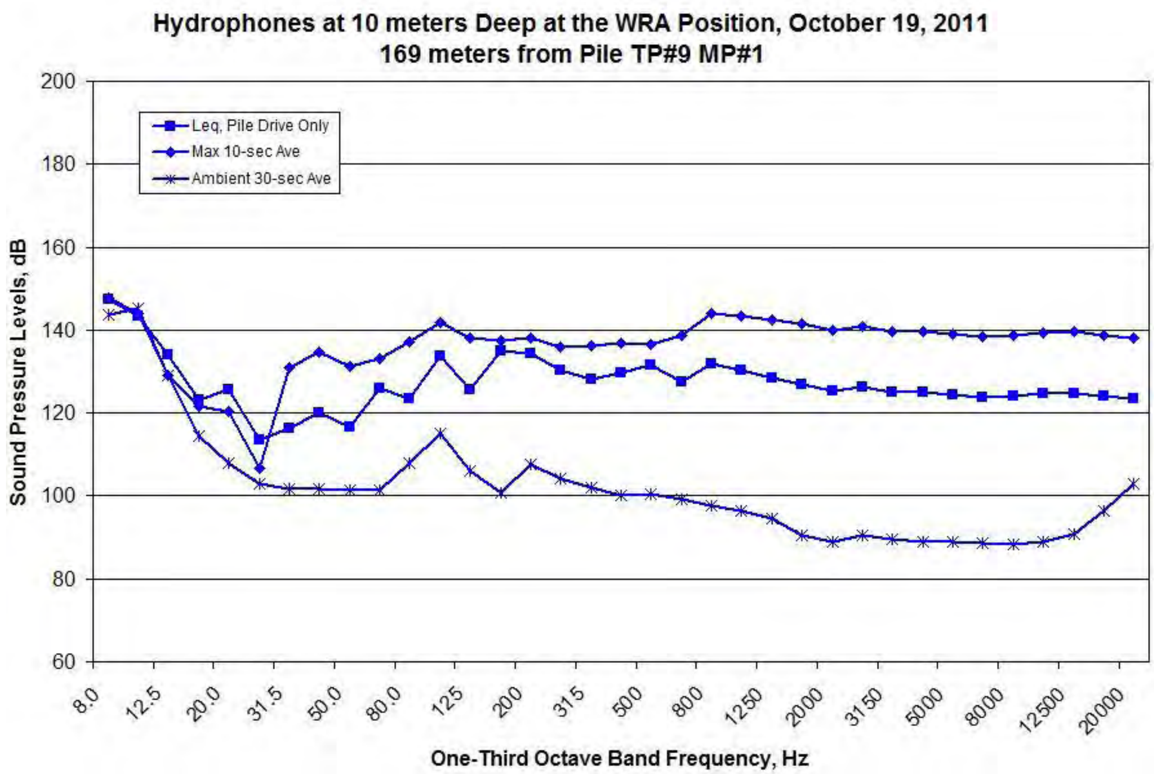

Figure A750. Spectral Data Measured at the WRA Location during TP#9 MP#1, 14:34-14:40, Measured at Depths of 10 meters on October 19, 2011

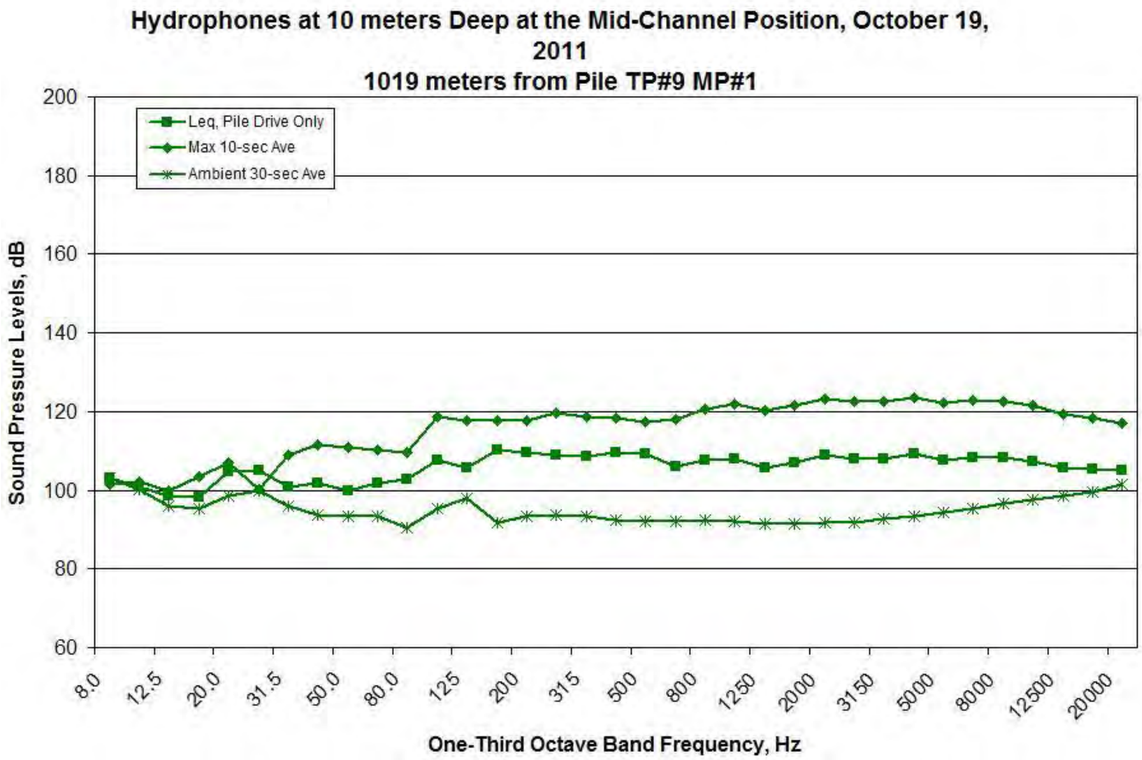

Figure A751. Spectral Data Measured at the MID Location during TP#9 MP#1, 14:34-14:40, Measured at Depths of 10 meters on October 19, 2011

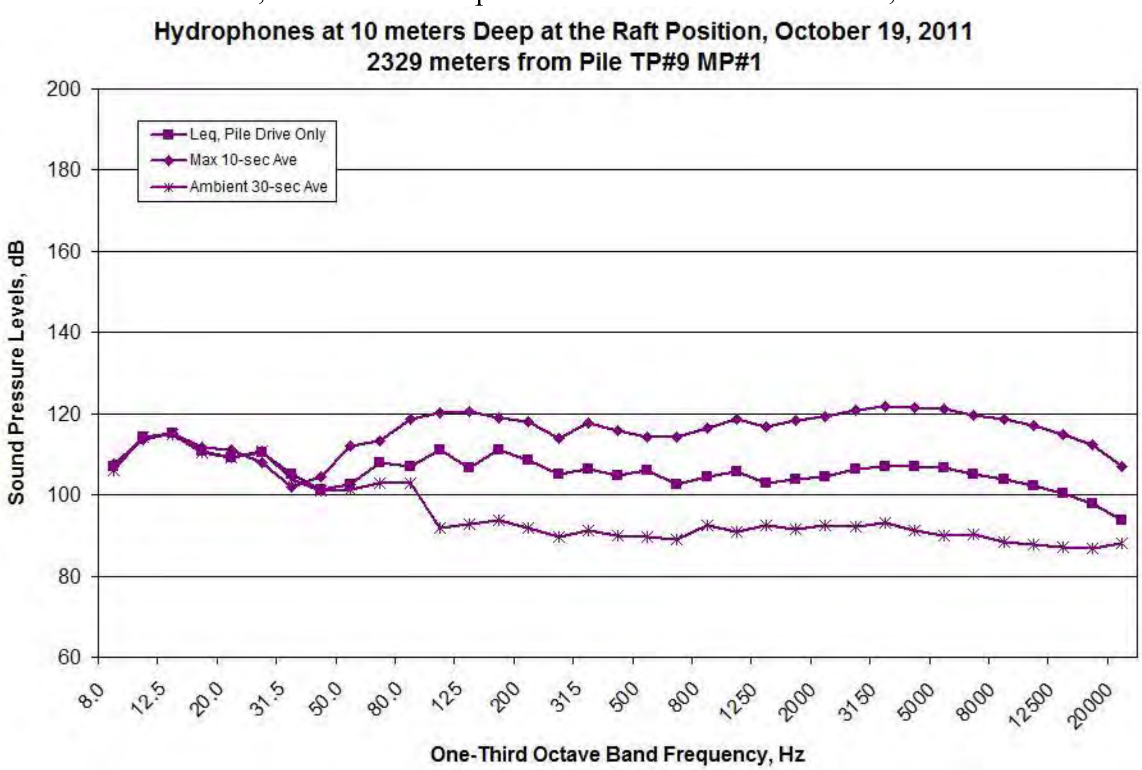

Figure A752. Spectral Data Measured at the RFT Location during TP#9 MP#1, 14:34-14:40, Measured at Depths of 10 meters on October 19, 2011

TP#9 (Vibratory Removal)

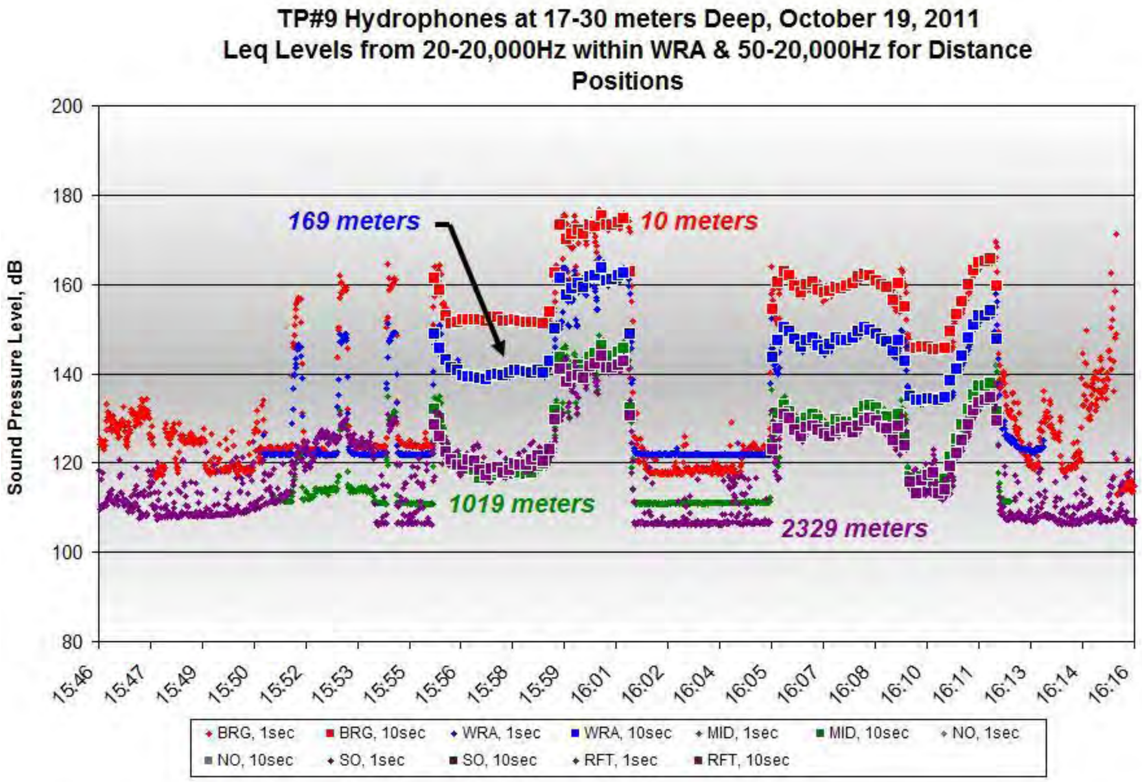

Figure A753. One-second and 10-second Average Data for TP#9, 15:55-16:12, Measured at Depths of 17-30 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A754. Spectral Data Measured at the BRG Location during TP#9, 15:55-16:12, Measured at Depths of 20 meters on October 19, 2011

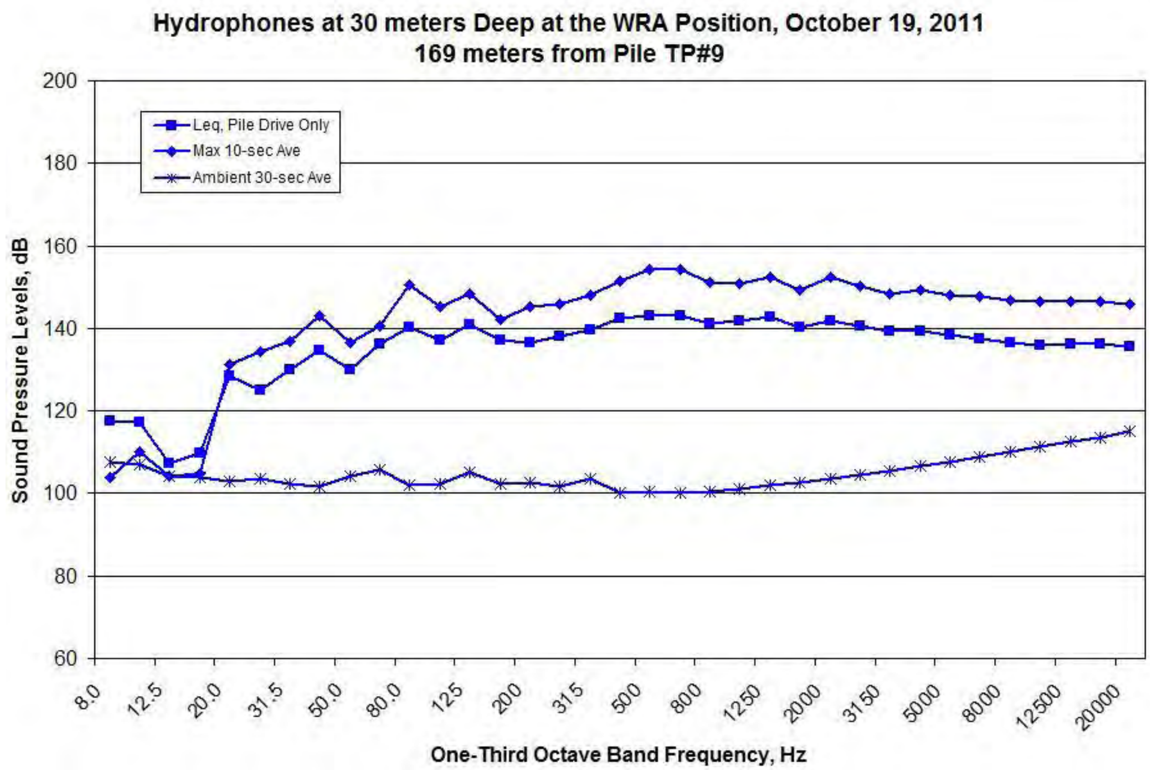

Figure A755. Spectral Data Measured at the WRA Location during TP#9, 15:55-16:12, Measured at Depths of 30 meters on October 19, 2011

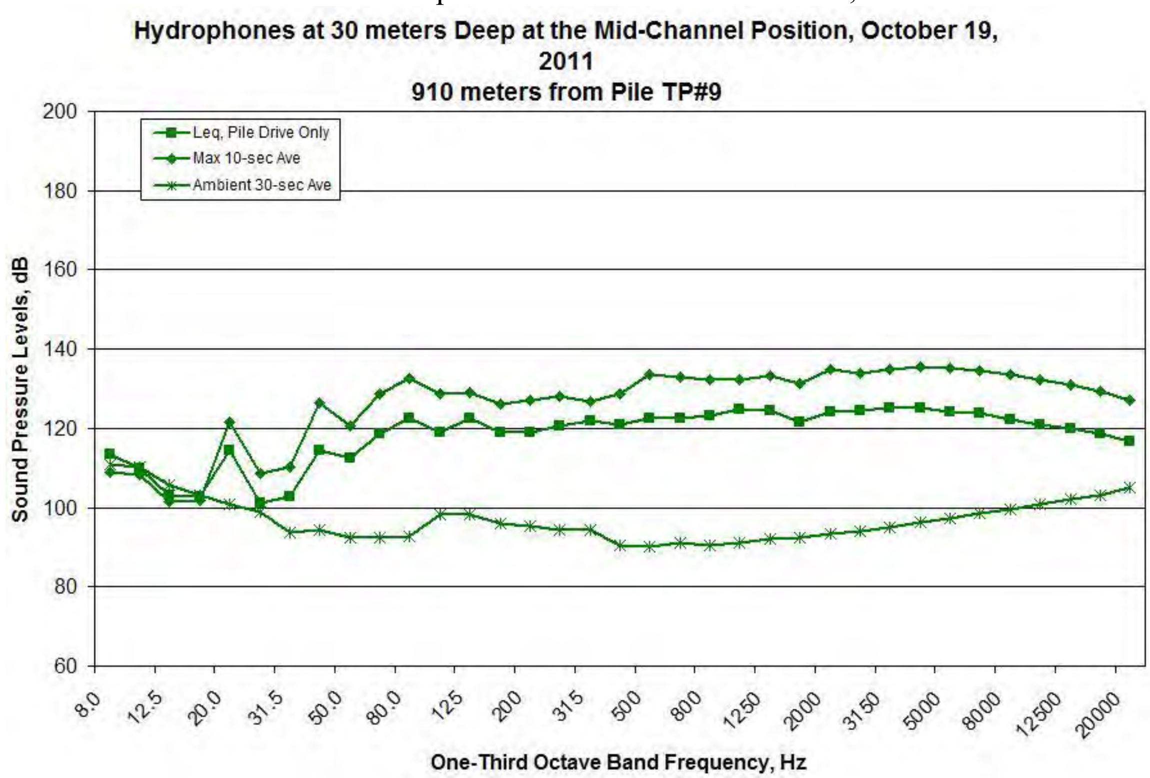

Figure A756. Spectral Data Measured at the MID Location during TP#9, 15:55-16:12, Measured at Depths of 30 meters on October 19, 2011

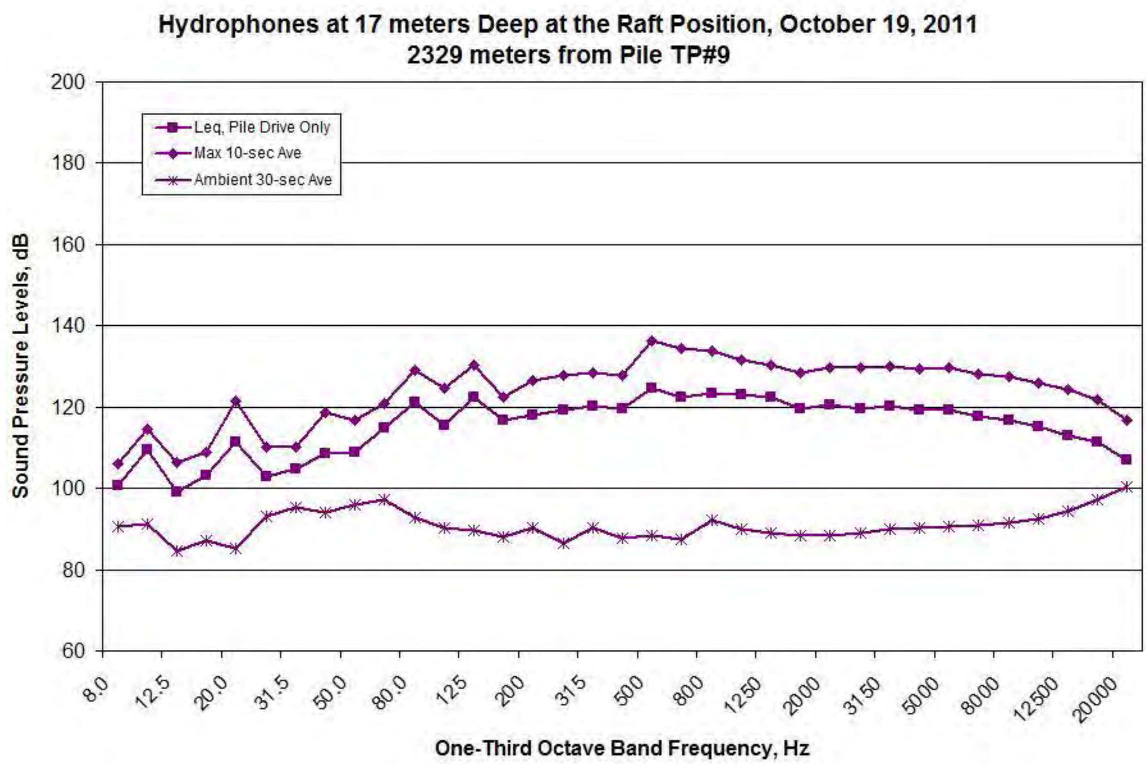

Figure A757. Spectral Data Measured at the RFT Location during TP#9, 15:55-16:12, Measured at Depths of 17 meters on October 19, 2011

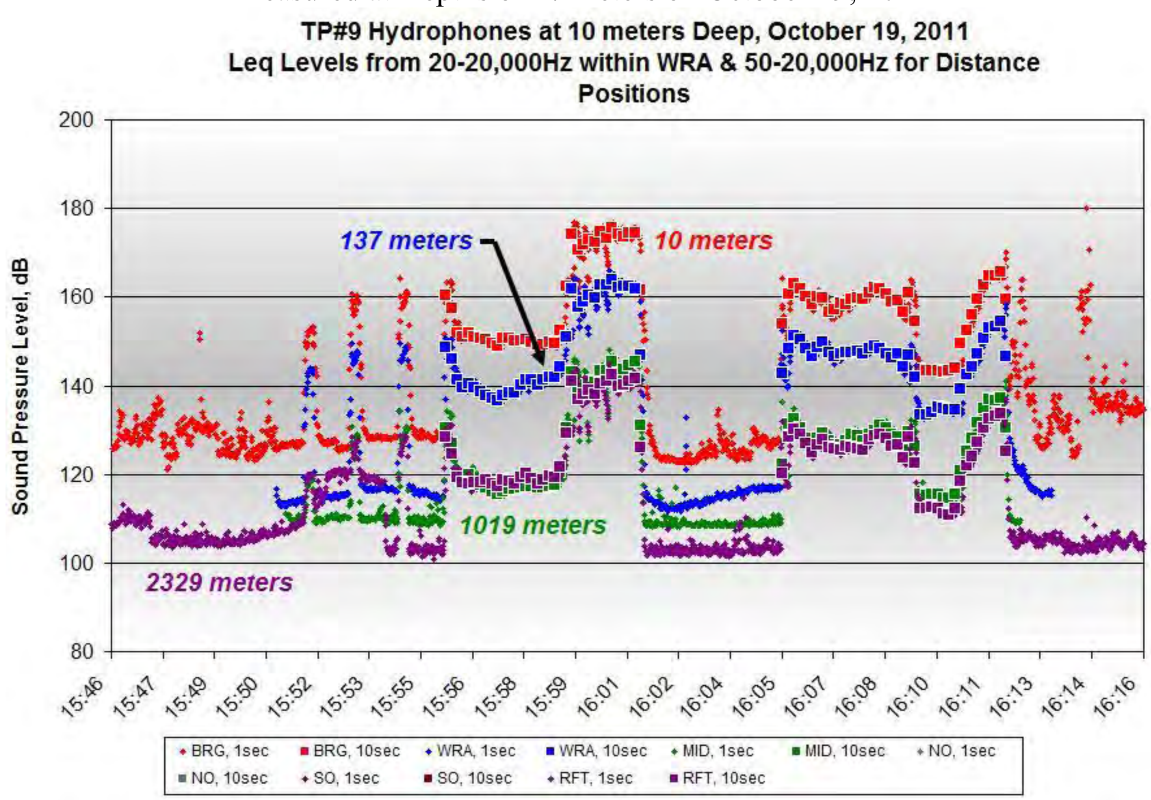

Figure A758. One-second and 10-second Average Data for TP#9, 15:55-16:12, Measured at Depths of 10 meters on October 19, 2011

NO SPECTRA DATA AVAILABLE

Figure A759. Spectral Data Measured at the BRG Location during TP#9, 15:55-16:12, Measured at Depths of 10 meters on October 19, 2011

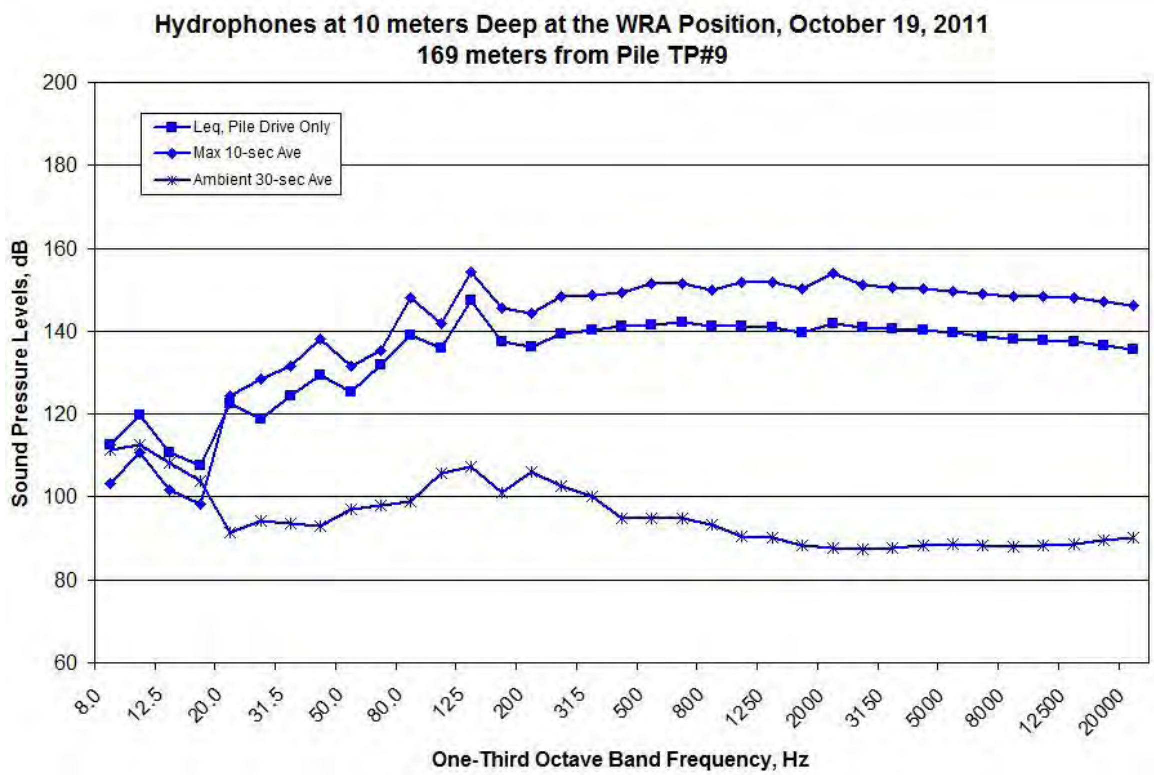

Figure A760. Spectral Data Measured at the WRA Location during TP#9, 15:55-16:12, Measured at Depths of 10 meters on October 19, 2011

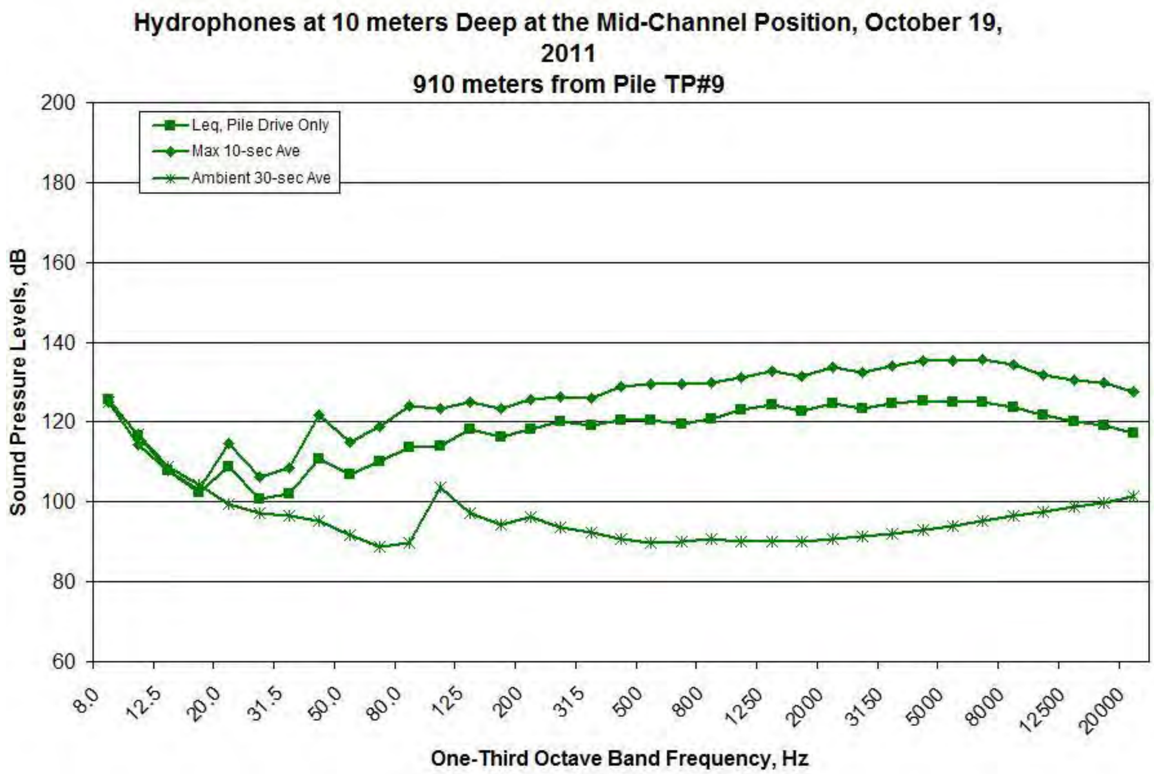

Figure A761. Spectral Data Measured at the MID Location during TP#9, 15:55-16:12, Measured at Depths of 10 meters on October 19, 2011

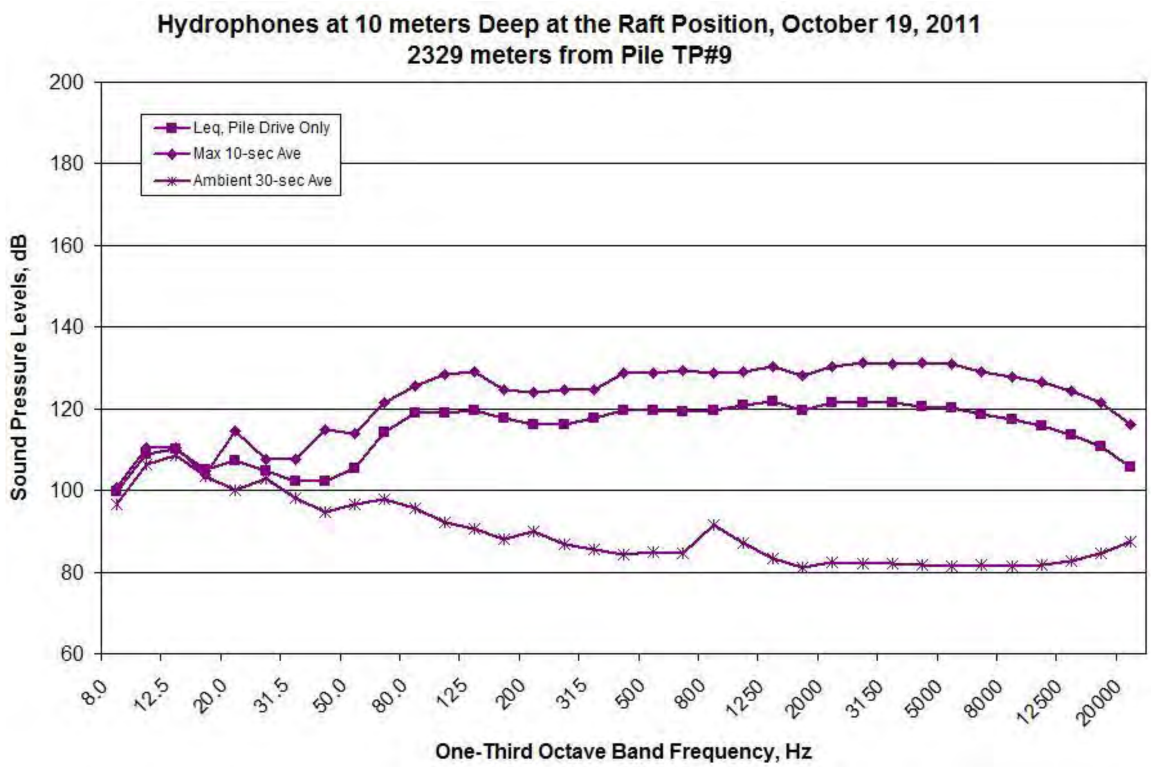

Figure A762. Spectral Data Measured at the RFT Location during TP#9, 15:55-16:12, Measured at Depths of 10 meters on October 19, 2011

10/20/2011 – TP#9 RP#3 (Vibratory Removal)

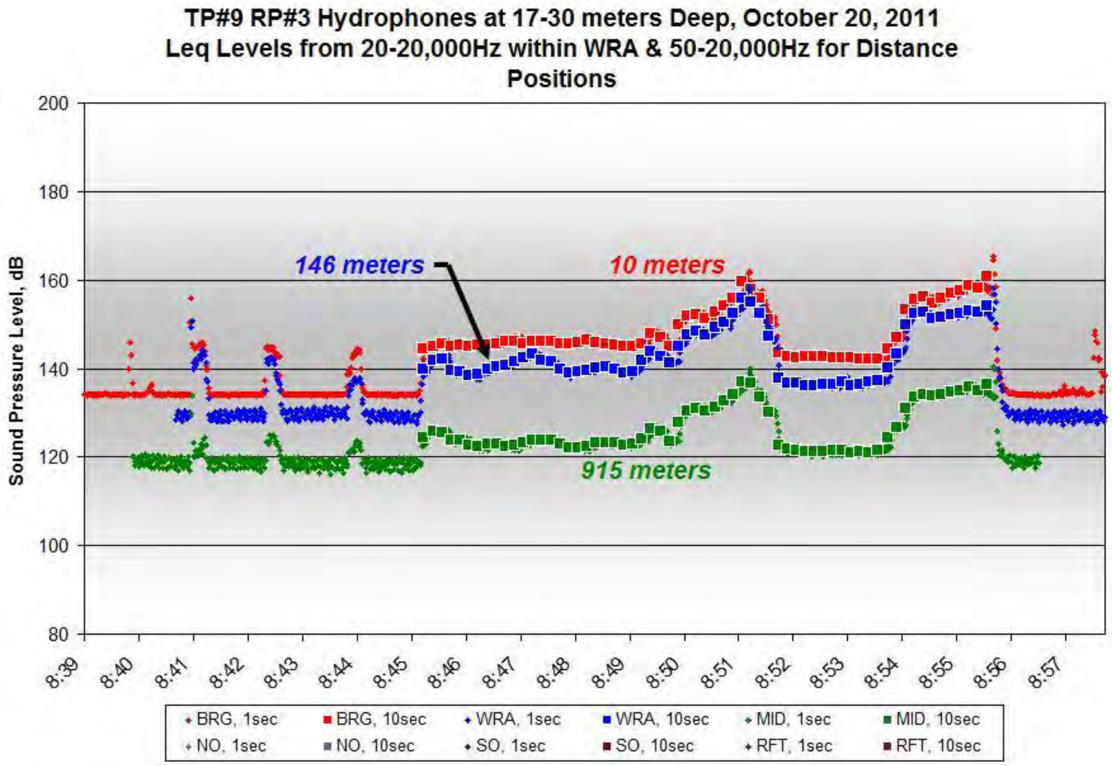

Figure A763. One-second and 10-second Average Data for TP#9 RP#3, 8:40-8:56, Measured at Depths of 17-30 meters on October 20, 2011

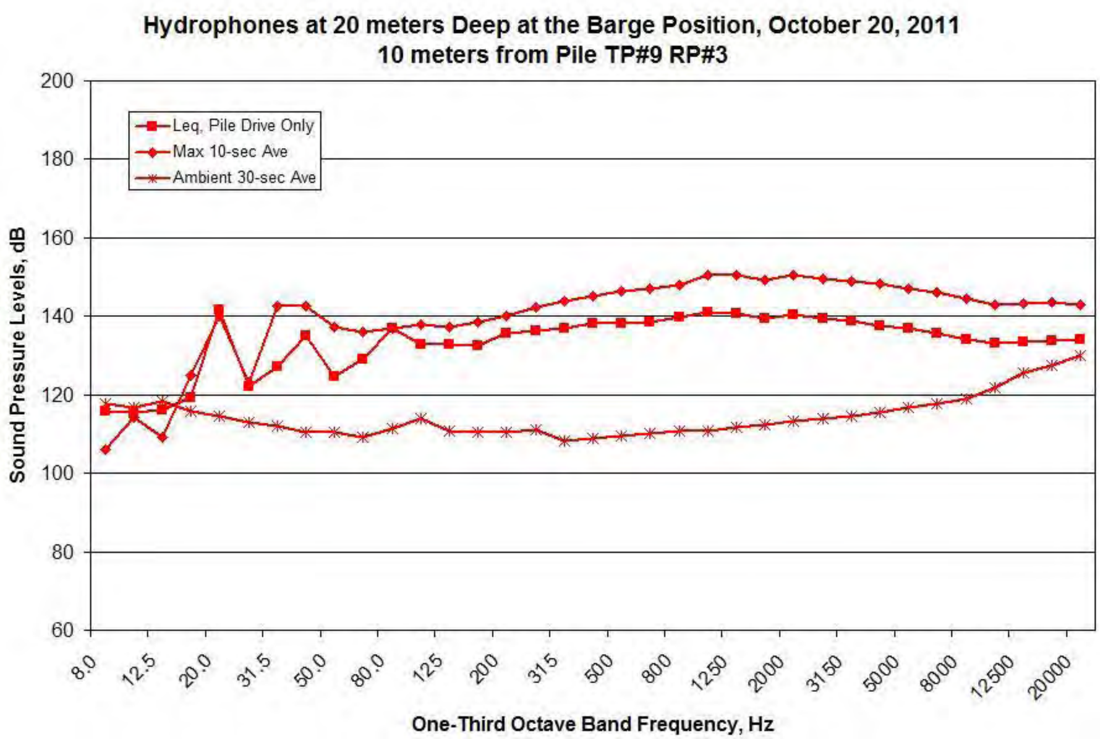

Figure A764. Spectral Data Measured at the BRG Location during TP#9 RP#3, 8:40-8:56, Measured at Depths of 20 meters on October 20, 2011

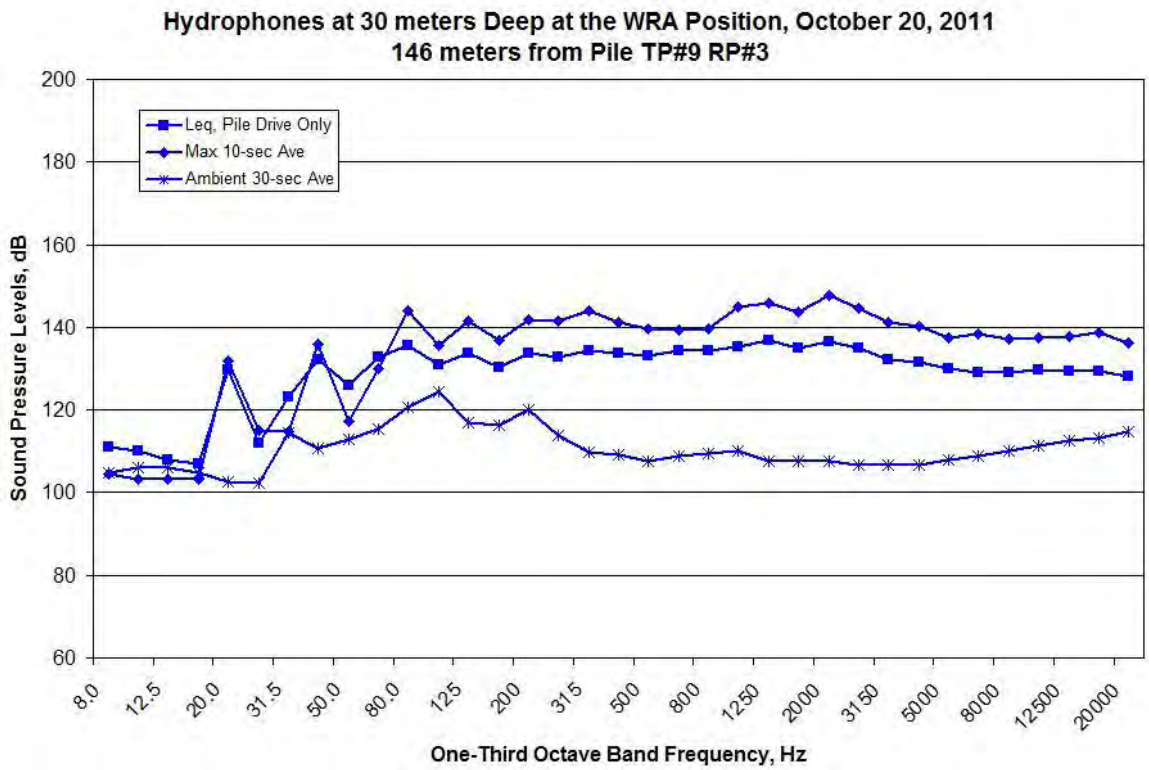

Figure A765. Spectral Data Measured at the WRA Location during TP#9 RP#3, 8:40-8:56, Measured at Depths of 30 meters on October 20, 2011

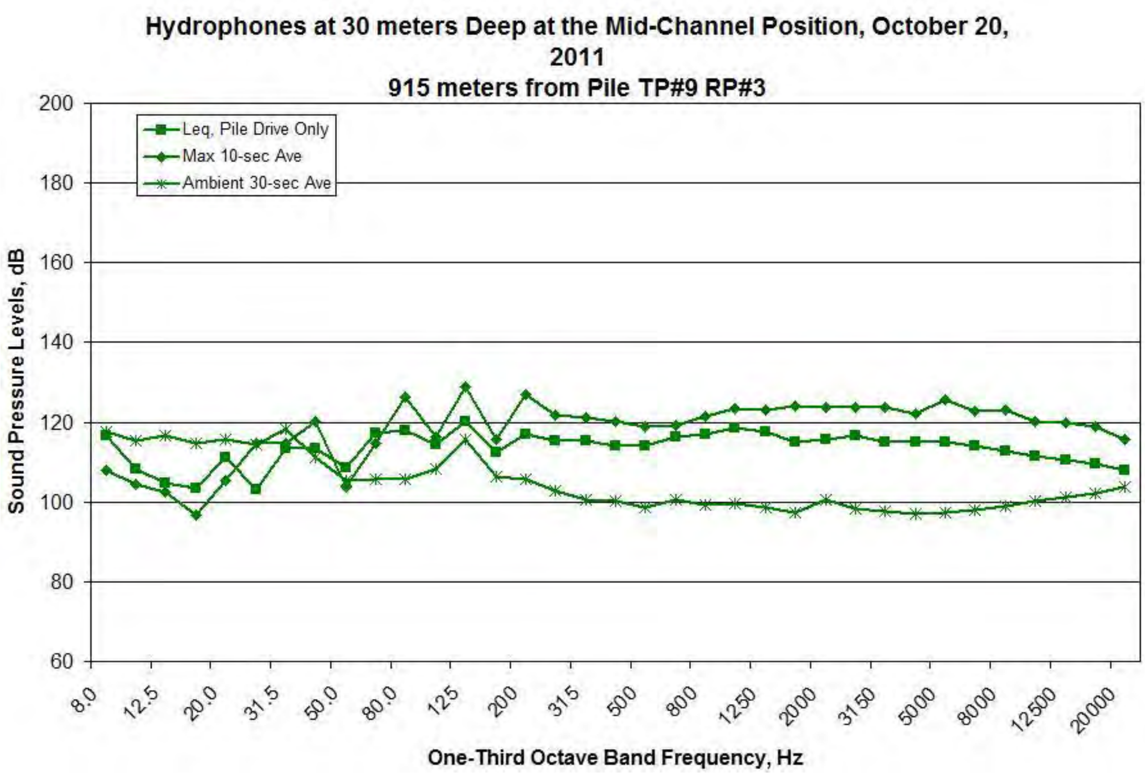

Figure A766. Spectral Data Measured at the MID Location during TP#9 RP#3, 8:40-8:56, Measured at Depths of 30 meters on October 20, 2011

DATA NOT USABLE – TOO MUCH NOISE

Figure A767. Spectral Data Measured at the RFT Location during TP#9 RP#3, 8:40-8:56, Measured at Depths of 17 meters on October 20, 2011

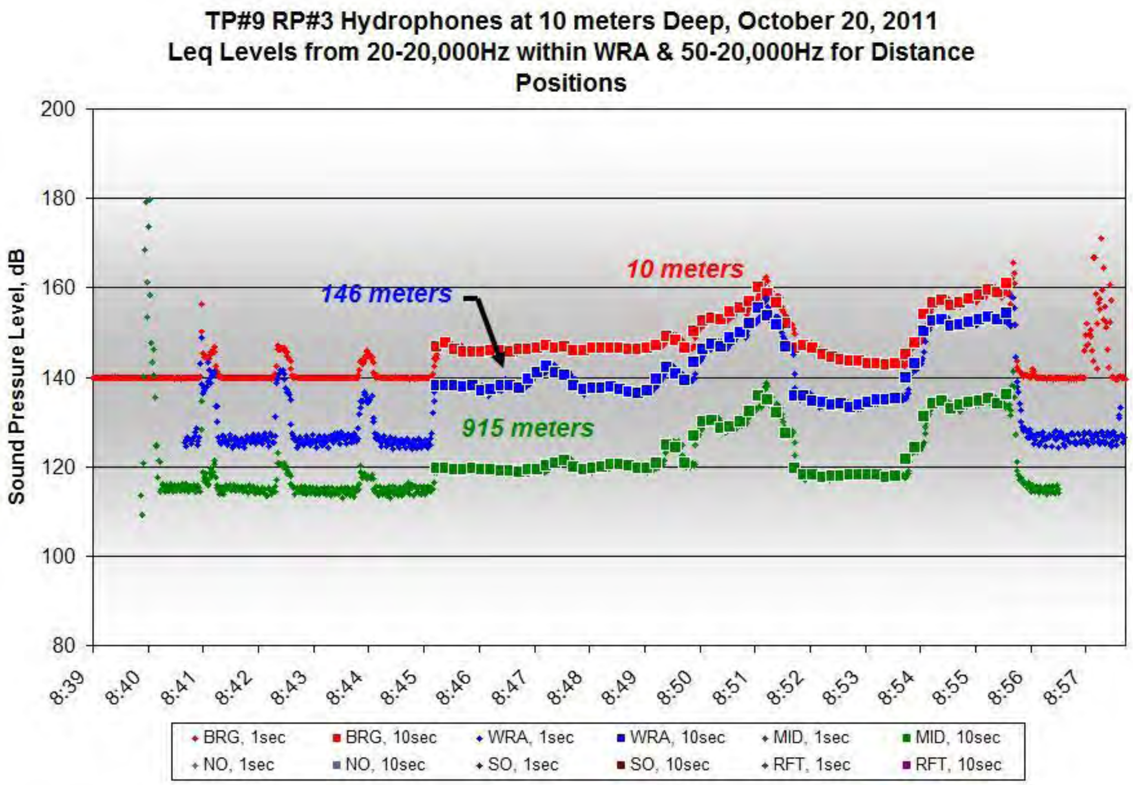

Figure A768. One-second and 10-second Average Data for TP#9 RP#3, 8:40-8:56, Measured at Depths of 10 meters on October 20, 2011

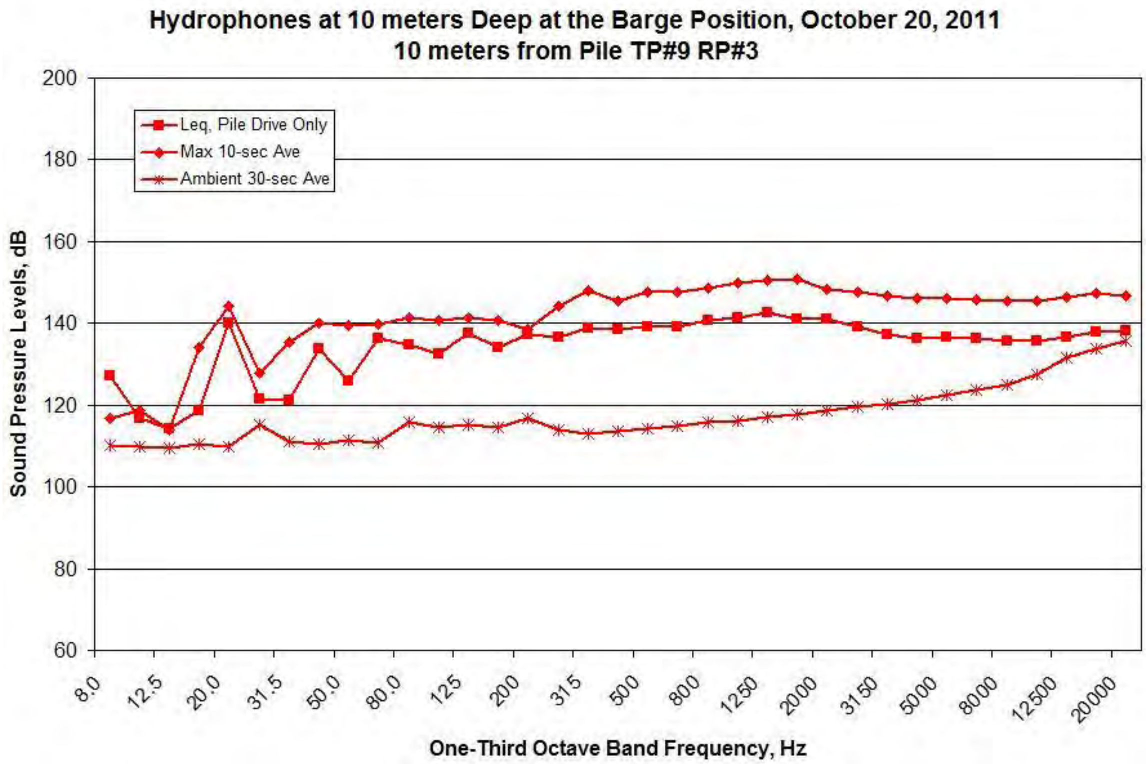

Figure A769. Spectral Data Measured at the BRG Location during TP#9 RP#3, 8:40-8:56, Measured at Depths of 10 meters on October 20, 2011

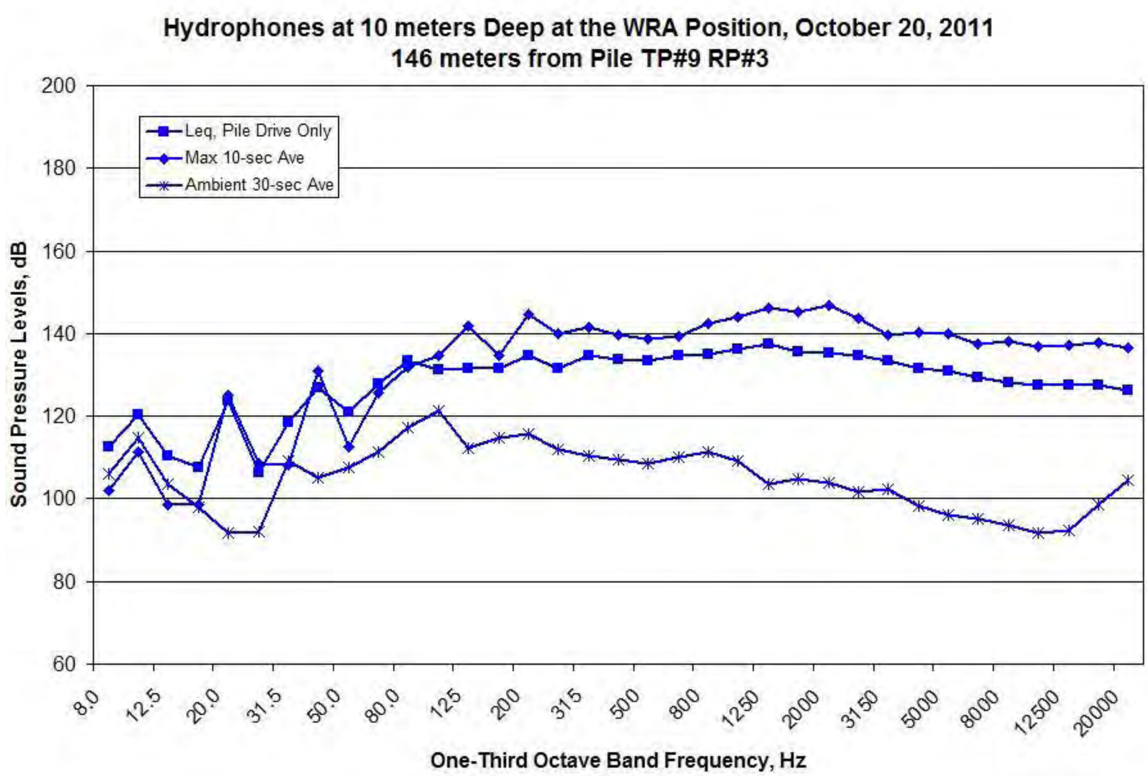

Figure A770. Spectral Data Measured at the WRA Location during TP#9 RP#3, 8:40-8:56, Measured at Depths of 10 meters on October 20, 2011

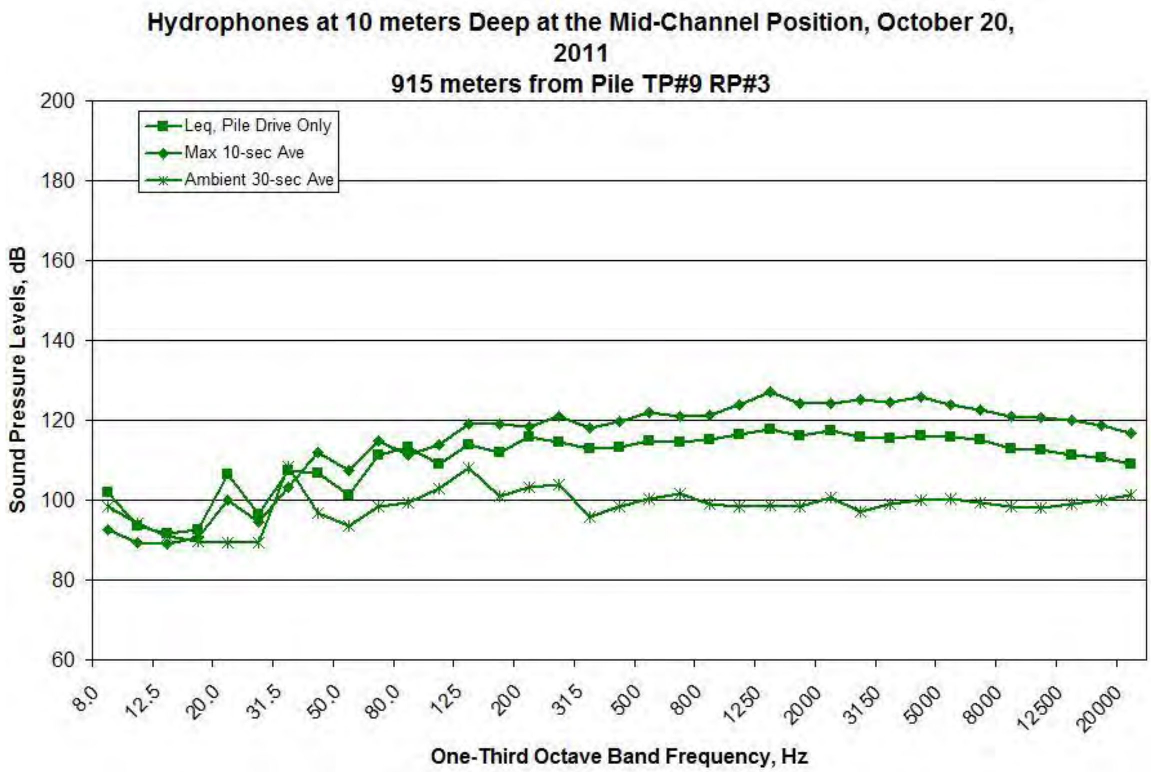

Figure A771. Spectral Data Measured at the MID Location during TP#9 RP#3, 8:40-8:56, Measured at Depths of 10 meters on October 20, 2011

DATA NOT USABLE – TOO MUCH NOISE

Figure A772. Spectral Data Measured at the RFT Location during TP#9 RP#3, 8:40-8:56, Measured at Depths of 10 meters on October 20, 2011

TP#9 RP#1 (Vibratory Removal)

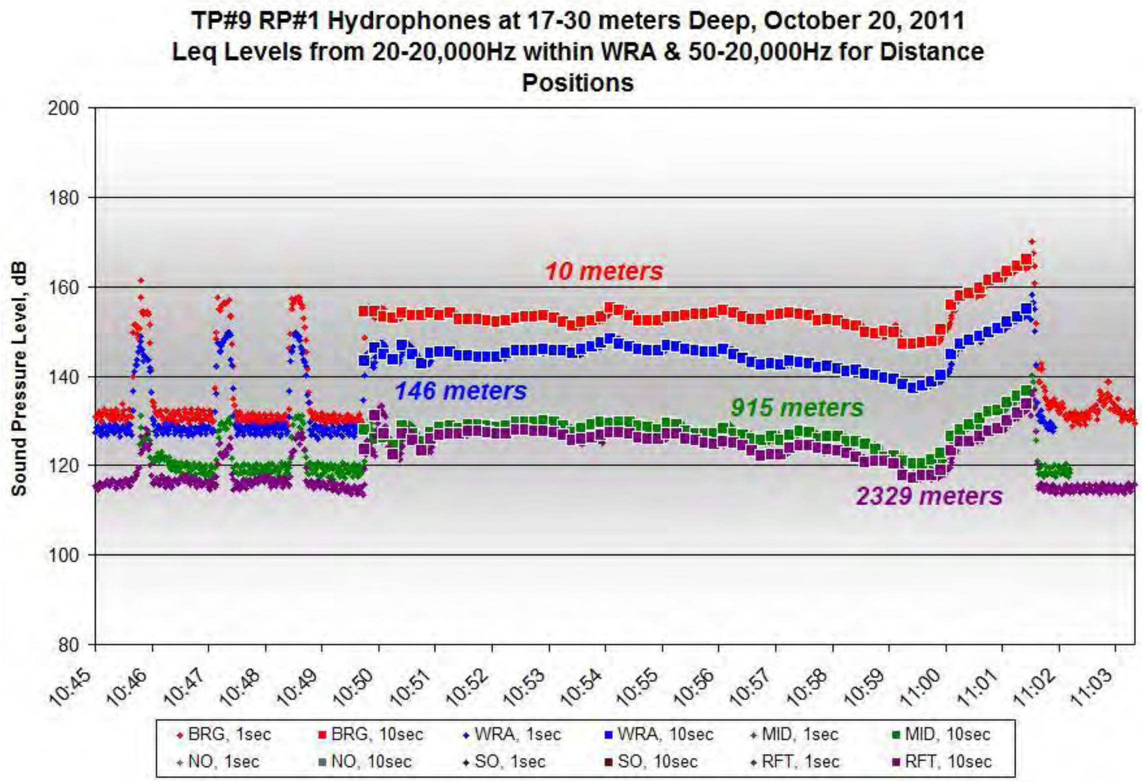

Figure A773. One-second and 10-second Average Data for TP#9 RP#1, 10:51-11:02, Measured at Depths of 17-30 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A774. Spectral Data Measured at the BRG Location during TP#9 RP#1, 10:51-11:02, Measured at Depths of 20 meters on October 20, 2011

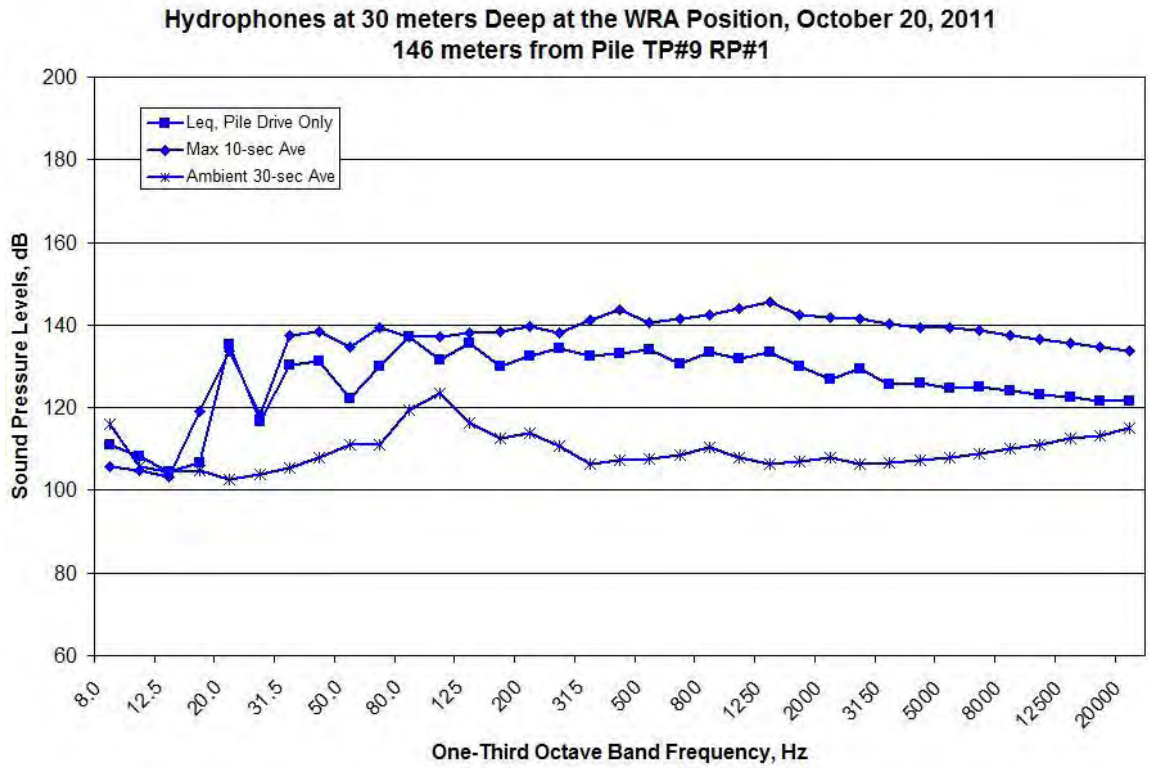

Figure A775. Spectral Data Measured at the WRA Location during TP#9 RP#1, 10:51-11:02, Measured at Depths of 30 meters on October 20, 2011

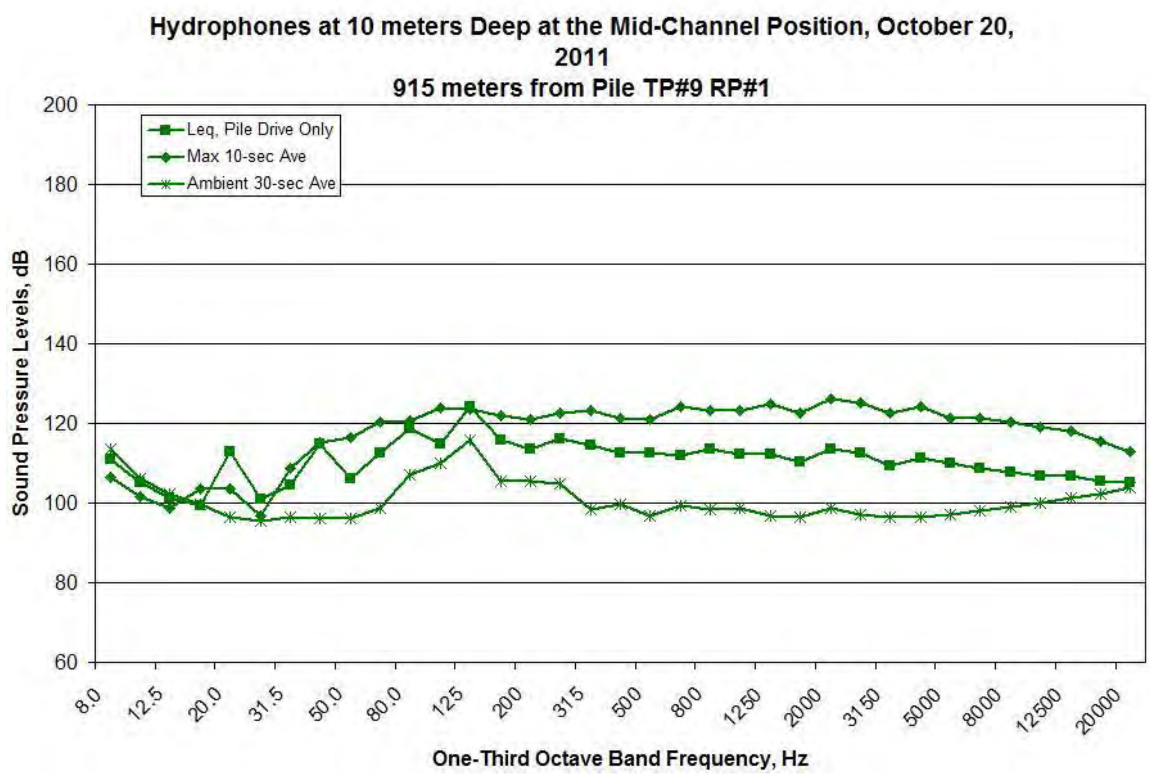

Figure A776. Spectral Data Measured at the MID Location during TP#9 RP#1, 10:51-11:02, Measured at Depths of 30 meters on October 20, 2011

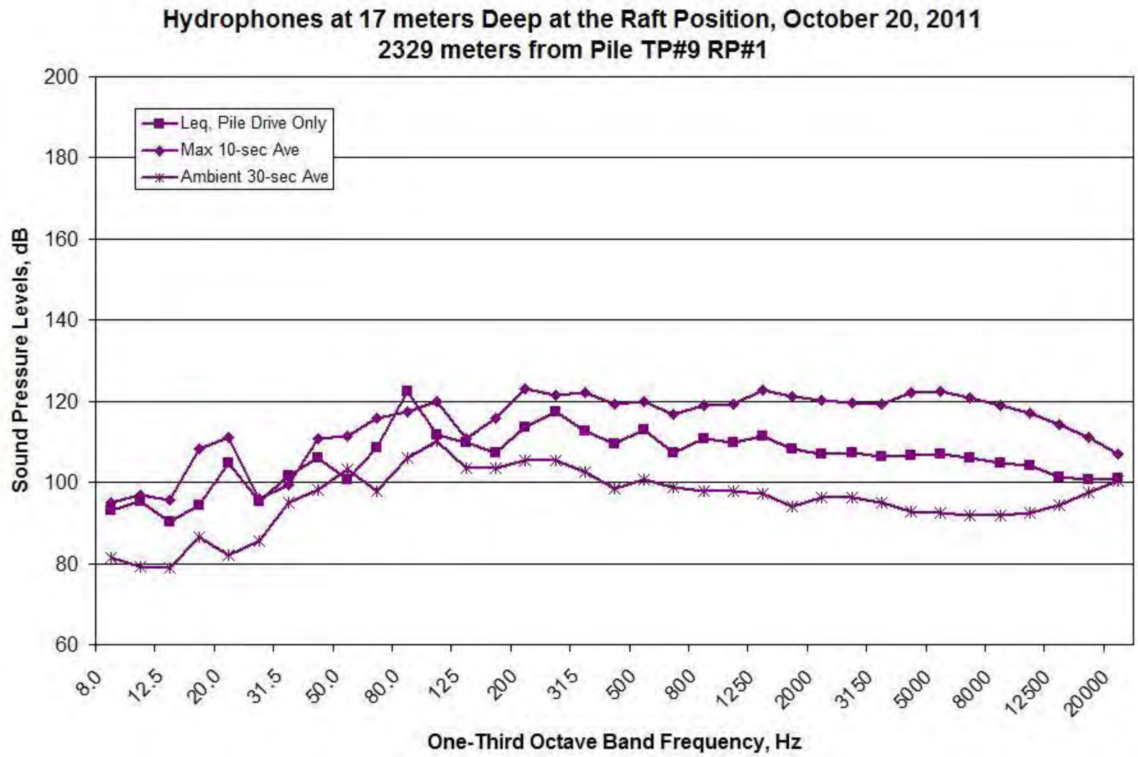

Figure A777. Spectral Data Measured at the RFT Location during TP#9 RP#1, 10:51-11:02, Measured at Depths of 17 meters on October 20, 2011

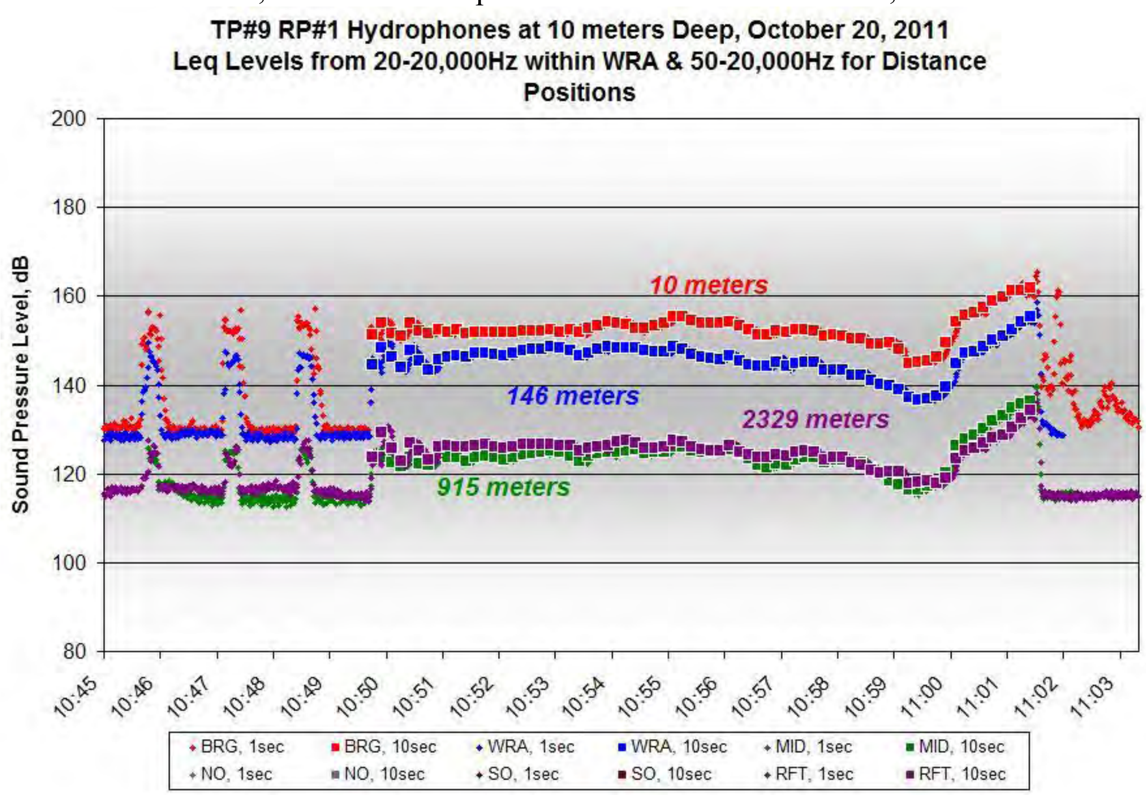

Figure A778. One-second and 10-second Average Data for TP#9 RP#1, 10:51-11:02, Measured at Depths of 10 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A779. Spectral Data Measured at the BRG Location during TP#9 RP#1, 10:51-11:02, Measured at Depths of 10 meters on October 20, 2011

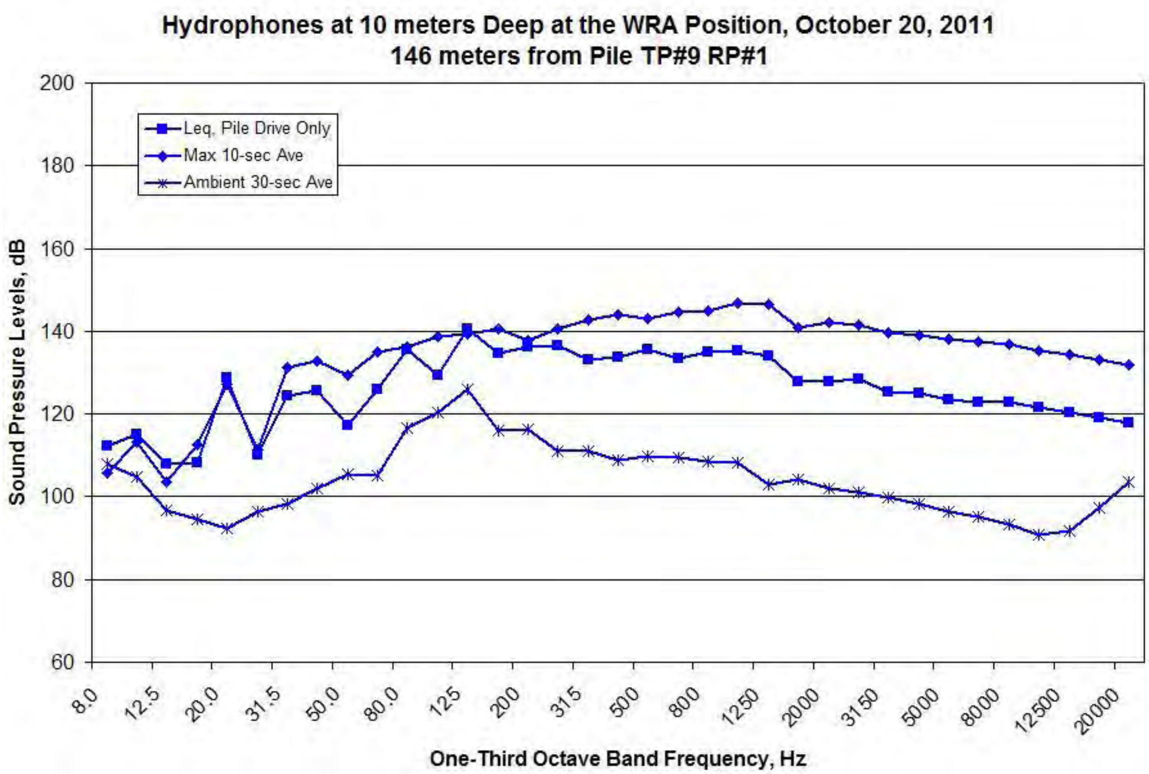

Figure A780. Spectral Data Measured at the WRA Location during TP#9 RP#1, 10:51-11:02, Measured at Depths of 10 meters on October 20, 2011

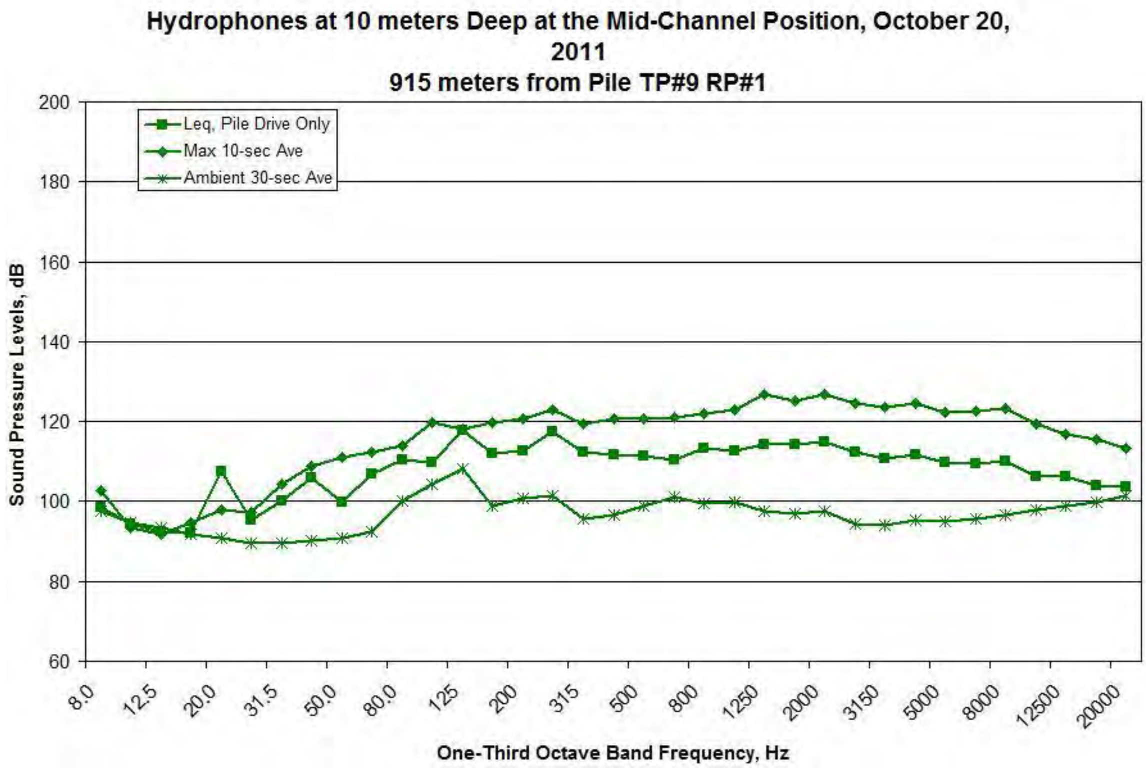

Figure A781. Spectral Data Measured at the MID Location during TP#9 RP#1, 10:51-11:02, Measured at Depths of 10 meters on October 20, 2011

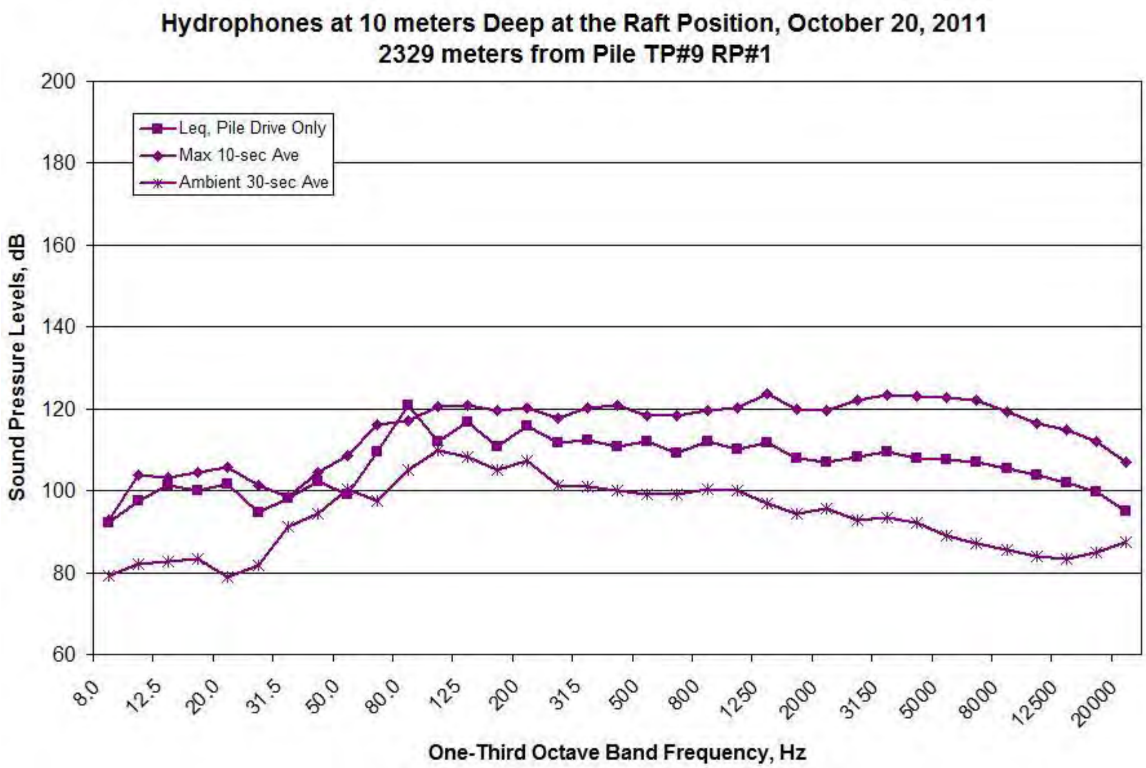

Figure A782. Spectral Data Measured at the RFT Location during TP#9 RP#1, 10:51-11:02, Measured at Depths of 10 meters on October 20, 2011

TP#9 RP#2 (Vibratory Removal)

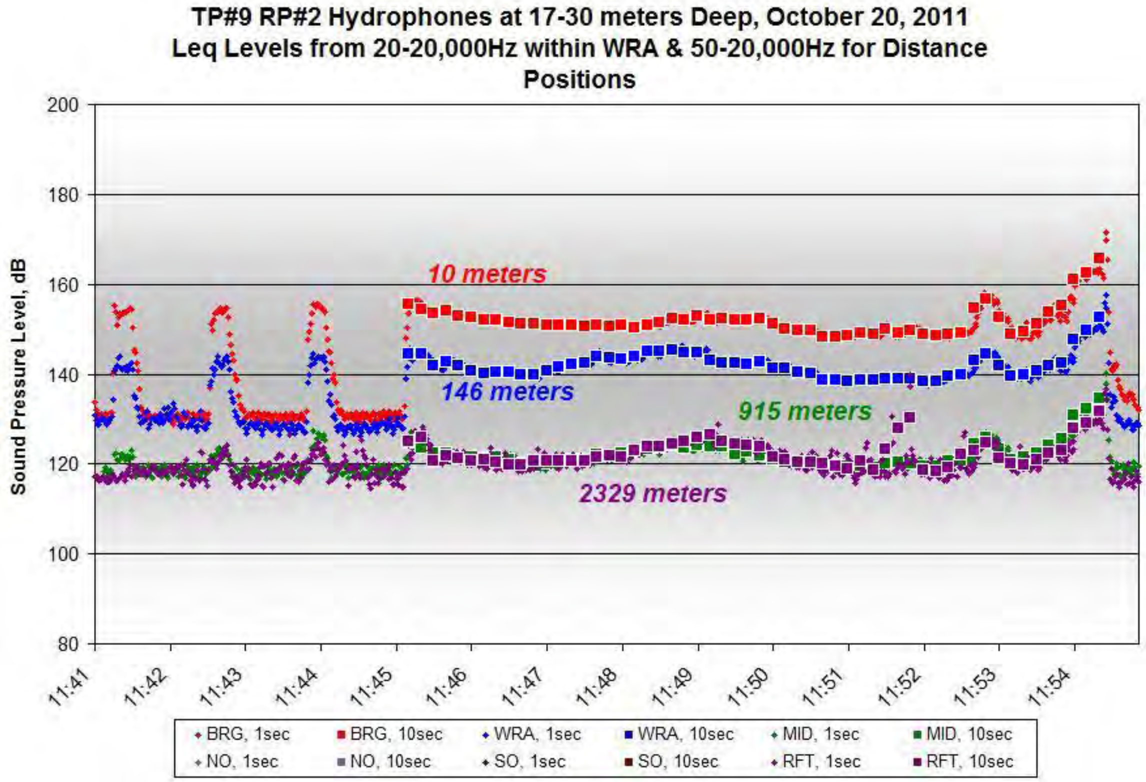

Figure A783. One-second and 10-second Average Data for TP#9 RP#2, 11:46-11:55, Measured at Depths of 17-30 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A784. Spectral Data Measured at the BRG Location during TP#9 RP#2, 11:46-11:55, Measured at Depths of 20 meters on October 20, 2011

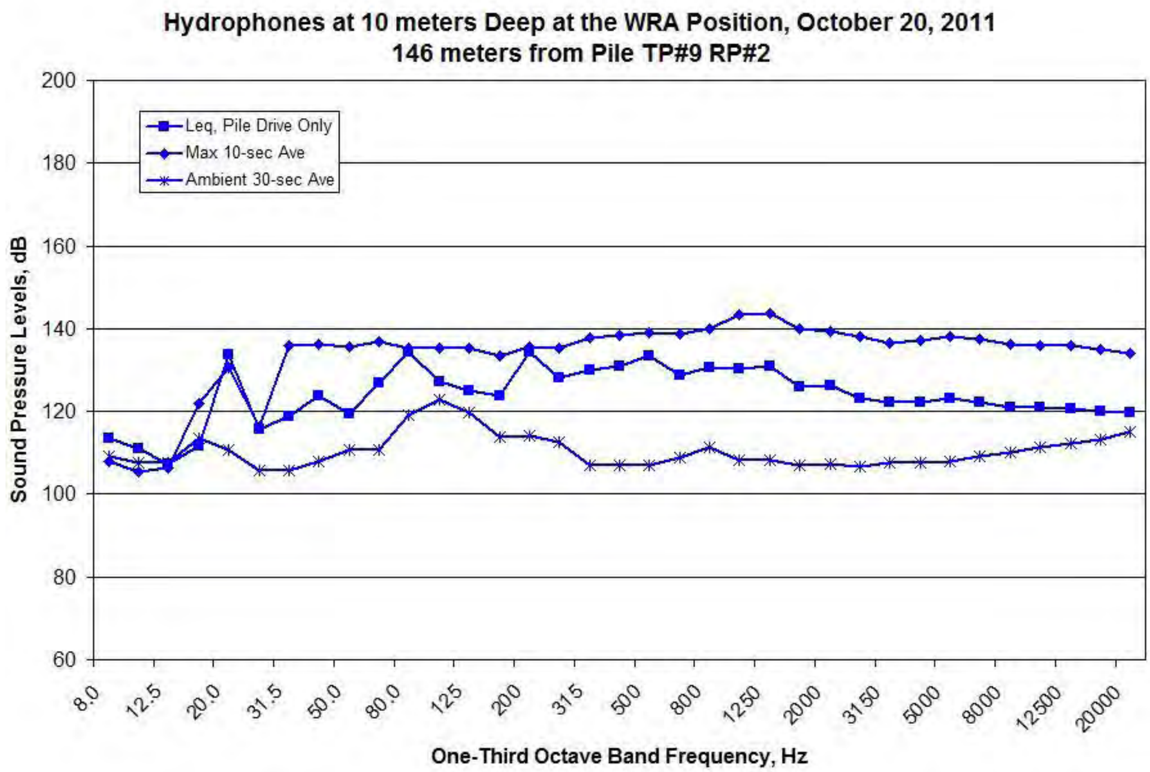

Figure A785. Spectral Data Measured at the WRA Location during TP#9 RP#2, 11:46-11:55, Measured at Depths of 30 meters on October 20, 2011

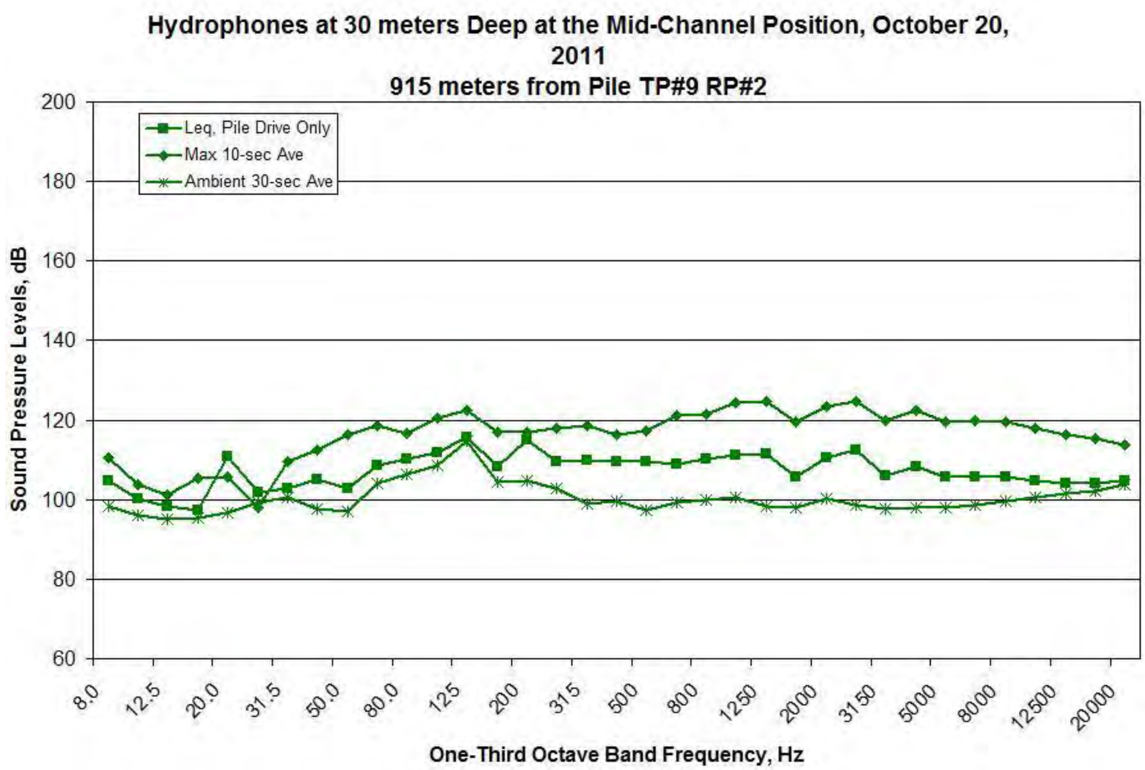

Figure A786. Spectral Data Measured at the MID Location during TP#9 RP#2, 11:46-11:55, Measured at Depths of 30 meters on October 20, 2011

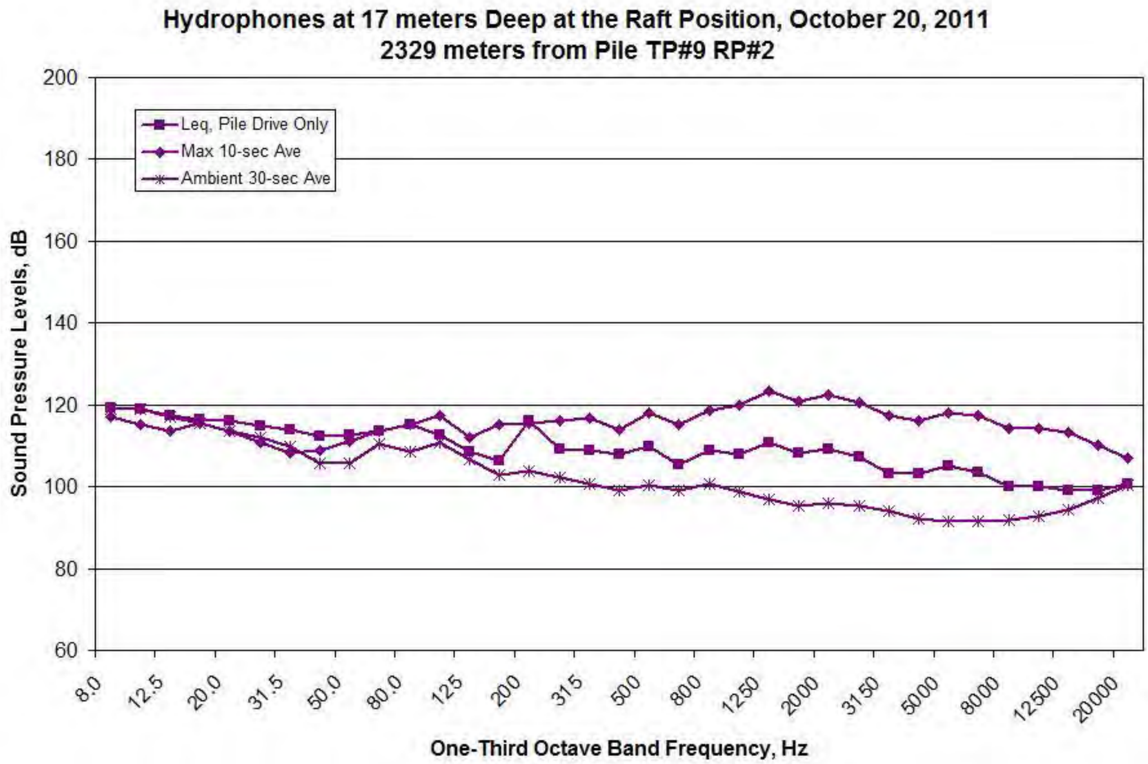

Figure A787. Spectral Data Measured at the RFT Location during TP#9 RP#2, 11:46-11:55, Measured at Depths of 17 meters on October 20, 2011

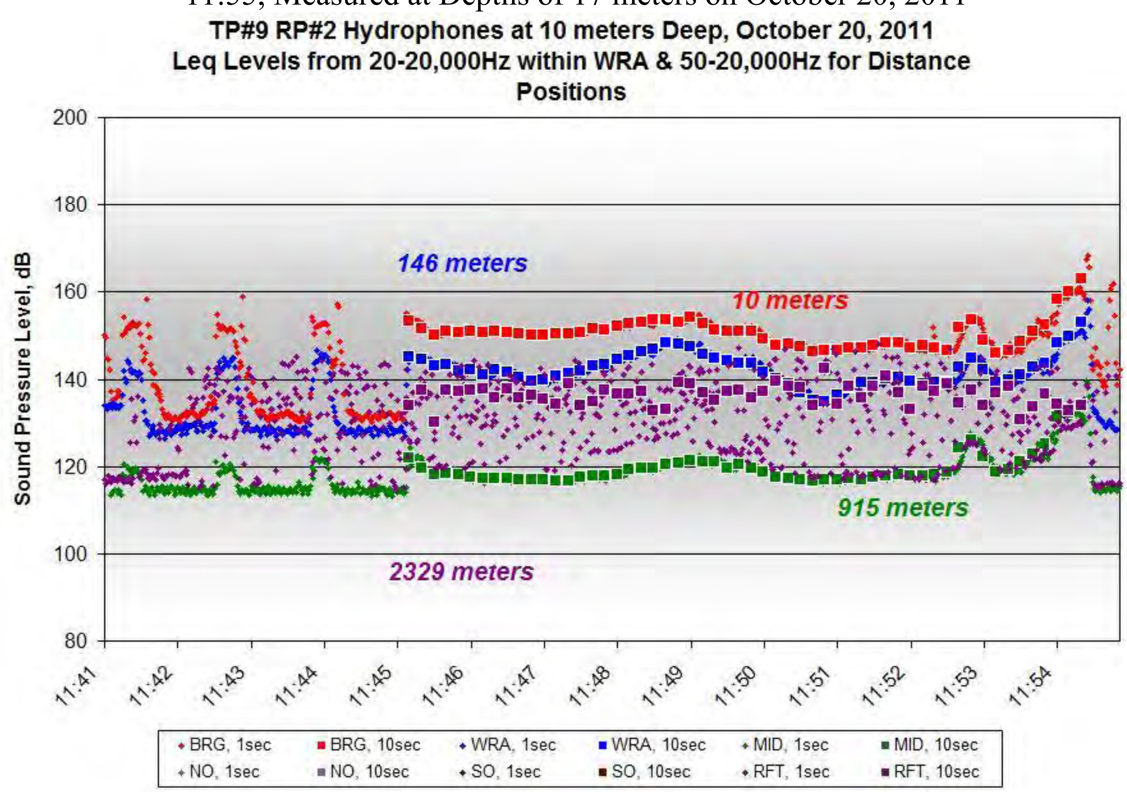

Figure A788. One-second and 10-second Average Data for TP#9 RP#2, 11:46-11:55, Measured at Depths of 10 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A789. Spectral Data Measured at the BRG Location during TP#9 RP#2, 11:46-11:55, Measured at Depths of 10 meters on October 20, 2011

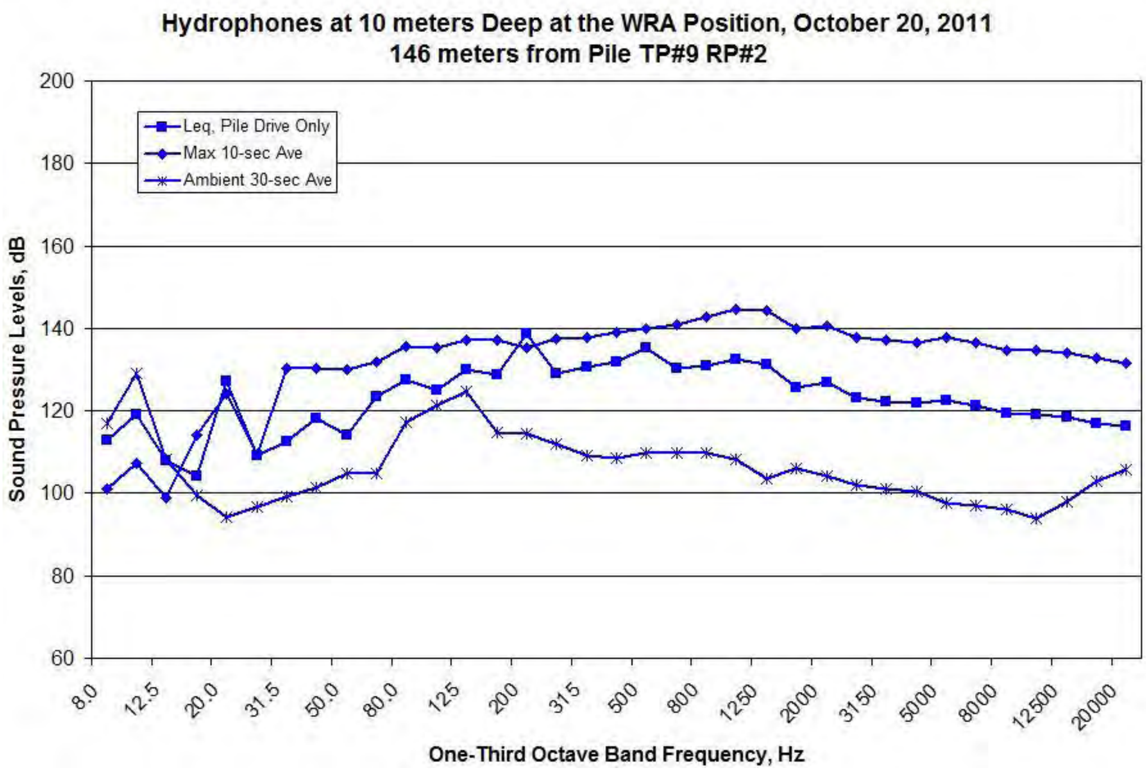

Figure A790. Spectral Data Measured at the WRA Location during TP#9 RP#2, 11:46-11:55, Measured at Depths of 10 meters on October 20, 2011

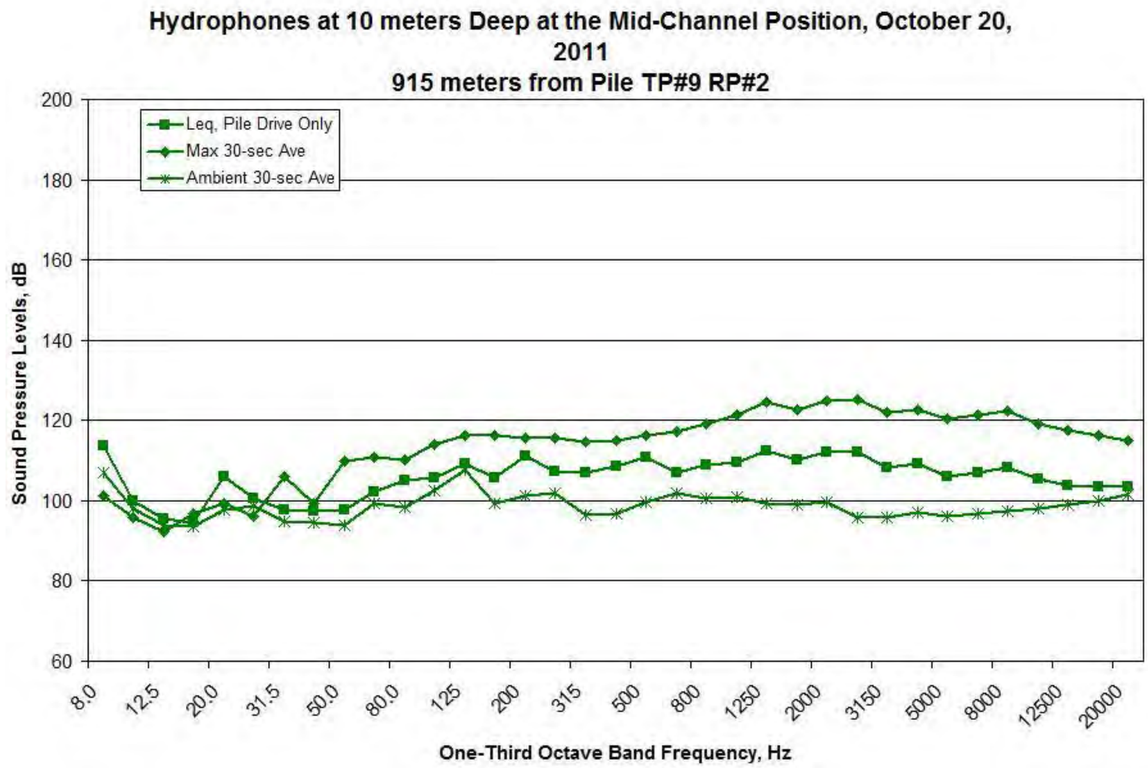

Figure A791. Spectral Data Measured at the MID Location during TP#9 RP#2, 11:46-11:55, Measured at Depths of 10 meters on October 20, 2011

DATA NOT USABLE – TOO MUCH NOISE

Figure A792. Spectral Data Measured at the RFT Location during TP#9 RP#2, 11:46-11:55, Measured at Depths of 10 meters on October 20, 2011

TTP#4, 13:33-13:40 (Vibratory Removal)

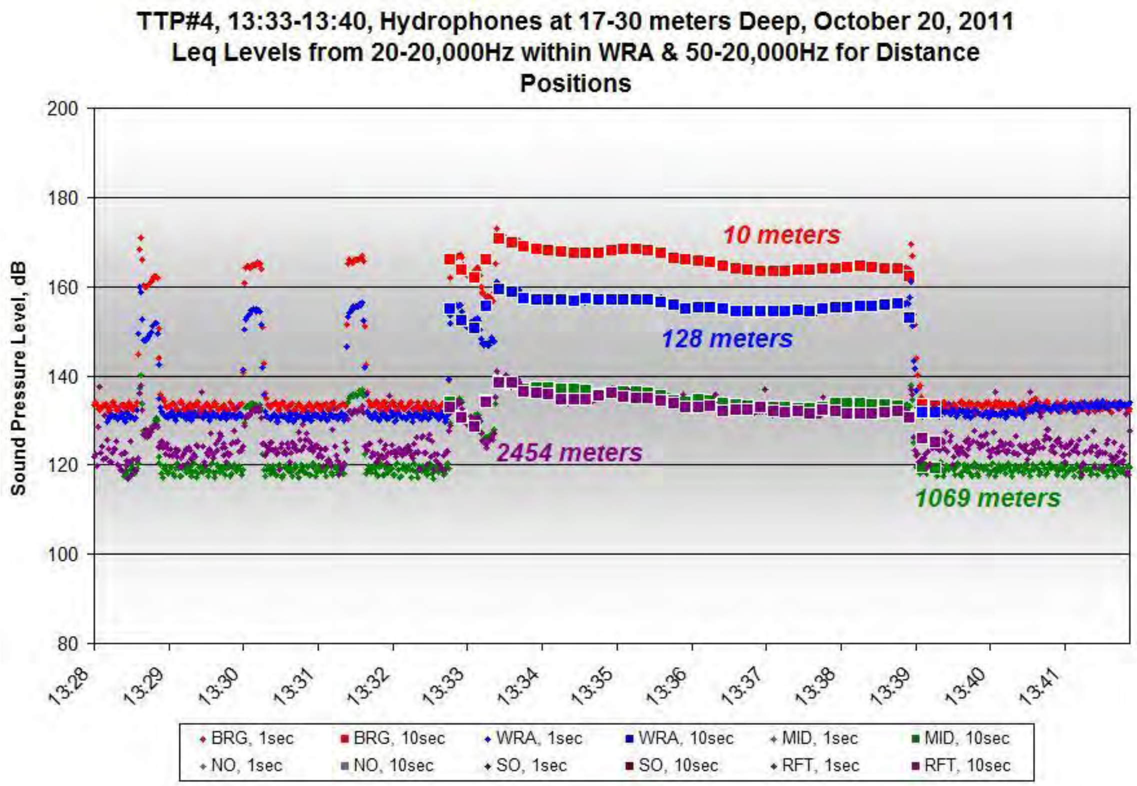

Figure A793. One-second and 10-second Average Data for TTP#4, 13:33-13:40, Measured at Depths of 17-30 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A794. Spectral Data Measured at the BRG Location during TTP#4, 13:33-13:40, Measured at Depths of 20 meters on October 20, 2011

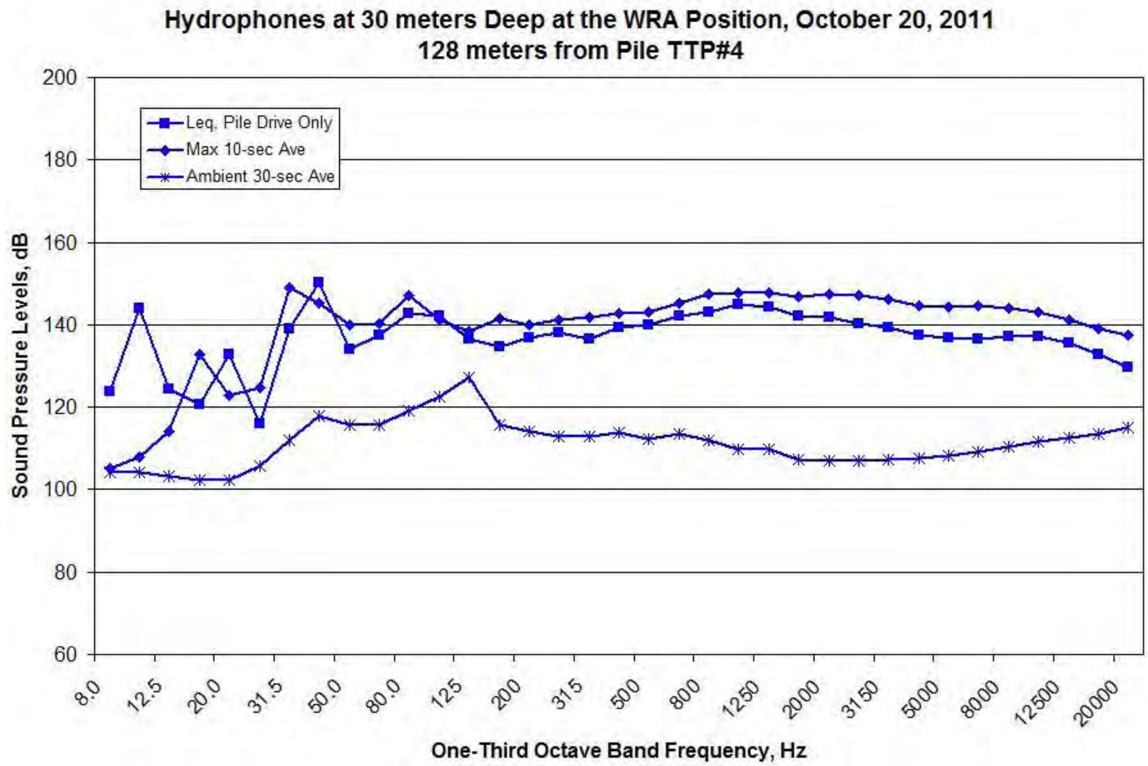

Figure A795. Spectral Data Measured at the WRA Location during TTP#4, 13:33-13:40, Measured at Depths of 30 meters on October 20, 2011

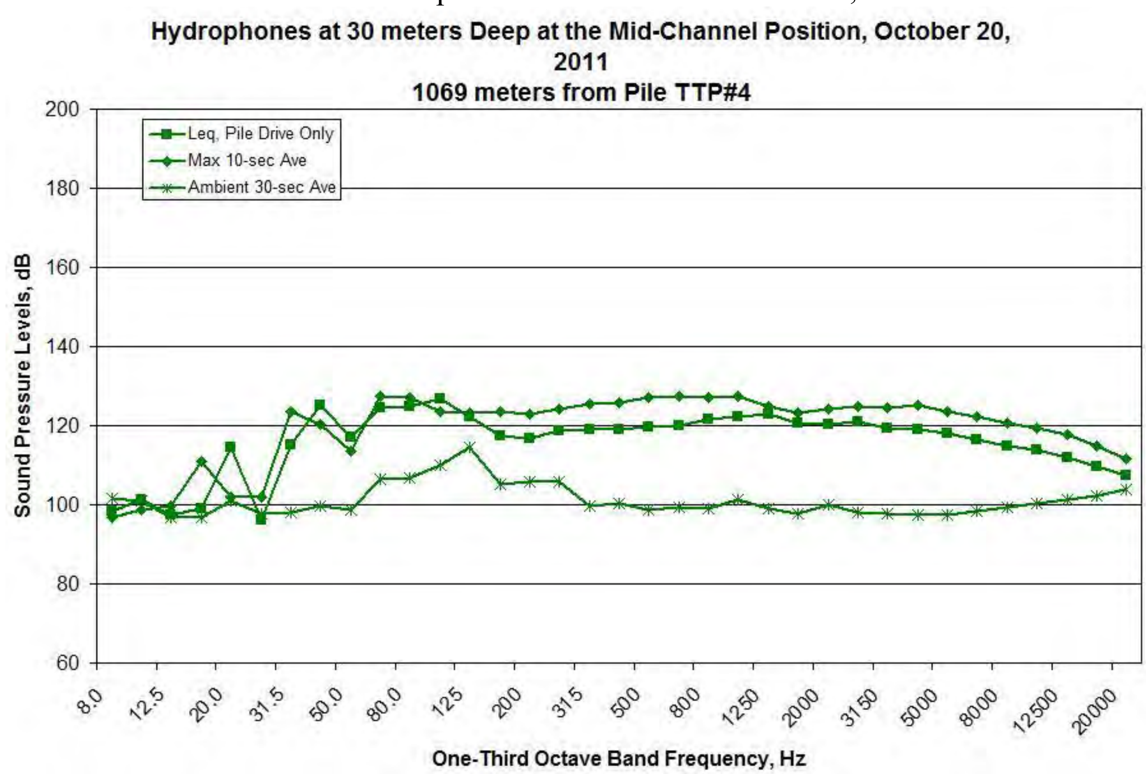

Figure A796. Spectral Data Measured at the MID Location during TTP#4, 13:33-13:40, Measured at Depths of 30 meters on October 20, 2011

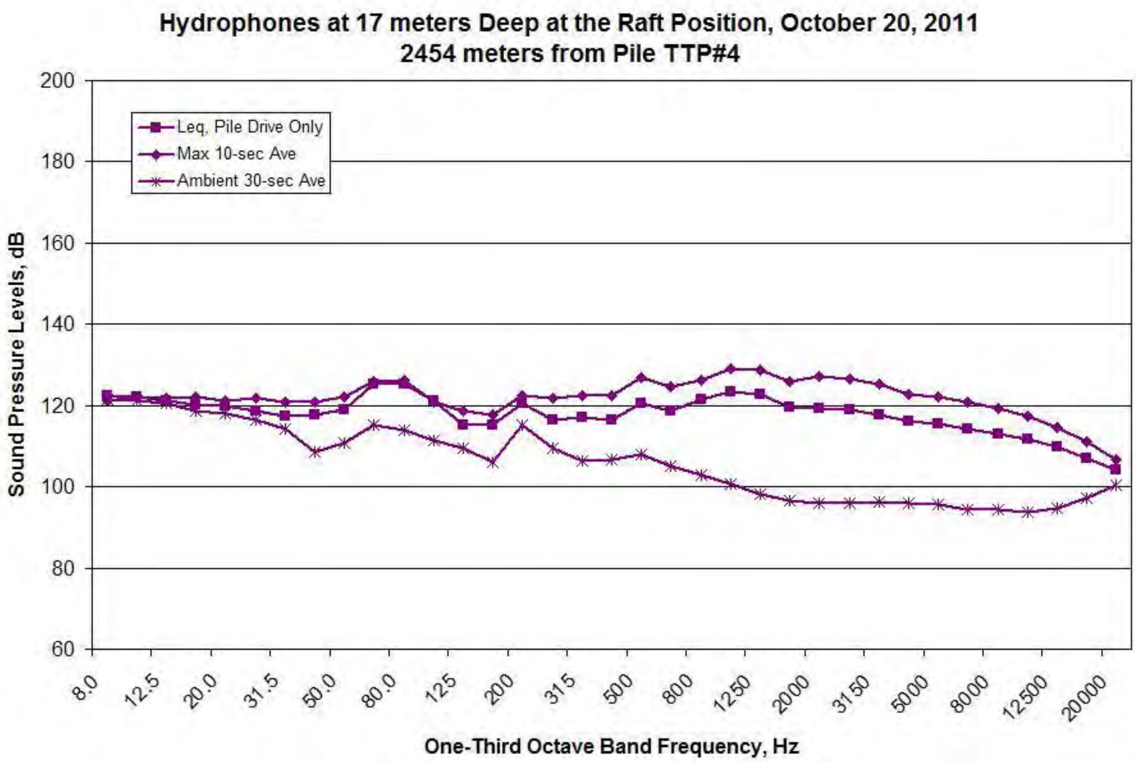

Figure A797. Spectral Data Measured at the RFT Location during TTP#4, 13:33-13:40, Measured at Depths of 17 meters on October 20, 2011

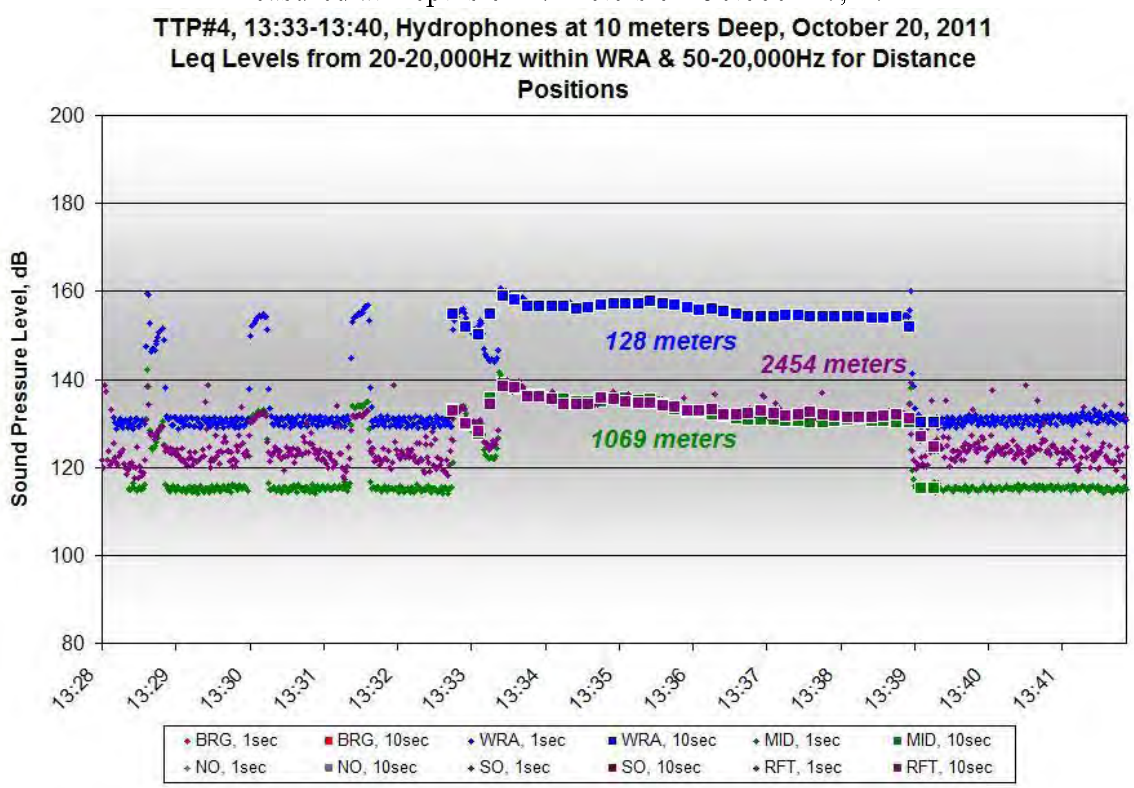

Figure A798. One-second and 10-second Average Data for TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A799. Spectral Data Measured at the BRG Location during TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

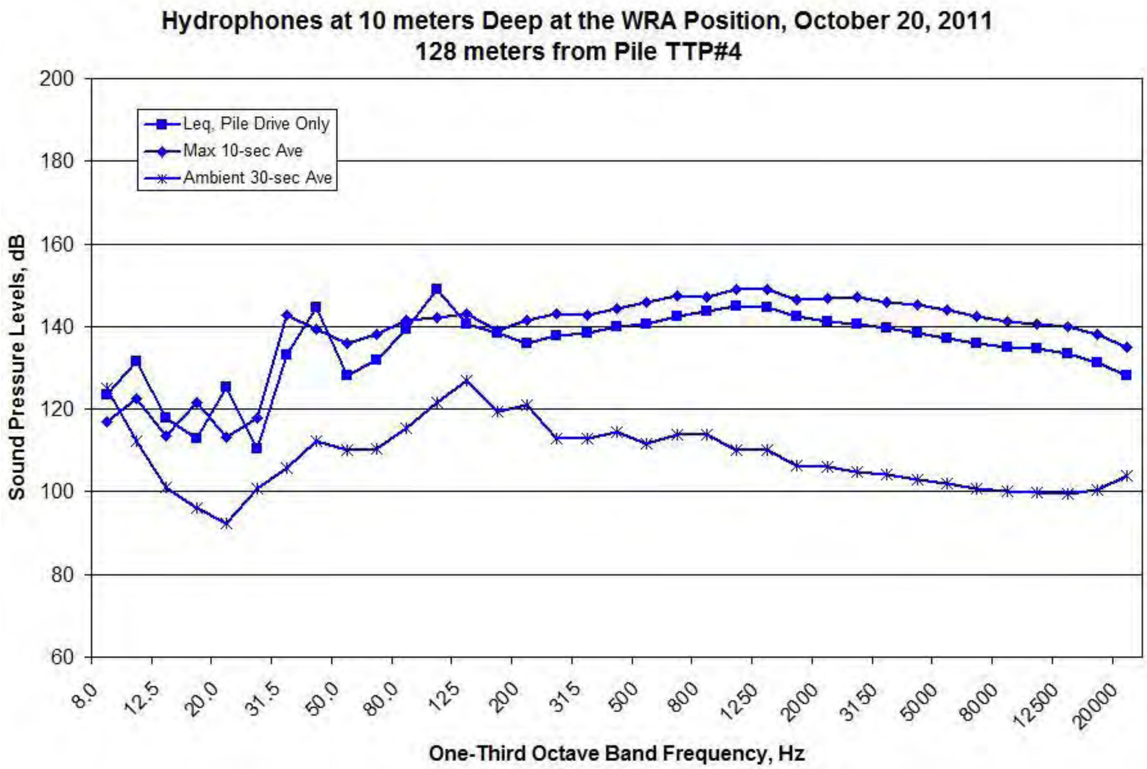

Figure A800. Spectral Data Measured at the WRA Location during TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

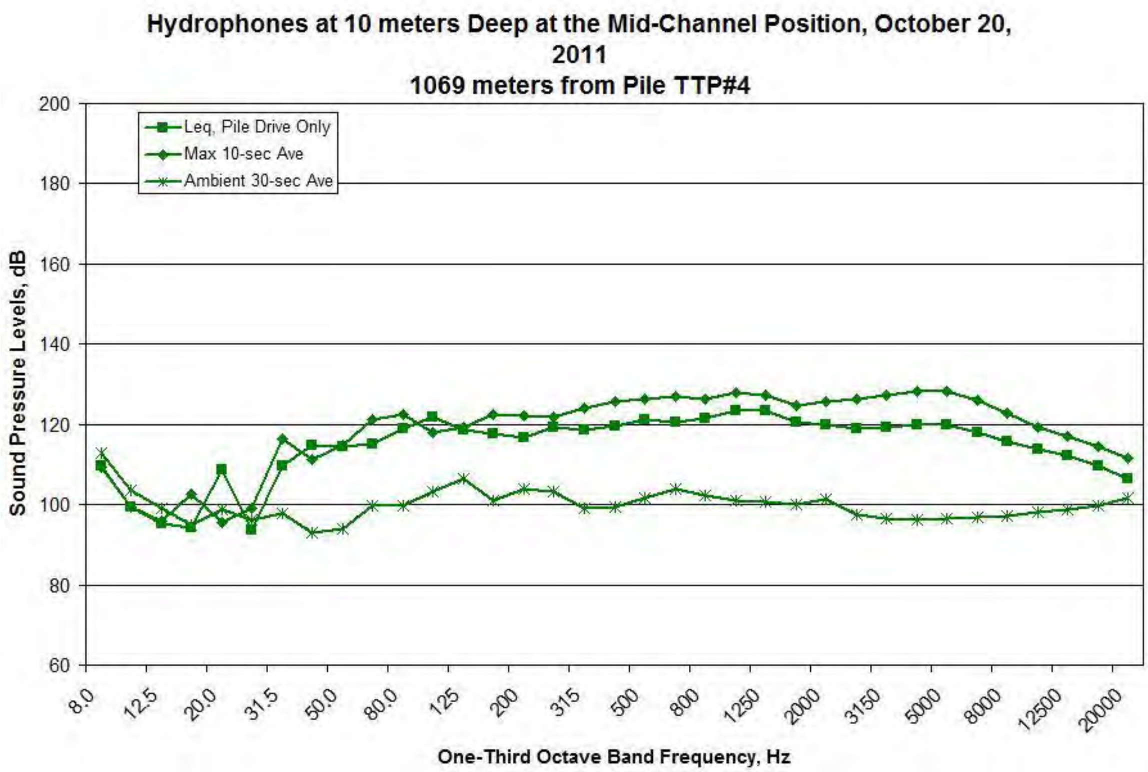

Figure A801. Spectral Data Measured at the MID Location during TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A802. Spectral Data Measured at the RFT Location during TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

TTP#4, 14:03-14:13 (Vibratory Removal)

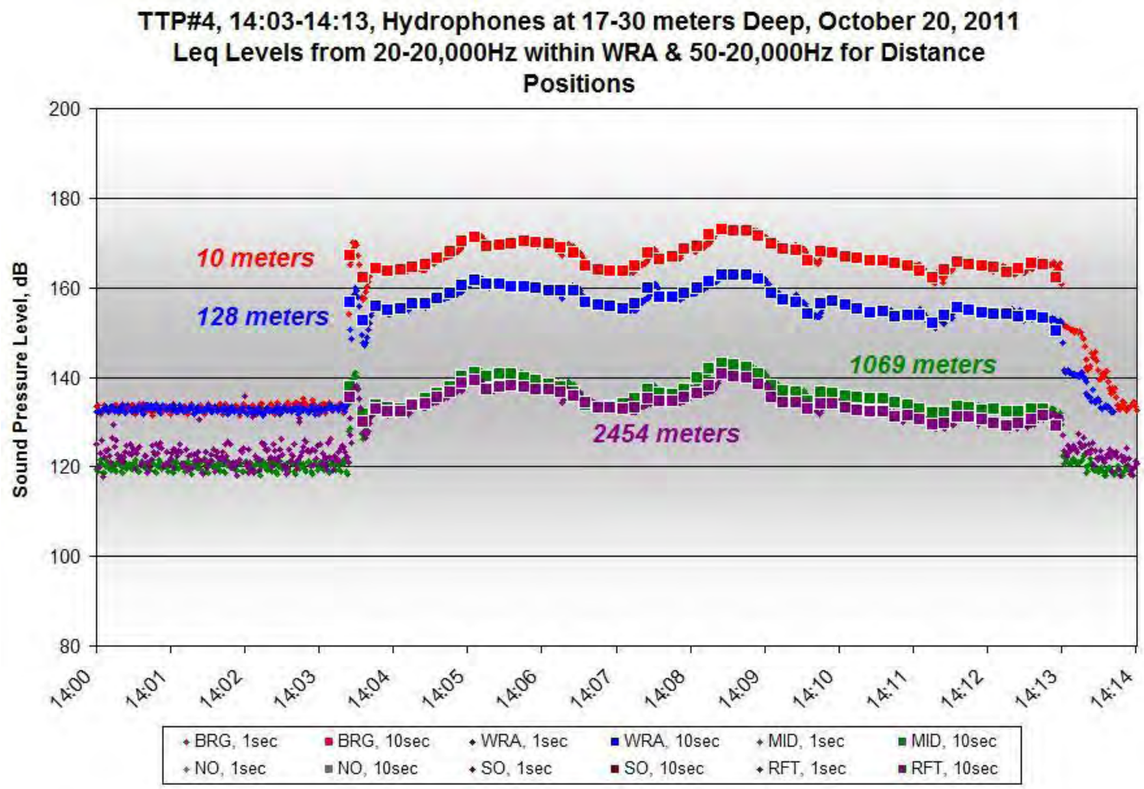

Figure A803. One-second and 10-second Average Data for TTP#4, 14:03-14:13, Measured at Depths of 17-30 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A804. Spectral Data Measured at the BRG Location during TTP#4, 14:03-14:13, Measured at Depths of 20 meters on October 20, 2011

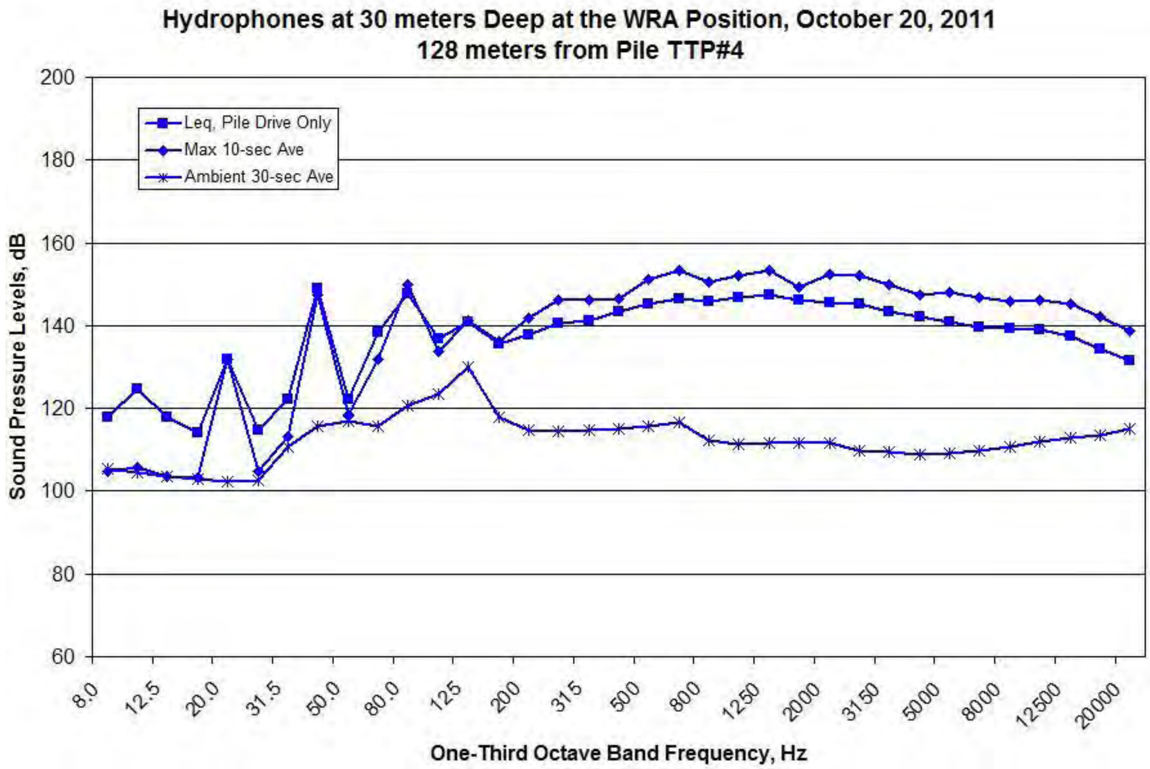

Figure A805. Spectral Data Measured at the WRA Location during TTP#4, 14:03-14:13, Measured at Depths of 30 meters on October 20, 2011

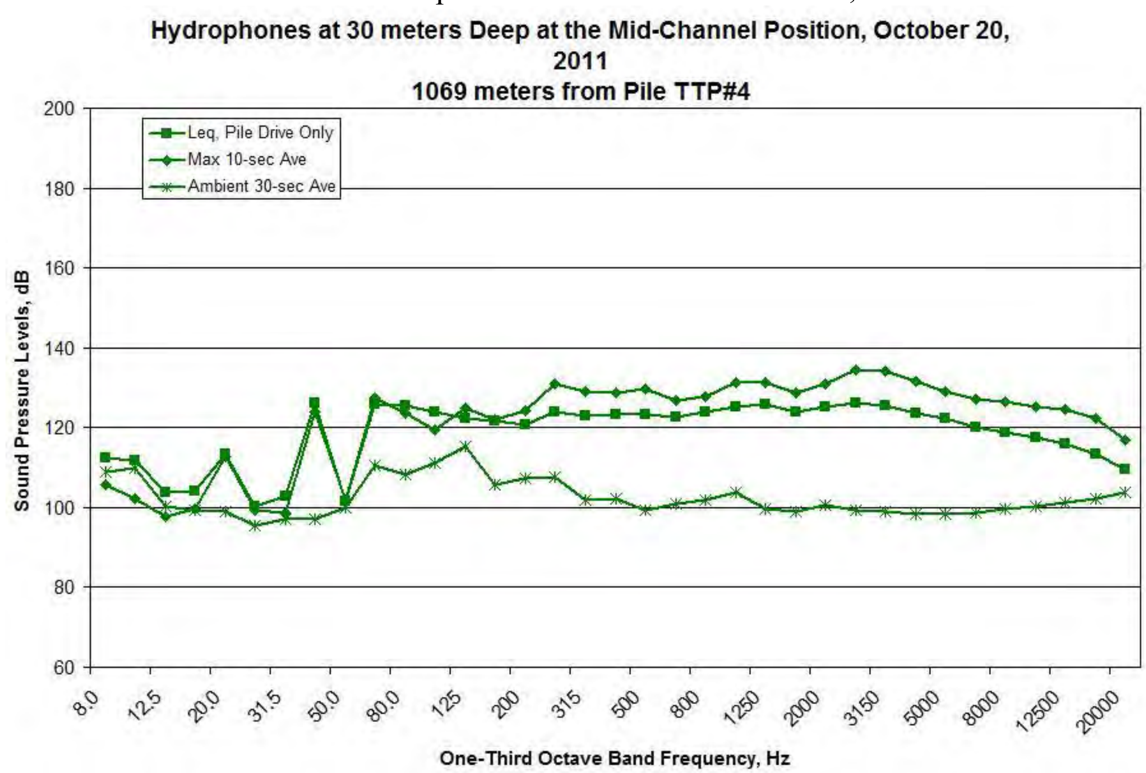

Figure A806. Spectral Data Measured at the MID Location during TTP#4, 14:03-14:13, Measured at Depths of 30 meters on October 20, 2011

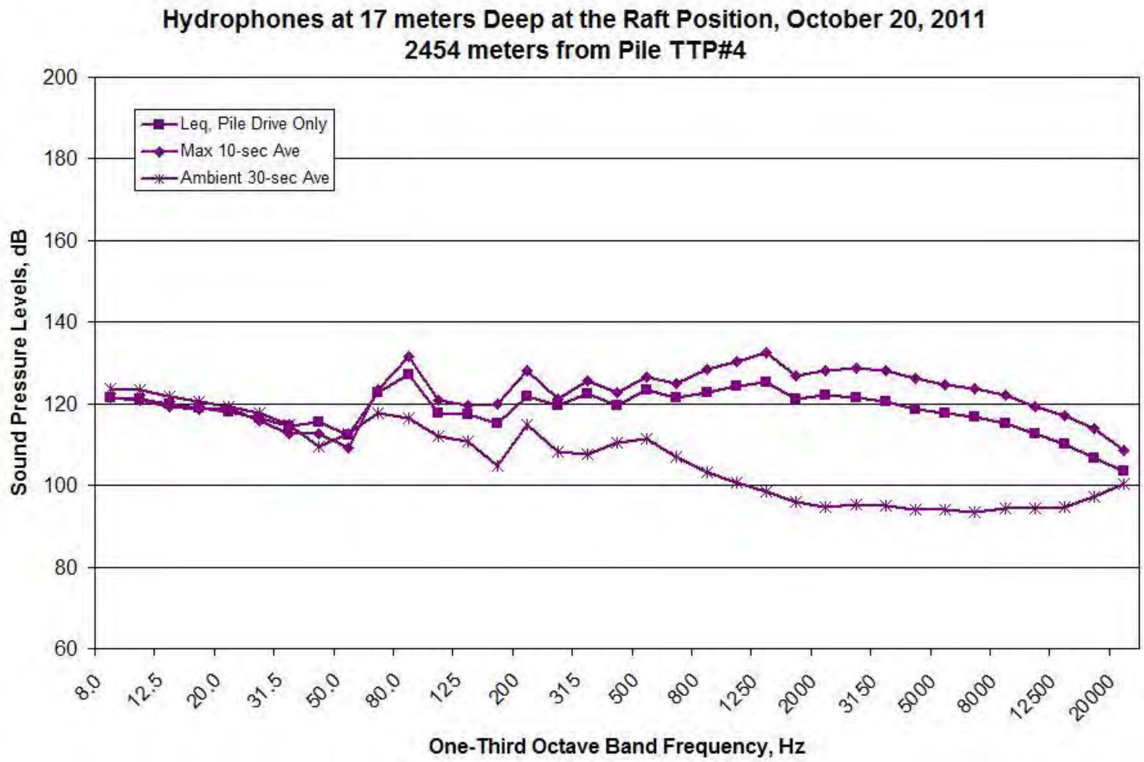

Figure A807. Spectral Data Measured at the RFT Location during TTP#4, 14:03-14:13, Measured at Depths of 17 meters on October 20, 2011

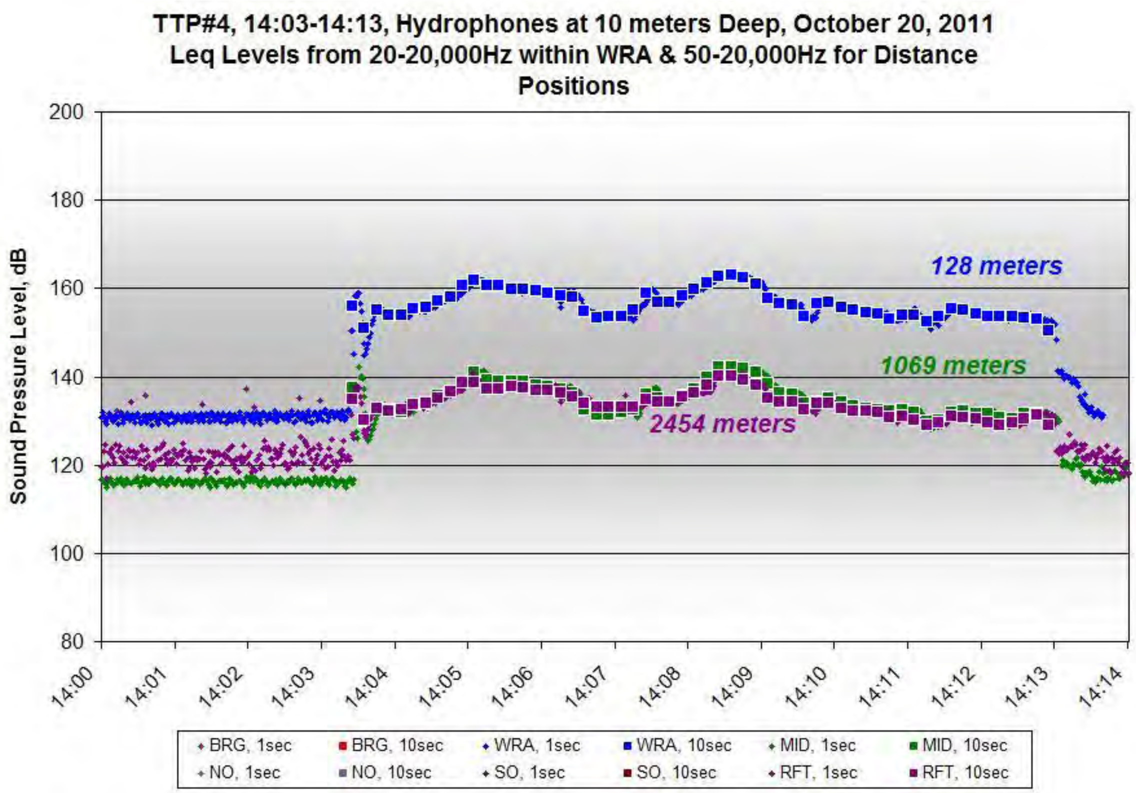

Figure A808. One-second and 10-second Average Data for TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A809. Spectral Data Measured at the BRG Location during TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

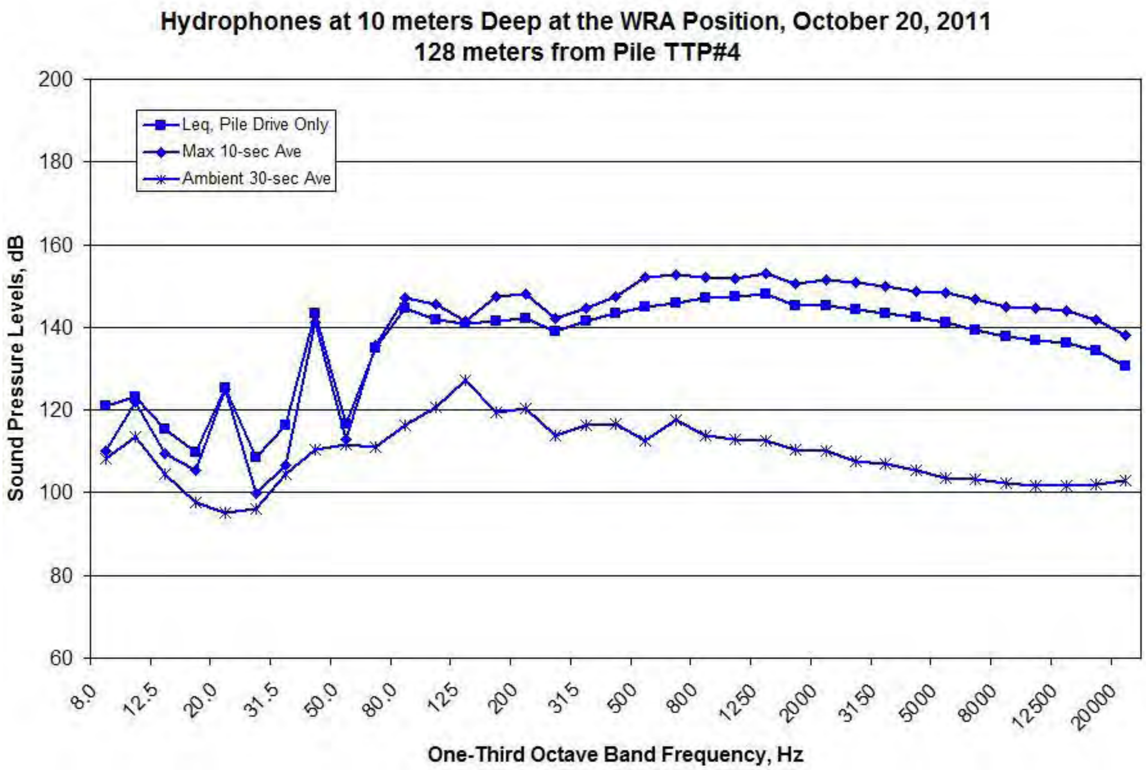

Figure A810. Spectral Data Measured at the WRA Location during TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

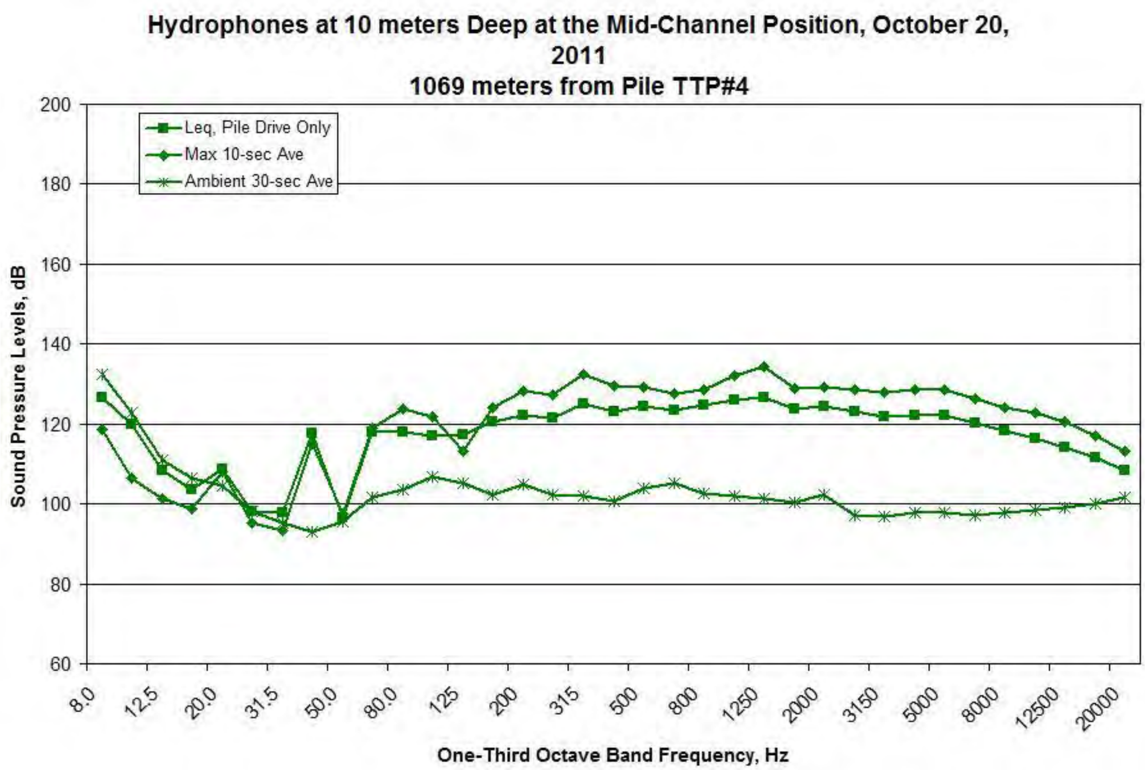

Figure A812. Spectral Data Measured at the MID Location during TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A813. Spectral Data Measured at the RFT Location during TTP#4, 13:33-13:40, Measured at Depths of 10 meters on October 20, 2011

TTP#3 (Vibratory Removal)

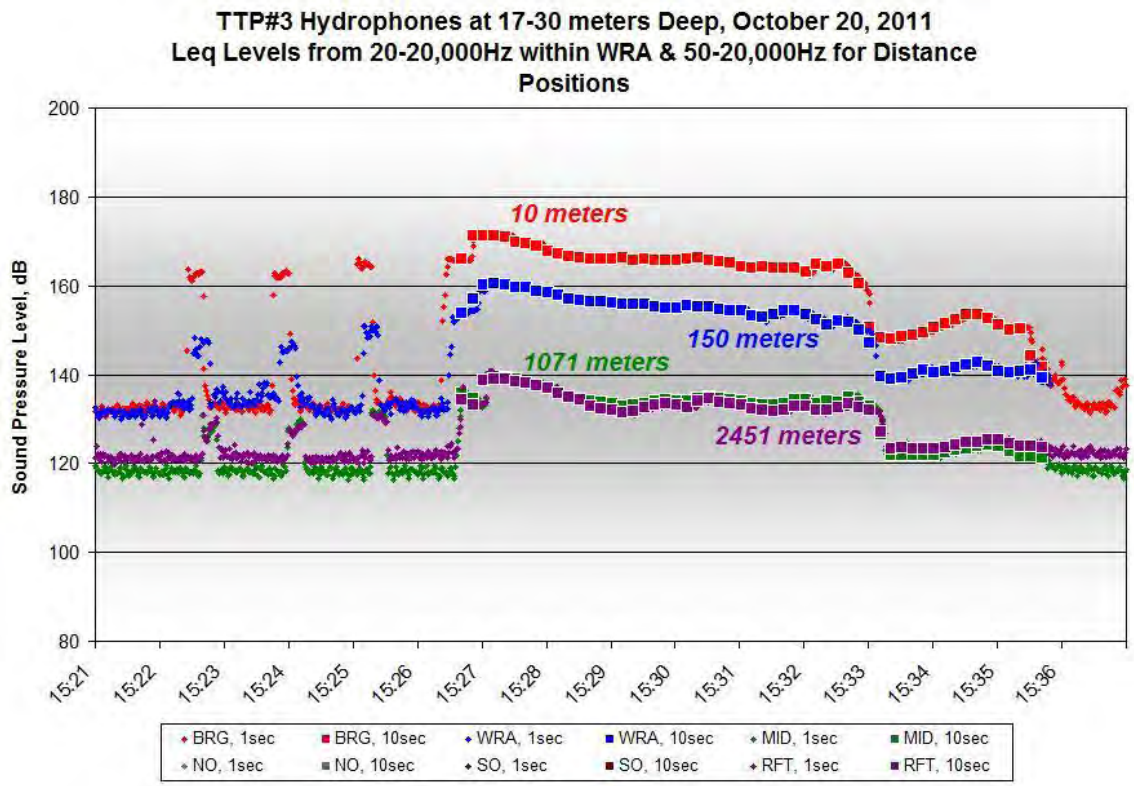

Figure A814. One-second and 10-second Average Data for TTP#3, 15:26-15:36, Measured at Depths of 17-30 meters on October 20, 2011

NO SPECTRA DATA AVAILABLE

Figure A815. Spectral Data Measured at the BRG Location during TTP#3, 15:26-15:36, Measured at Depths of 20 meters on October 20, 2011

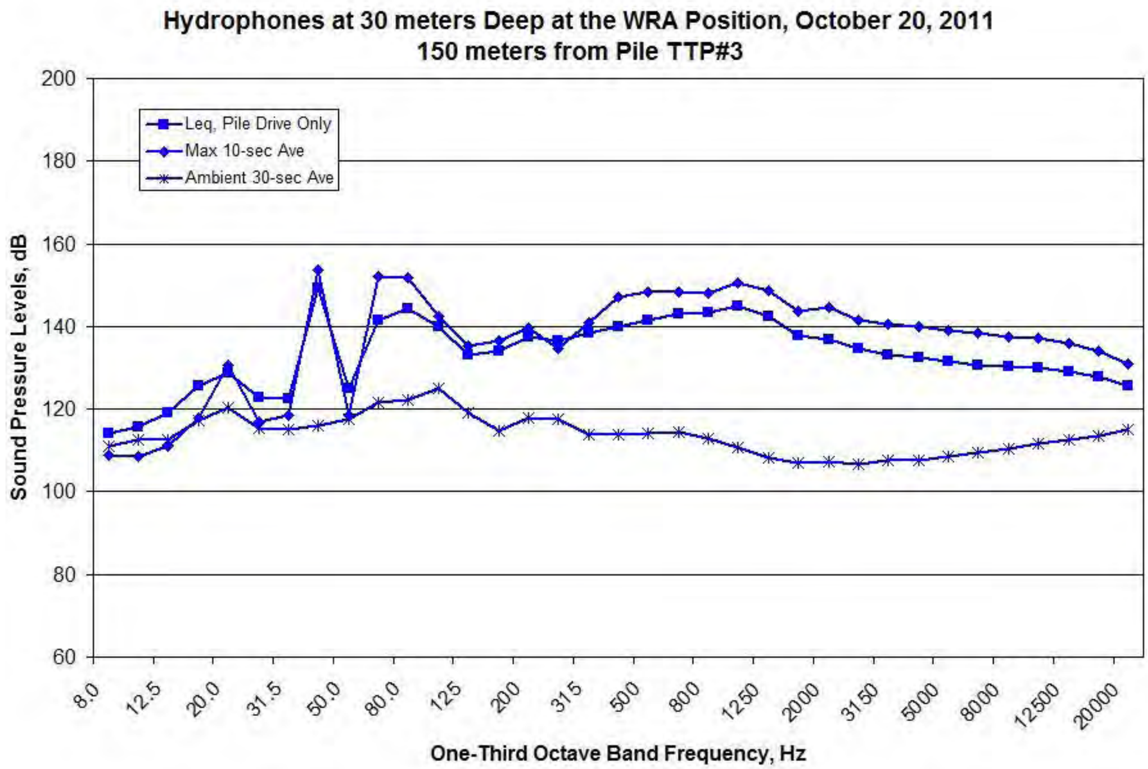

Figure A816. Spectral Data Measured at the WRA Location during TTP#3, 15:26-15:36, Measured at Depths of 30 meters on October 20, 2011

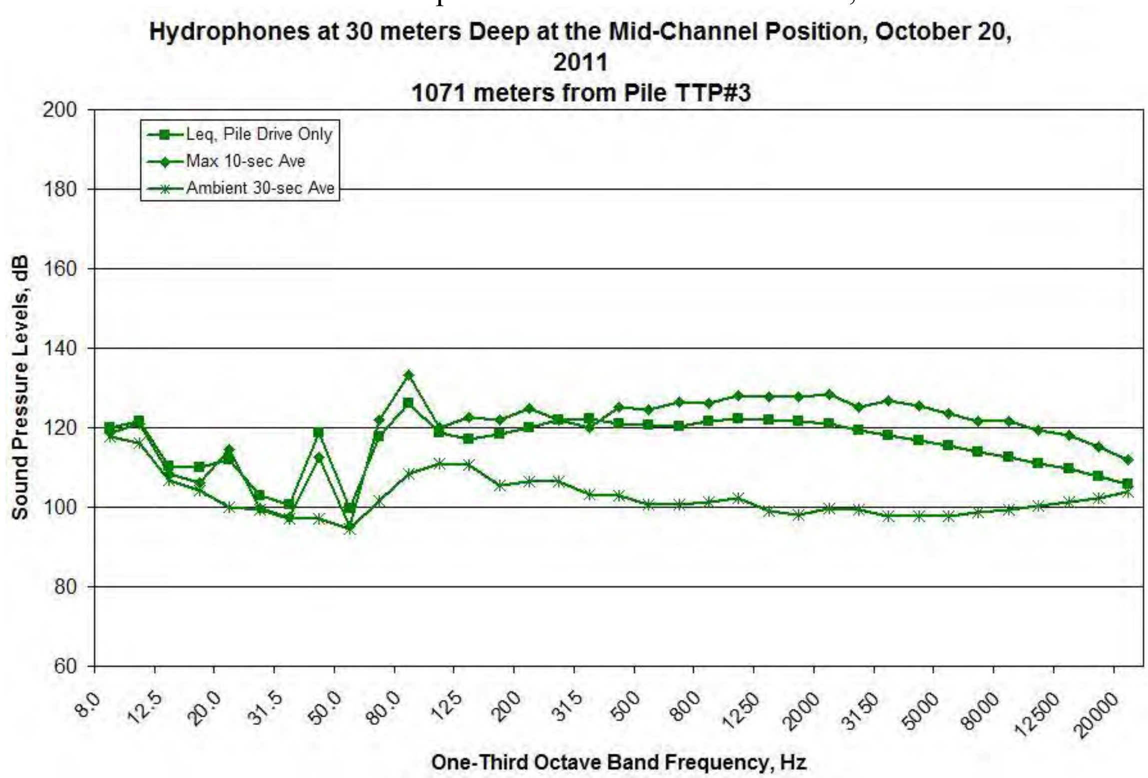

Figure A817. Spectral Data Measured at the MID Location during TTP#3, 15:26-15:36, Measured at Depths of 30 meters on October 20, 2011

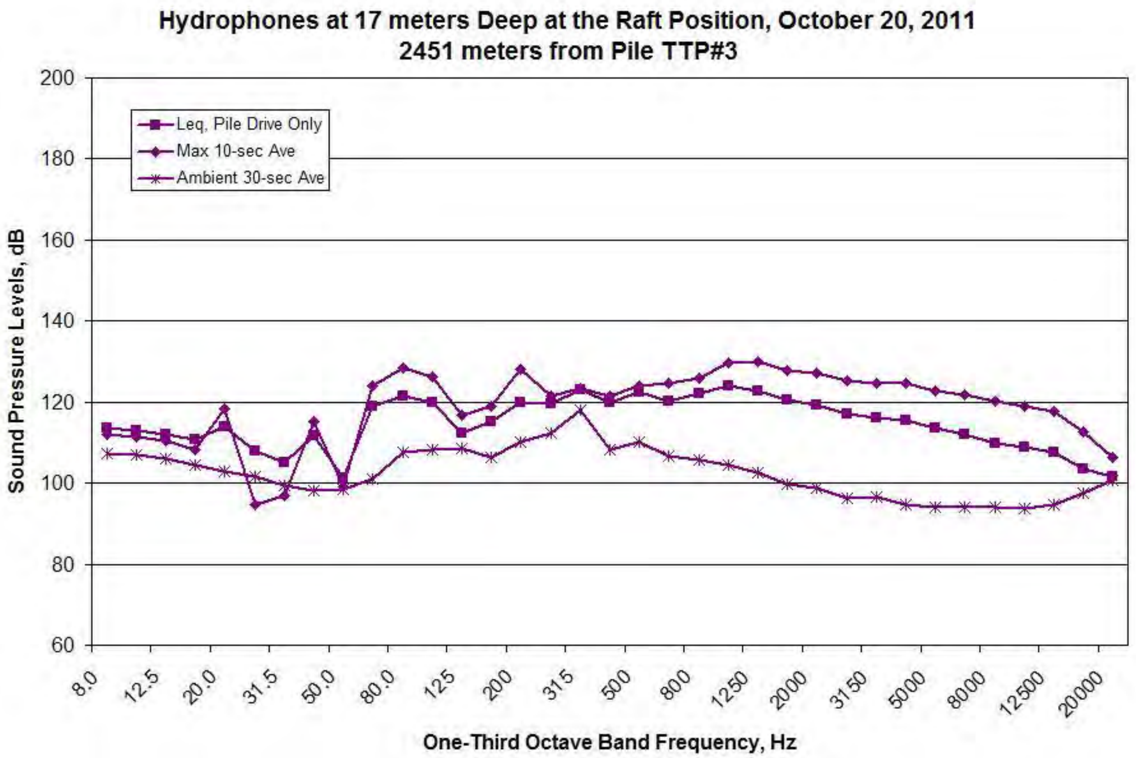

Figure A818. Spectral Data Measured at the RFT Location during TTP#3, 15:26-15:36, Measured at Depths of 17 meters on October 20, 2011

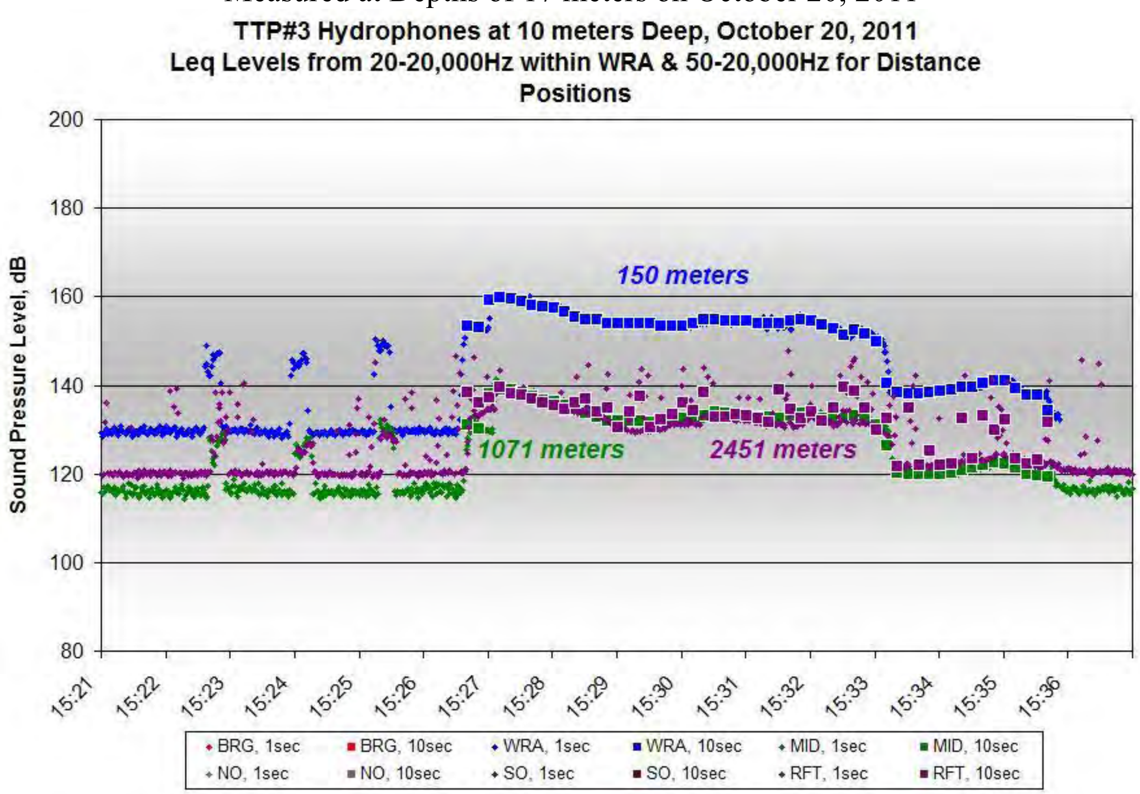

Figure A819. One-second and 10-second Average Data for TTP#3, 15:26-15:36, Measured at Depths of 10 meters on October 20, 2011

NO DATA AVAILABLE DUE TO DAMAGED HYDROPHONE

Figure A820. Spectral Data Measured at the BRG Location during TTP#3, 15:26-15:36, Measured at Depths of 10 meters on October 20, 2011

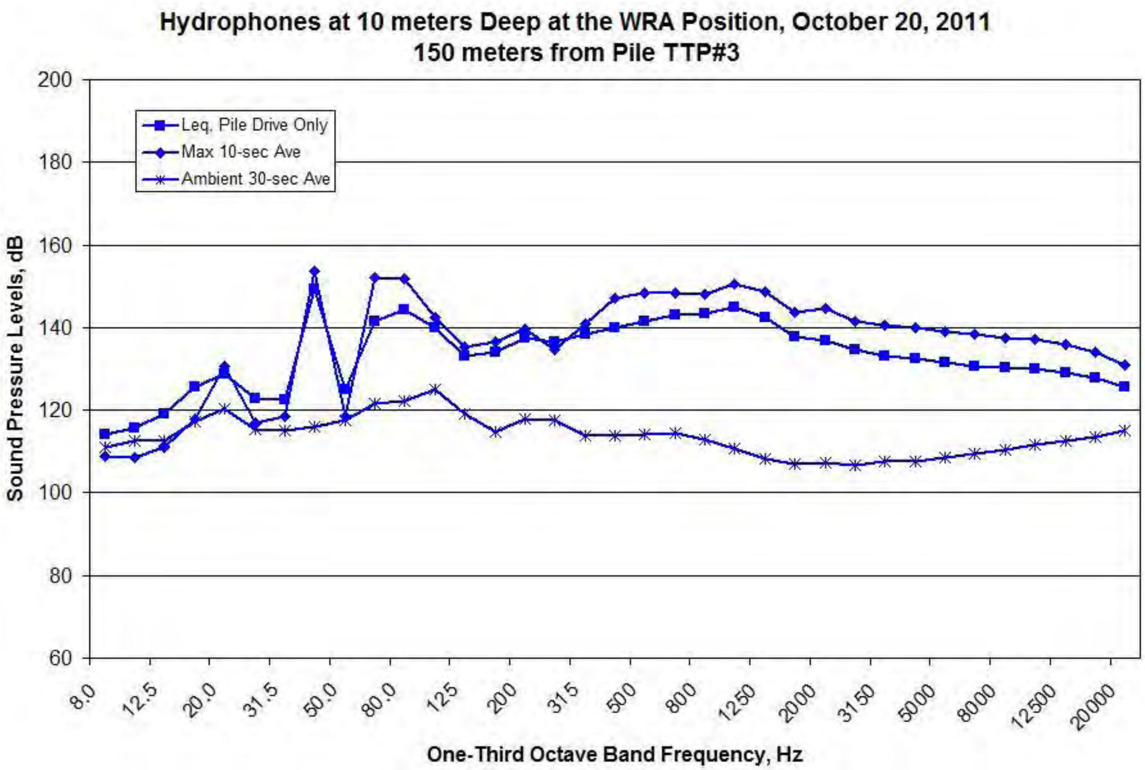

Figure A821. Spectral Data Measured at the WRA Location during TTP#3, 15:26-15:36, Measured at Depths of 10 meters on October 20, 2011

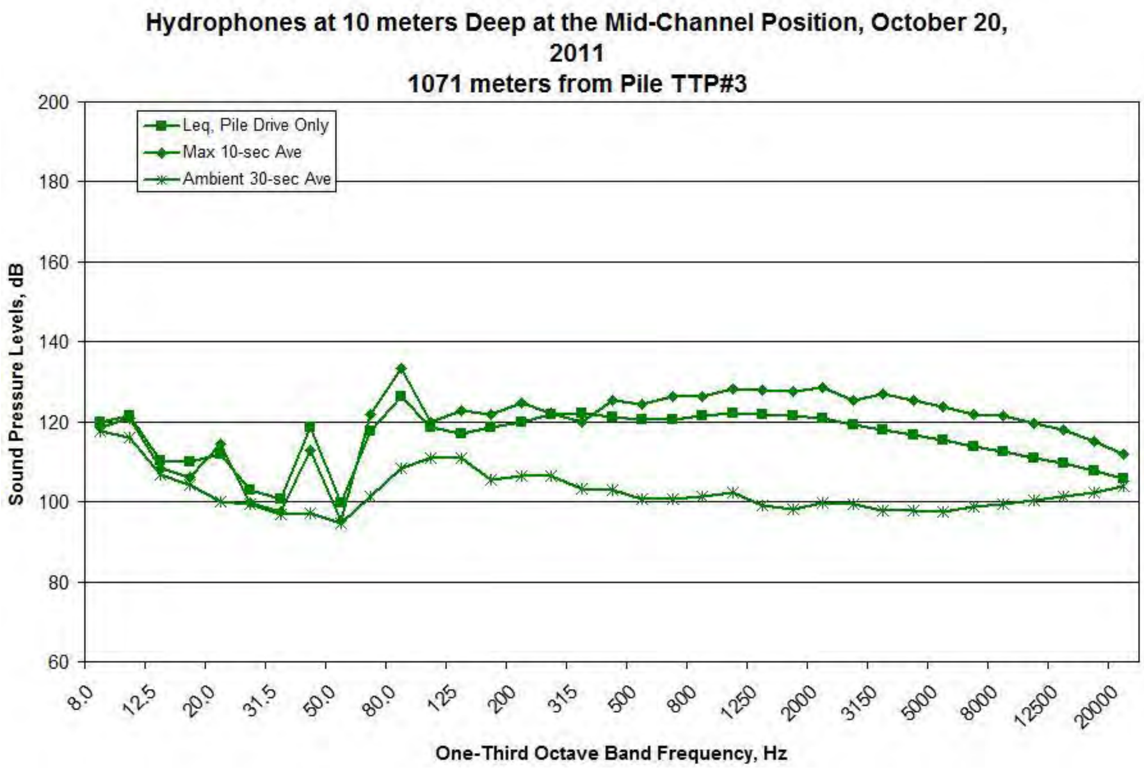

Figure A822. Spectral Data Measured at the MID Location during TTP#3, 15:26-15:36, Measured at Depths of 10 meters on October 20, 2011

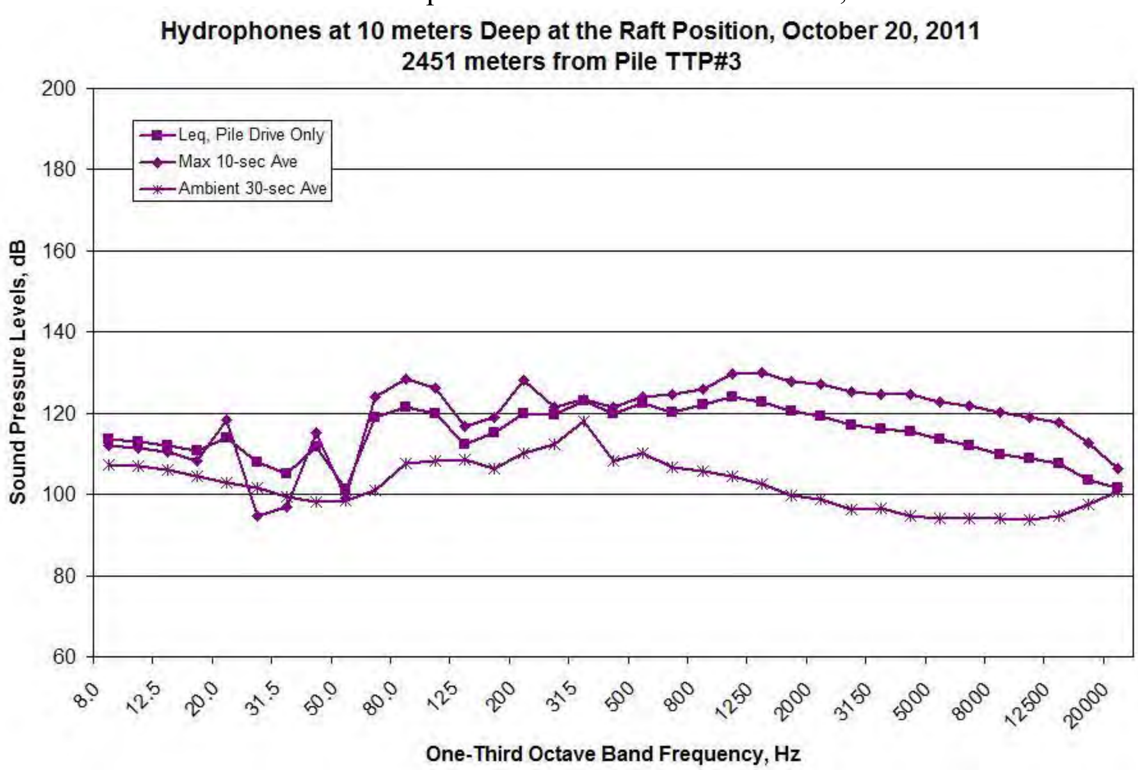

Figure A823. Spectral Data Measured at the RFT Location during TTP#3, 15:26-15:36, Measured at Depths of 10 meters on October 20, 2011

APPENDIX B

IMPACT PILE DRIVING RESULTS

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APPENDIX B – IMPACT PILE DRIVING RESULTS

9/1/2011 – TPP#1

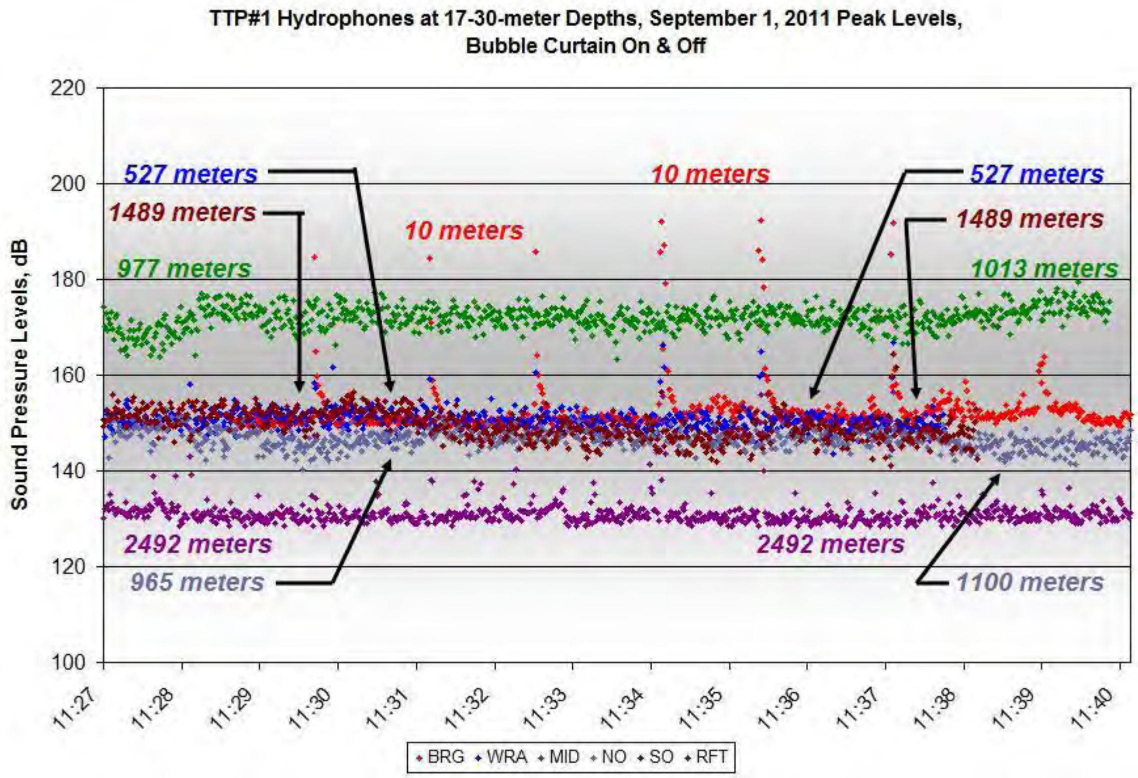

Figure B1. One-second Peak Level Data for TTP#1 during Bubble On and Off Conditions, 11:30-11:37, at Depths of 17-30 meters on September 1, 2011

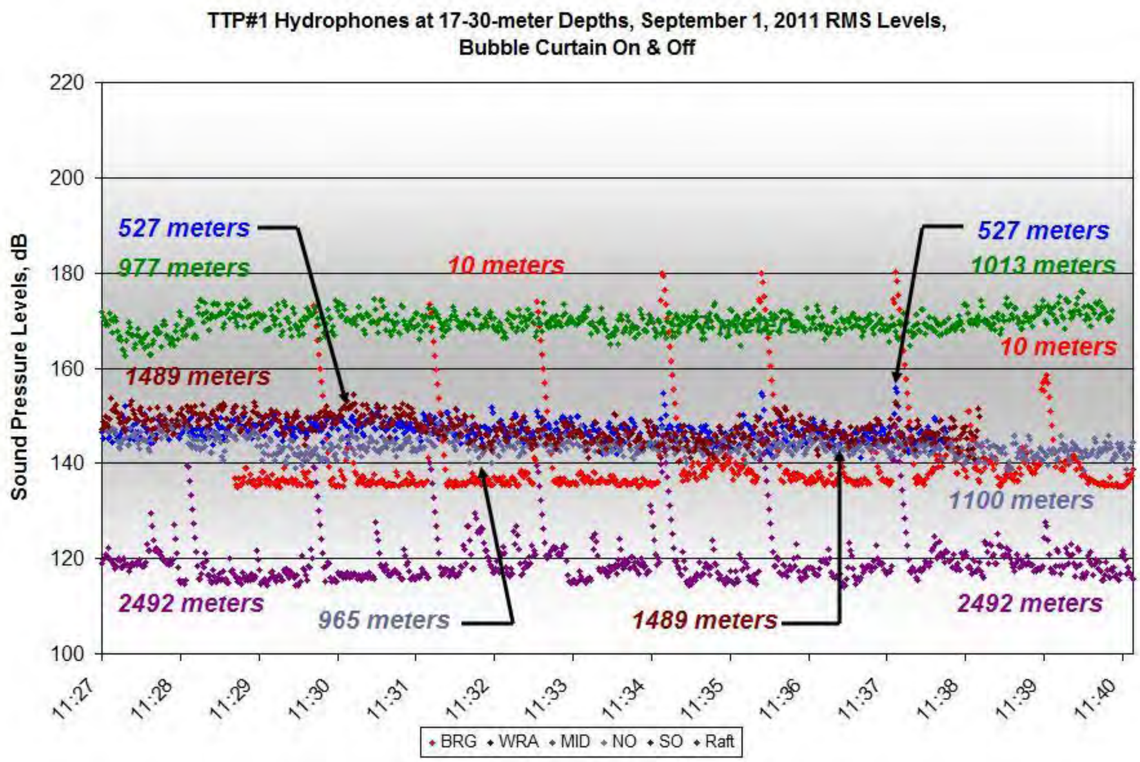

Figure B2. Impulse RMS Data for TTP#1 during Bubble On and Off Conditions, 11:30-11:37, at Depths of 17-30 meters on September 1, 2011

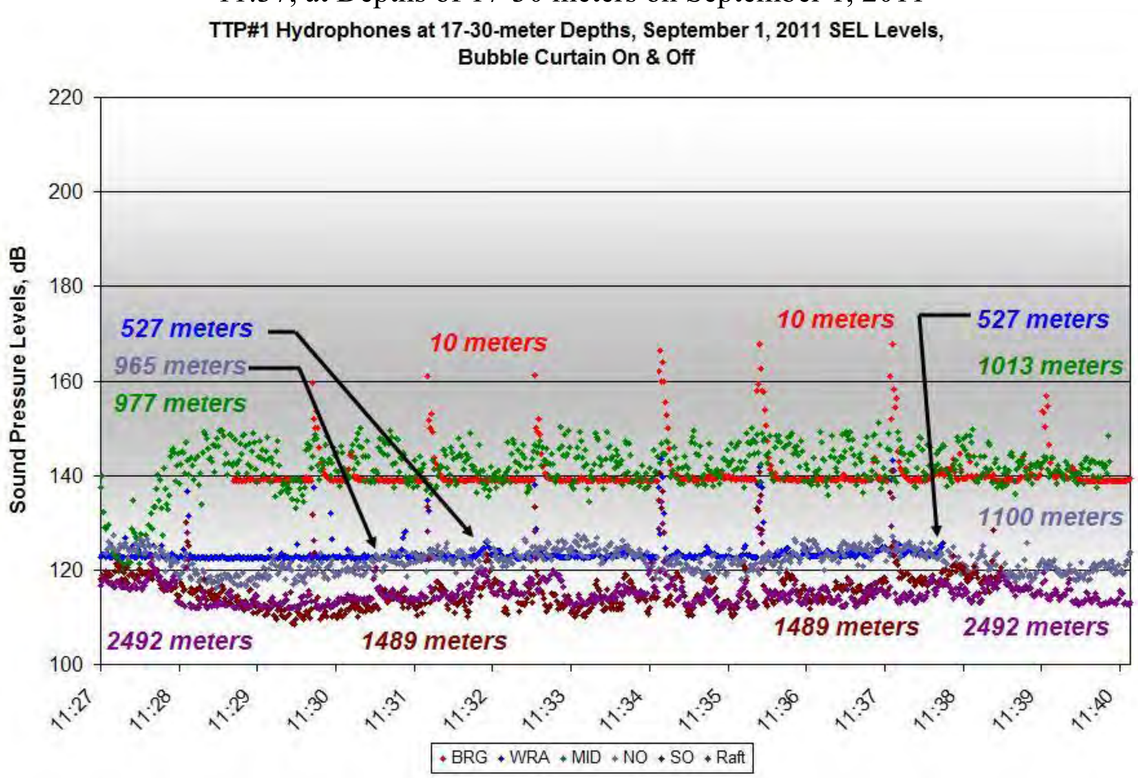

Figure B3. One-second SEL Data for TTP#1 during Bubble On and Off Conditions, 11:30-11:37, at Depths of 17-30 meters on September 1, 2011

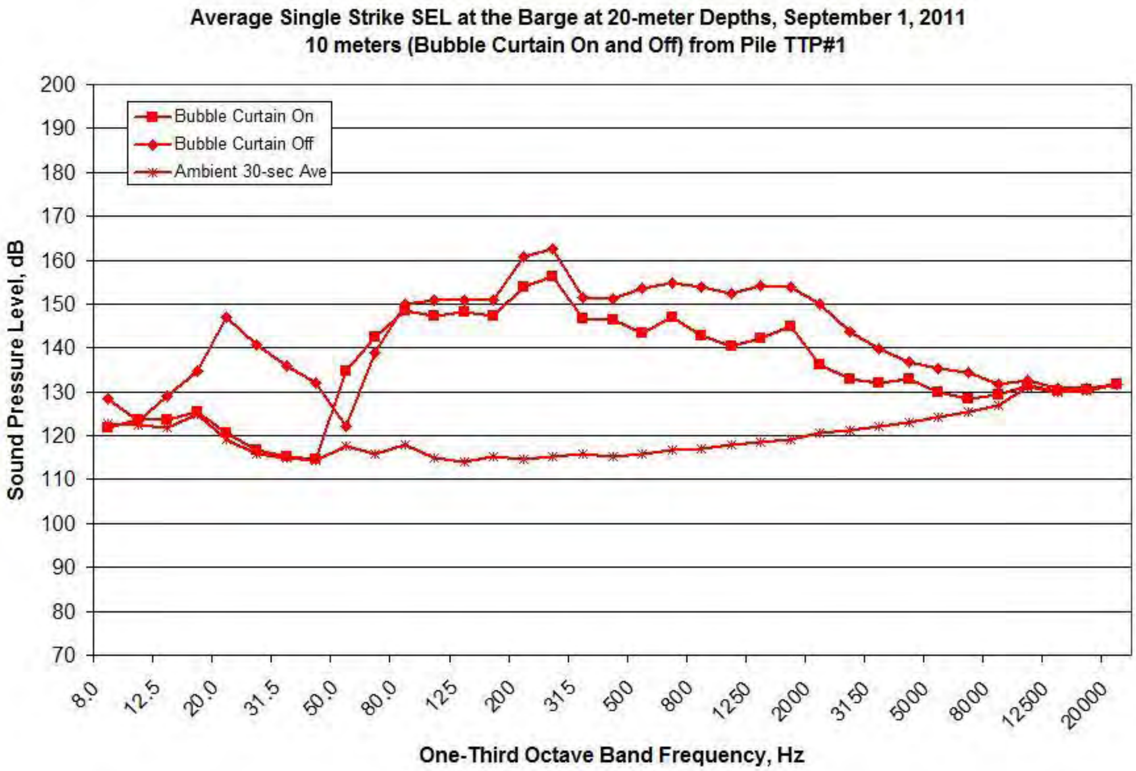

Figure B4. Average One-second SEL Spectral Data Measured at the BRG Location during TTP#1, 11:30-11:37, Depths of 20 meters on September 1, 2011

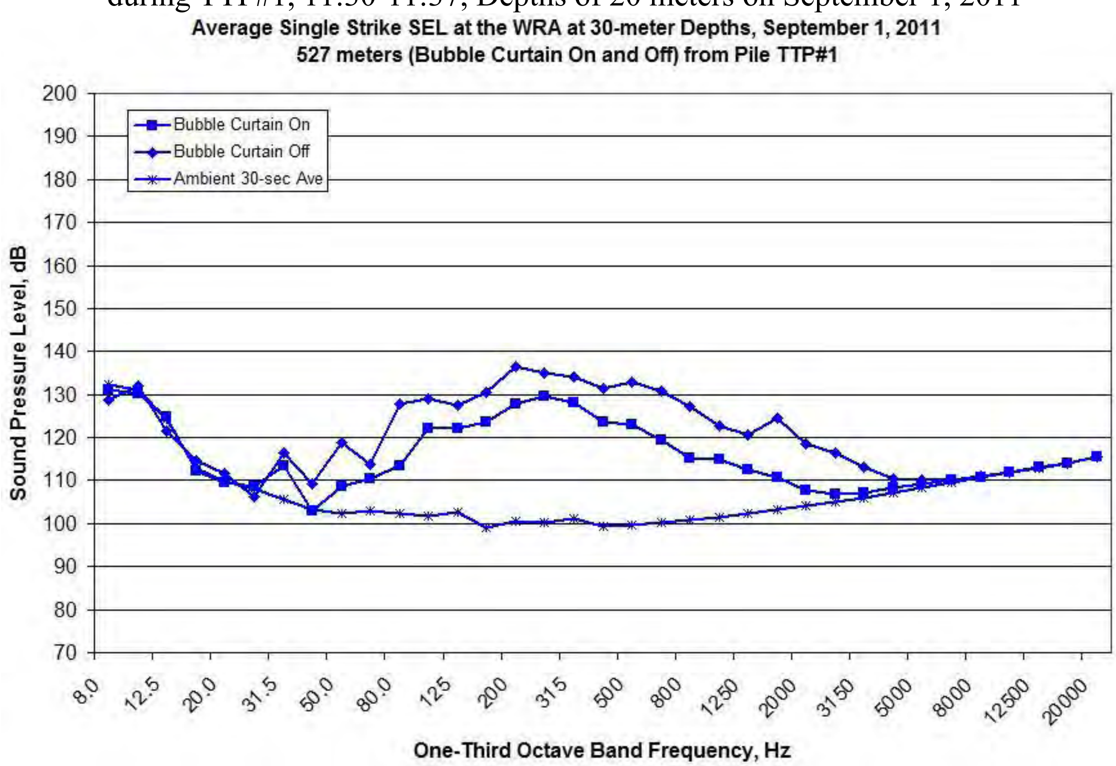

Figure B5. Average One-second SEL Spectral Data Measured at the WRA Location during TTP#1, 11:30-11:37, Depths of 30 meters on September 1, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B6. Average One-second SEL Spectral Data Measured at the MID Location during TTP#1, 11:30-11:37, Depths of 30 meters on September 1, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B7. Average One-second SEL Spectral Data Measured at the NO Location during TTP#1, 11:30-11:37, Depths of 30 meters on September 1, 2011

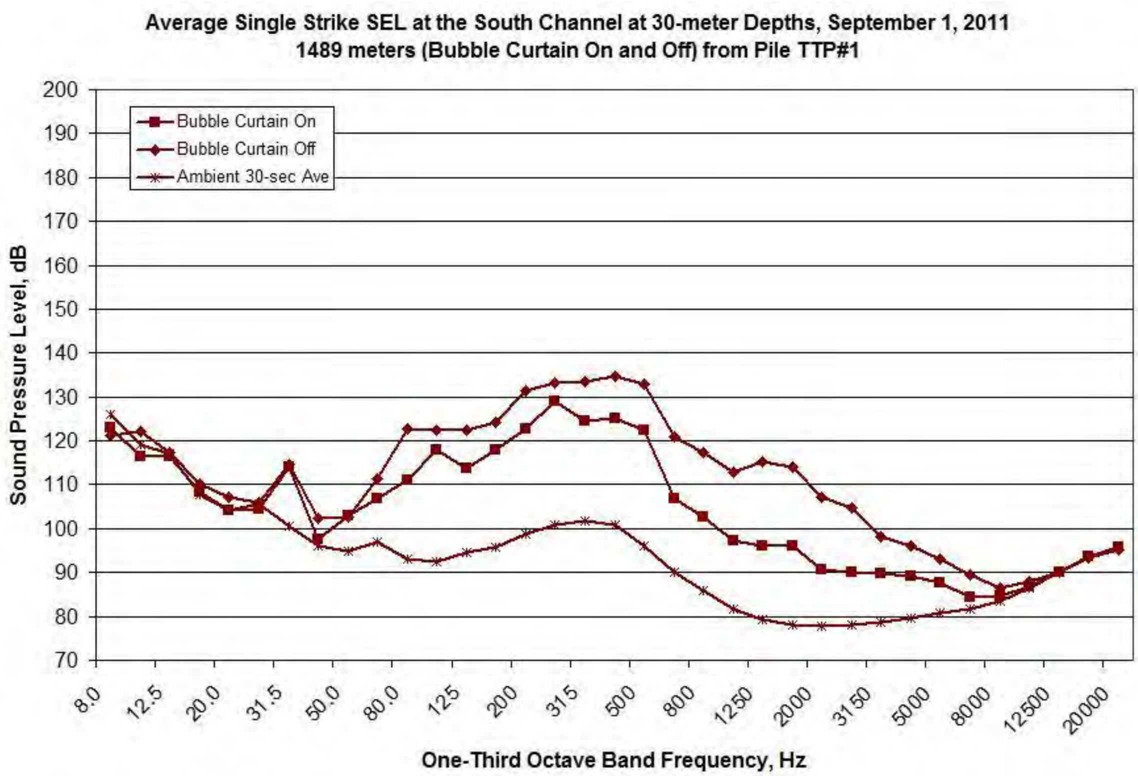

Figure B8. Average One-second SEL Spectral Data Measured at the SO Location during TTP#1, 11:30-11:37, Depths of 30 meters on September 1, 2011

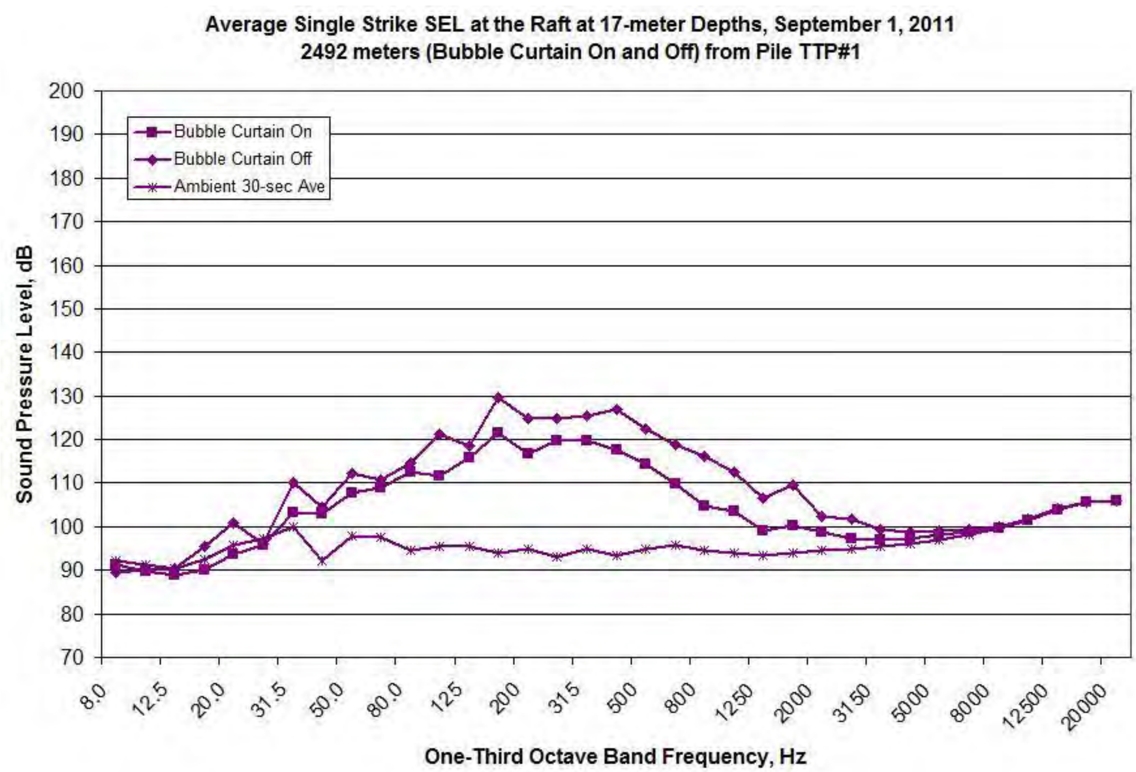

Figure B9. Average One-second SEL Spectral Data Measured at the RFT Location during TTP#1, 11:30-11:37, Depths of 17 meters on September 1, 2011

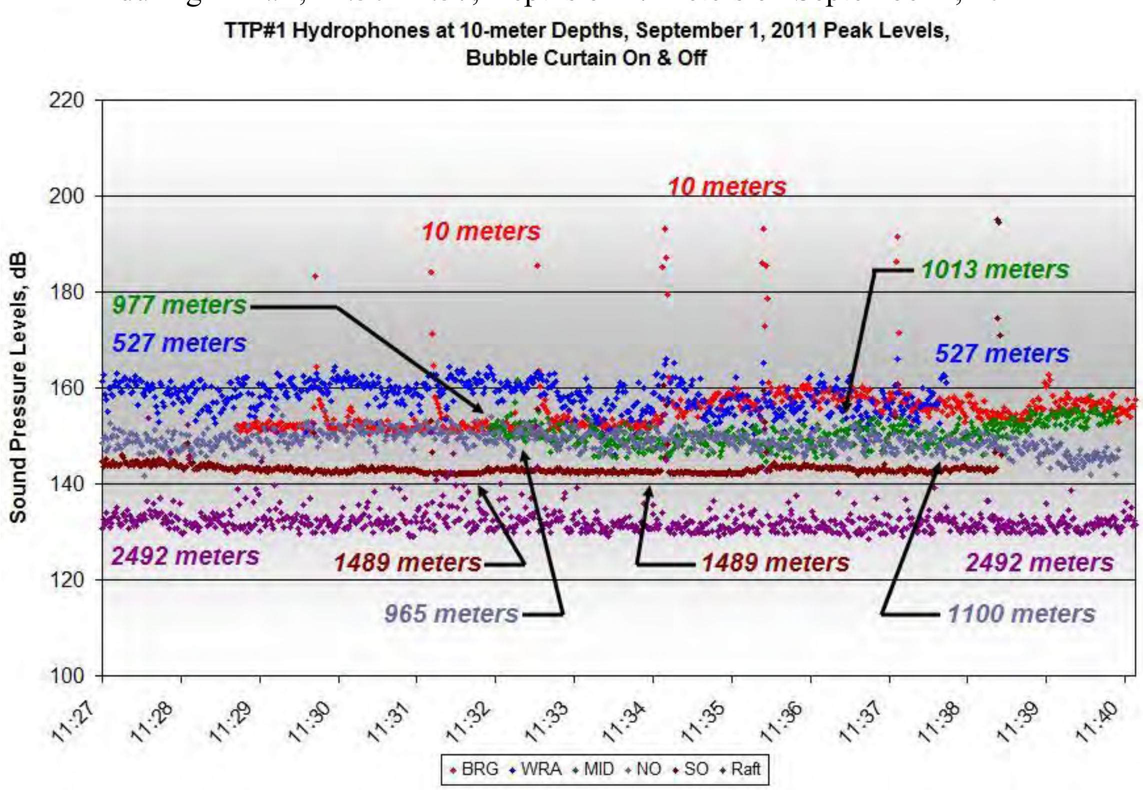

Figure B10. One-second Peak Level Data for TTP#1 during Bubble On and Off Conditions, 11:30-11:37, at Depths of 10 meters on September 1, 2011

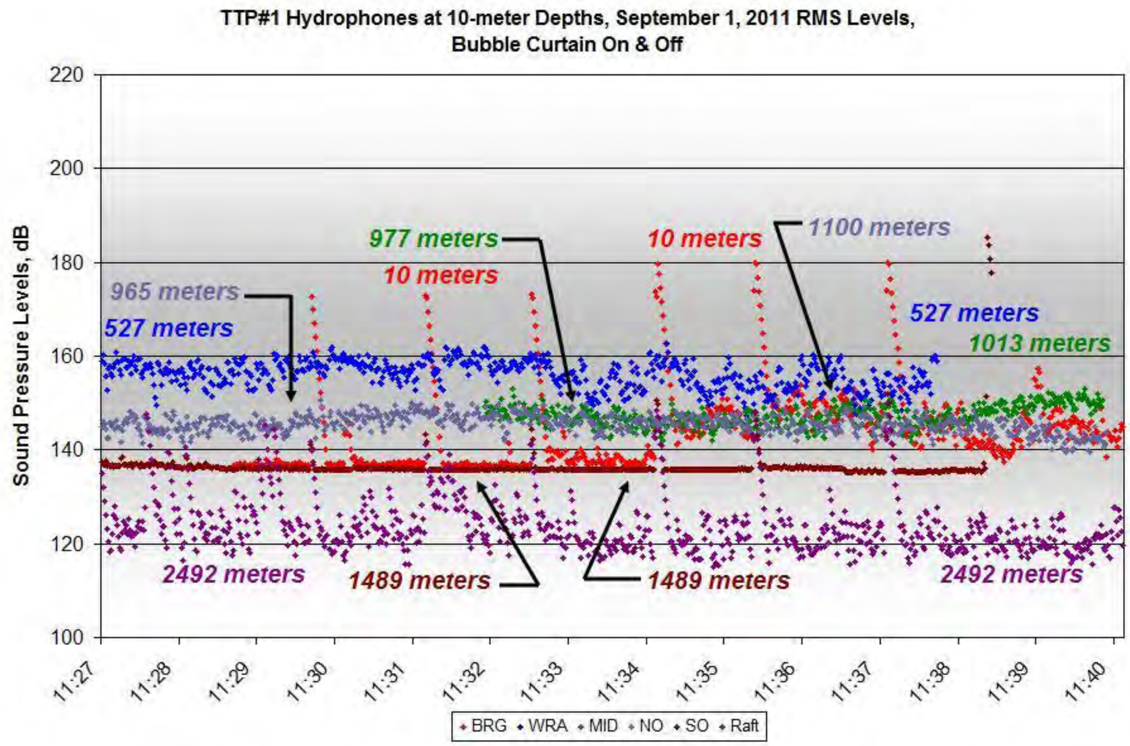

Figure B11. Impulse RMS Data for TTP#1 during Bubble On and Off Conditions, 11:30-11:37, at Depths of 10 meters on September 1, 2011

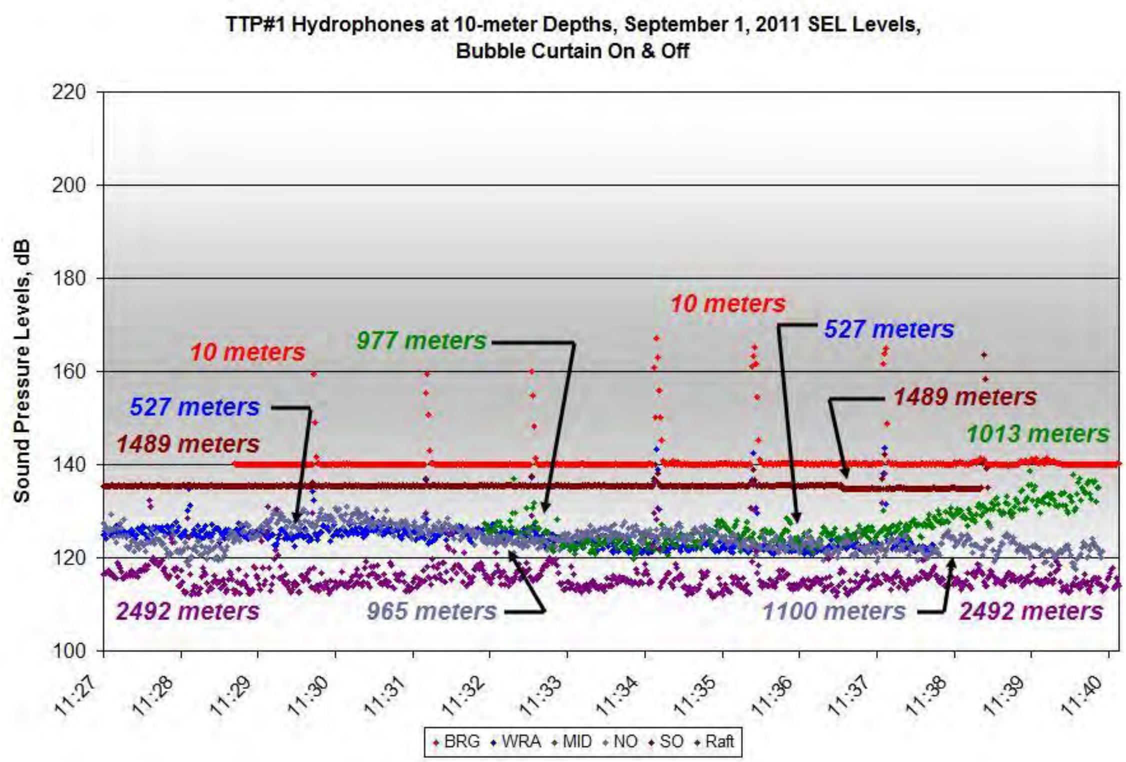

Figure B12. One-second SEL Data for TTP#1 during Bubble On and Off Conditions, 11:30-11:37, at Depths of 10 meters on September 1, 2011

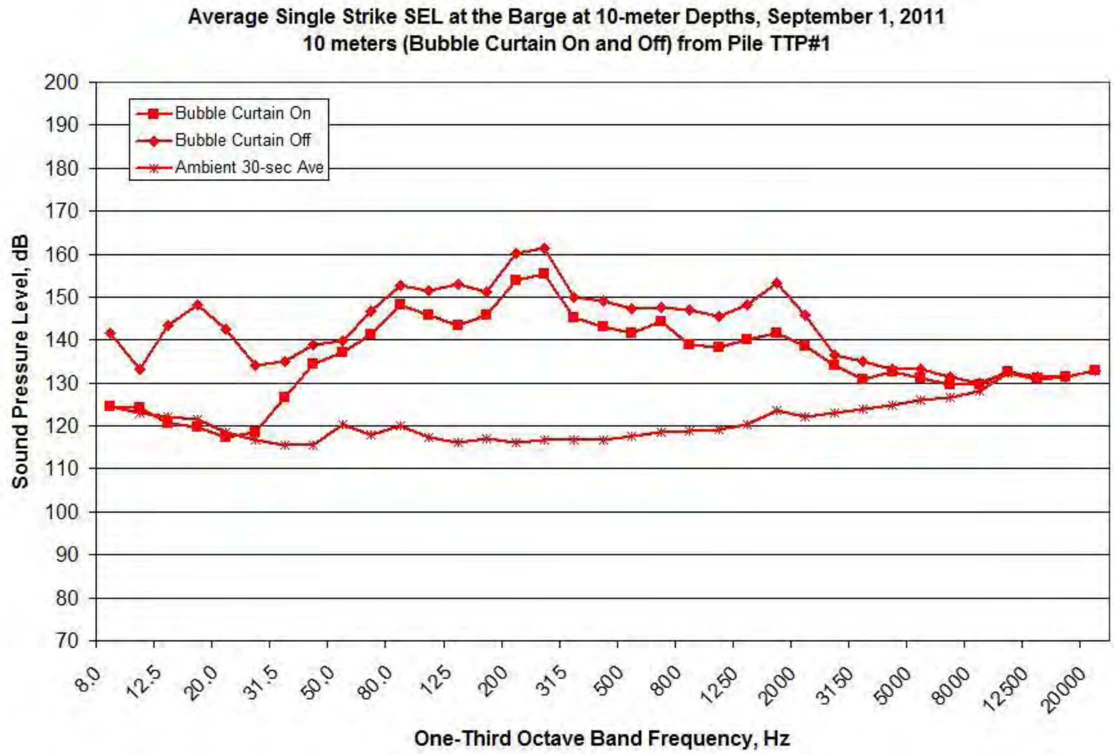

Figure B13. Average One-second SEL Spectral Data Measured at the BRG Location during TTP#1, 11:30-11:37, Depths of 10 meters on September 1, 2011

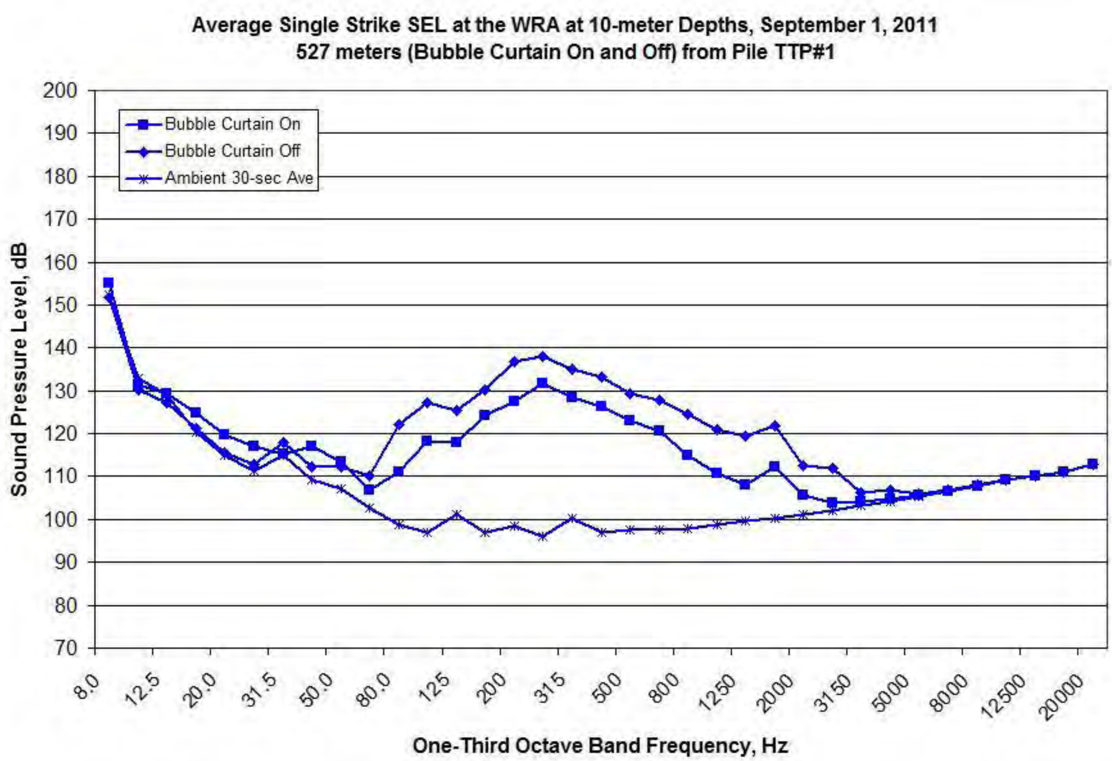

Figure B14. Average One-second SEL Spectral Data Measured at the WRA Location during TTP#1, 11:30-11:37, Depths of 10 meters on September 1, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B15. Average One-second SEL Spectral Data Measured at the MID Location during TTP#1, 11:30-11:37, Depths of 10 meters on September 1, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B16. Average One-second SEL Spectral Data Measured at the NO Location during TTP#1, 11:30-11:37, Depths of 10 meters on September 1, 2011

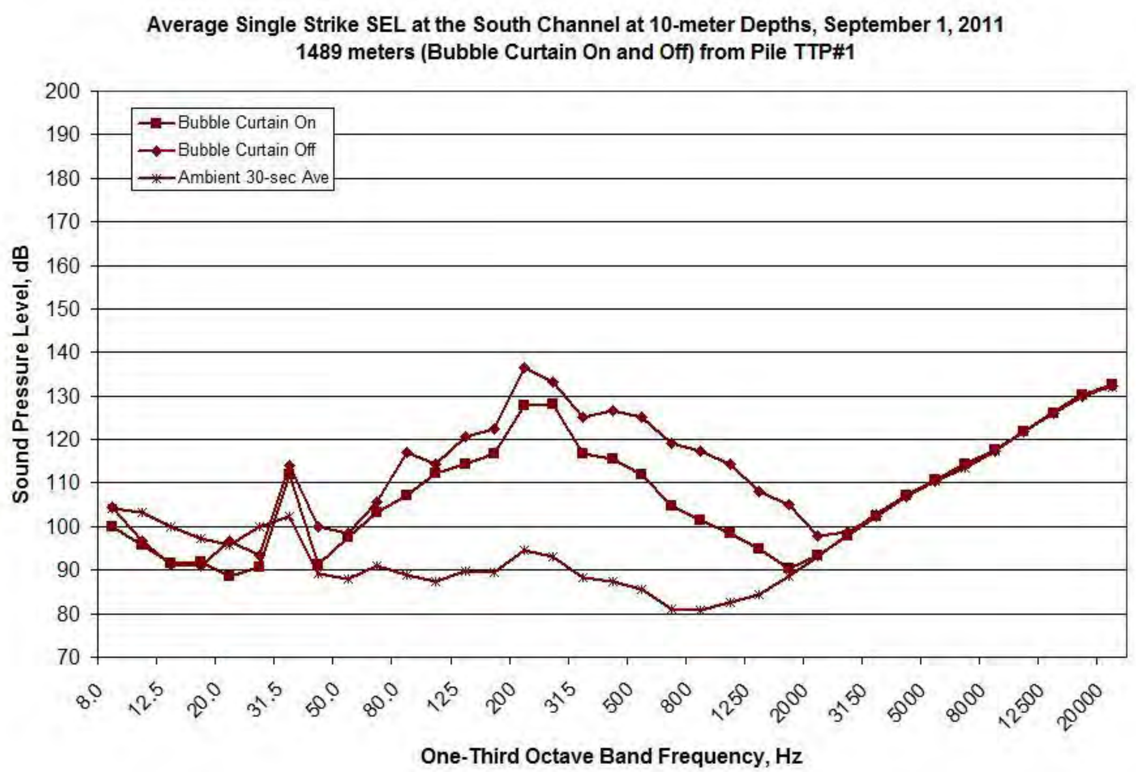

Figure B17. Average One-second SEL Spectral Data Measured at the SO Location during TTP#1, 11:30-11:37, Depths of 10 meters on September 1, 2011

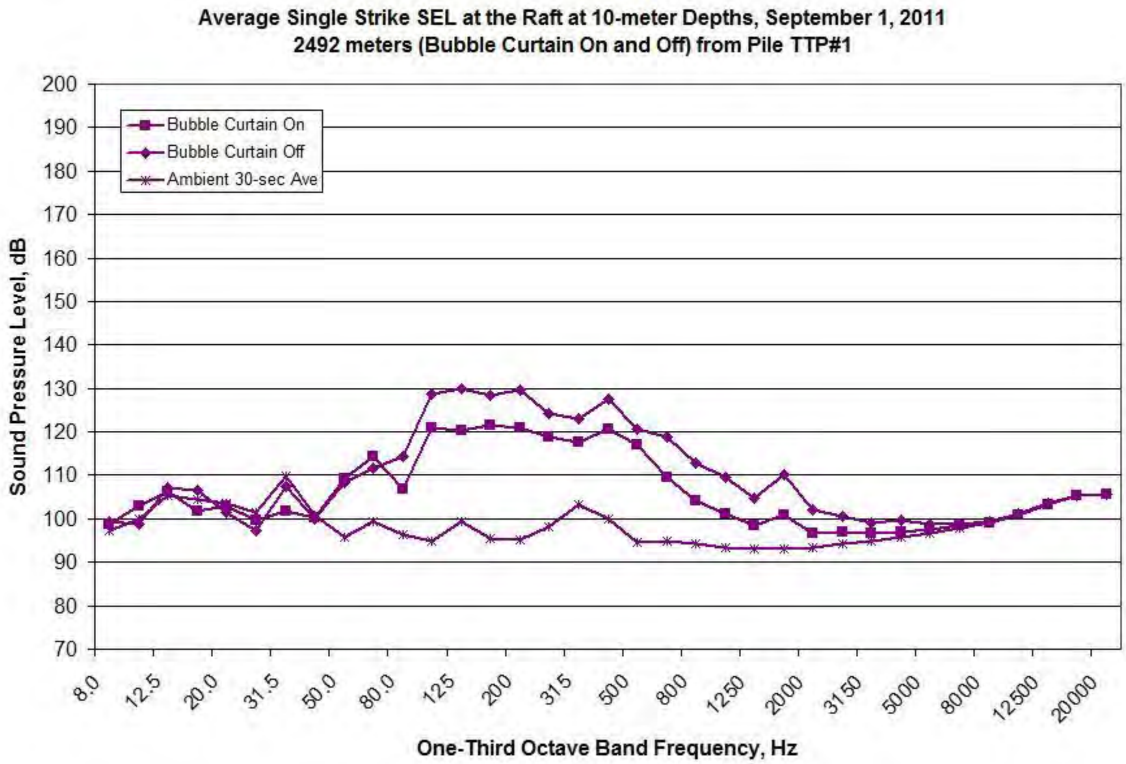

Figure B18. Average One-second SEL Spectral Data Measured at the RFT Location during TTP#1, 11:30-11:37, Depths of 10 meters on September 1, 2011

TTP#2

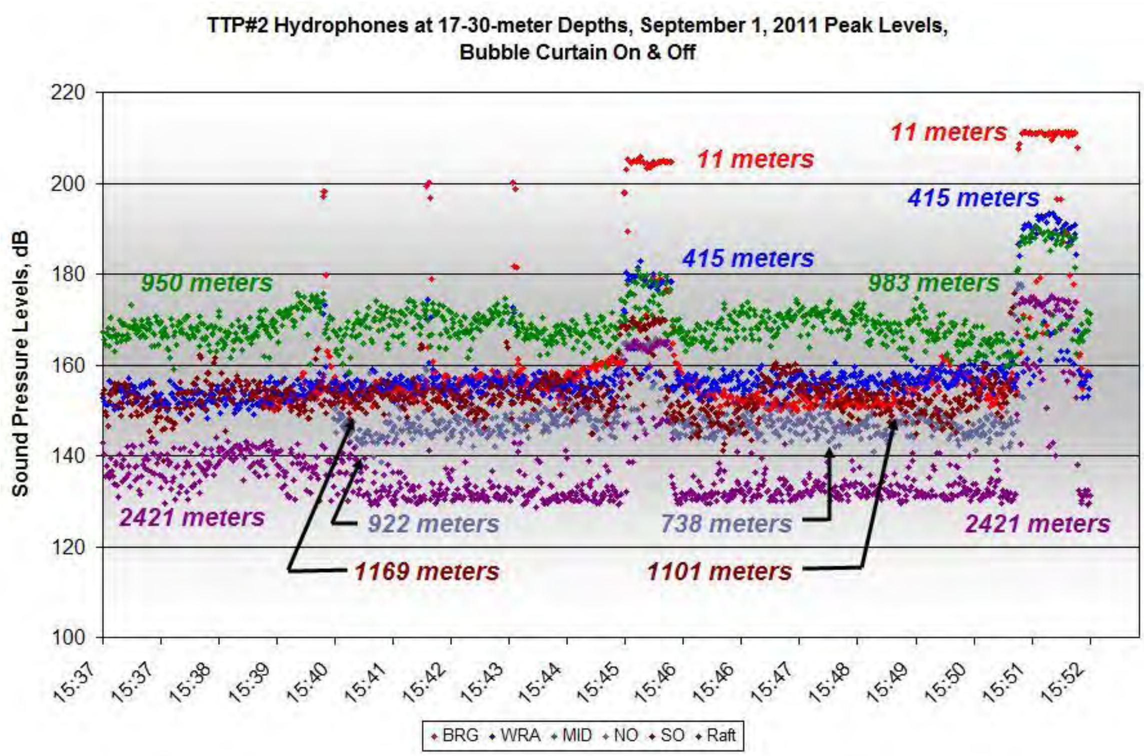

Figure B19. One-second Peak Level Data for TTP#2 during Bubble On and Off Conditions, 15:40-15:52, at Depths of 17-30 meters on September 1, 2011

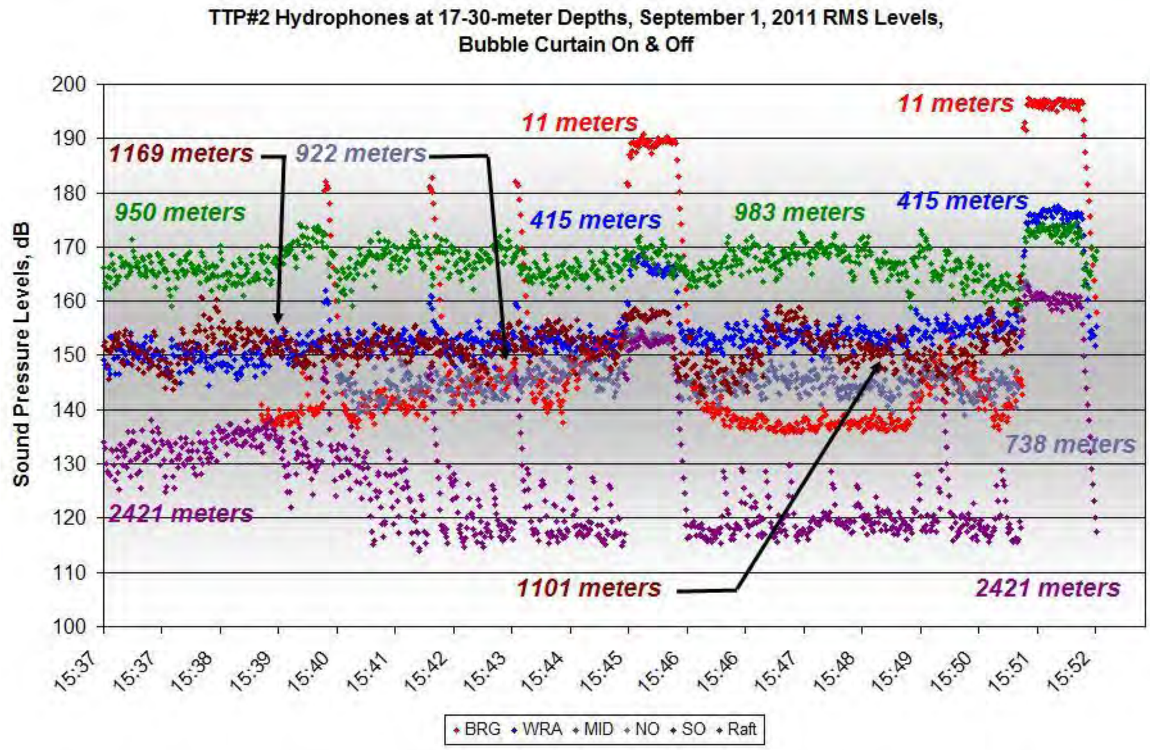

Figure B20. Impulse RMS Data for TTP#2 during Bubble On and Off Conditions, 15:40-15:52, at Depths of 17-30 meters on September 1, 2011

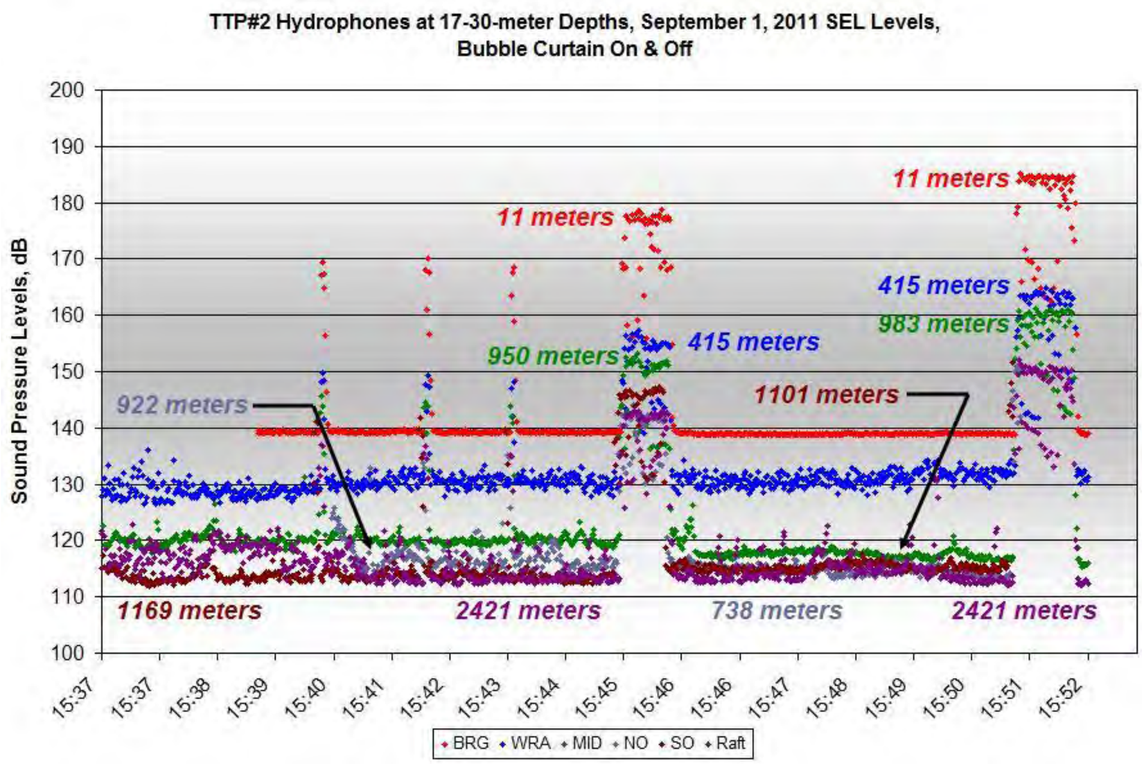

Figure B21. One-second SEL Data for TTP#2 during Bubble On and Off Conditions, 15:40-15:52, at Depths of 17-30 meters on September 1, 2011

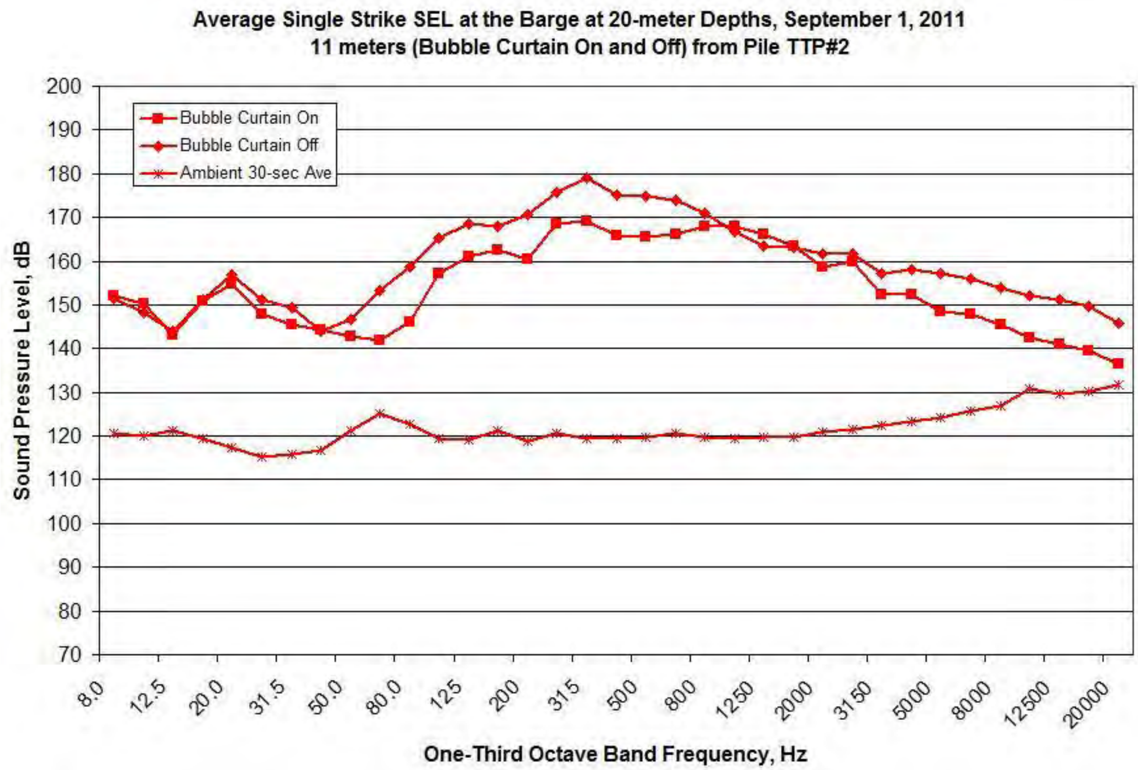

Figure B22. Average One-second SEL Spectral Data Measured at the BRG Location during TTP#2, 15:40-15:52, Depths of 20 meters on September 1, 2011

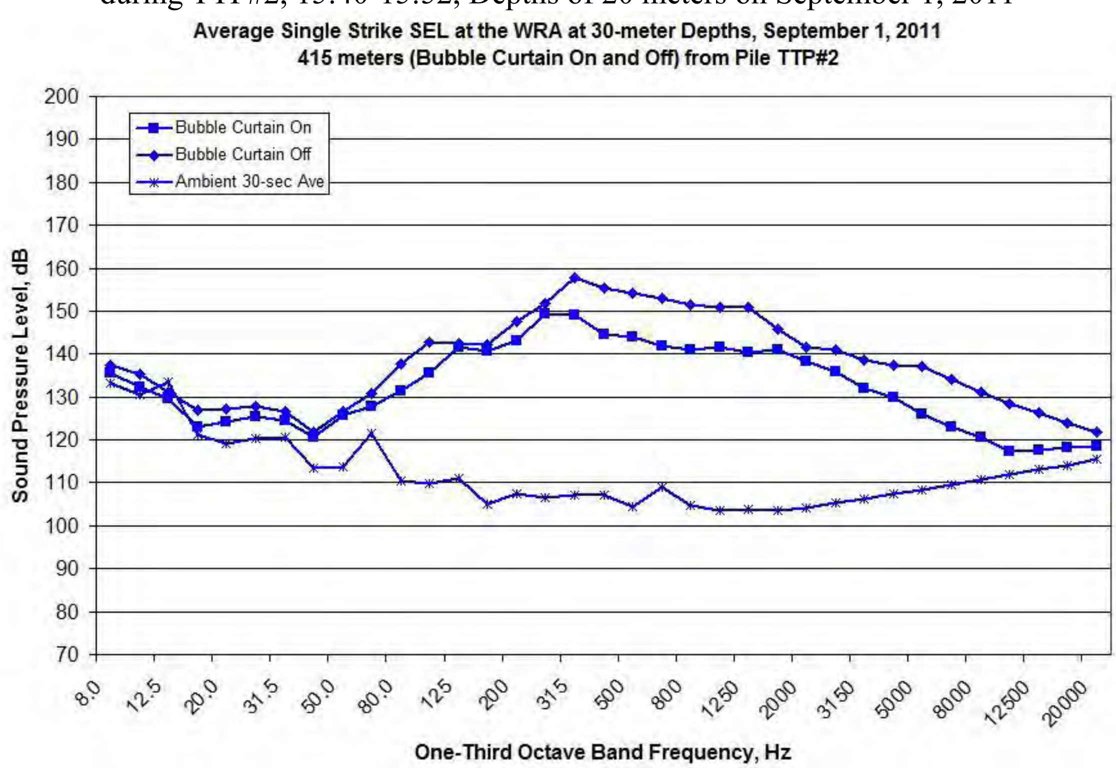

Figure B23. Average One-second SEL Spectral Data Measured at the WRA Location during TTP#2, 15:40-15:52, Depths of 30 meters on September 1, 2011

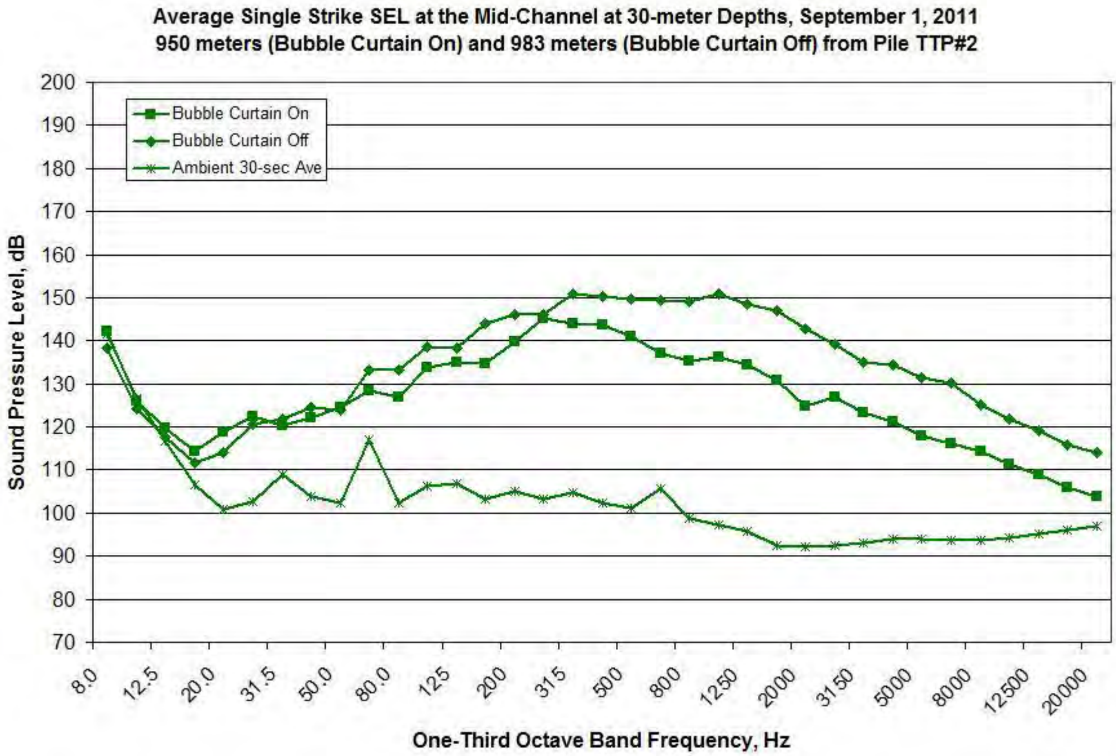

Figure B24. Average One-second SEL Spectral Data Measured at the MID Location during TTP#2, 15:40-15:52, Depths of 30 meters on September 1, 2011

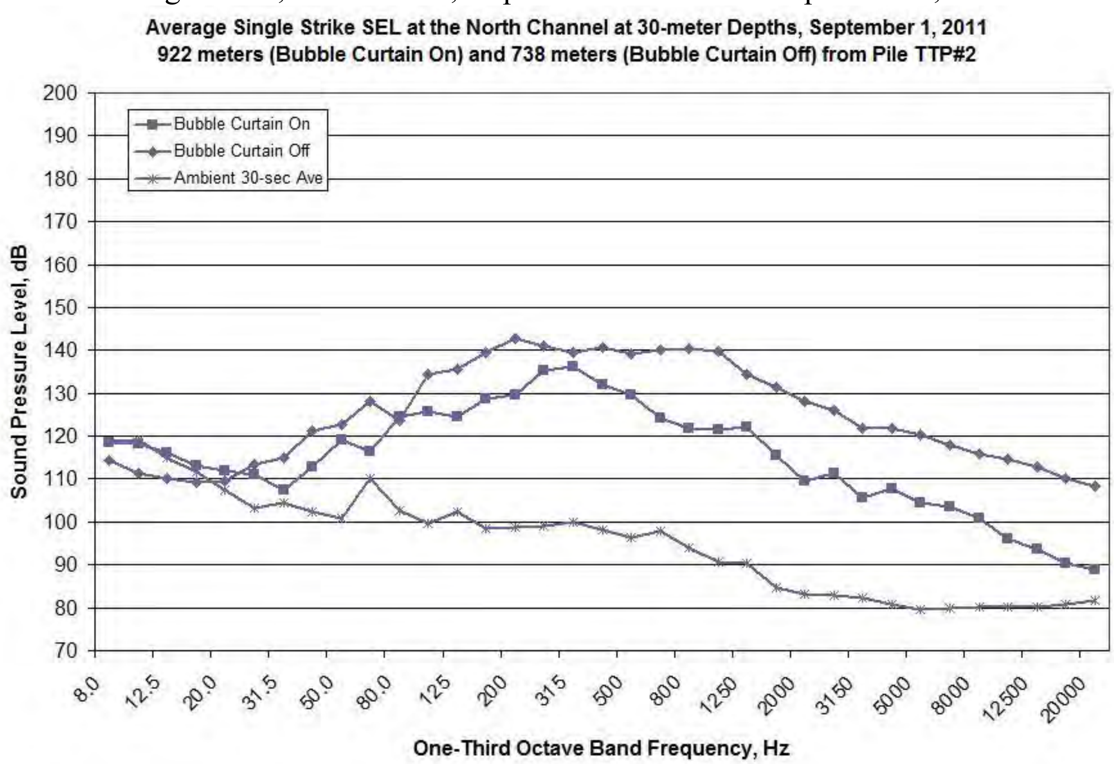

Figure B25. Average One-second SEL Spectral Data Measured at the NO Location during TTP#2, 15:40-15:52, Depths of 30 meters on September 1, 2011

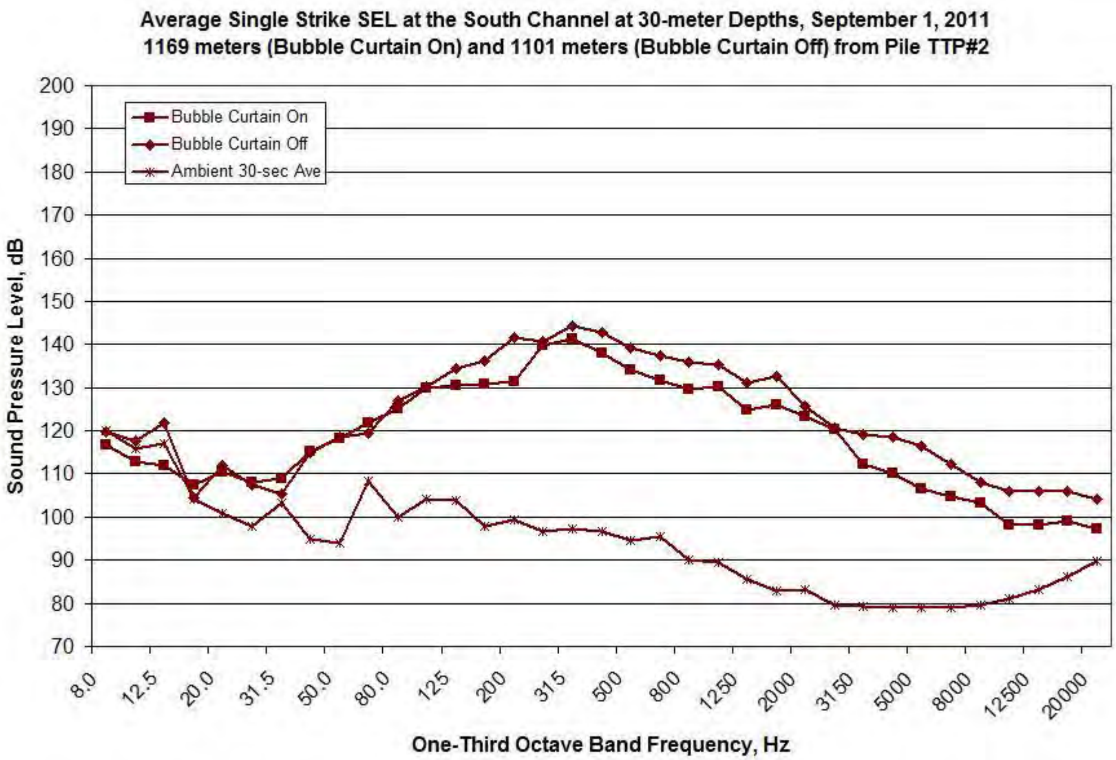

Figure B26. Average One-second SEL Spectral Data Measured at the SO Location during TTP#2, 15:40-15:52, Depths of 30 meters on September 1, 2011

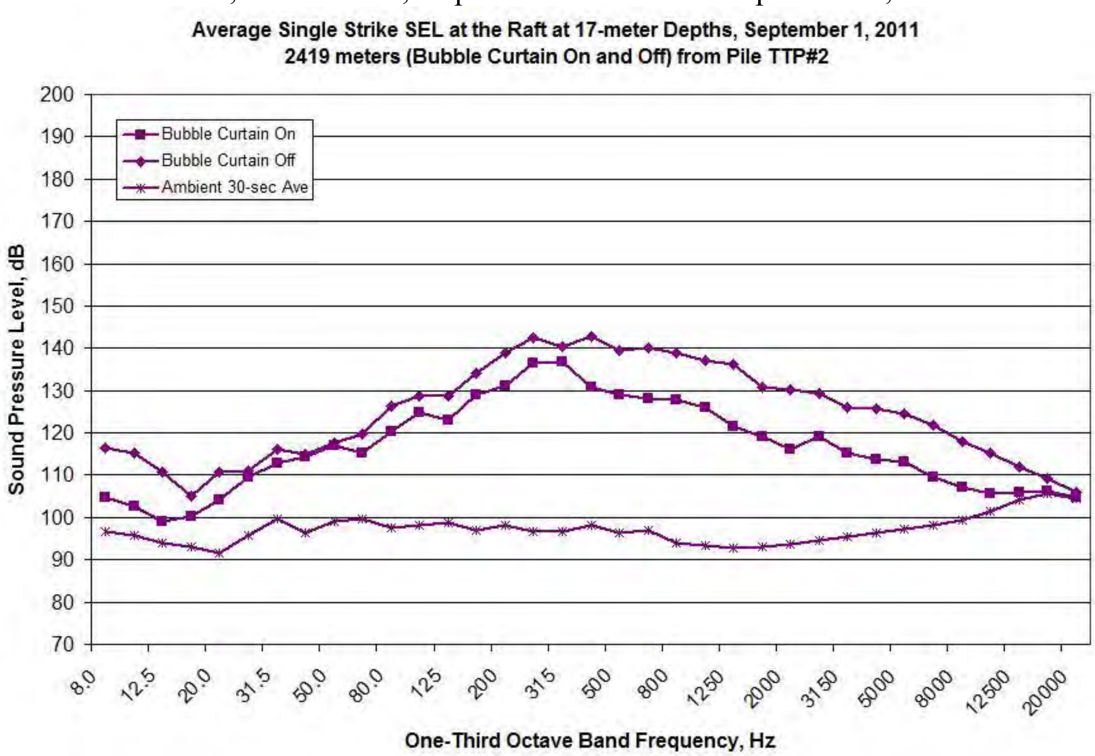

Figure B27. Average One-second SEL Spectral Data Measured at the RFT Location during TTP#2, 15:40-15:52, Depths of 17 meters on September 1, 2011

9/10/2011 – TP#7

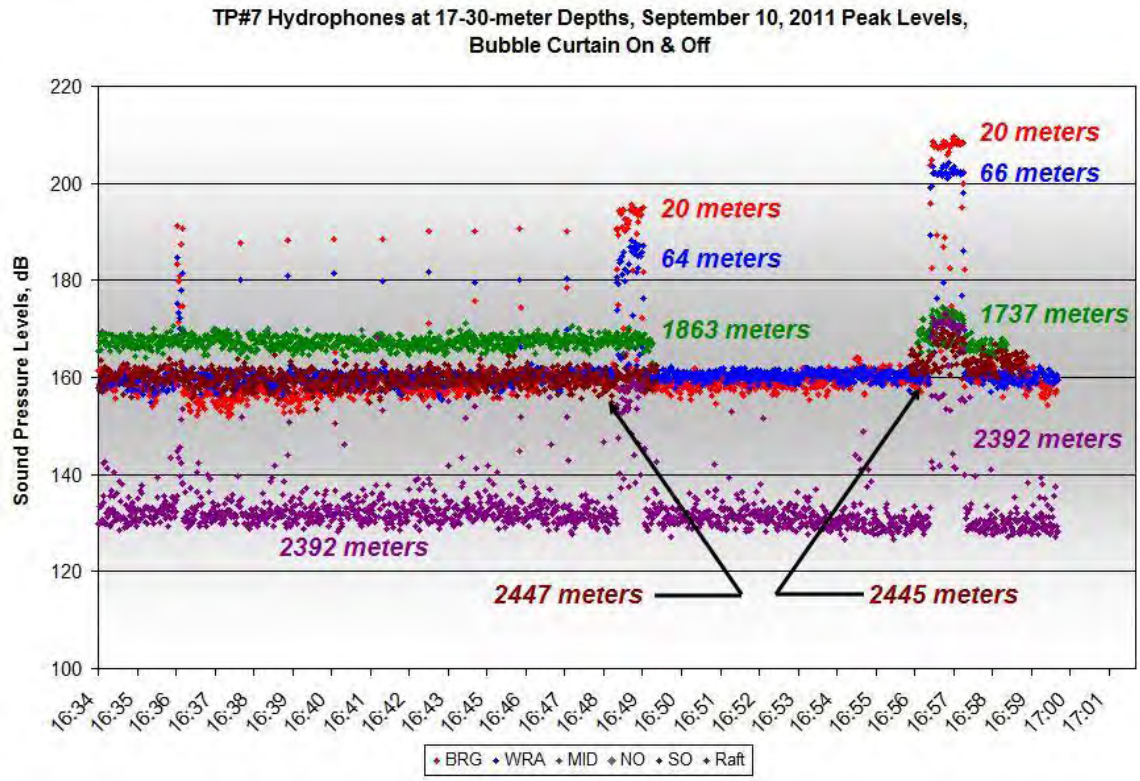

Figure B28. One-second Peak Level Data for TP#7 during Bubble On and Off Conditions, 16:37-16:57, at Depths of 17-30 meters on September 10, 2011

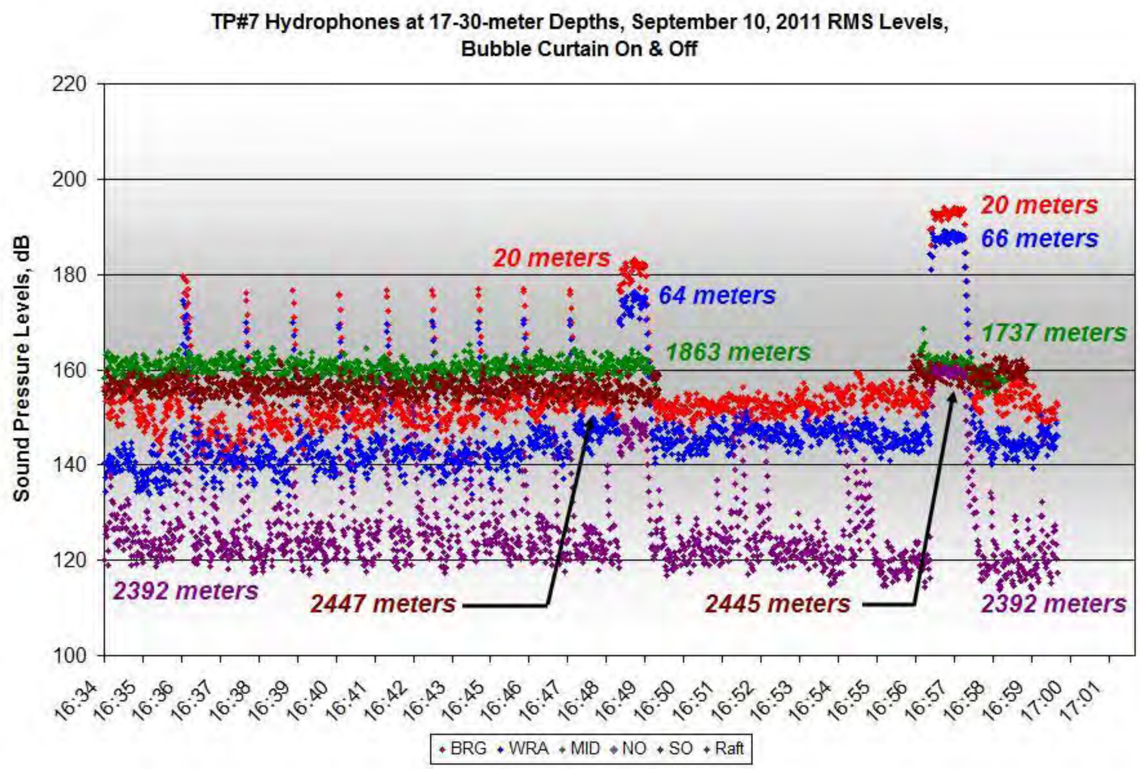

Figure B20. Impulse RMS Data for TP#7 during Bubble On and Off Conditions, 16:37-16:57, at Depths of 17-30 meters on September 10, 2011

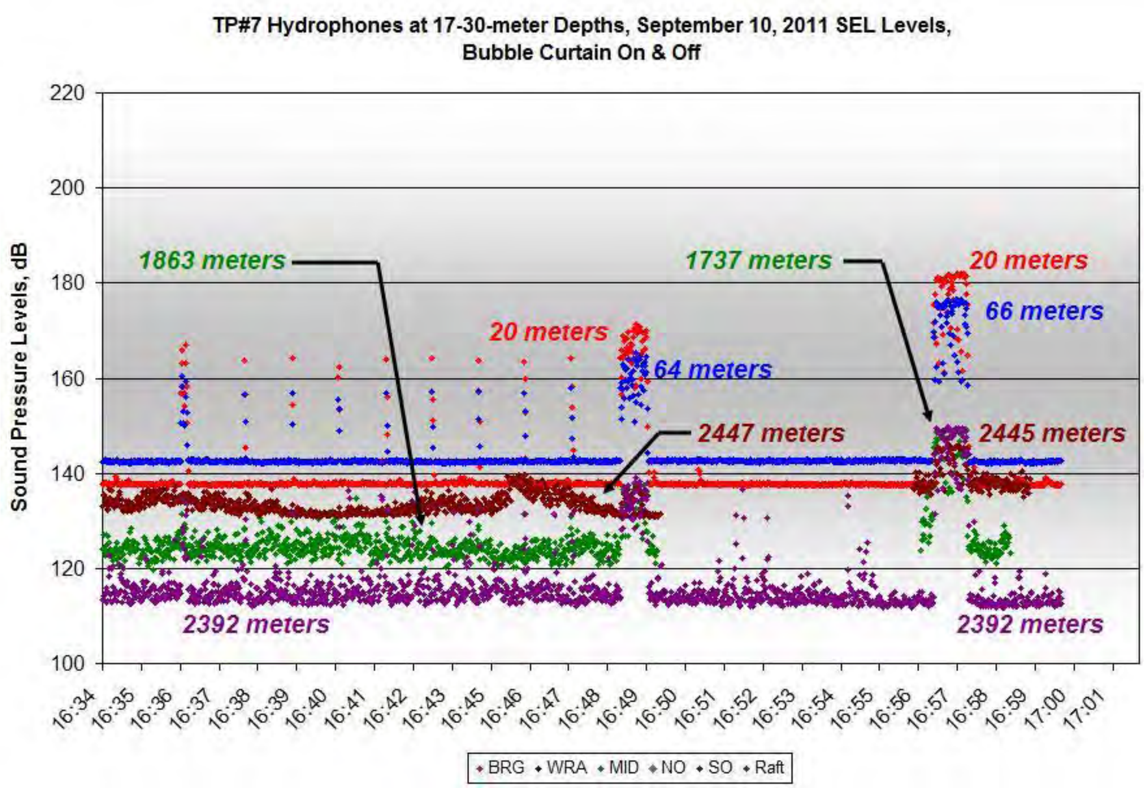

Figure B30. One-second SEL Data for TP#7 during Bubble On and Off Conditions, 16:37-16:57, at Depths of 17-30 meters on September 10, 2011

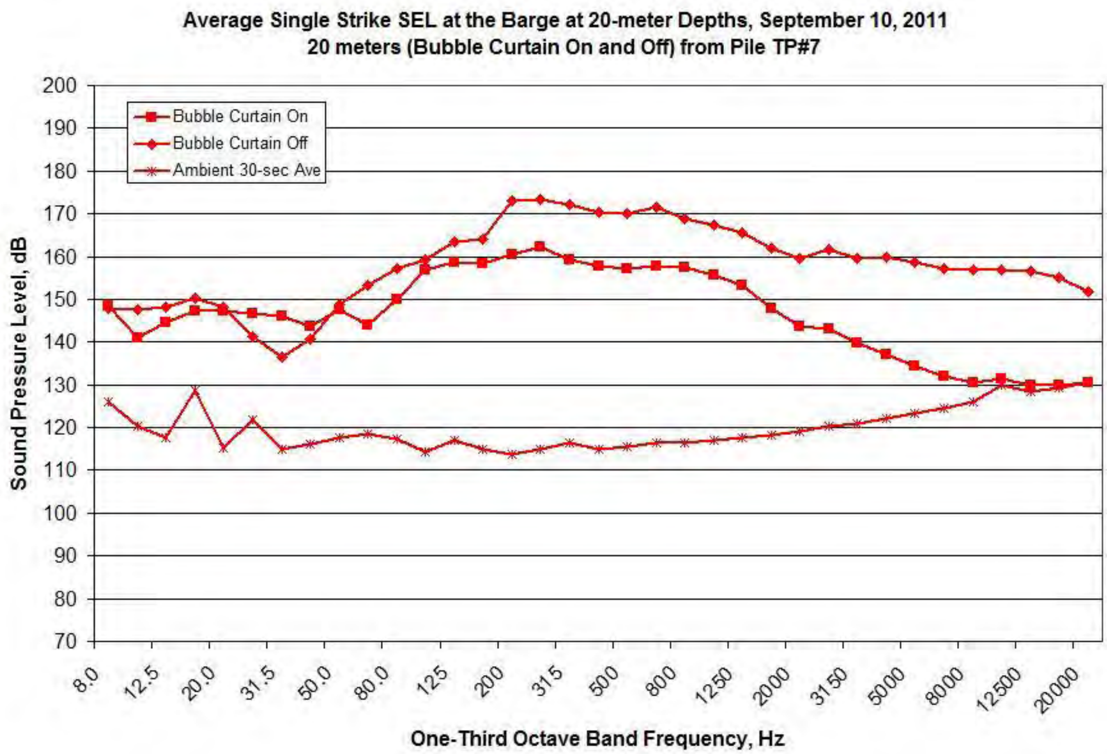

Figure B31. Average One-second SEL Spectral Data Measured at the BRG Location during TP#7, 16:37-16:57, Depths of 20 meters on September 10, 2011

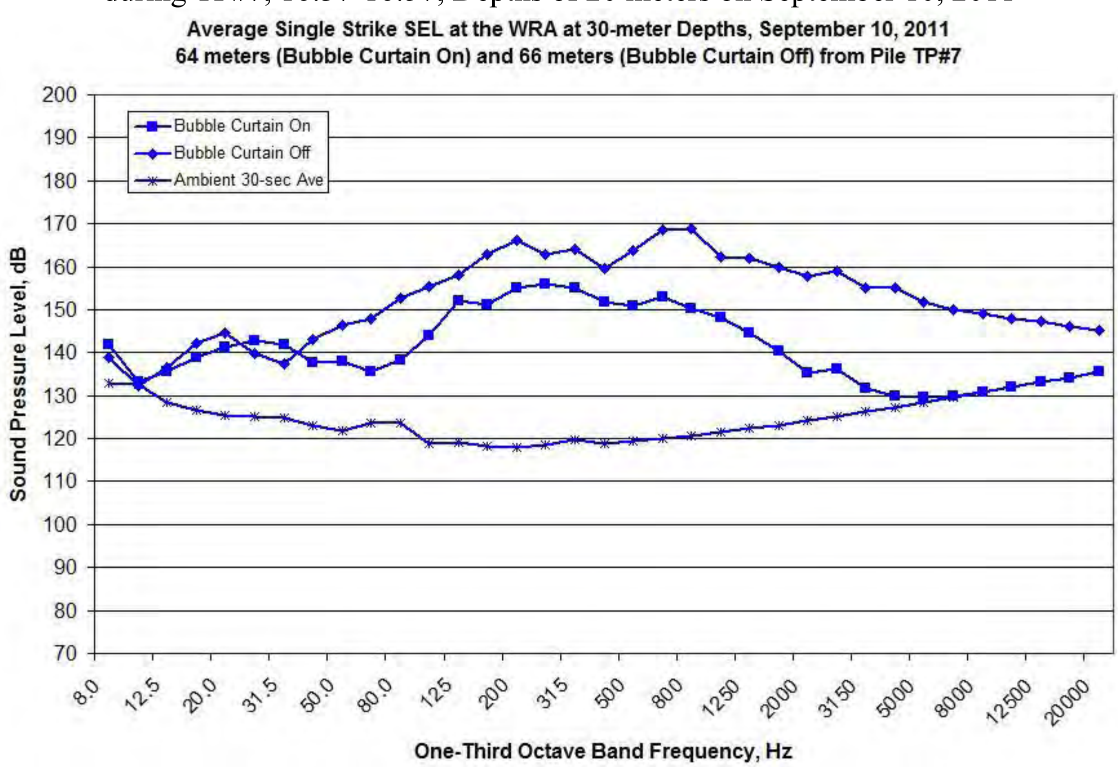

Figure B32. Average One-second SEL Spectral Data Measured at the WRA Location during TP#7, 16:37-16:57, Depths of 30 meters on September 10, 2011

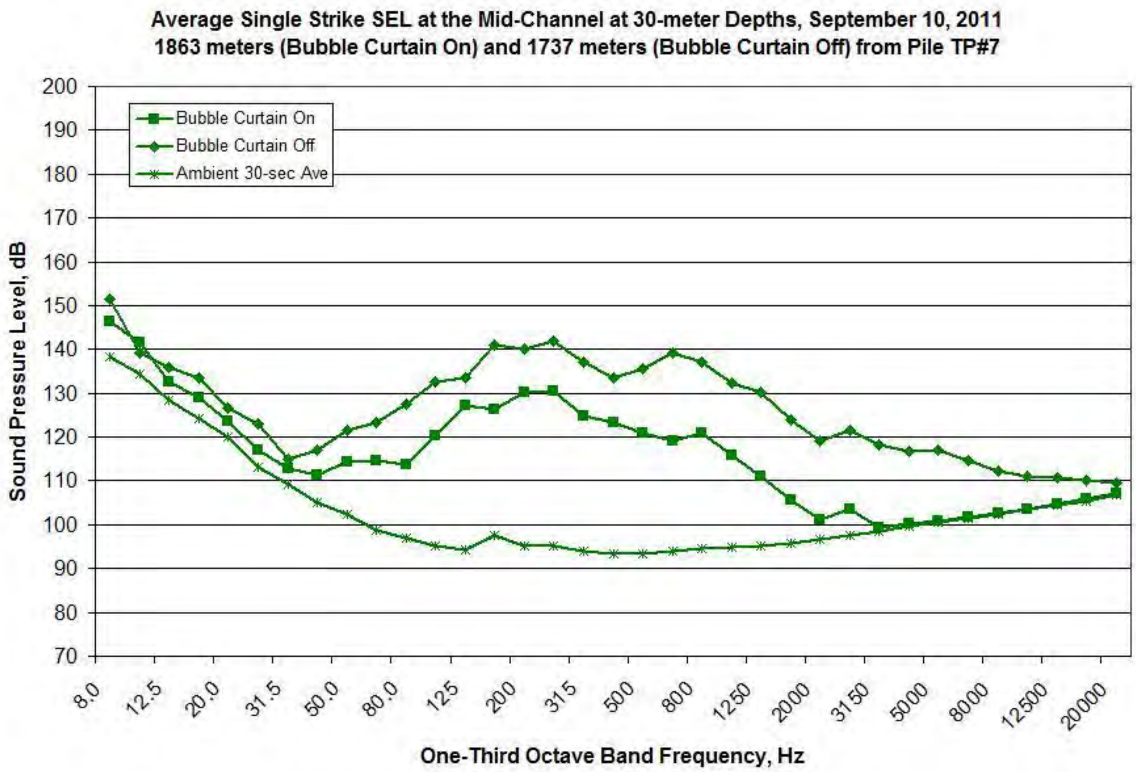

Figure B33. Average One-second SEL Spectral Data Measured at the MID Location during TP#7, 16:37-16:57, Depths of 30 meters on September 10, 2011

NO DATA AVAILABLE

Figure B34. Average One-second SEL Spectral Data Measured at the NO Location during TP#7, 16:37-16:57, Depths of 30 meters on September 10, 2011

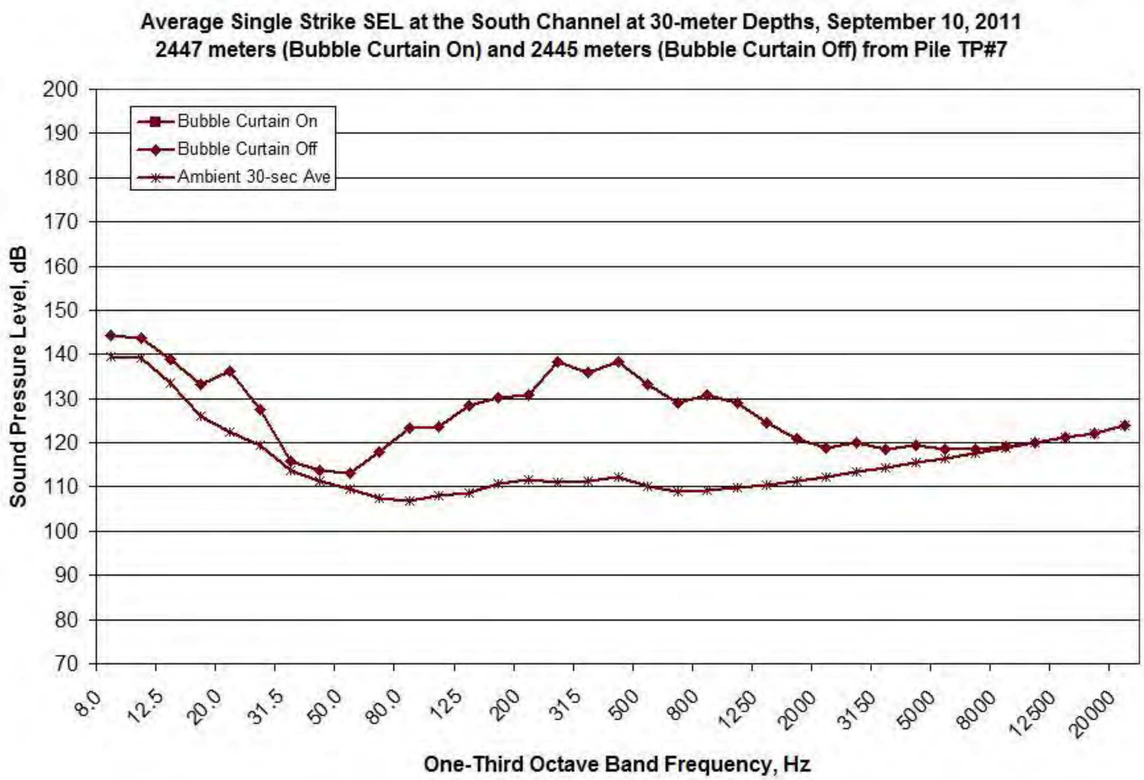

Figure B35. Average One-second SEL Spectral Data Measured at the SO Location during TP#7, 16:37-16:57, Depths of 30 meters on September 10, 2011

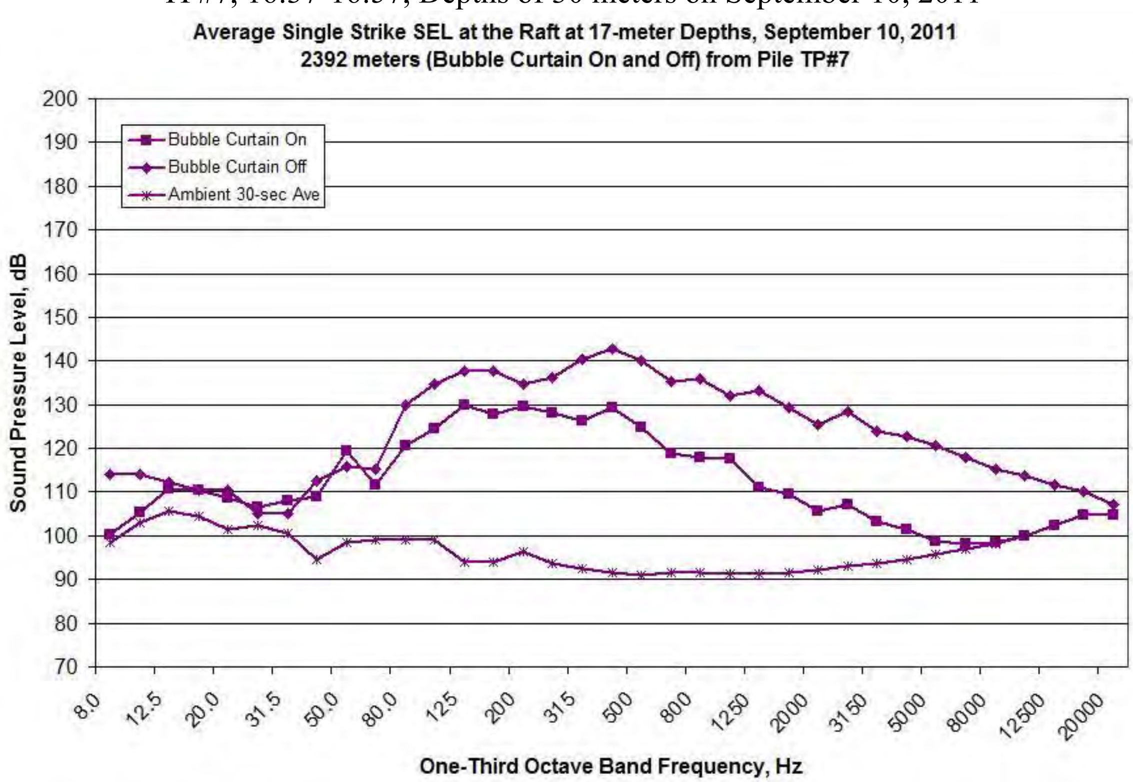

Figure B36. Average One-second SEL Spectral Data Measured at the RFT Location during TP#7, 16:37-16:57, Depths of 17 meters on September 10, 2011

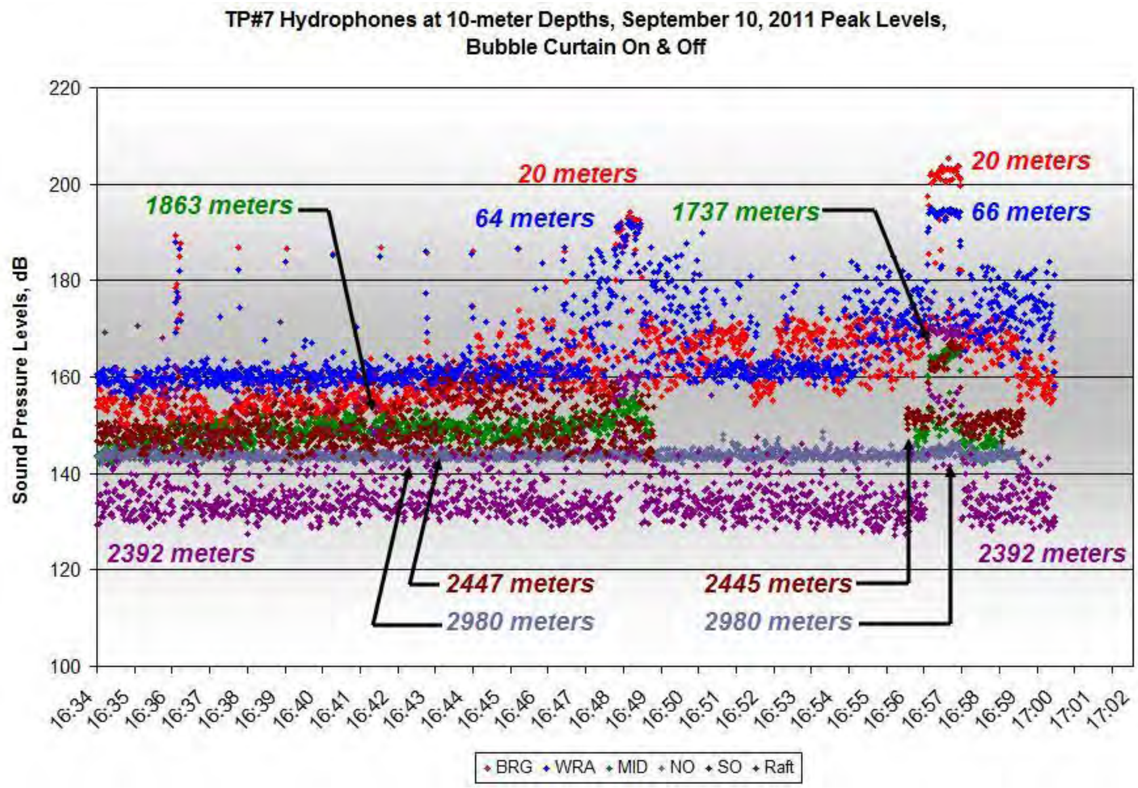

Figure B37. One-second Peak Level Data for TP#7 during Bubble On and Off Conditions, 16:37-16:57, at Depths of 10 meters on September 10, 2011

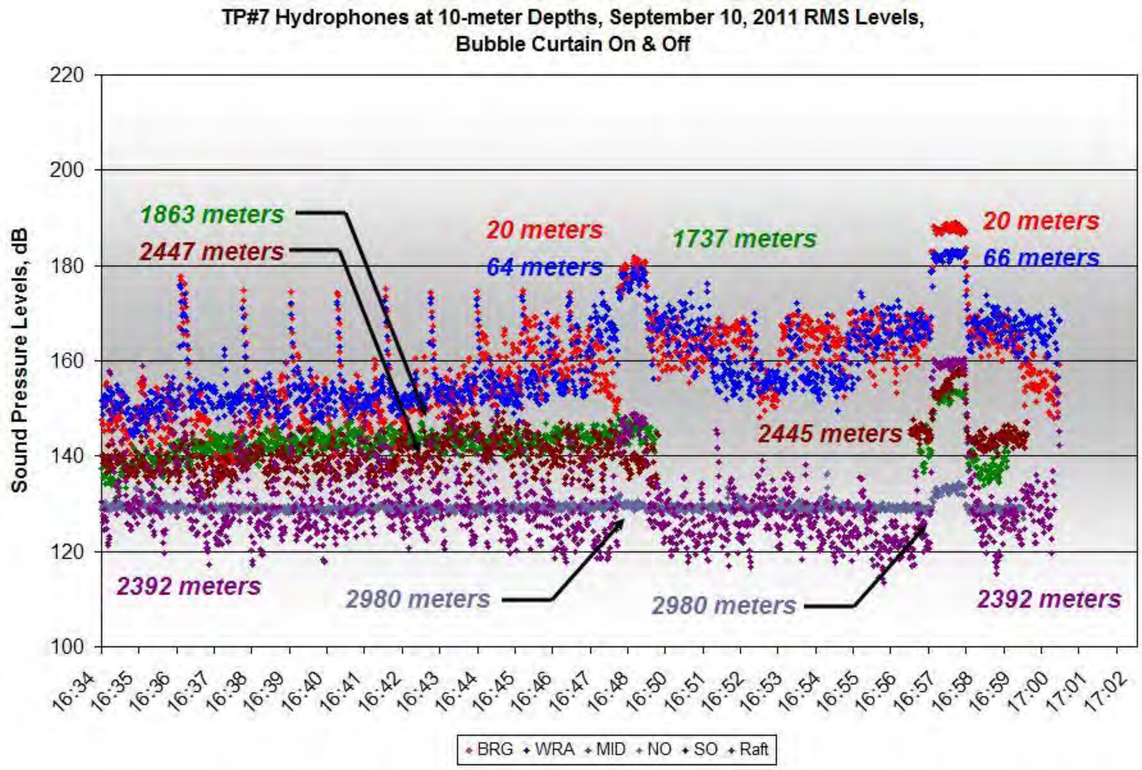

Figure B38. Impulse RMS Data for TP#7 during Bubble On and Off Conditions, 16:37-16:57, at Depths of 10 meters on September 10, 2011

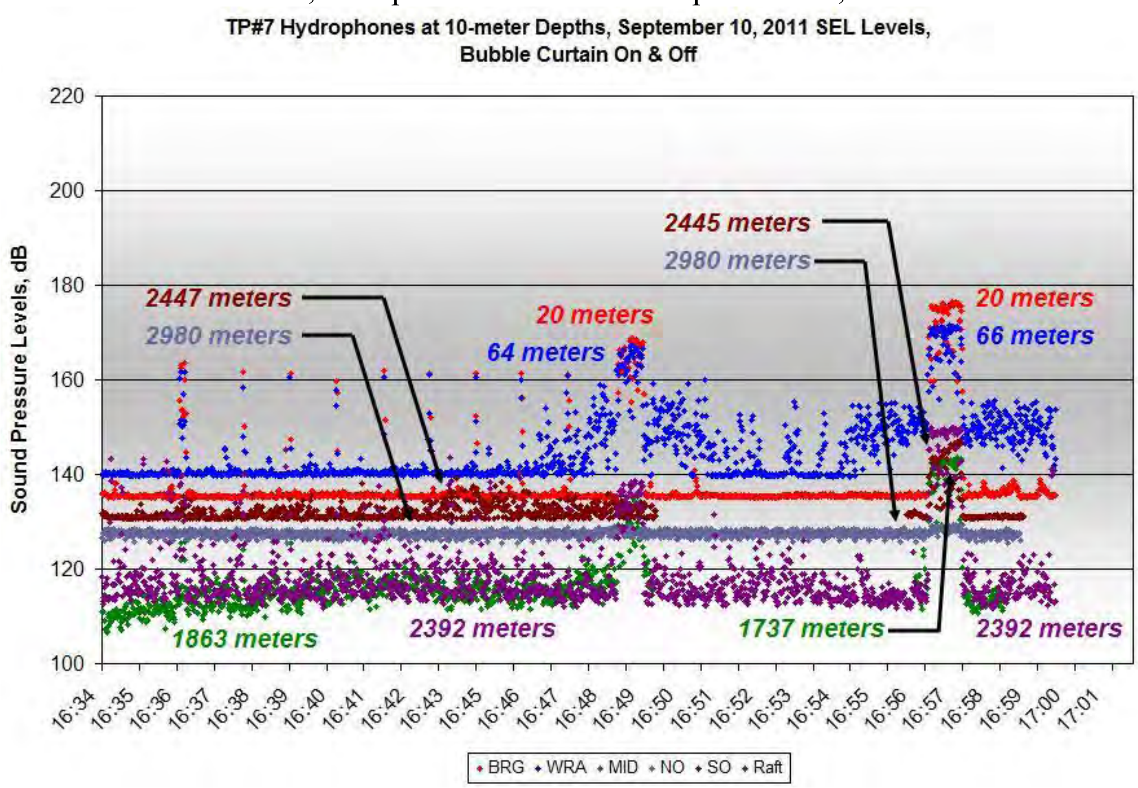

Figure B39. One-second SEL Data for TP#7 during Bubble On and Off Conditions, 16:37-16:57, at Depths of 10 meters on September 10, 2011

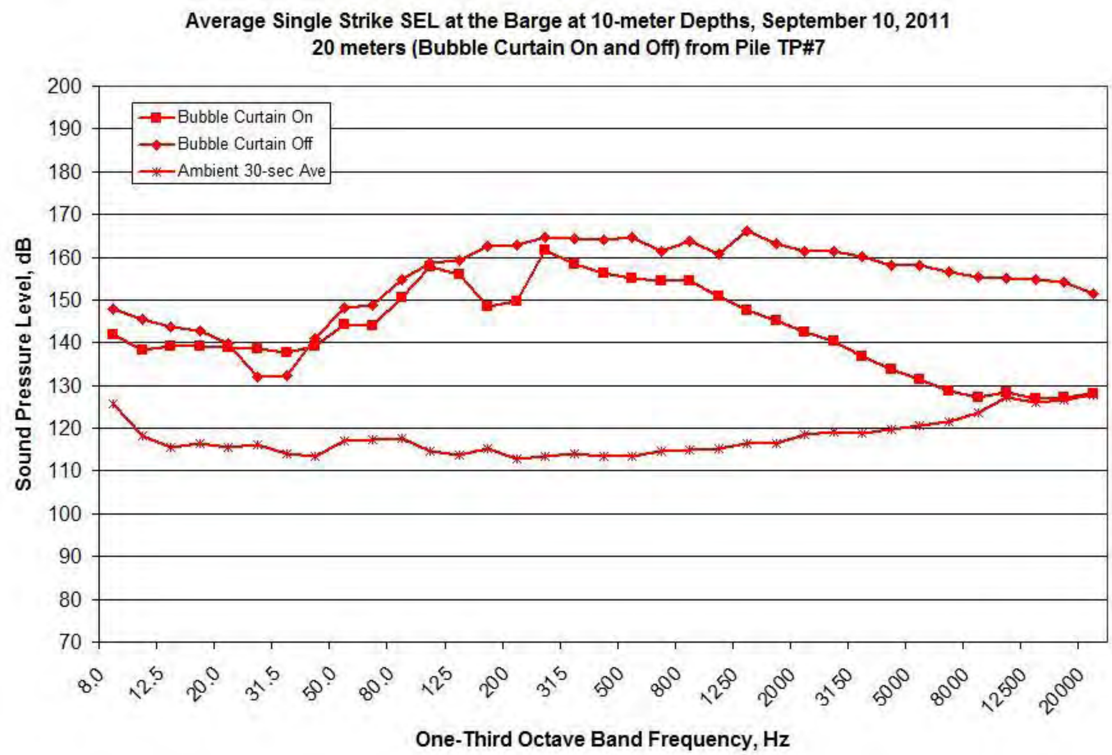

Figure B40. Average One-second SEL Spectral Data Measured at the BRG Location during TP#7, 16:37-16:57, Depths of 10 meters on September 10, 2011

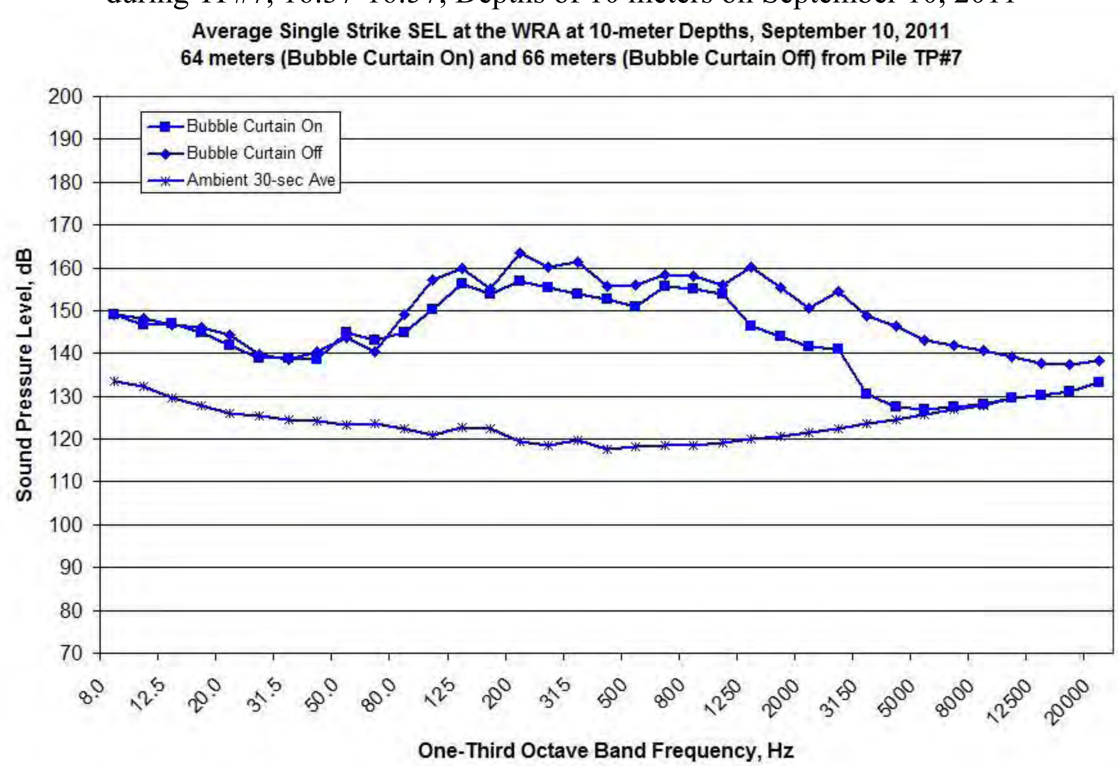

Figure B41. Average One-second SEL Spectral Data Measured at the WRA Location during TP#7, 16:37-16:57, Depths of 10 meters on September 10, 2011

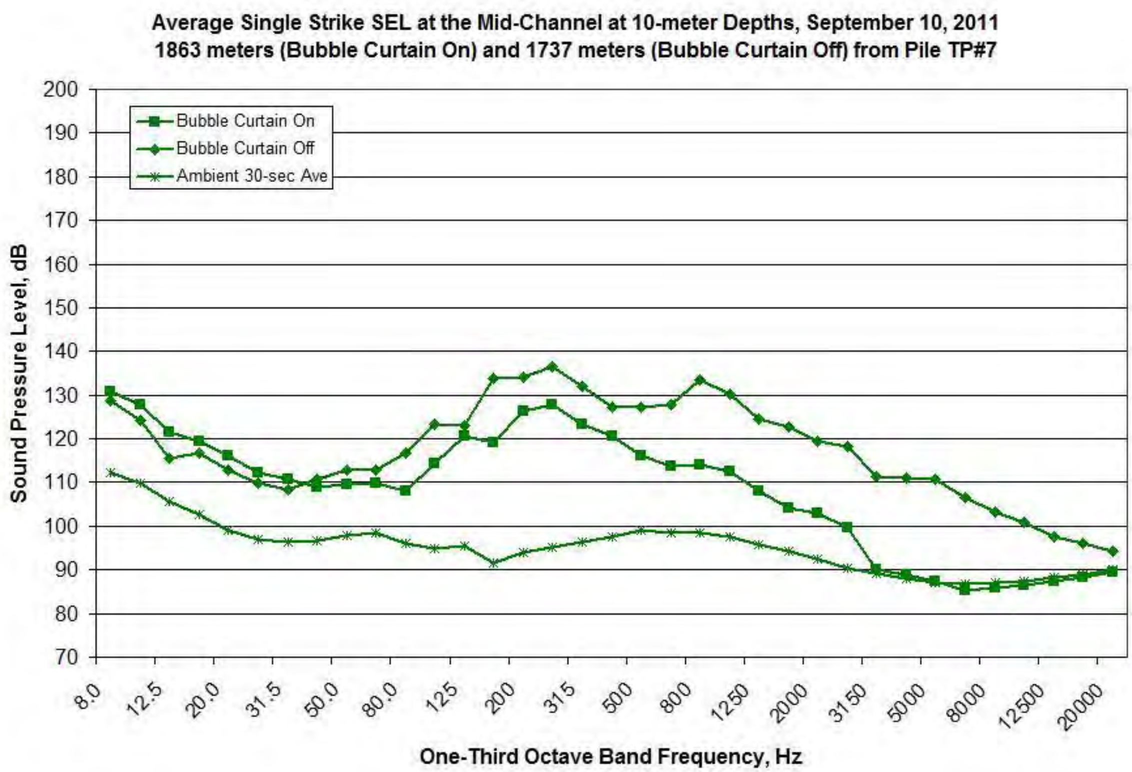

Figure B42. Average One-second SEL Spectral Data Measured at the MID Location during TP#7, 16:37-16:57, Depths of 10 meters on September 10, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B43. Average One-second SEL Spectral Data Measured at the NO Location during TP#7, 16:37-16:57, Depths of 10 meters on September 10, 2011

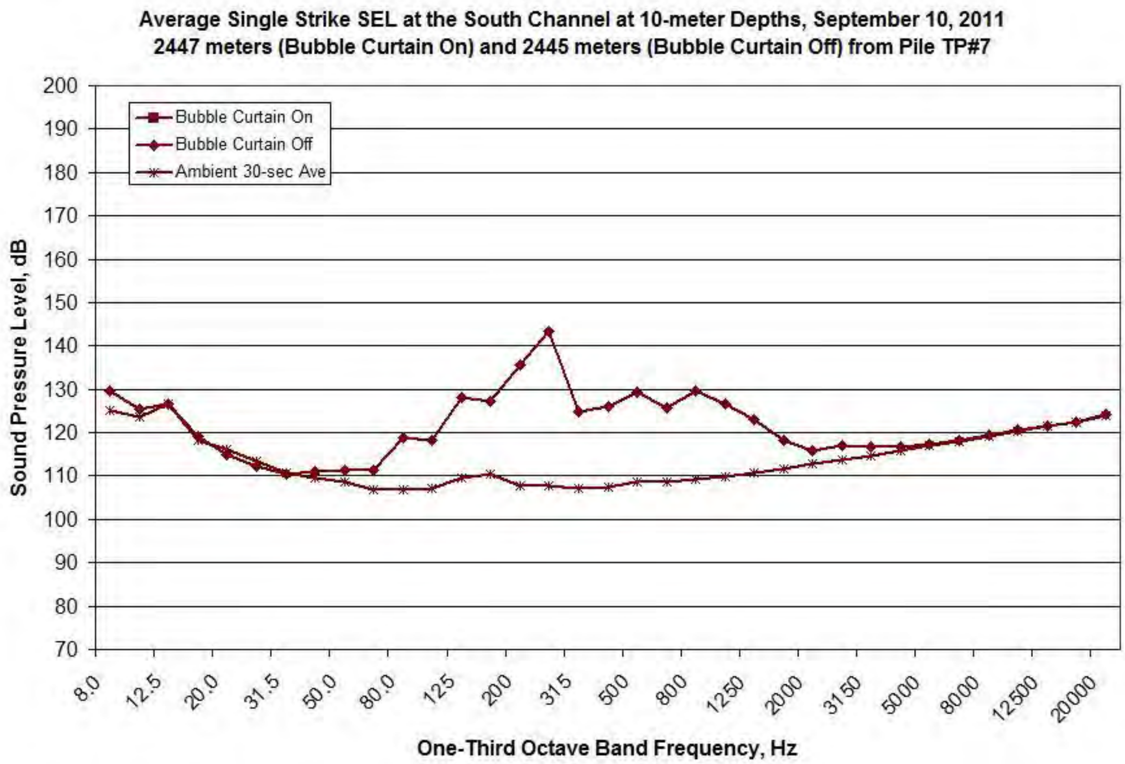

Figure B44. Average One-second SEL Spectral Data Measured at the SO Location during TP#7, 16:37-16:57, Depths of 10 meters on September 10, 2011

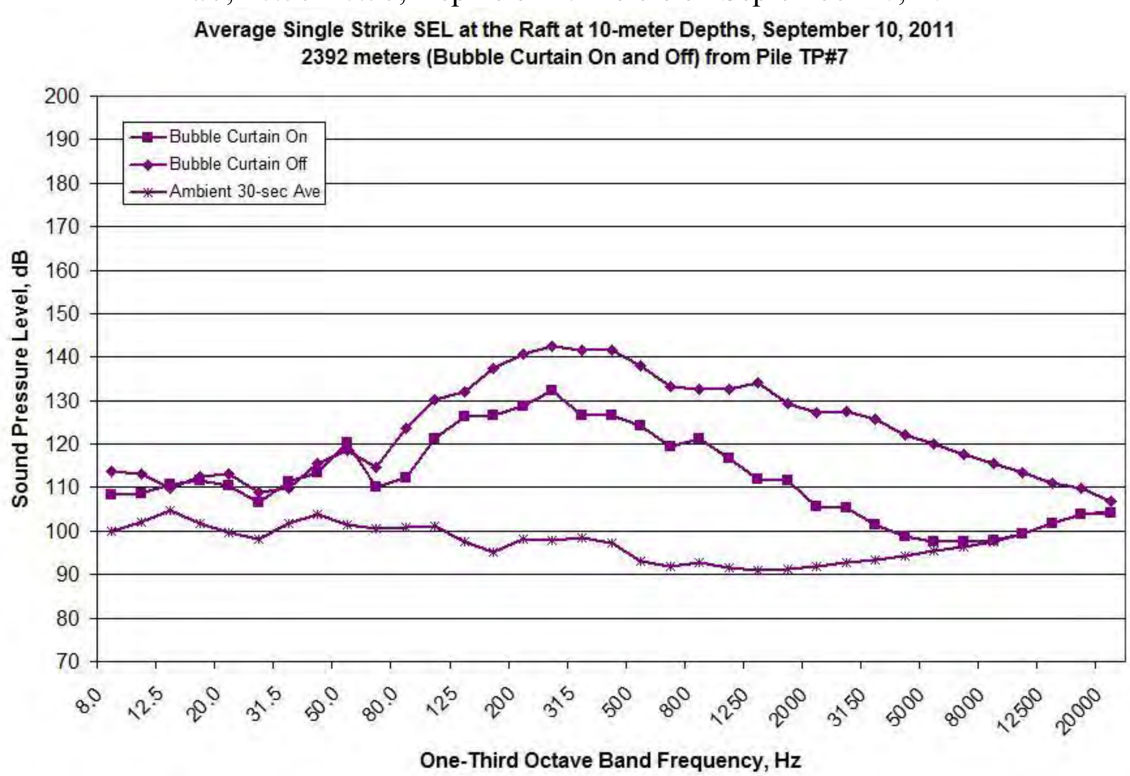

Figure B45. Average One-second SEL Spectral Data Measured at the RFT Location during TP#7, 16:37-16:57, Depths of 10 meters on September 10, 2011

9/15/2011 – TP#3 RP#3

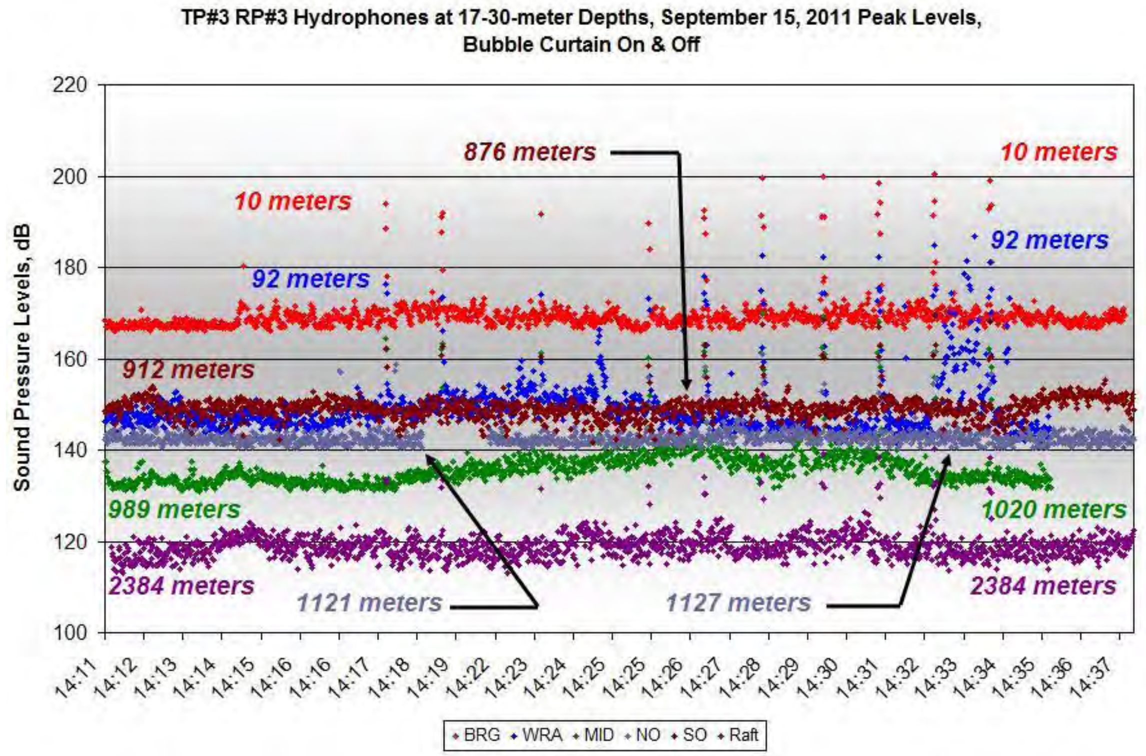

Figure B46. One-second Peak Level Data for TP#3 RP#3 during Bubble On and Off Conditions, 14:18-14:34, at Depths of 17-30 meters on September 15, 2011

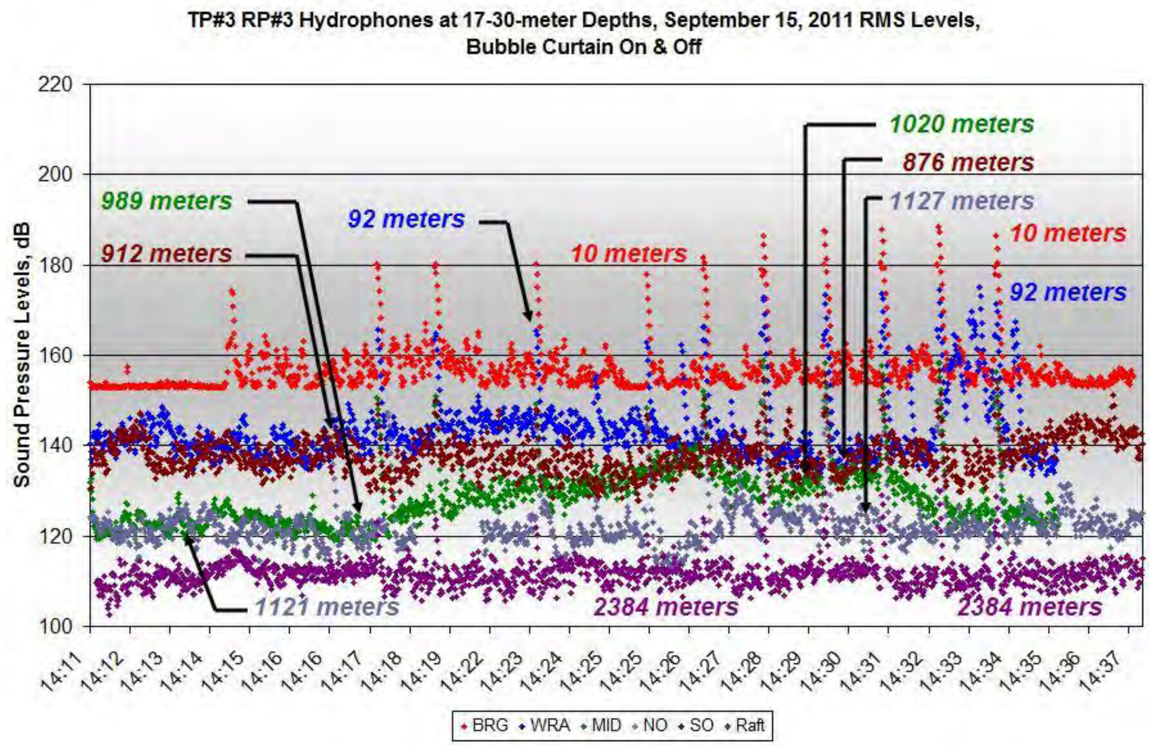

Figure B47. Impulse RMS Data for TP#3 RP#3 during Bubble On and Off Conditions, 14:18-14:34, at Depths of 17-30 meters on September 15, 2011

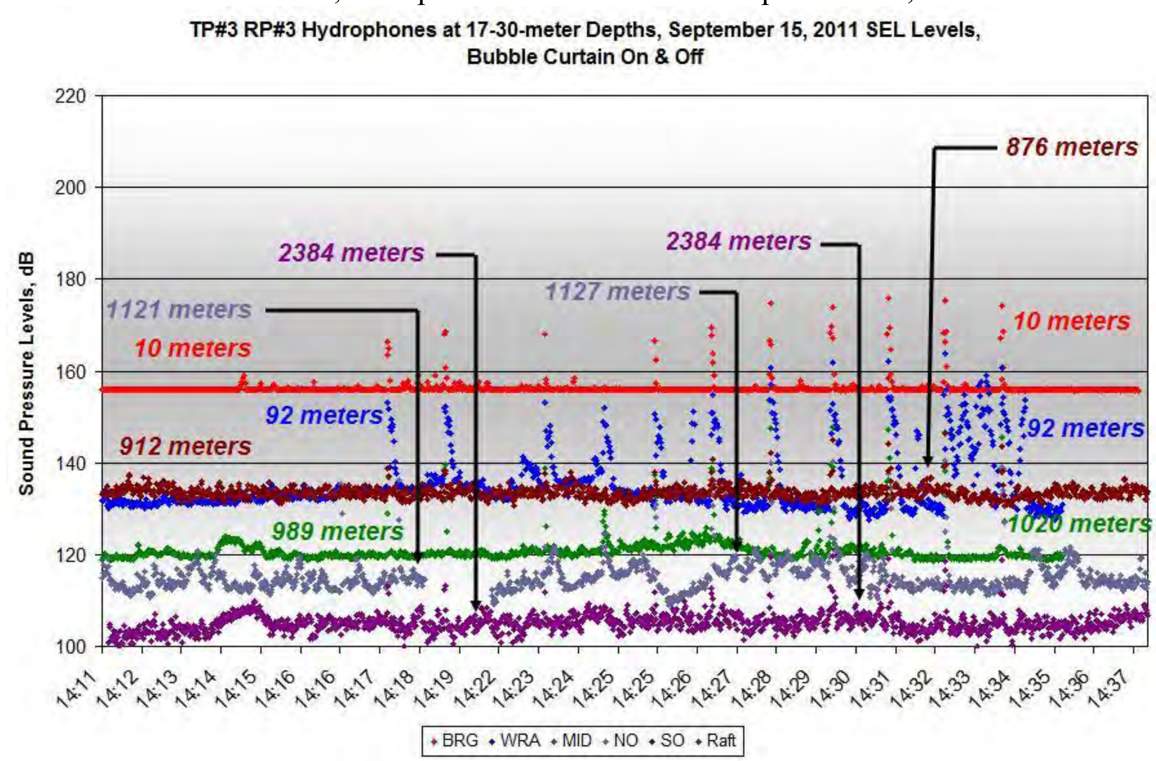

Figure B48. One-second SEL Data for TP#3 RP#3 during Bubble On and Off Conditions, 14:18-14:34, at Depths of 17-30 meters on September 15, 2011

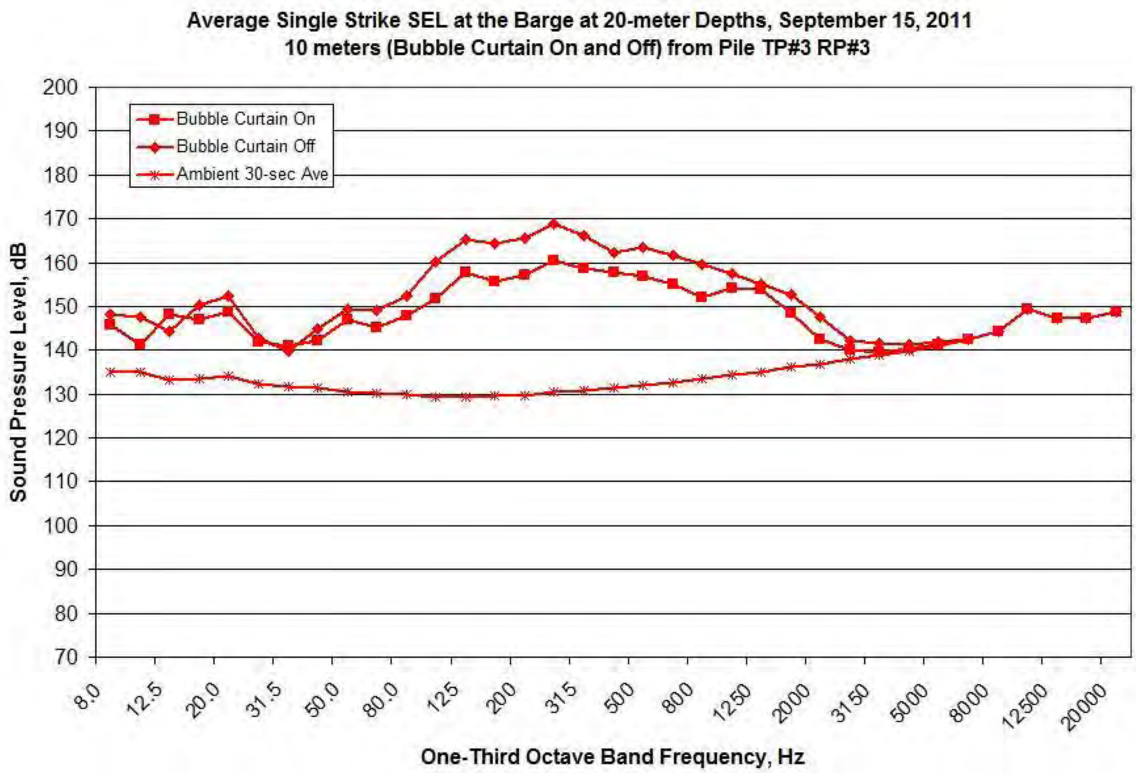

Figure B49. Average One-second SEL Spectral Data Measured at the BRG Location during TP#3 RP#3, 14:18-14:34, Depths of 20 meters on September 15, 2011

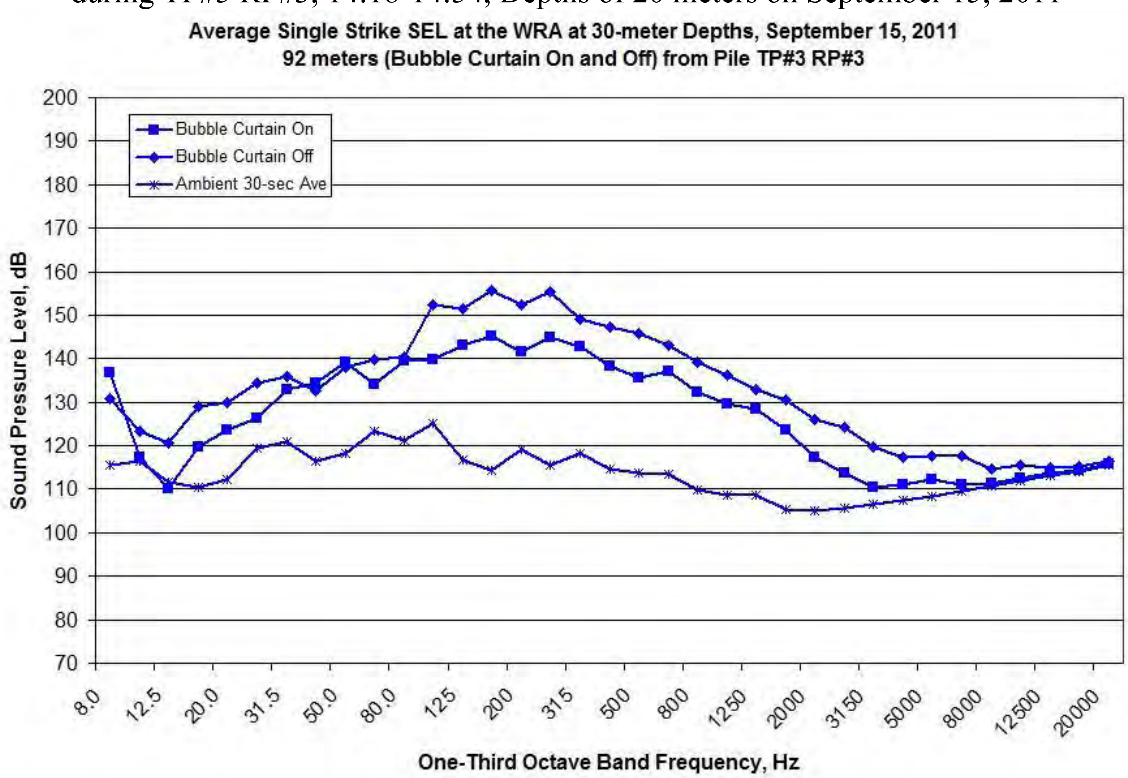

Figure B50. Average One-second SEL Spectral Data Measured at the WRA Location during TP#3 RP#3, 14:18-14:34, Depths of 30 meters on September 15, 2011

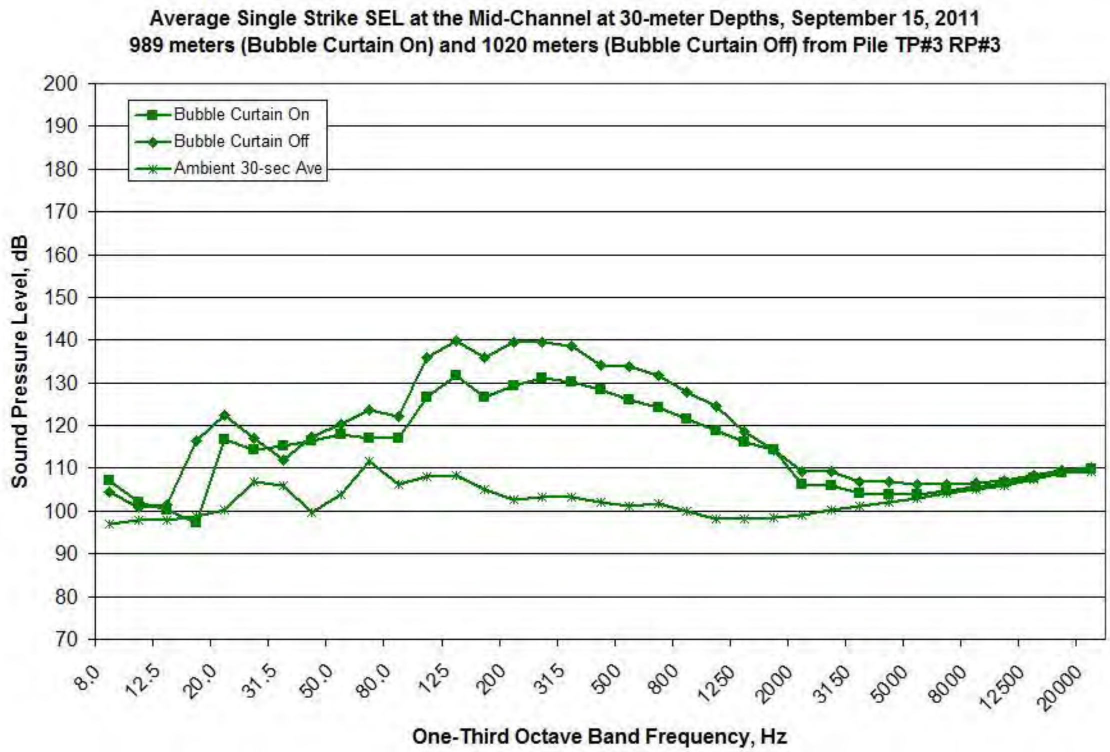

Figure B51. Average One-second SEL Spectral Data Measured at the MID Location during TP#3 RP#3, 14:18-14:34, Depths of 30 meters on September 15, 2011

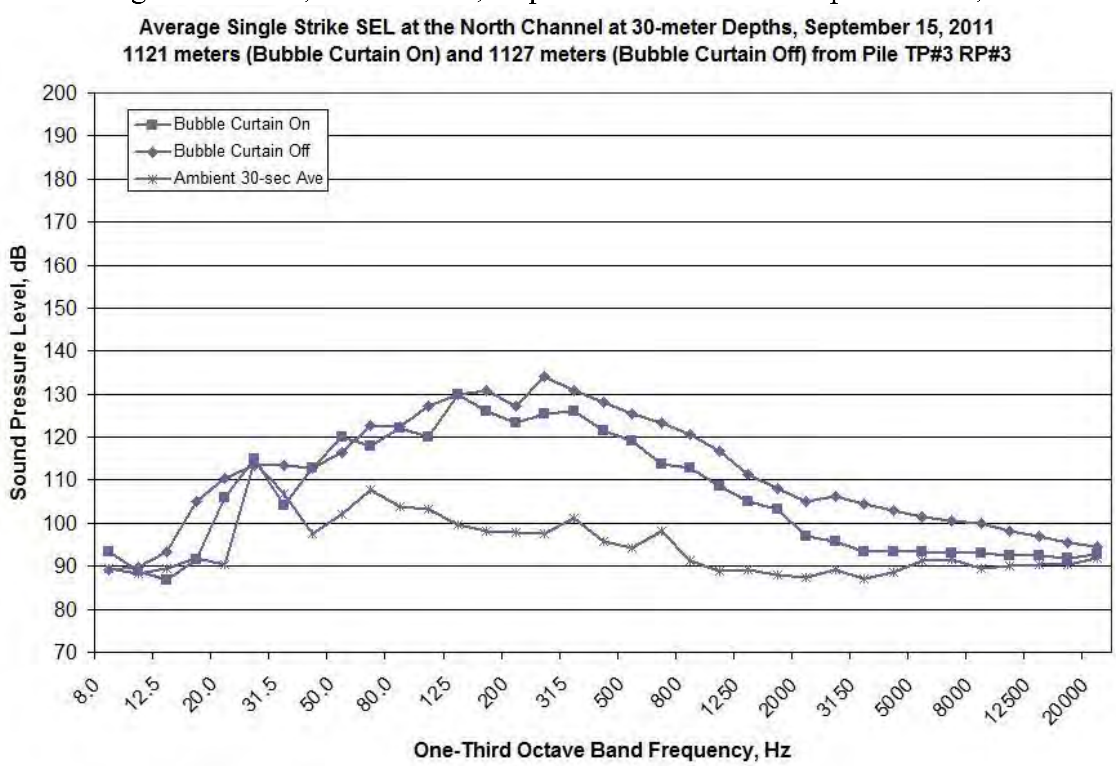

Figure B52. Average One-second SEL Spectral Data Measured at the NO Location during TP#3 RP#3, 14:18-14:34, Depths of 30 meters on September 15, 2011

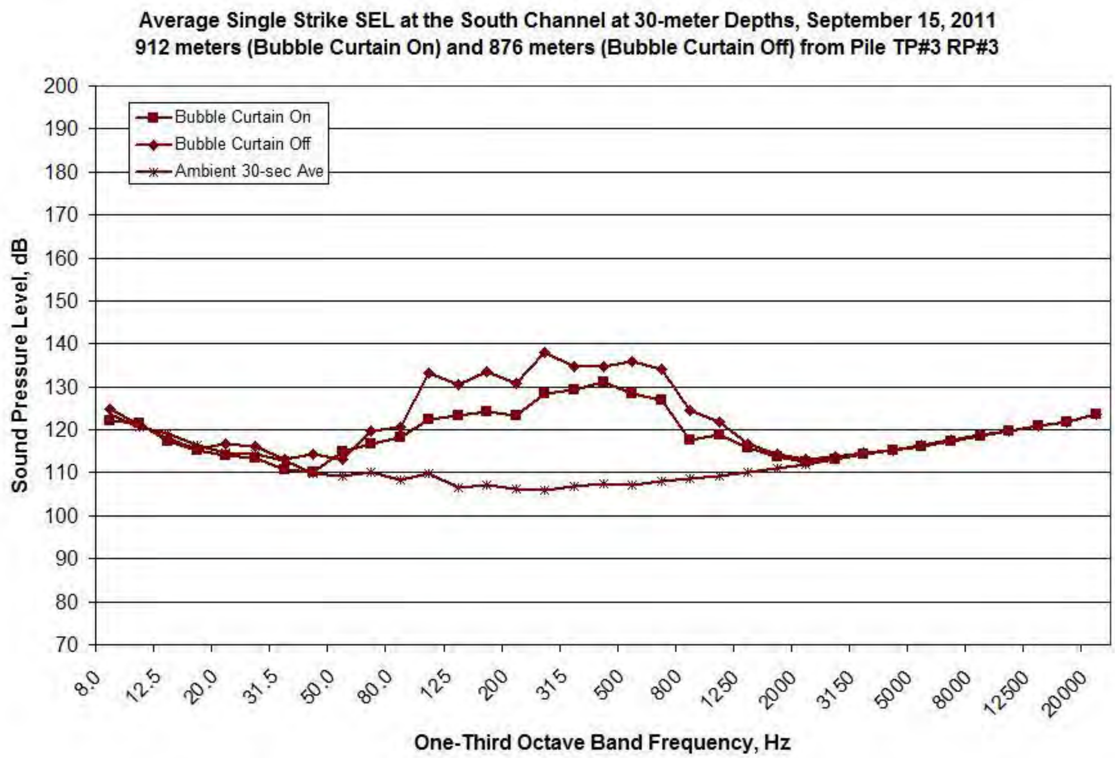

Figure B53. Average One-second SEL Spectral Data Measured at the SO Location during TP#3 RP#3, 14:18-14:34, Depths of 30 meters on September 15, 2011

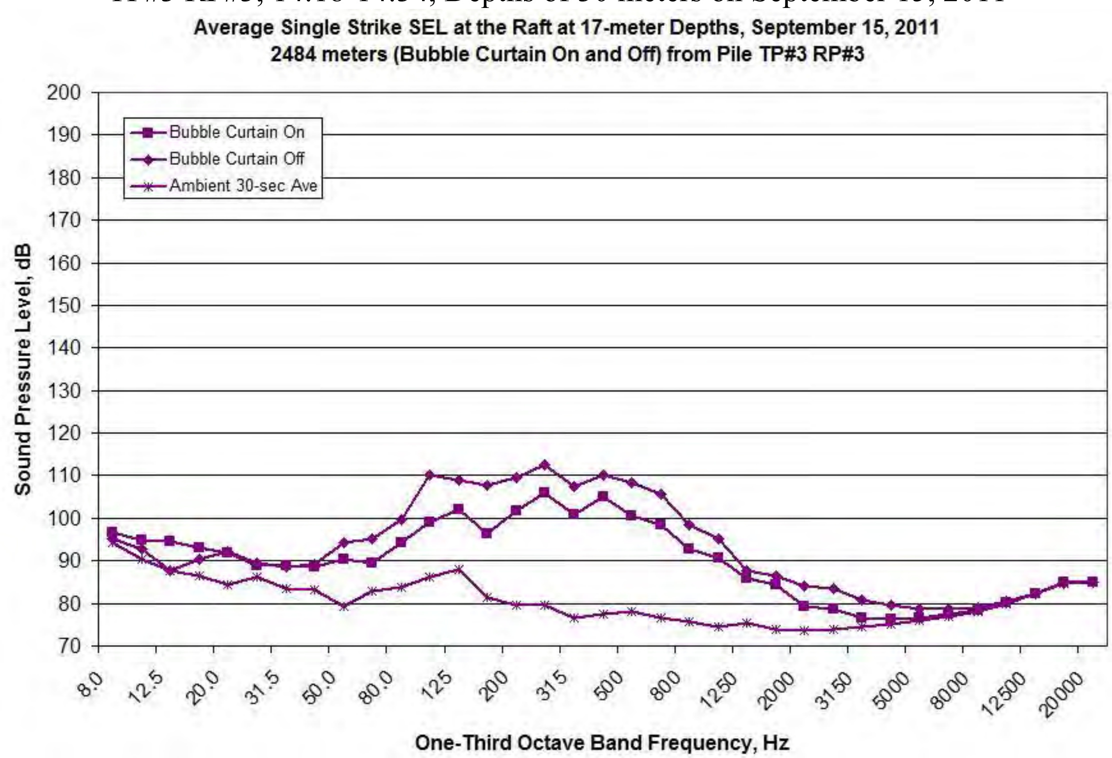

Figure B54. Average One-second SEL Spectral Data Measured at the RFT Location during TP#3 RP#3, 14:18-14:34, Depths of 17 meters on September 15, 2011

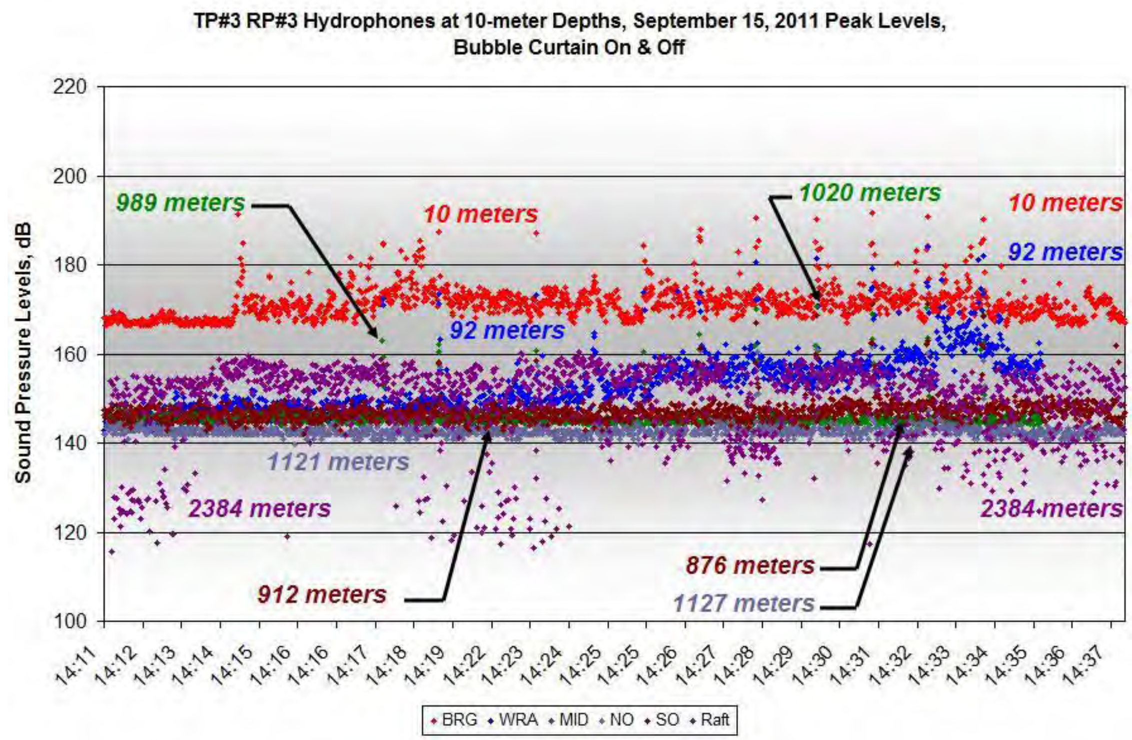

Figure B55. One-second Peak Level Data for TP#3 RP#3 during Bubble On and Off Conditions, 14:18-14:34, at Depths of 10 meters on September 15, 2011

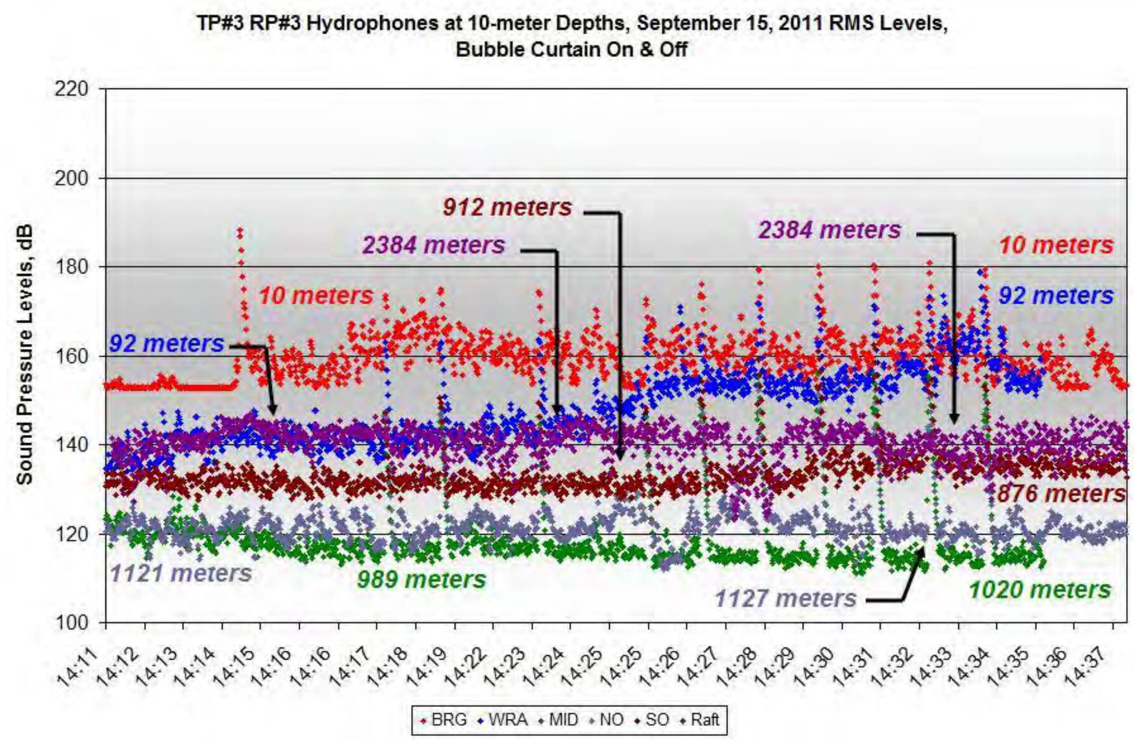

Figure B56. Impulse RMS Data for TP#3 RP#3 during Bubble On and Off Conditions, 14:18-14:34, at Depths of 10 meters on September 15, 2011

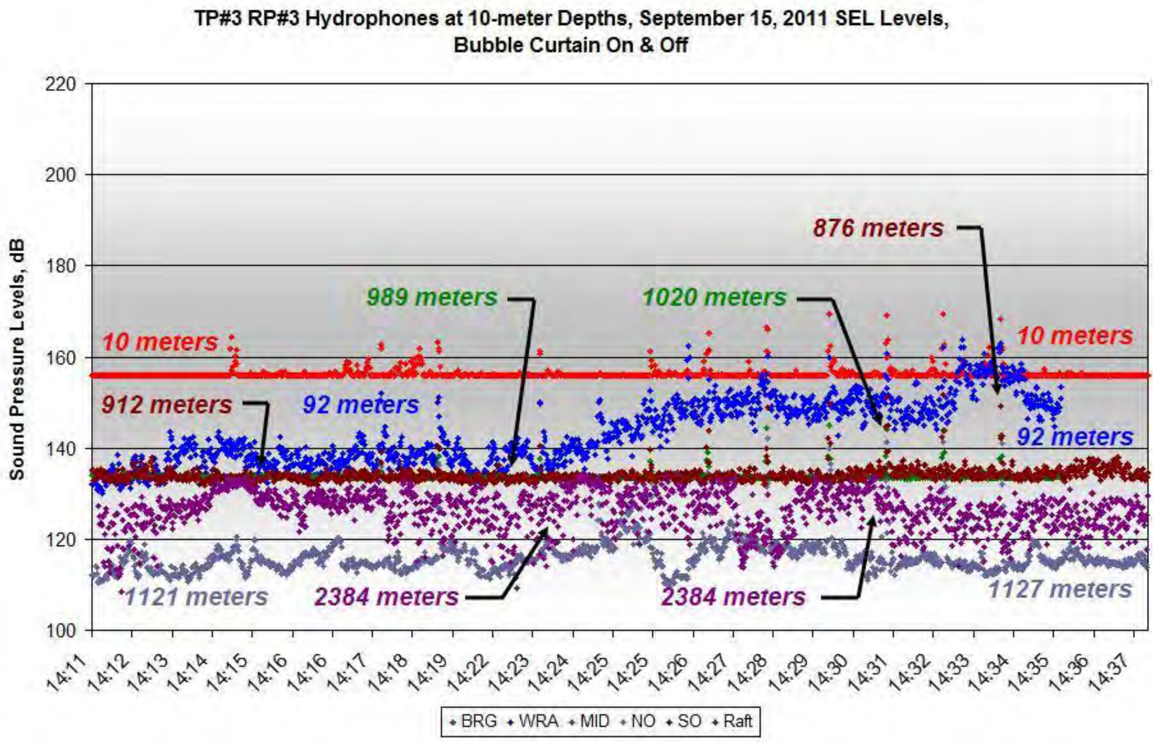

Figure B57. One-second SEL Data for TP#3 RP#3 during Bubble On and Off Conditions, 14:18-14:34, at Depths of 10 meters on September 15, 2011

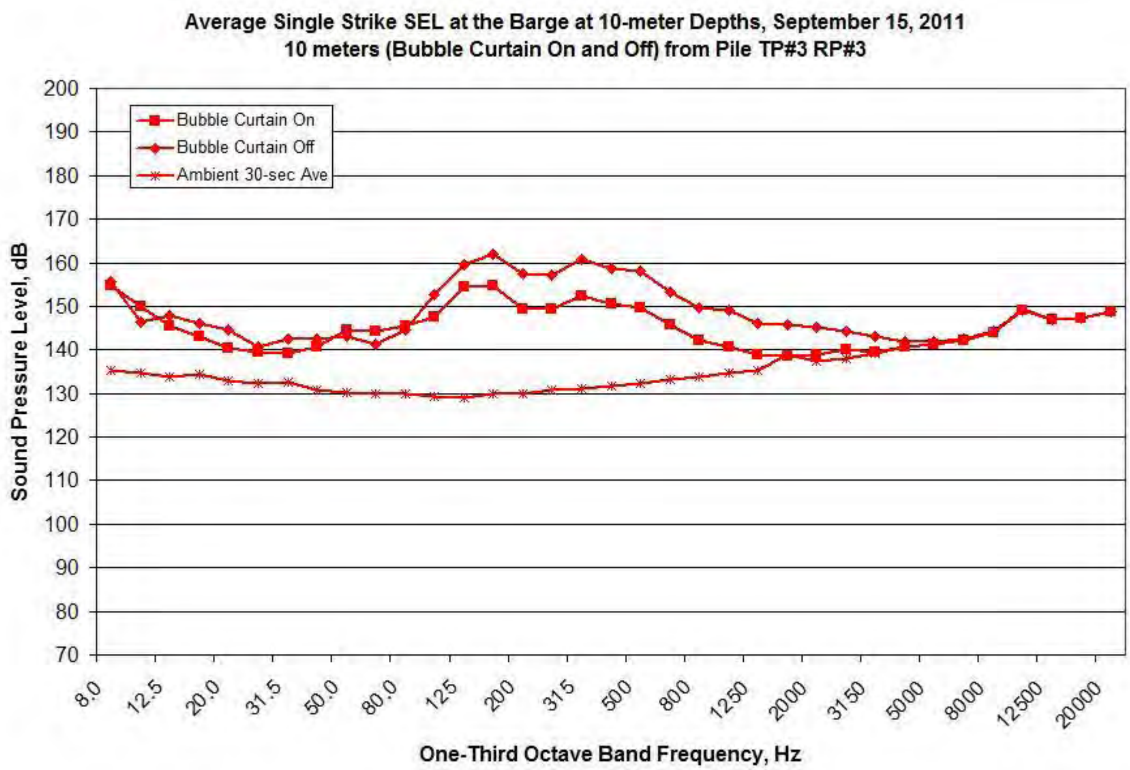

Figure B58. Average One-second SEL Spectral Data Measured at the BRG Location during TP#3 RP#3, 14:18-14:34, Depths of 10 meters on September 15, 2011

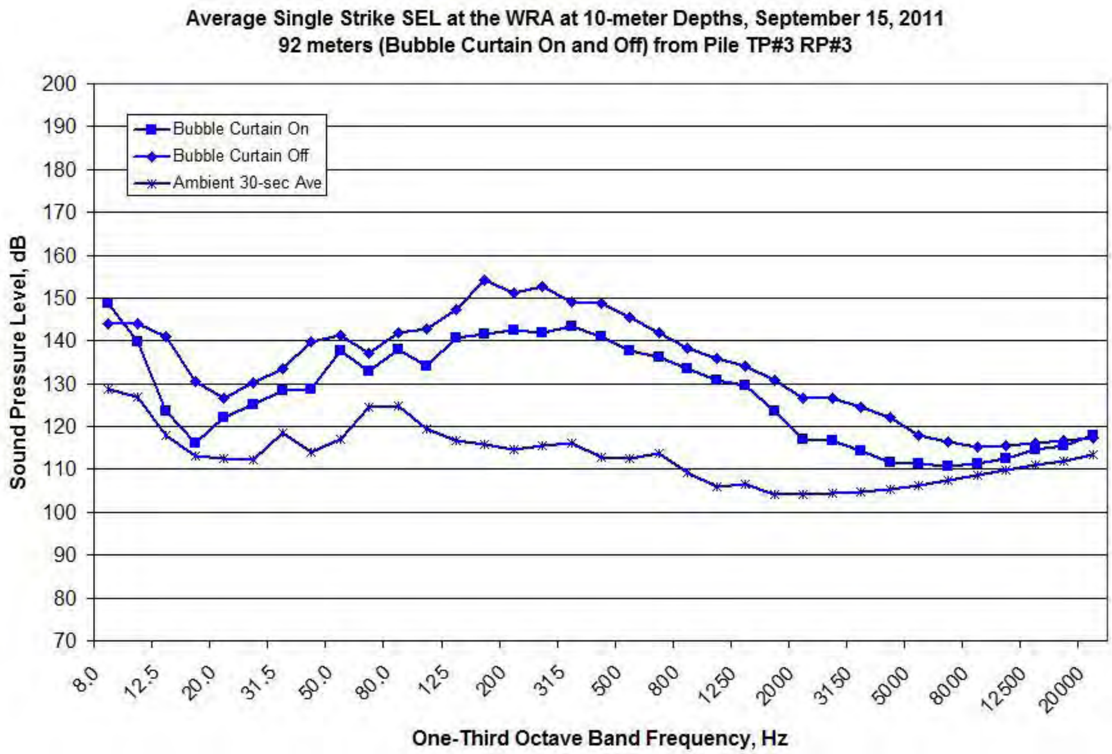

Figure B59. Average One-second SEL Spectral Data Measured at the WRA Location during TP#3 RP#3, 14:18-14:34, Depths of 10 meters on September 15, 2011

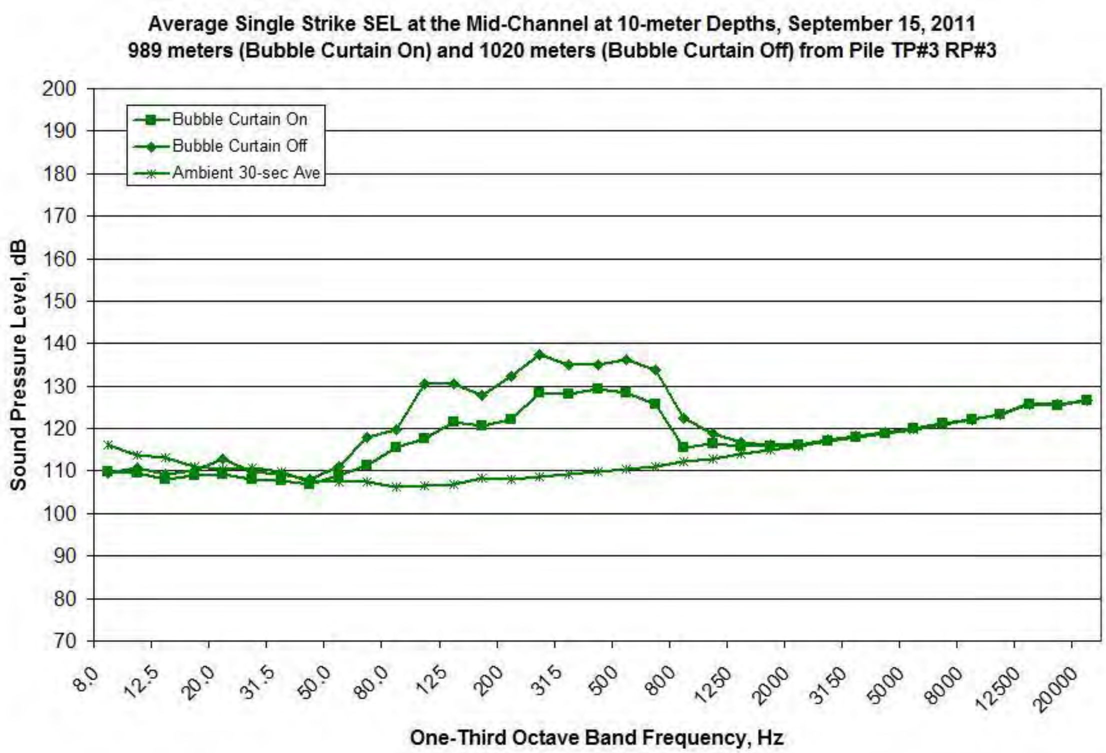

Figure B60. Average One-second SEL Spectral Data Measured at the MID Location during TP#3 RP#3, 14:18-14:34, Depths of 10 meters on September 15, 2011

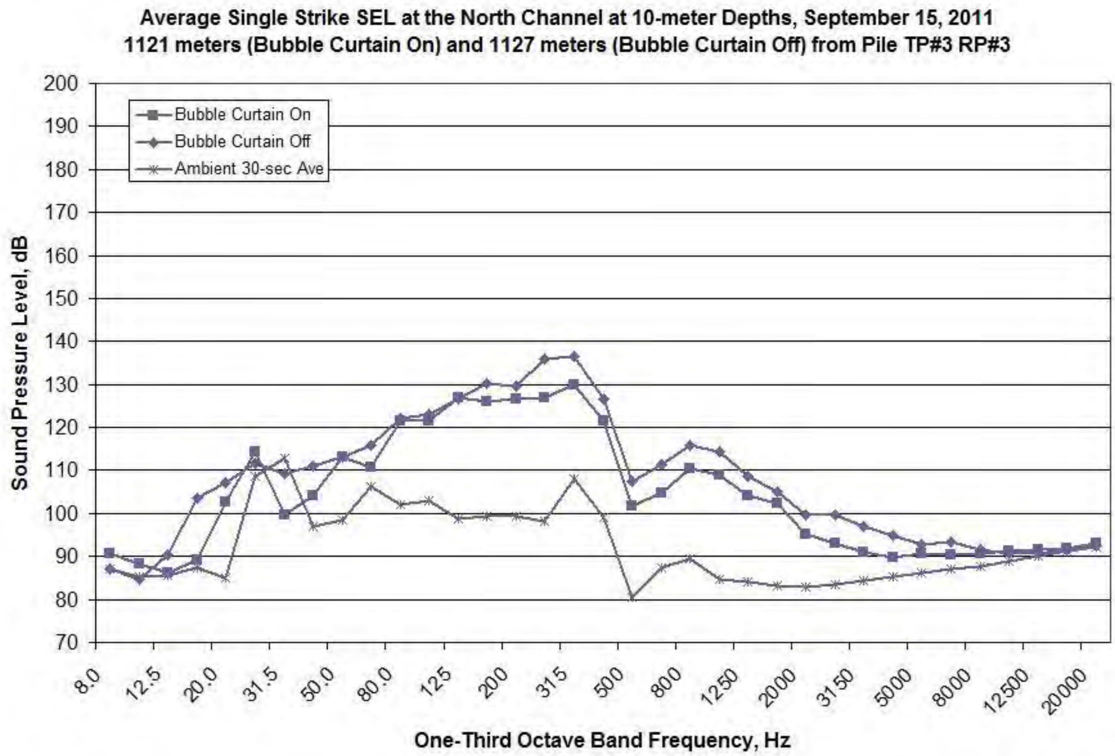

Figure B61. Average One-second SEL Spectral Data Measured at the NO Location during TP#3 RP#3, 14:18-14:34, Depths of 10 meters on September 15, 2011

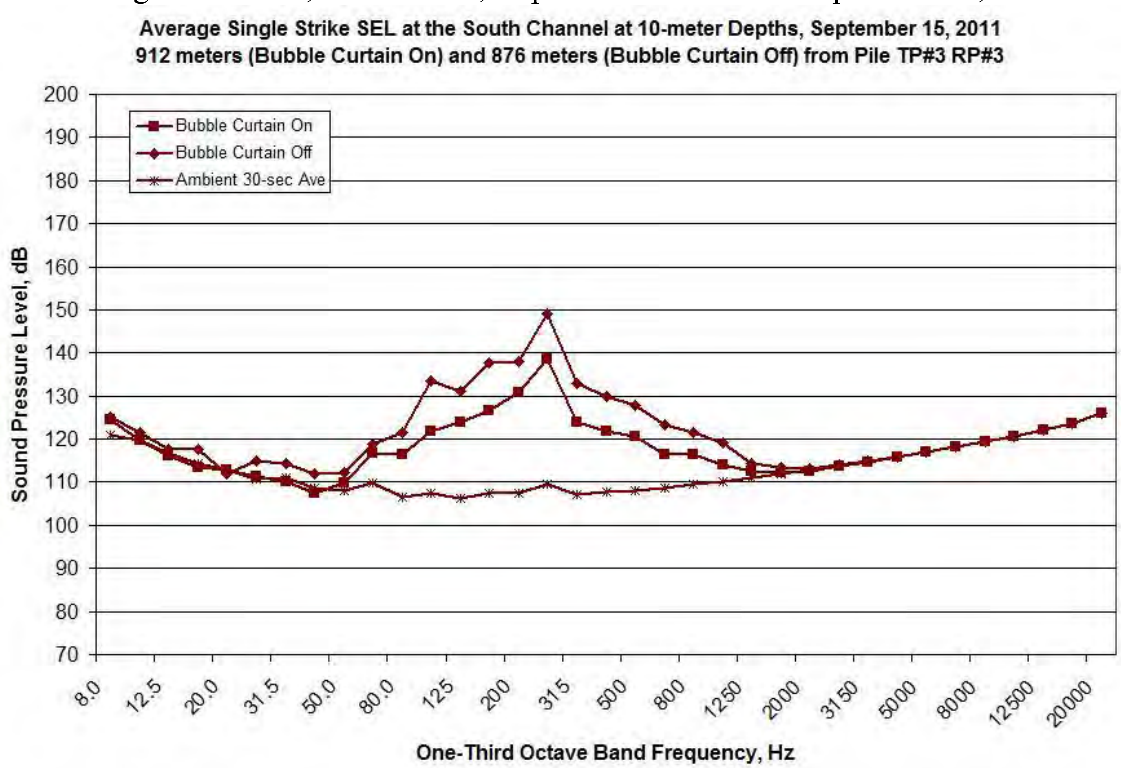

Figure B62. Average One-second SEL Spectral Data Measured at the SO Location during TP#3 RP#3, 14:18-14:34, Depths of 10 meters on September 15, 2011

NO DATA AVAILABLE – TO MUCH ELECTROINIC NOISE

Figure B63. Average One-second SEL Spectral Data Measured at the RFT Location during TP#3 RP#3, 14:18-14:34, Depths of 10 meters on September 15, 2011

9/16/2011 – TP#3 RP#2

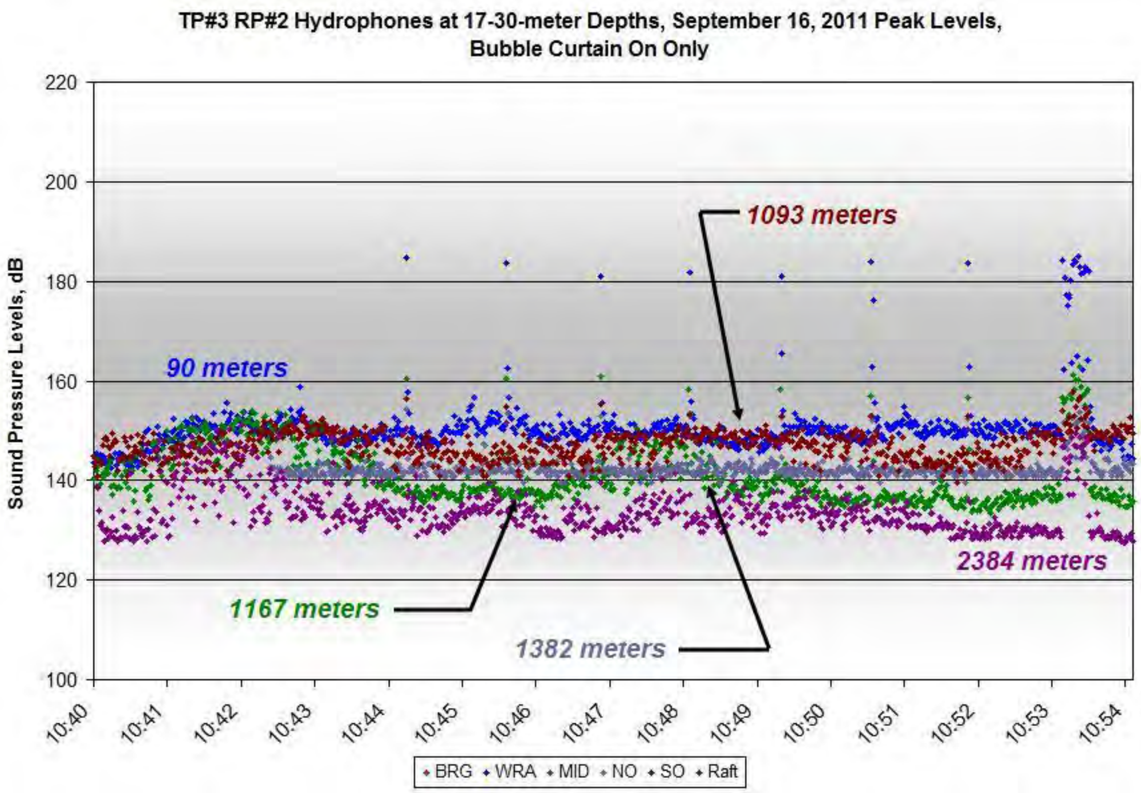

Figure B64. One-second Peak Level Data for TP#3 RP#2 during Bubble On Conditions, 10:44-10:53, at Depths of 17-30 meters on September 16, 2011

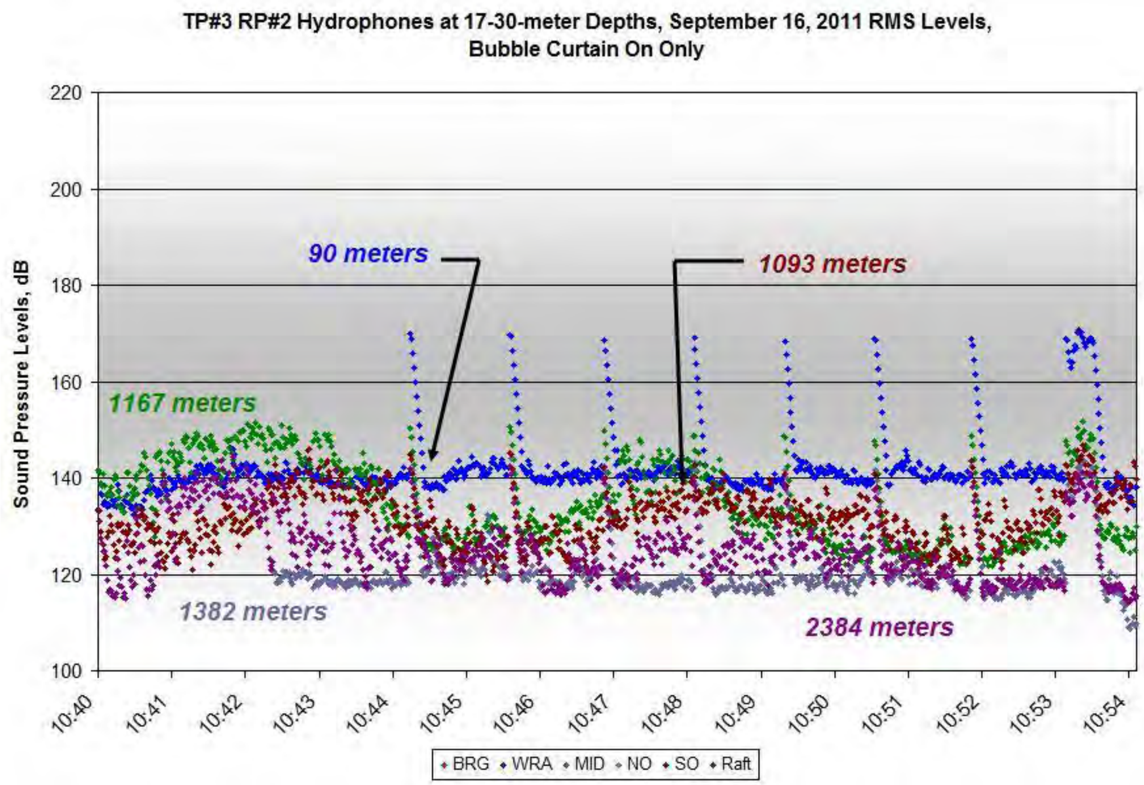

Figure B65. Impulse RMS Data for TP#3 RP#2 during Bubble On Conditions, 10:44-10:53, at Depths of 17-30 meters on September 16, 2011

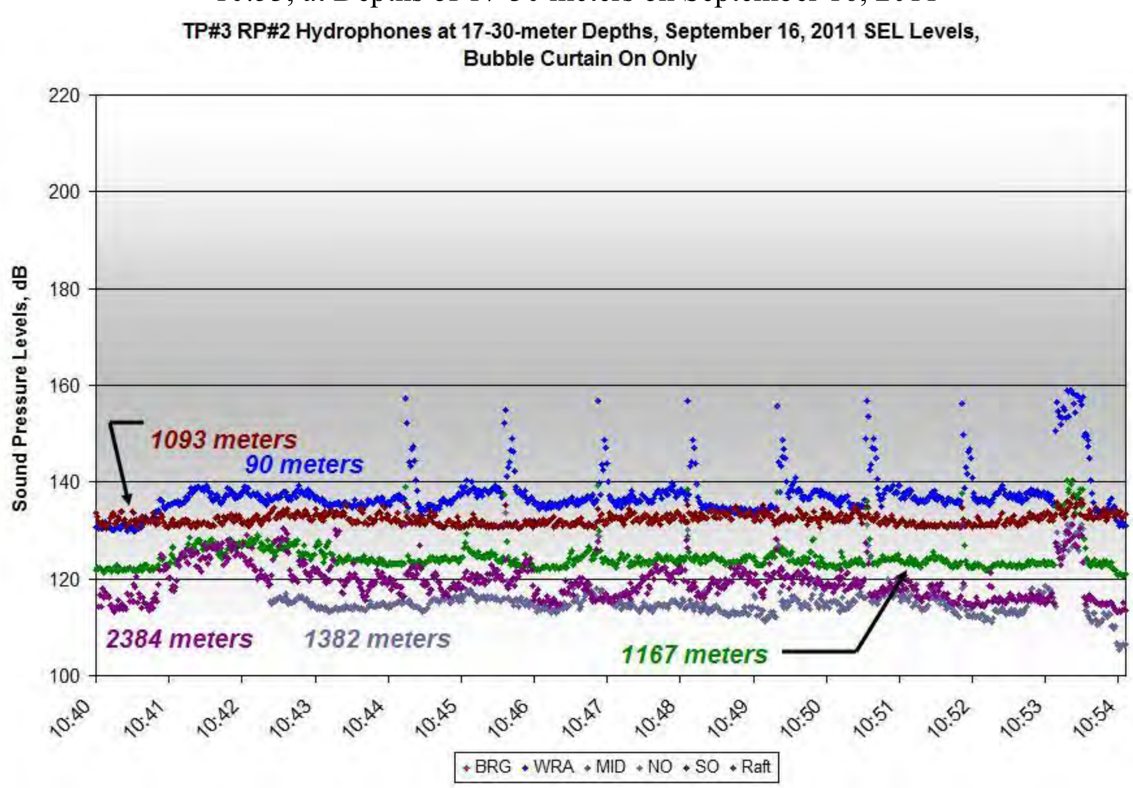

Figure B66. One-second SEL Data for TP#3 RP#2 during Bubble On Conditions, 10:44-10:53, at Depths of 17-30 meters on September 16, 2011

NO PILE DRIVING DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B67. Average One-second SEL Spectral Data Measured at the BRG Location during TP#3 RP#2, 10:44-10:53, Depths of 20 meters on September 16, 2011

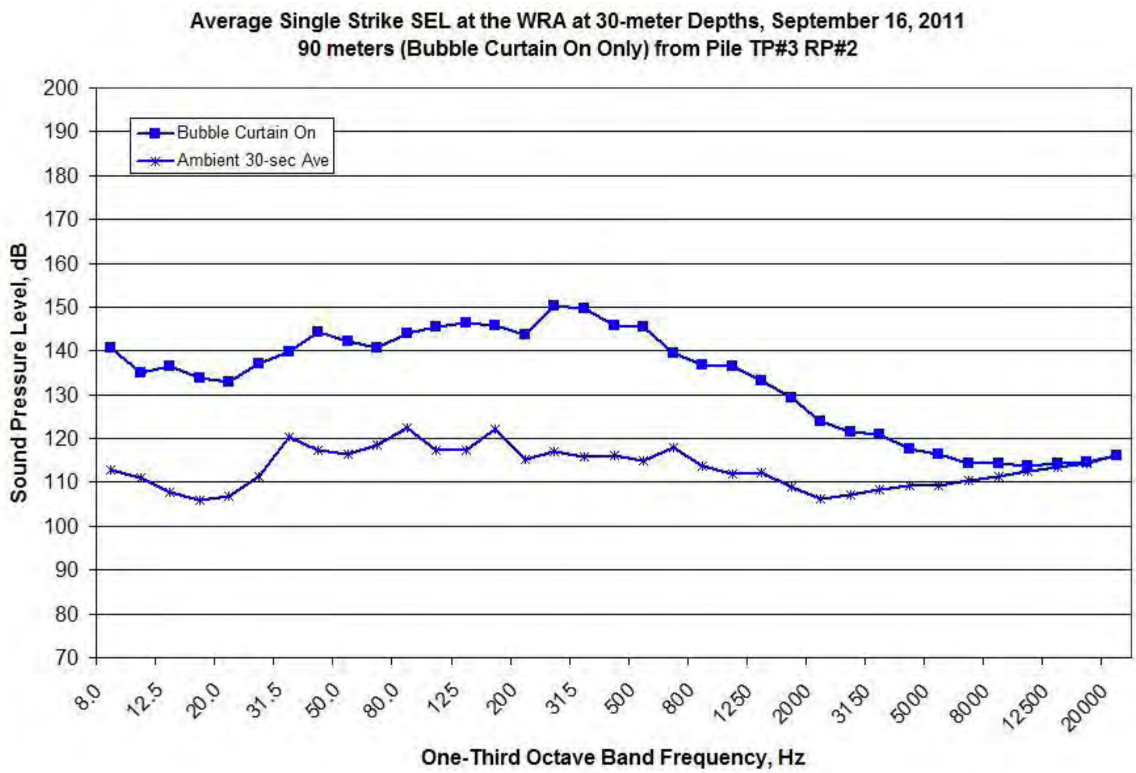

Figure B68. Average One-second SEL Spectral Data Measured at the WRA Location during TP#3 RP#2, 10:44-10:53, Depths of 30 meters on September 16, 2011

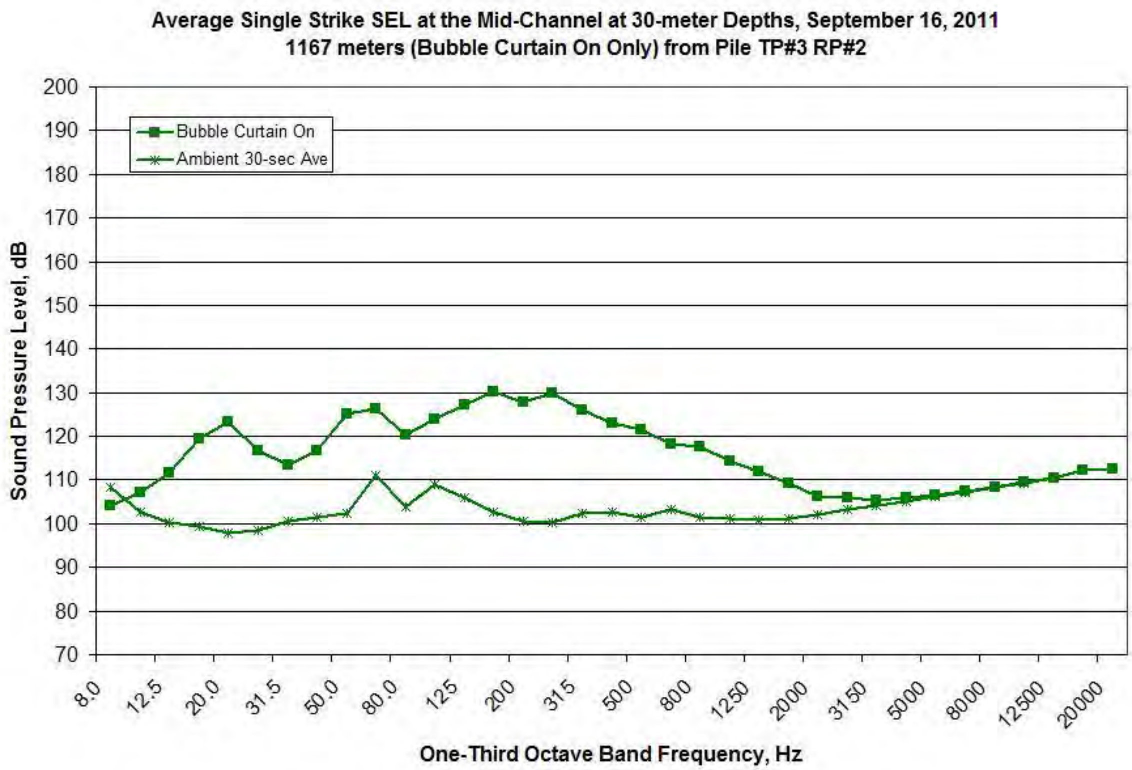

Figure B69. Average One-second SEL Spectral Data Measured at the MID Location during TP#3 RP#2, 10:44-10:53, Depths of 30 meters on September 16, 2011

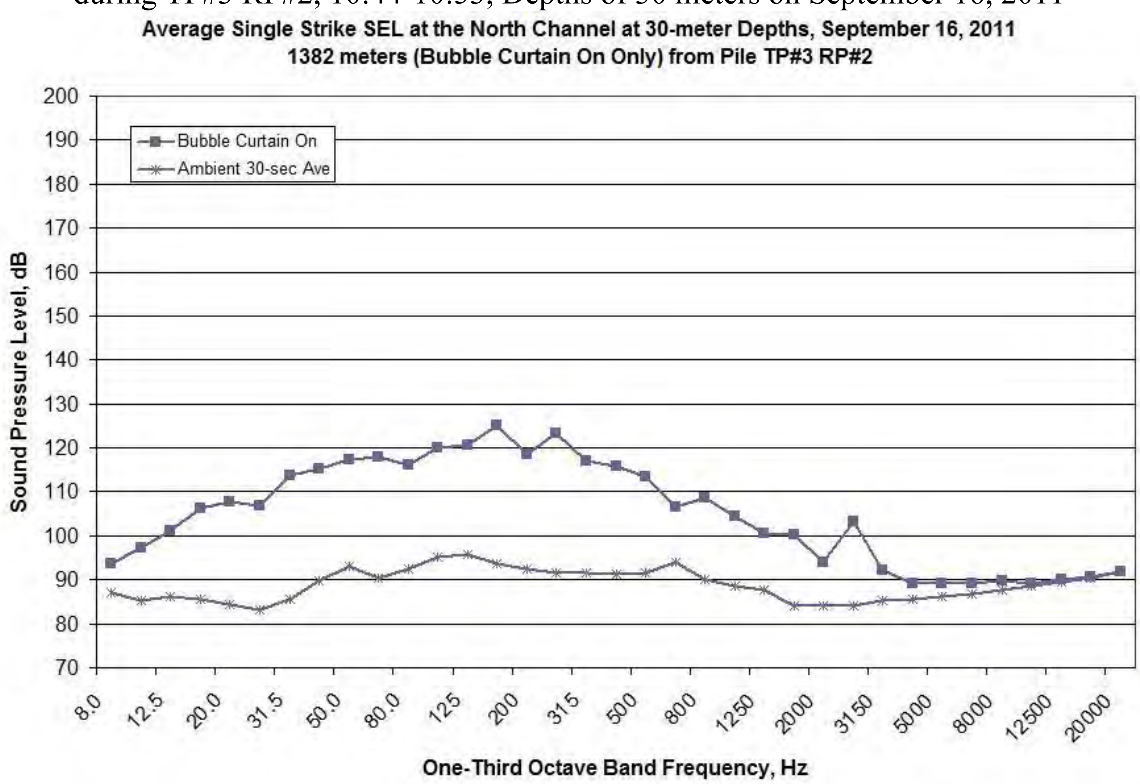

Figure B70. Average One-second SEL Spectral Data Measured at the NO Location during TP#3 RP#2, 10:44-10:53, Depths of 30 meters on September 16, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B71. Average One-second SEL Spectral Data Measured at the SO Location during TP#3 RP#2, 10:44-10:53, Depths of 30 meters on September 16, 2011

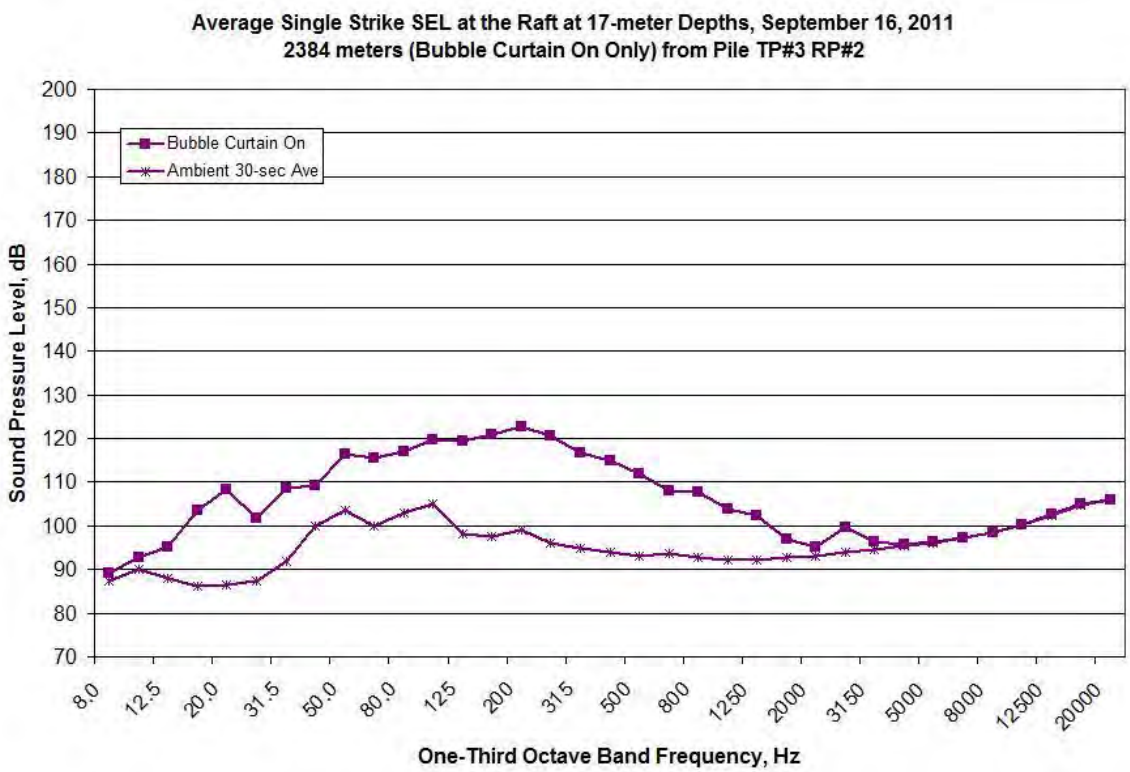

Figure B72. Average One-second SEL Spectral Data Measured at the RFT Location during TP#3 RP#2, 10:44-10:53, Depths of 17 meters on September 16, 2011

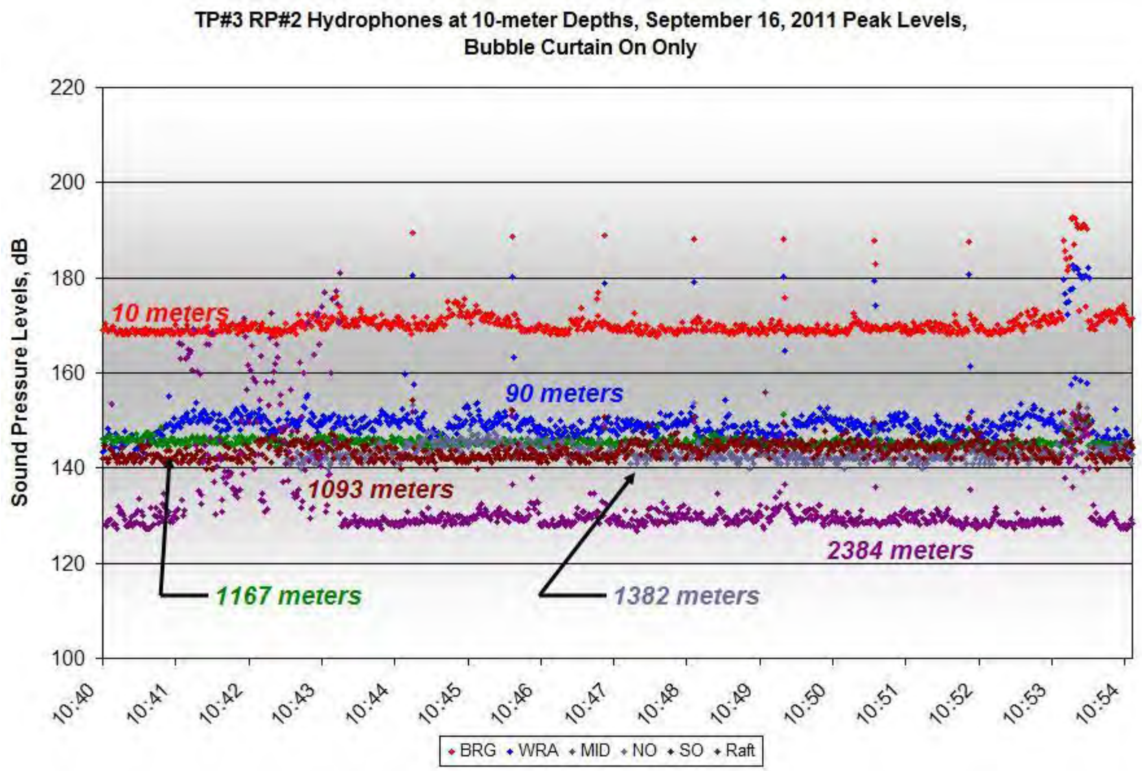

Figure B73. One-second Peak Level Data for TP#3 RP#2 during Bubble On Conditions, 10:44-10:53, at Depths of 10 meters on September 16, 2011

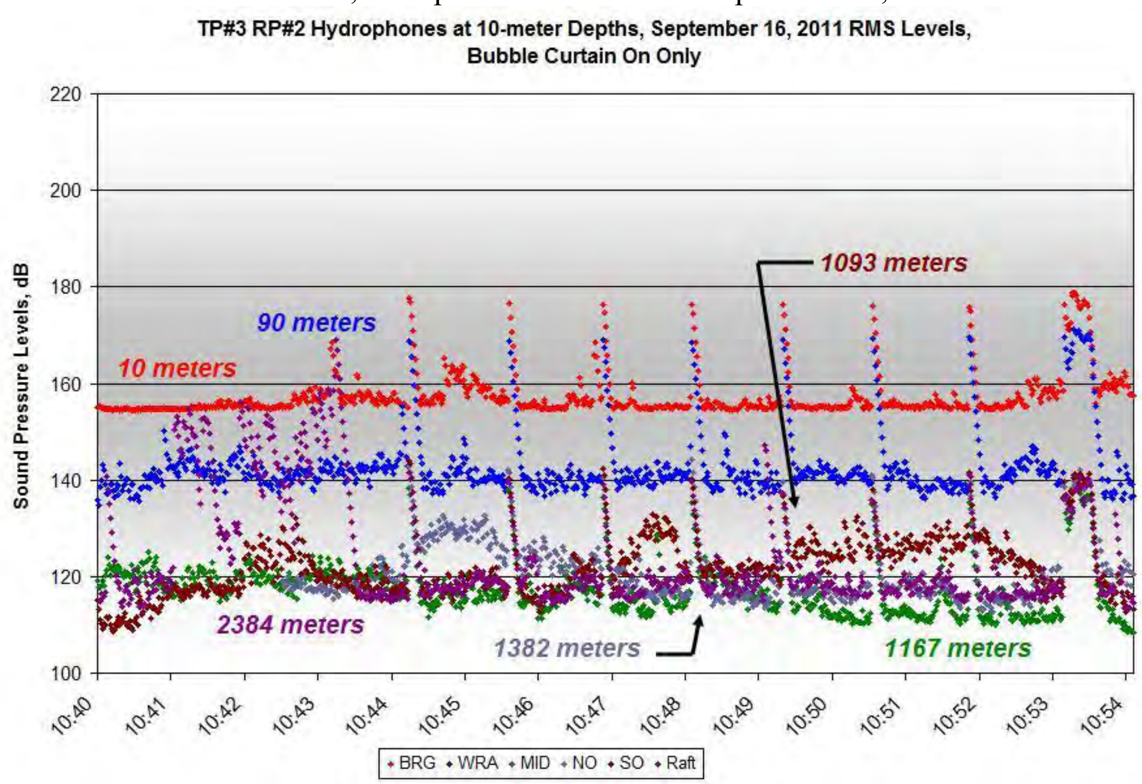

Figure B74. Impulse RMS Data for TP#3 RP#2 during Bubble On Conditions, 10:44-10:53, at Depths of 10 meters on September 16, 2011

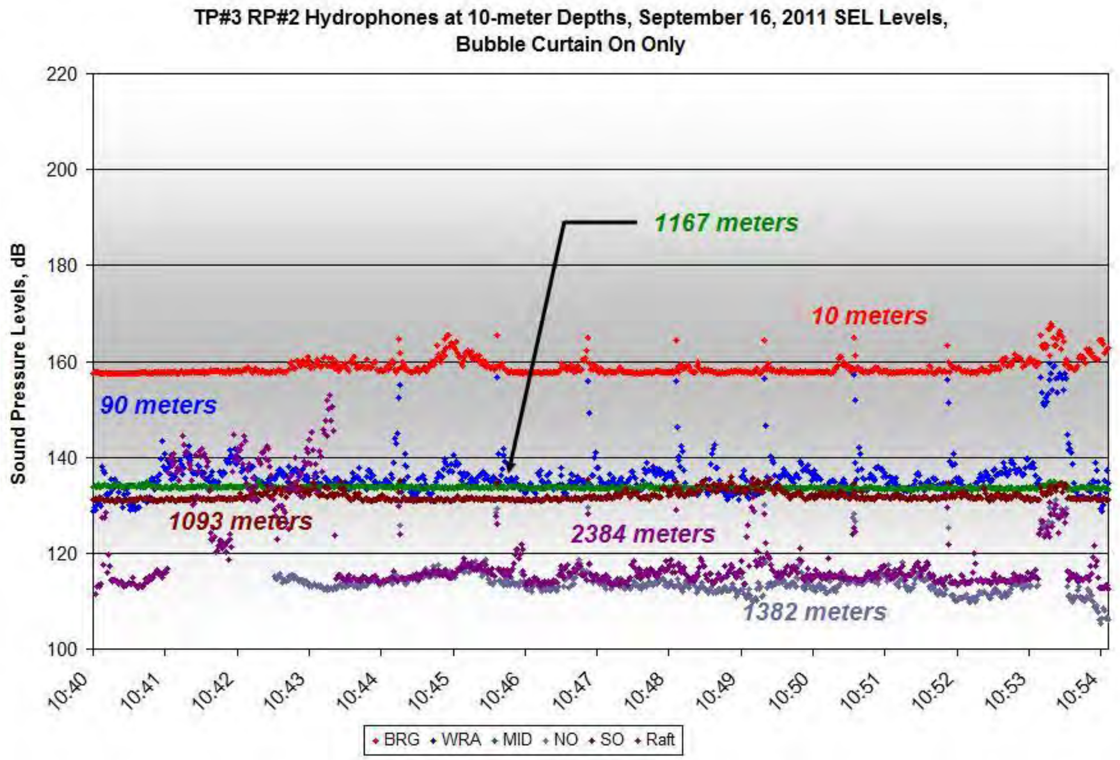

Figure B75. One-second SEL Data for TP#3 RP#2 during Bubble On Conditions, 10:44-10:53, at Depths of 10 meters on September 16, 2011

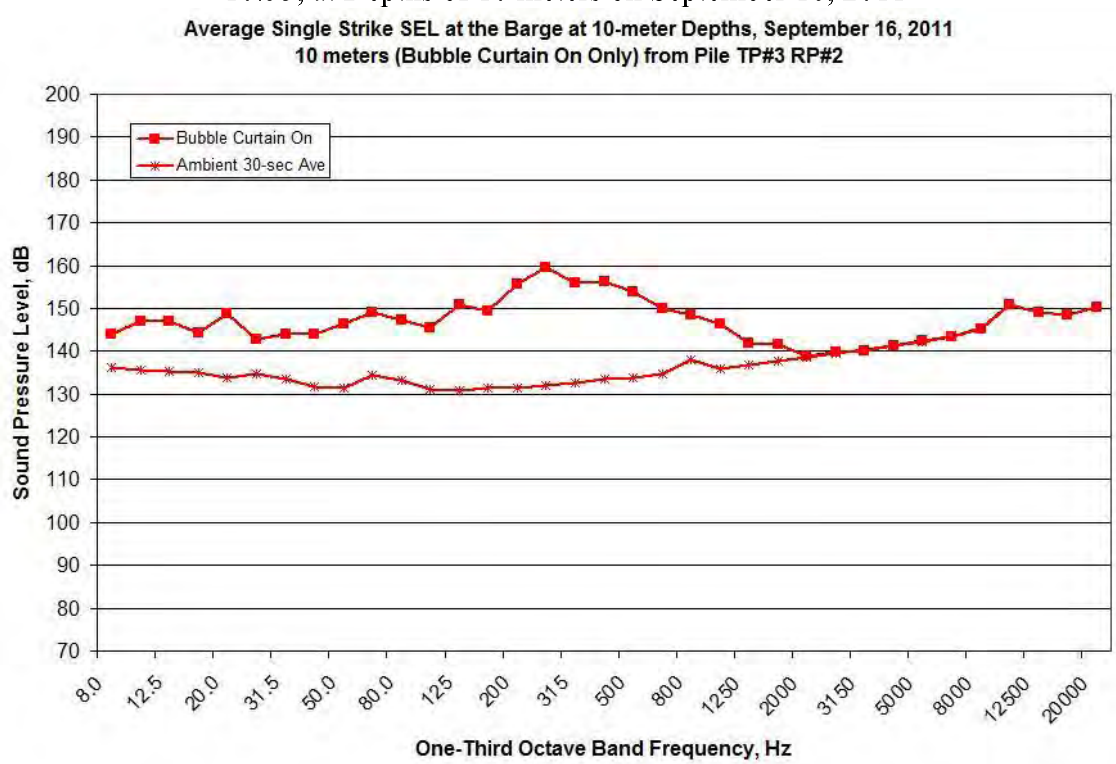

Figure B76. Average One-second SEL Spectral Data Measured at the BRG Location during TP#3 RP#2, 10:44-10:53, Depths of 10 meters on September 16, 2011

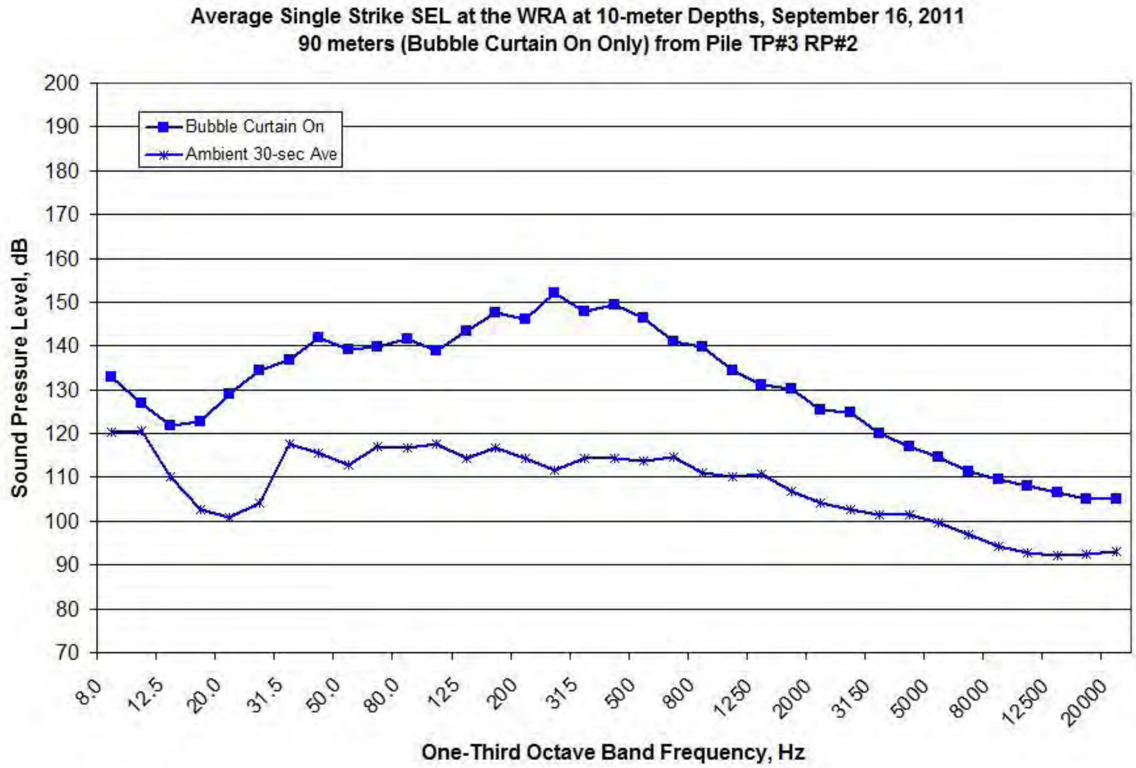

Figure B77. Average One-second SEL Spectral Data Measured at the WRA Location during TP#3 RP#2, 10:44-10:53, Depths of 10 meters on September 16, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B78. Average One-second SEL Spectral Data Measured at the MID Location during TP#3 RP#2, 10:44-10:53, Depths of 10 meters on September 16, 2011

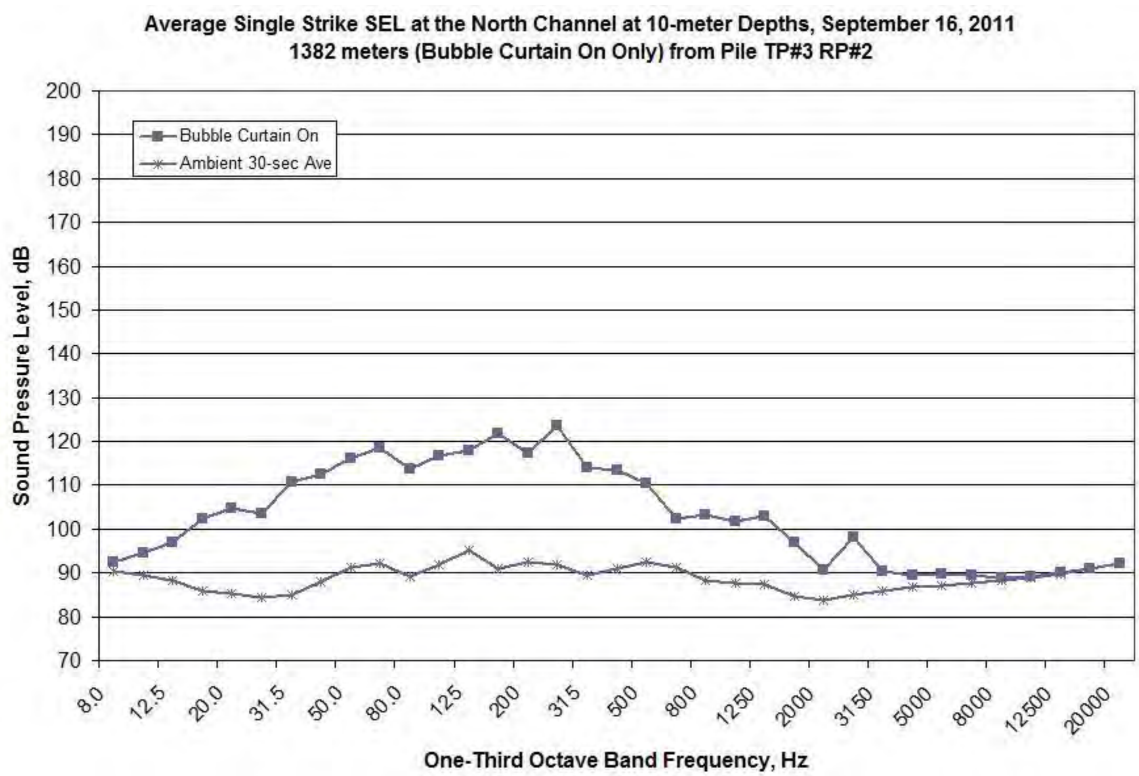

Figure B79. Average One-second SEL Spectral Data Measured at the NO Location during TP#3 RP#2, 10:44-10:53, Depths of 10 meters on September 16, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B80. Average One-second SEL Spectral Data Measured at the SO Location during TP#3 RP#2, 10:44-10:53, Depths of 10 meters on September 16, 2011

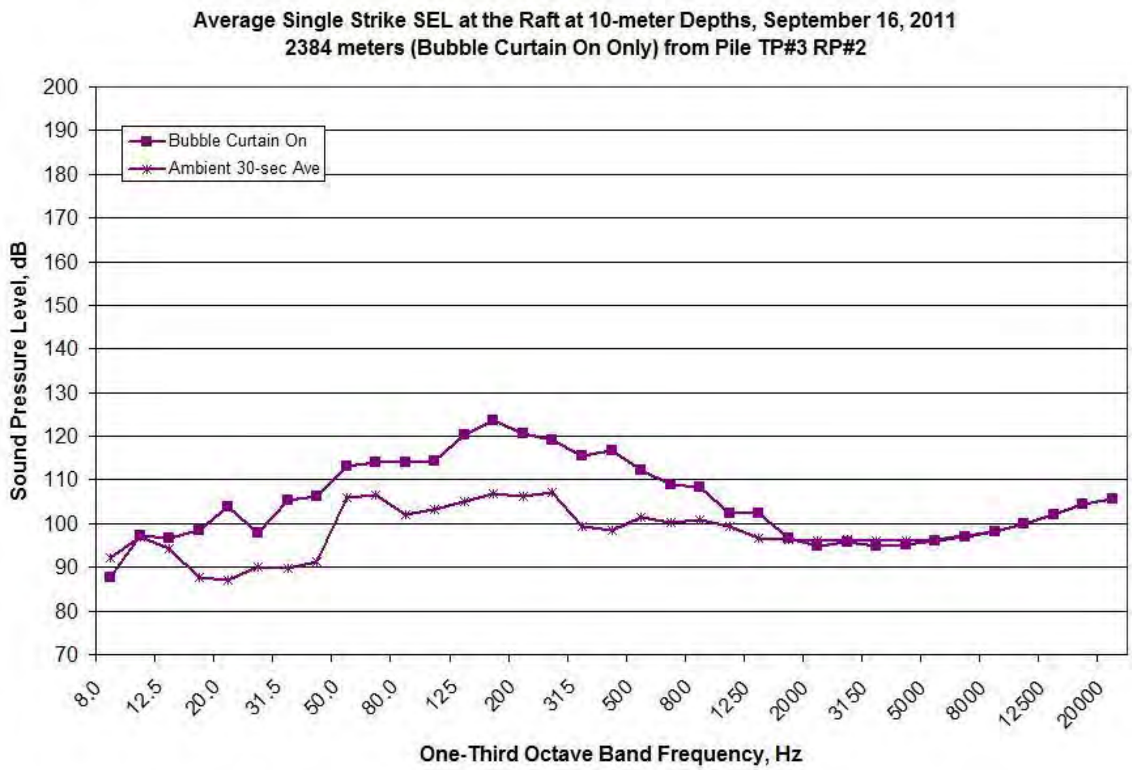

Figure B81. Average One-second SEL Spectral Data Measured at the RFT Location during TP#3 RP#2, 10:44-10:53, Depths of 10 meters on September 16, 2011

TP#3 RP#1

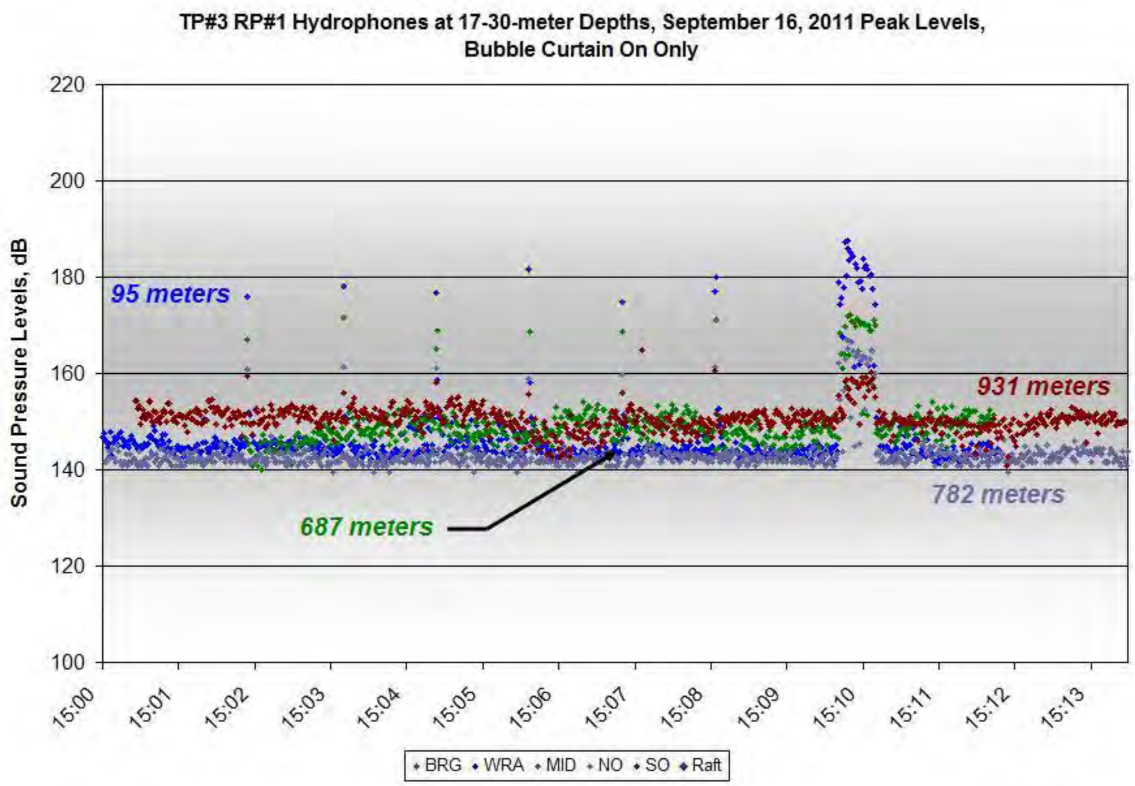

Figure B82. One-second Peak Level Data for TP#3 RP#1 during Bubble On Conditions, 15:02-15:11, at Depths of 17-30 meters on September 16, 2011

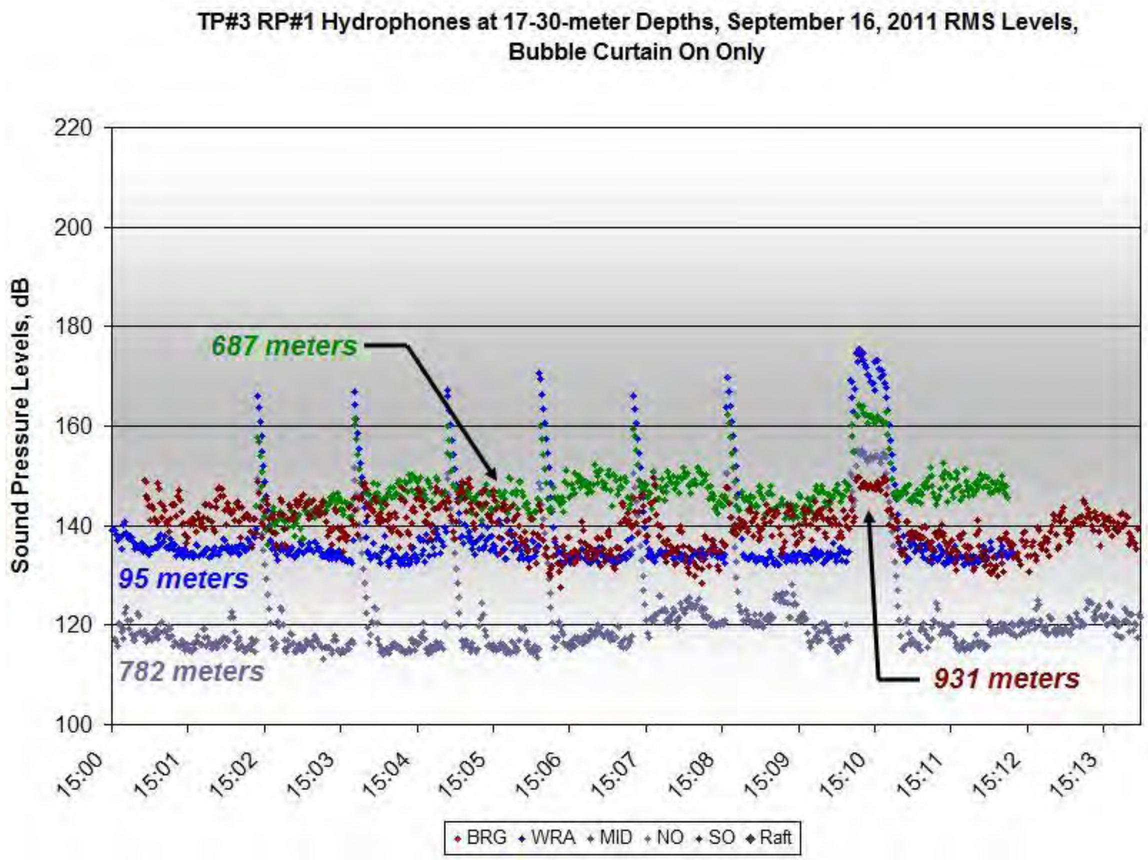

Figure B83. Impulse RMS Data for TP#3 RP#1 during Bubble On Conditions, 15:02-15:11, at Depths of 17-30 meters on September 16, 2011

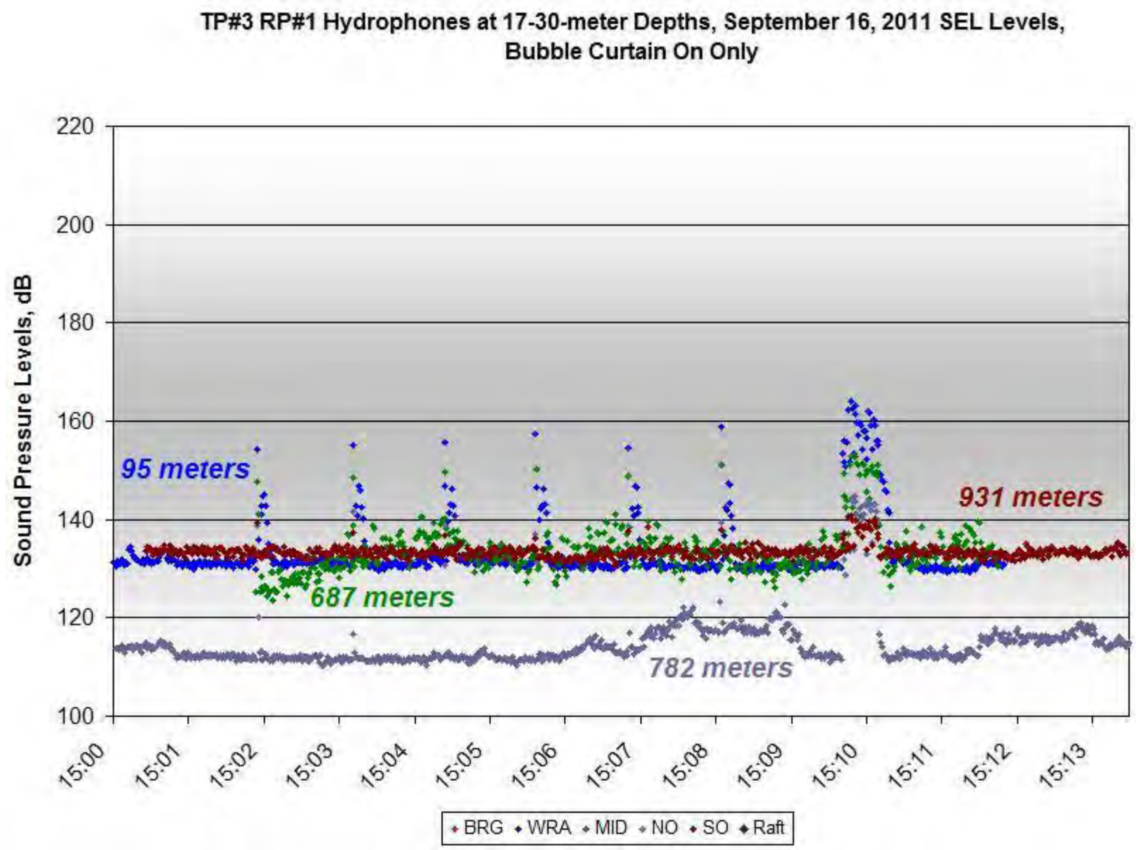

Figure B84. One-second SEL Data for TP#3 RP#1 during Bubble On Conditions, 15:02-15:11, at Depths of 17-30 meters on September 16, 2011

NO PILE DRIVING DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B85. Average One-second SEL Spectral Data Measured at the BRG Location during TP#3 RP#1, 15:02-15:11, Depths of 20 meters on September 16, 2011

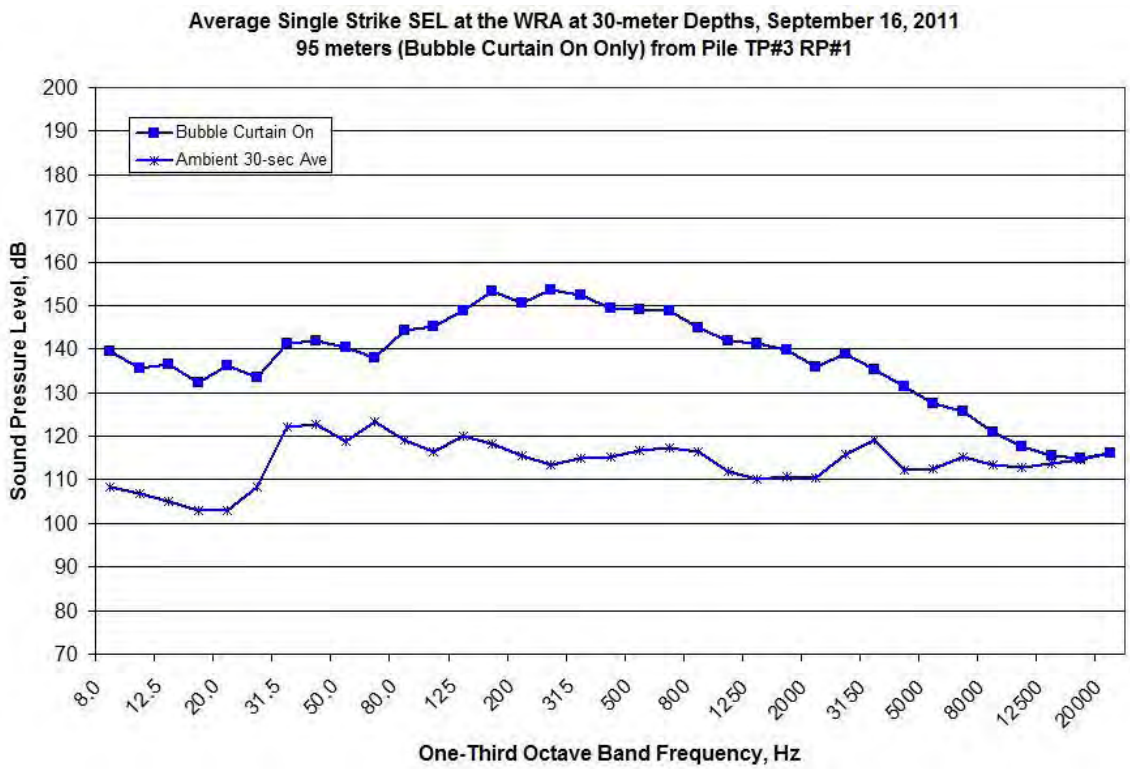

Figure B86. Average One-second SEL Spectral Data Measured at the WRA Location during TP#3 RP#1, 15:02-15:11, Depths of 30 meters on September 16, 2011

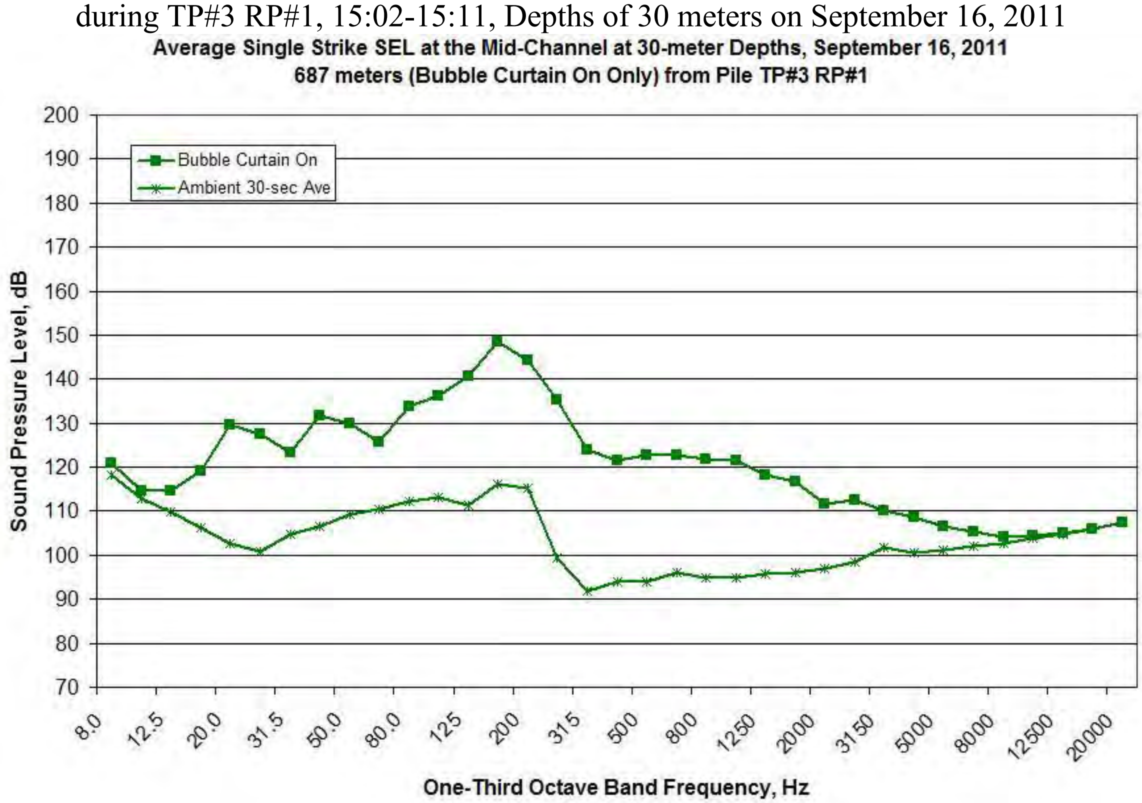

Figure B87. Average One-second SEL Spectral Data Measured at the MID Location during TP#3 RP#1, 15:02-15:11, Depths of 30 meters on September 16, 2011

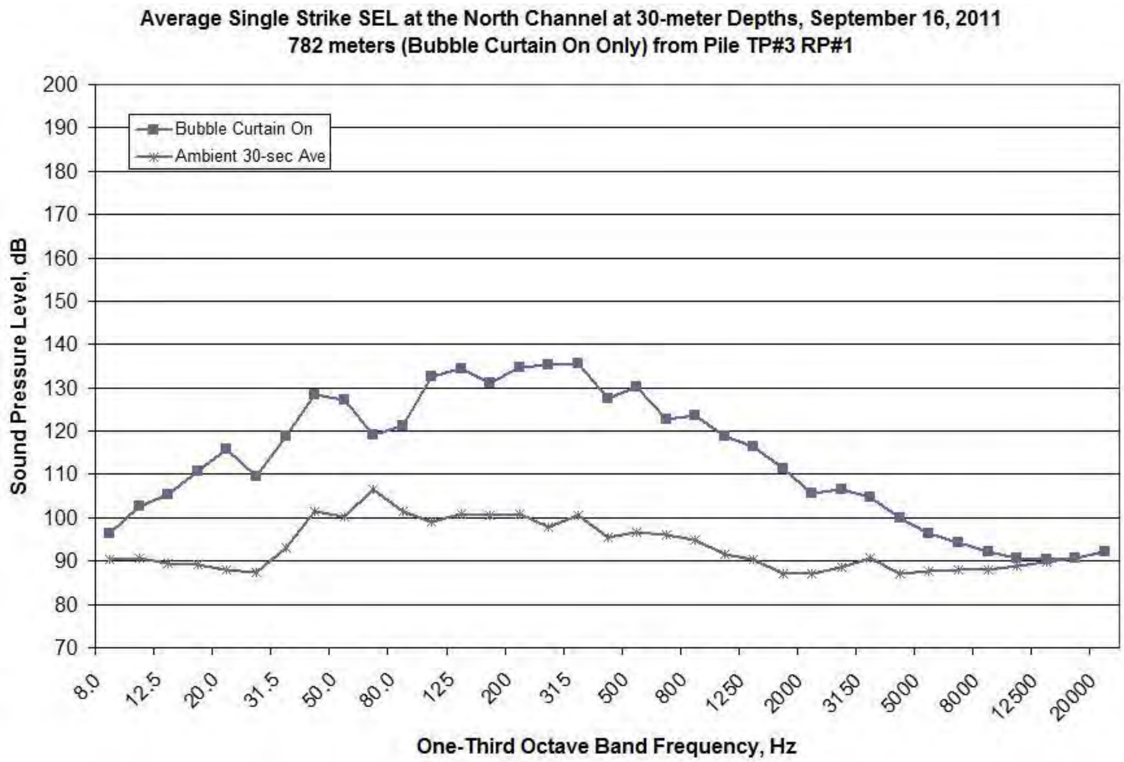

Figure B88. Average One-second SEL Spectral Data Measured at the NO Location during TP#3 RP#1, 15:02-15:11, Depths of 30 meters on September 16, 2011

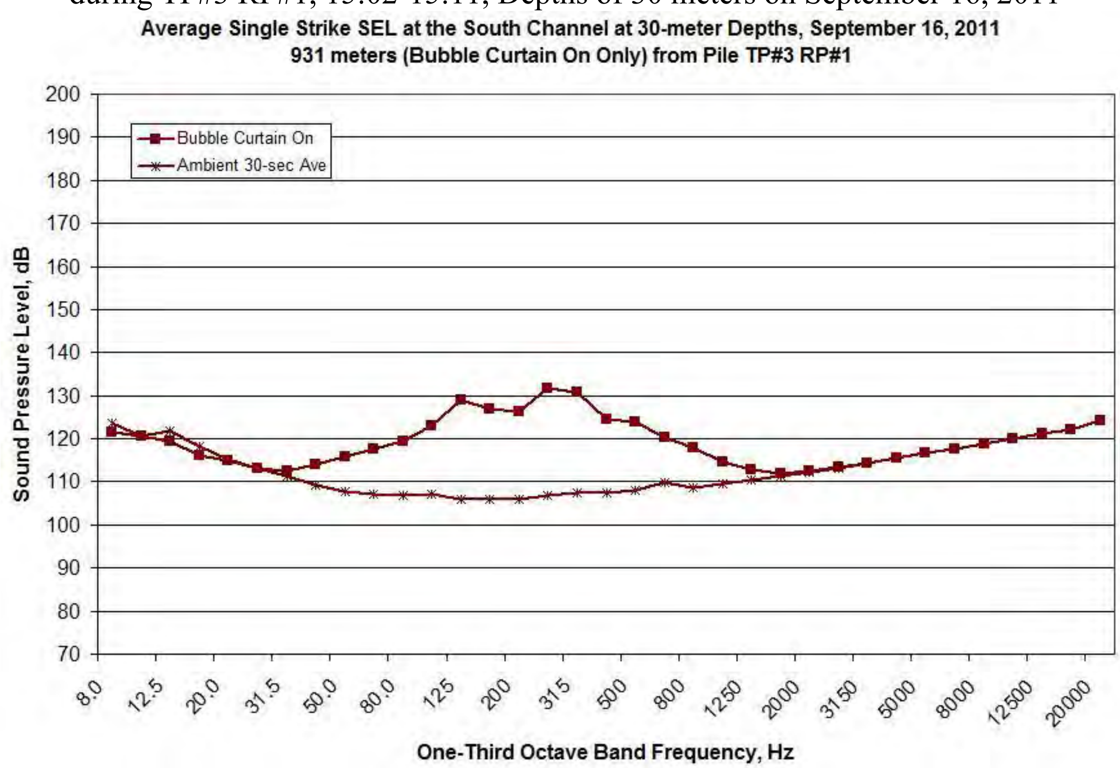

Figure B89. Average One-second SEL Spectral Data Measured at the SO Location during TP#3 RP#1, 15:02-15:11, Depths of 30 meters on September 16, 2011

NO DATA AVAILABLE

Figure B90. Average One-second SEL Spectral Data Measured at the RFT Location during TP#3 RP#1, 15:02-15:11, Depths of 17 meters on September 16, 2011

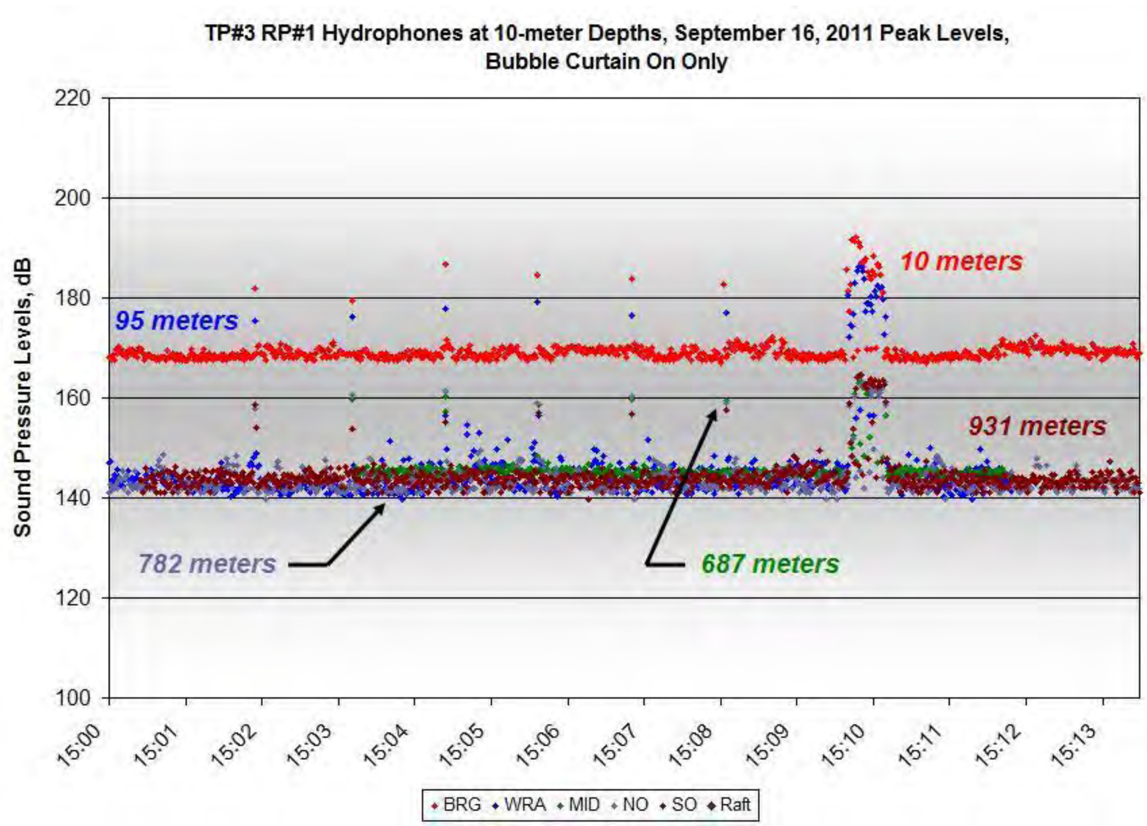

Figure B91. One-second Peak Level Data for TP#3 RP#1 during Bubble On Conditions, 15:02-15:11, at Depths of 10 meters on September 16, 2011

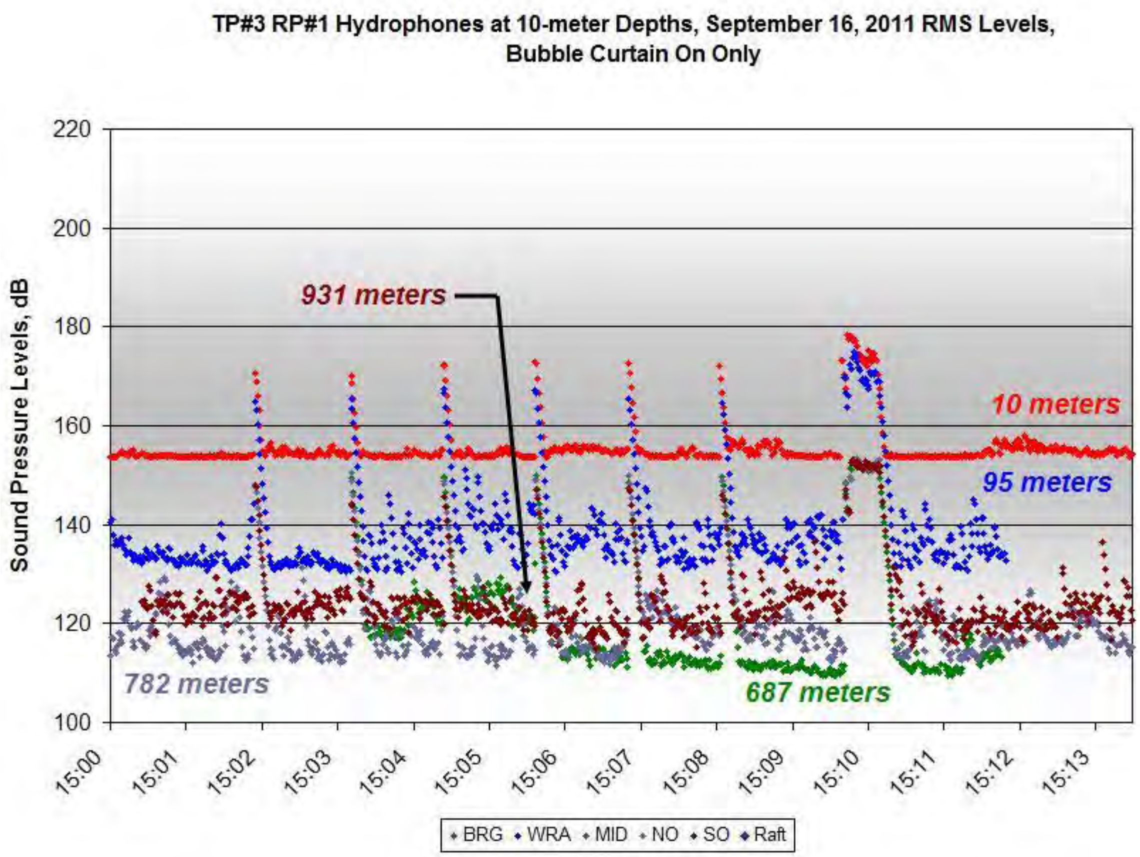

Figure B92. Impulse RMS Data for TP#3 RP#1 during Bubble On Conditions, 15:02-15:11, at Depths of 10 meters on September 16, 2011

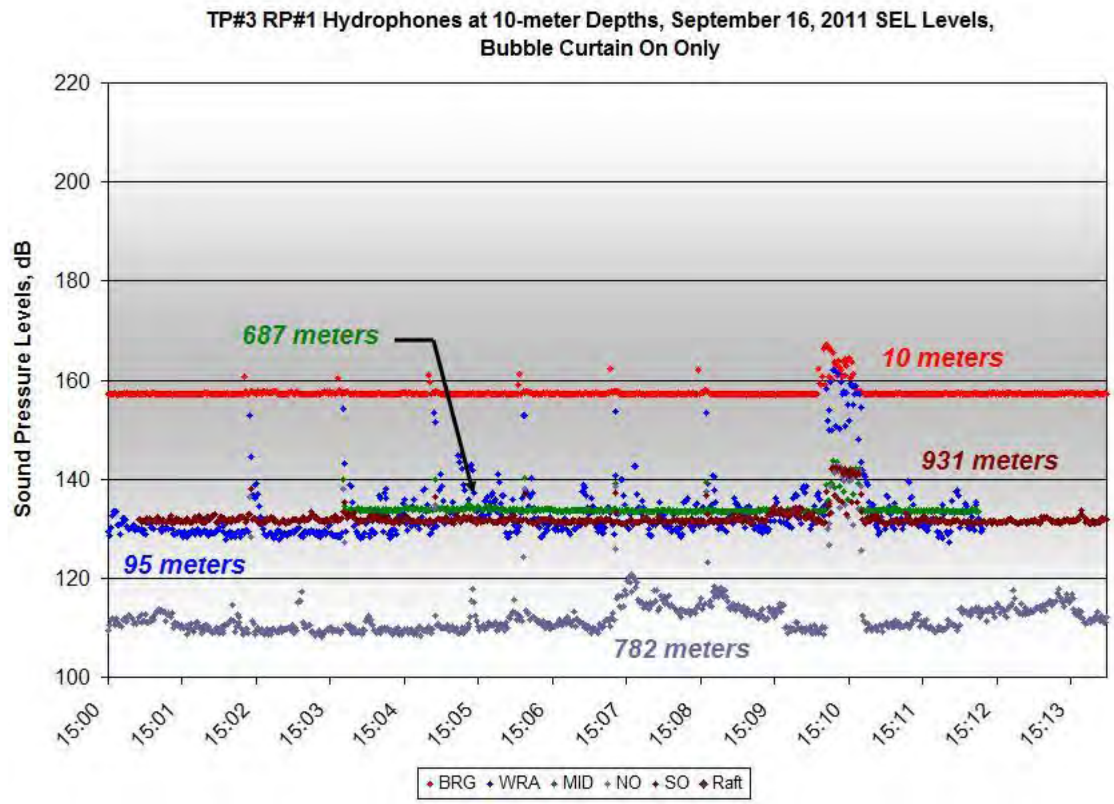

Figure B93. One-second SEL Data for TP#3 RP#1 during Bubble On Conditions, 15:02-15:11, at Depths of 10 meters on September 16, 2011

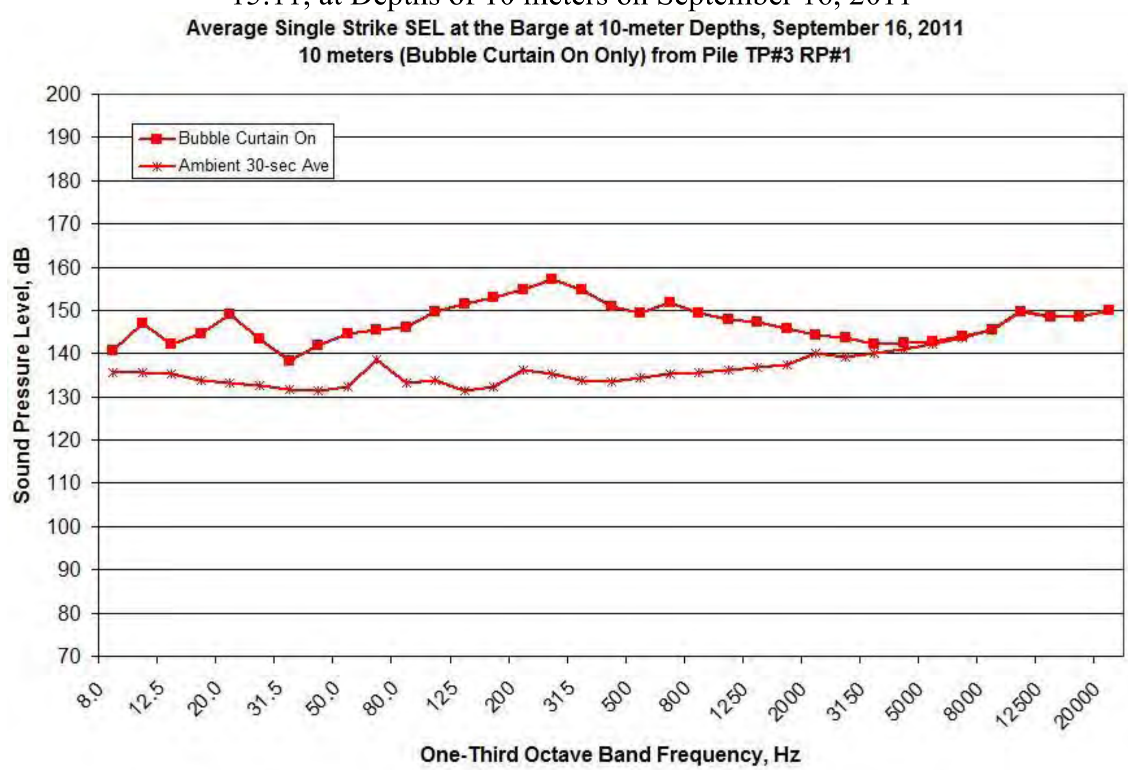

Figure B94. Average One-second SEL Spectral Data Measured at the BRG Location during TP#3 RP#1, 15:02-15:11, Depths of 10 meters on September 16, 2011

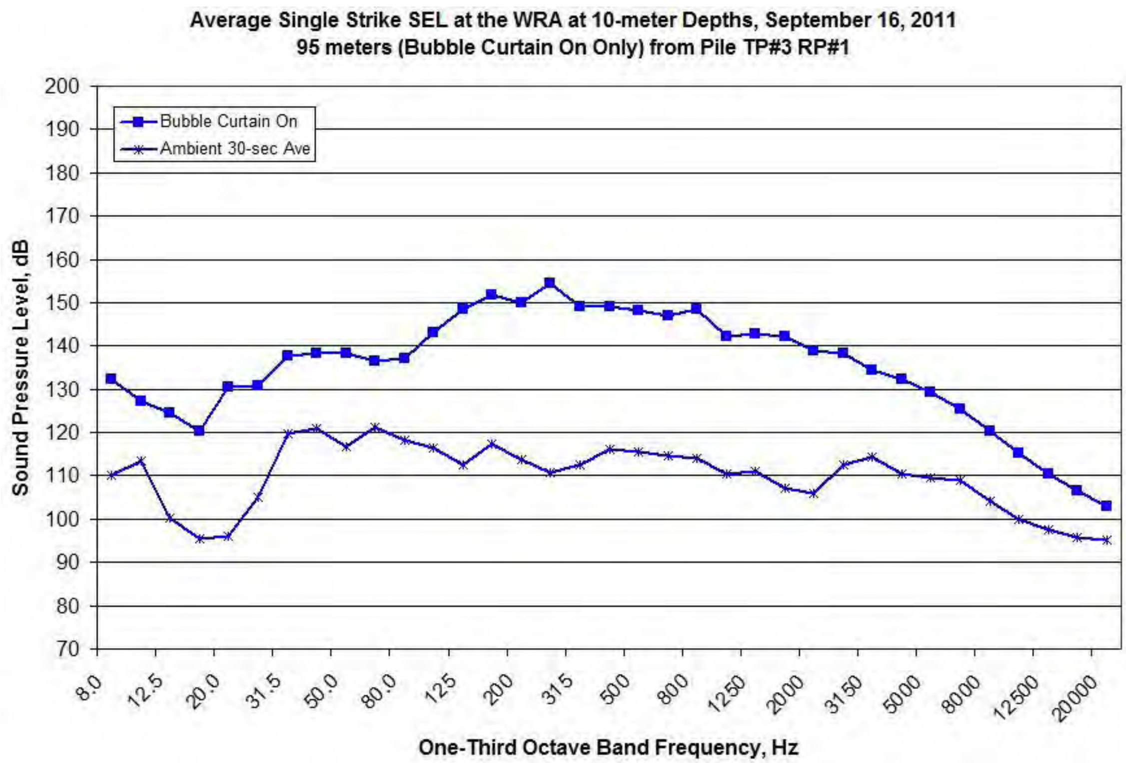

Figure B95. Average One-second SEL Spectral Data Measured at the WRA Location during TP#3 RP#1, 15:02-15:11, Depths of 10 meters on September 16, 2011

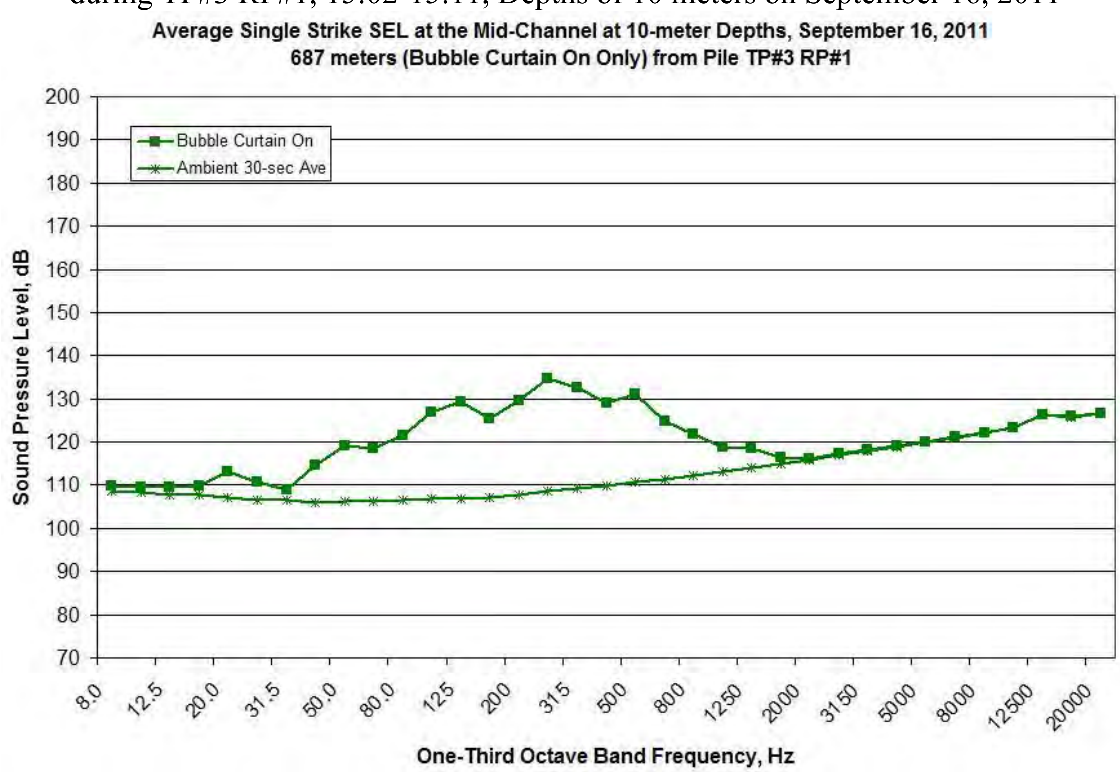

Figure B96. Average One-second SEL Spectral Data Measured at the MID Location during TP#3 RP#1, 15:02-15:11, Depths of 10 meters on September 16, 2011

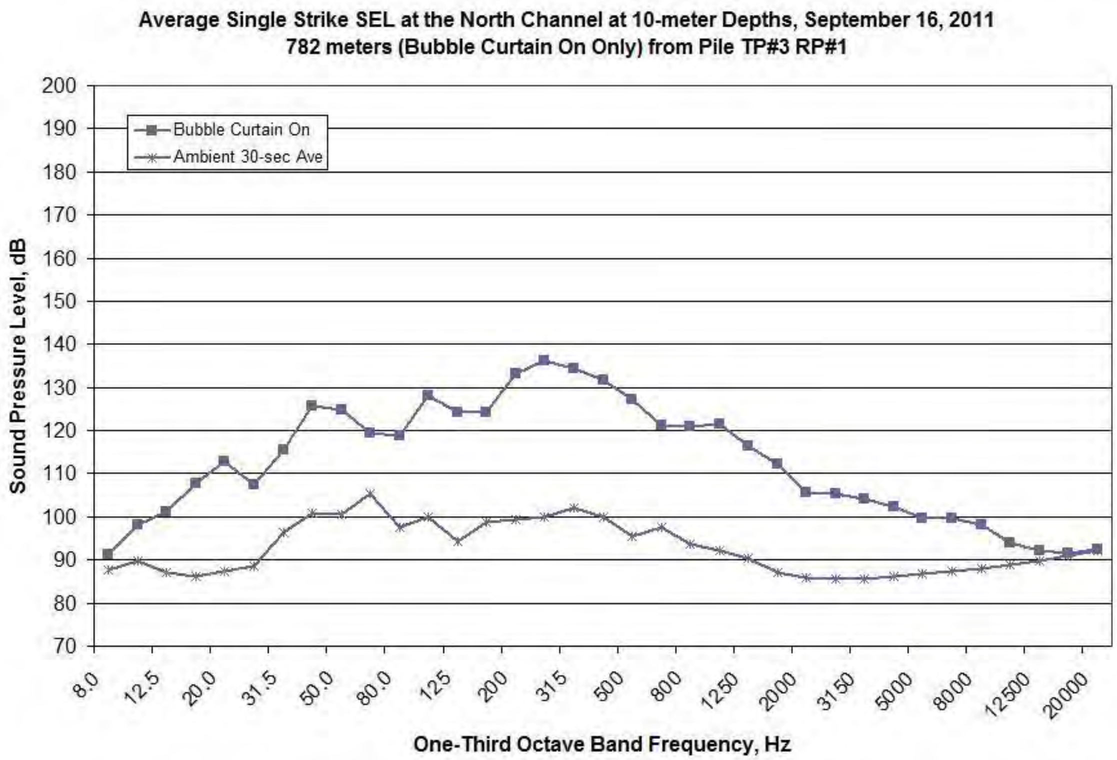

Figure B97. Average One-second SEL Spectral Data Measured at the NO Location during TP#3 RP#1, 15:02-15:11, Depths of 10 meters on September 16, 2011

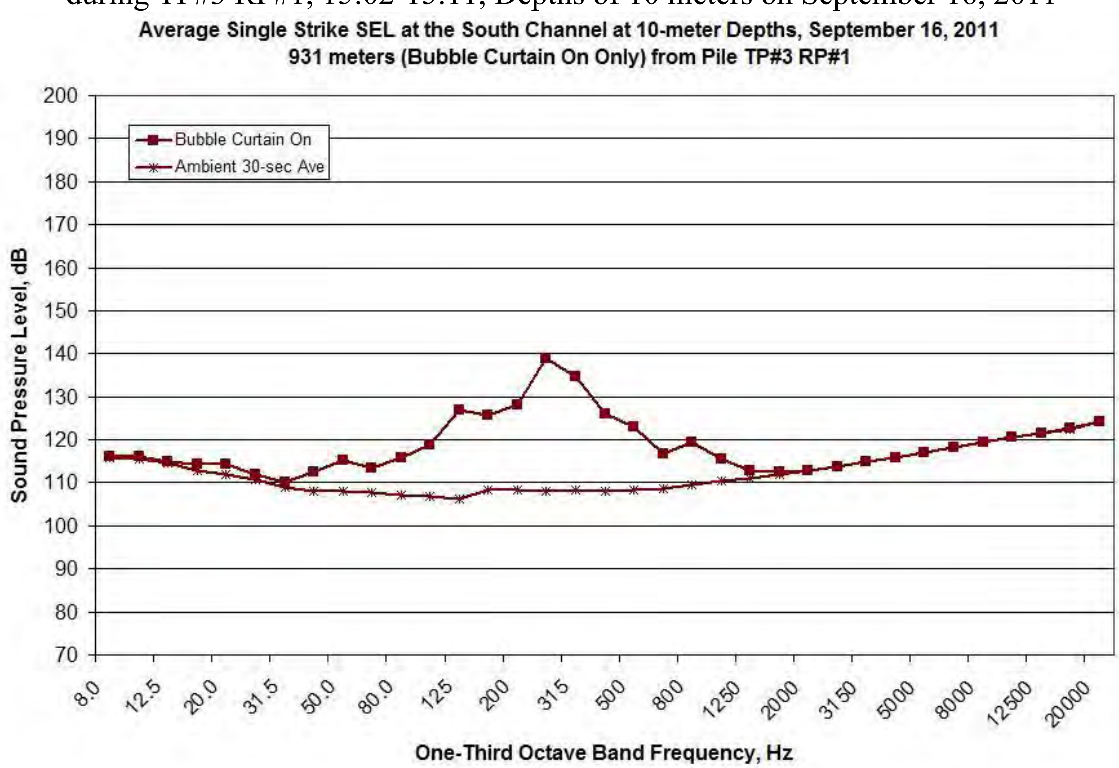

Figure B98. Average One-second SEL Spectral Data Measured at the SO Location during TP#3 RP#1, 15:02-15:11, Depths of 10 meters on September 16, 2011

NO DATA AVAILABLE

Figure B99. Average One-second SEL Spectral Data Measured at the RFT Location during TP#3 RP#1, 15:02-15:11, Depths of 10 meters on September 16, 2011

TP#3

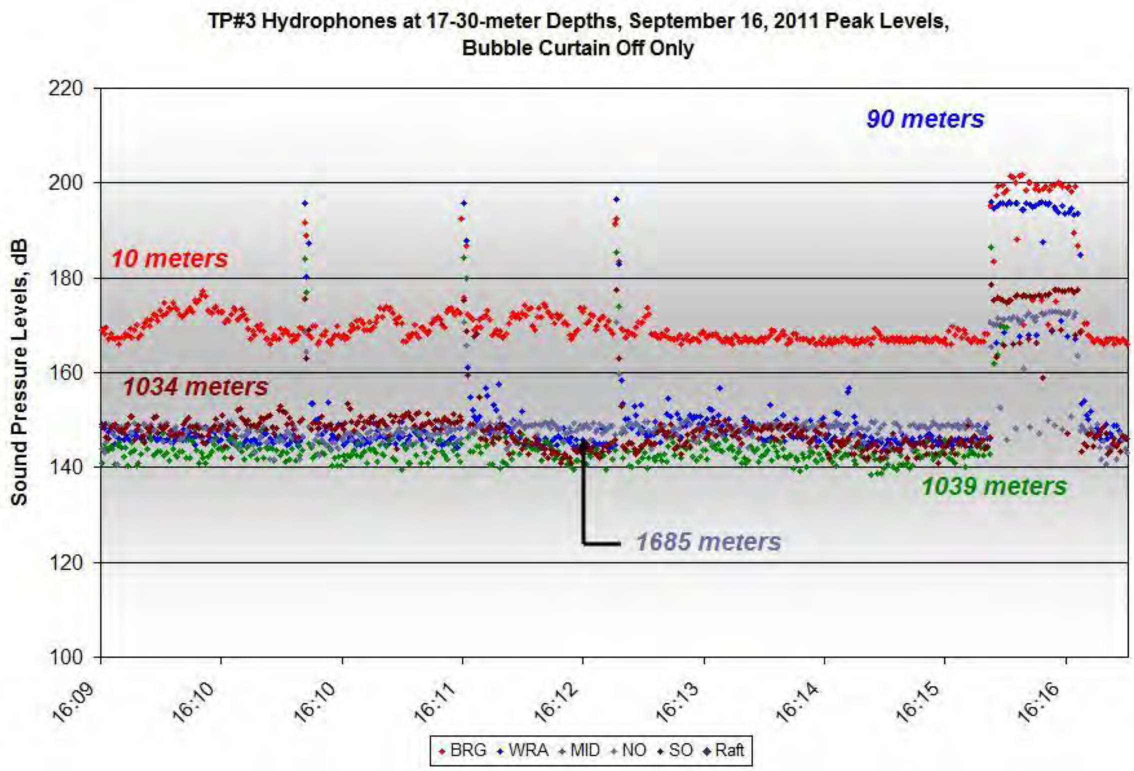

Figure B100. One-second Peak Level Data for TP#3 during Bubble Off Conditions, 16:10-16:16, at Depths of 17-30 meters on September 16, 2011

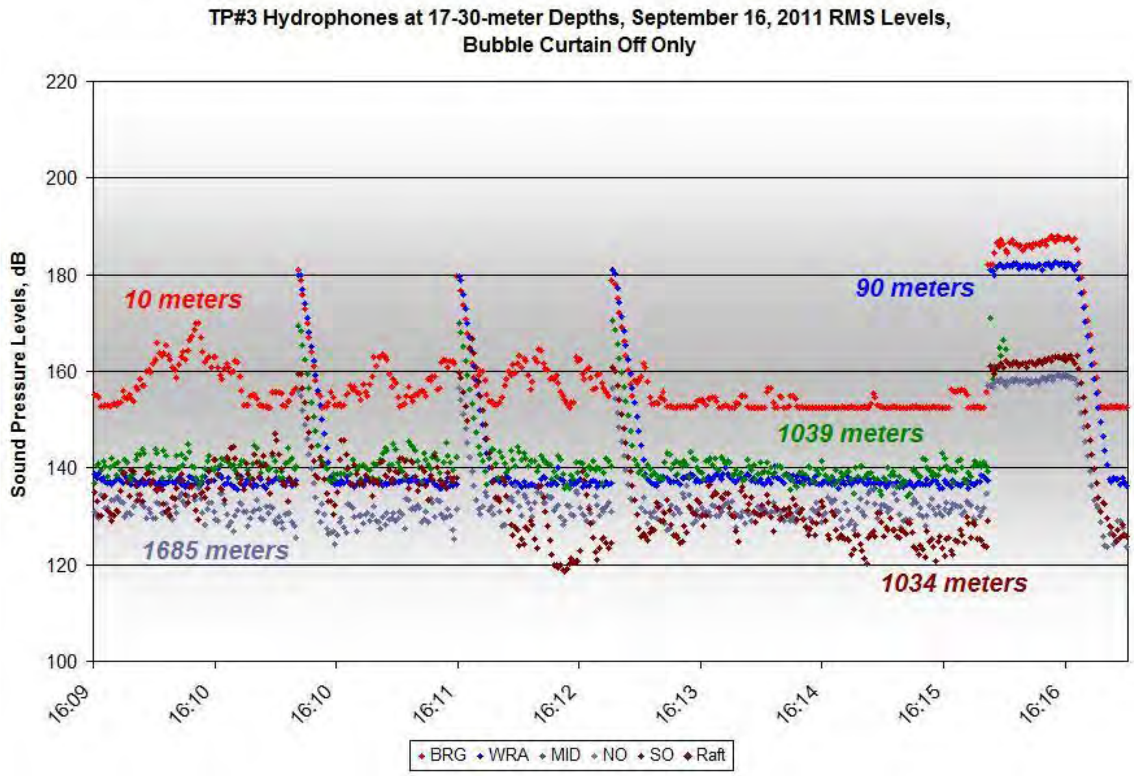

Figure B101. Impulse RMS Data for TP#3 during Bubble Off Conditions, 16:10-16:16, at Depths of 17-30 meters on September 16, 2011

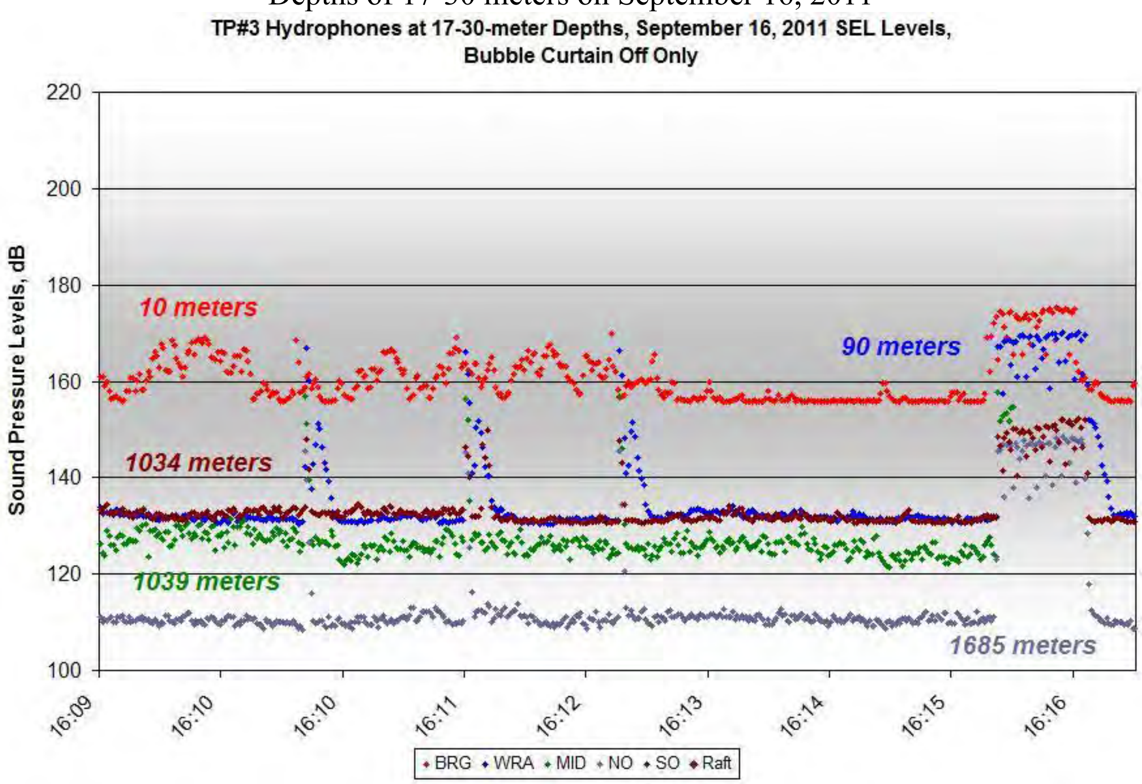

Figure B102. One-second SEL Data for TP#3 during Bubble Off Conditions, 16:10-16:16, at Depths of 17-30 meters on September 16, 2011

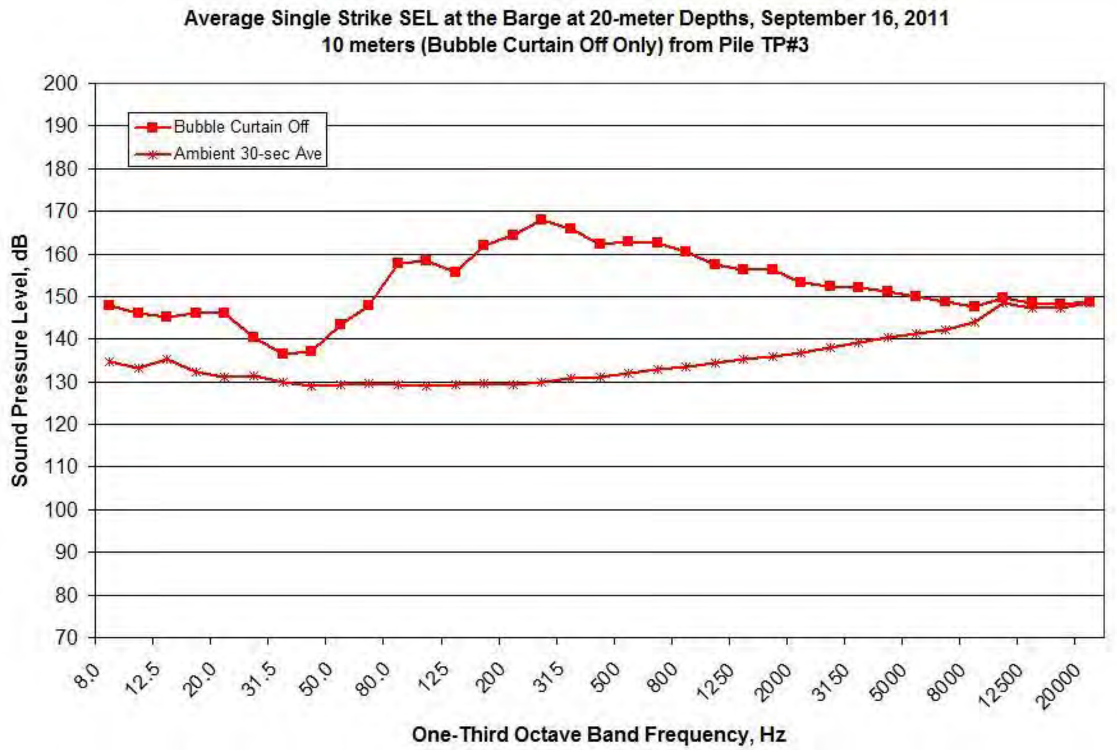

Figure B103. Average One-second SEL Spectral Data Measured at the BRG Location during TP#3, 16:10-16:16, Depths of 20 meters on September 16, 2011

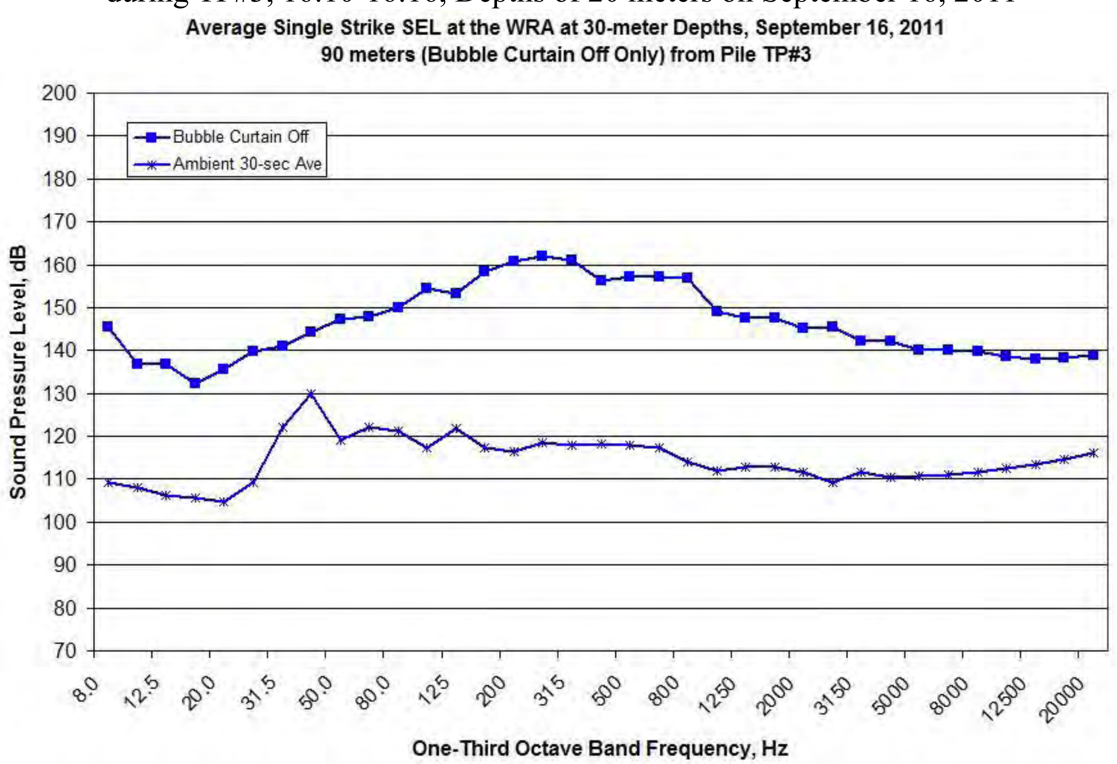

Figure B104. Average One-second SEL Spectral Data Measured at the WRA Location during TP#3, 16:10-16:16, Depths of 30 meters on September 16, 2011

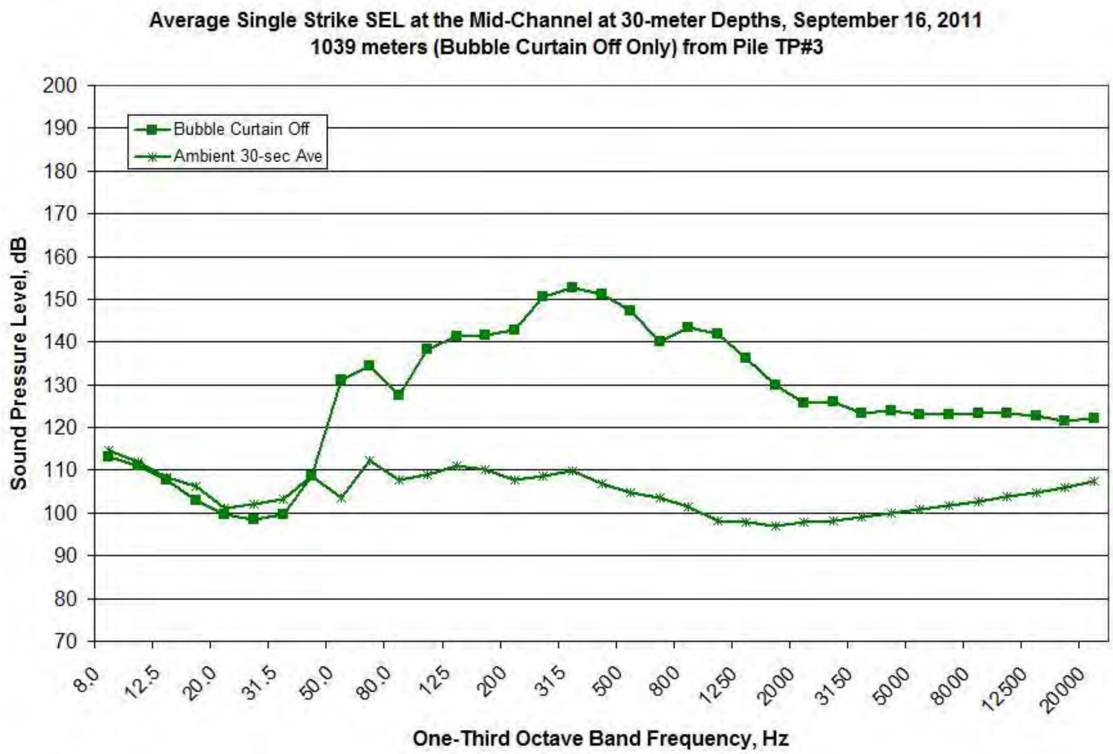

Figure B105. Average One-second SEL Spectral Data Measured at the MID Location during TP#3, 16:10-16:16, Depths of 30 meters on September 16, 2011

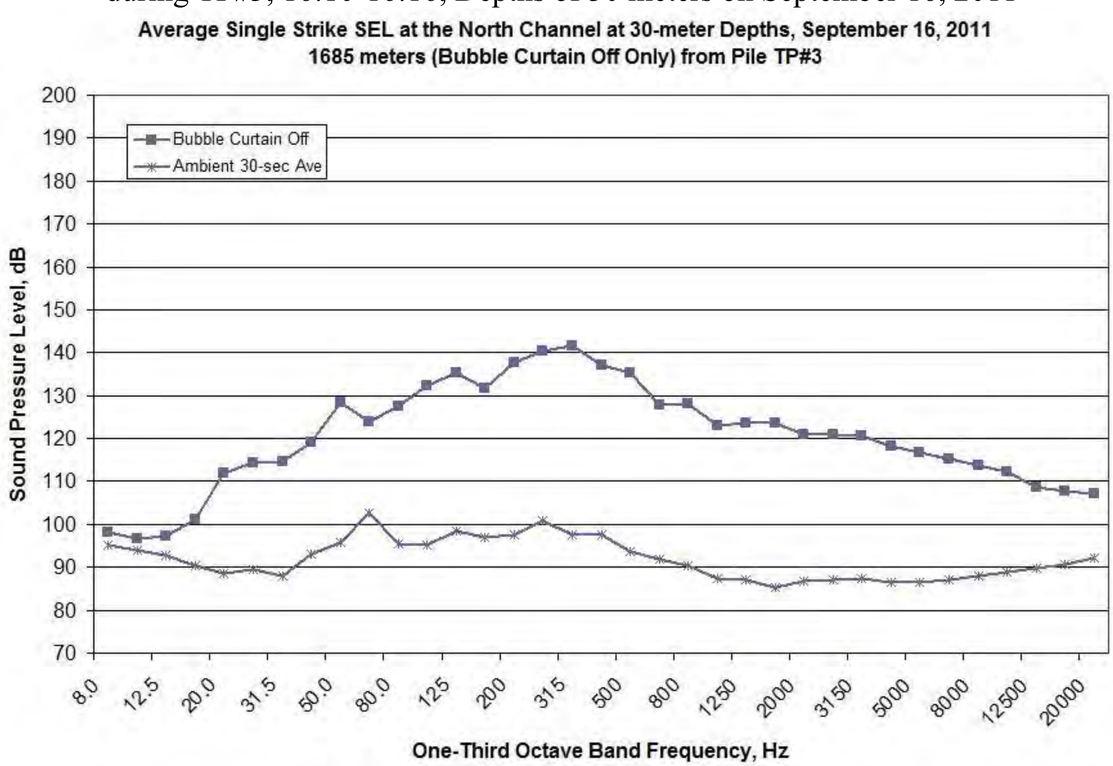

Figure B106. Average One-second SEL Spectral Data Measured at the NO Location during TP#3, 16:10-16:16, Depths of 30 meters on September 16, 2011

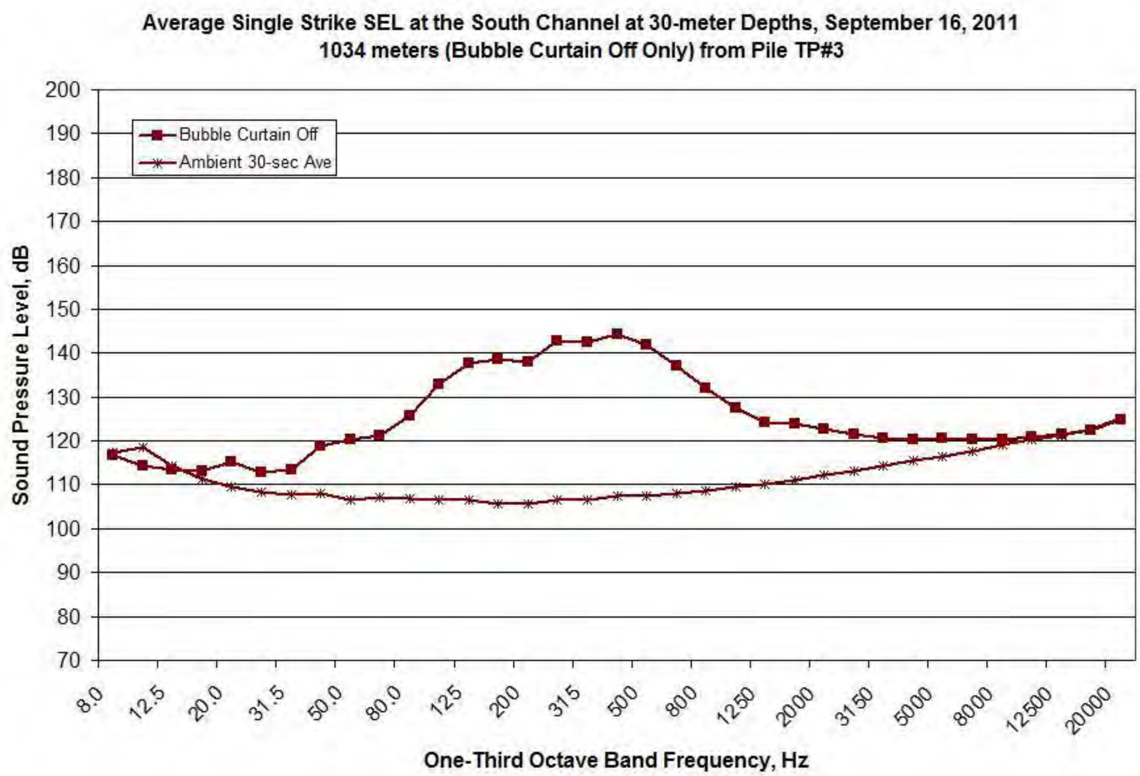

Figure B107. Average One-second SEL Spectral Data Measured at the SO Location during TP#3, 16:10-16:16, Depths of 30 meters on September 16, 2011

NO DATA AVAILABLE

Figure B108. Average One-second SEL Spectral Data Measured at the RFT Location during TP#3, 16:10-16:16, Depths of 17 meters on September 16, 2011

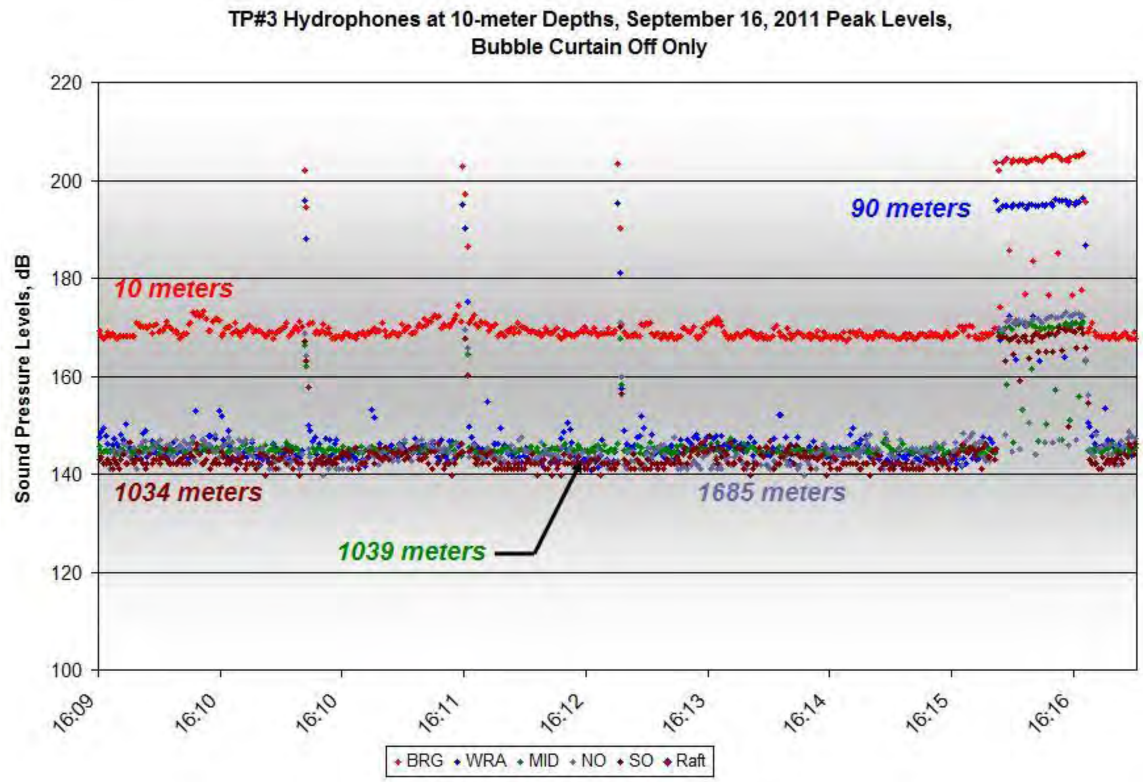

Figure B109. One-second Peak Level Data for TP#3 during Bubble Off Conditions, 16:10-16:16, at Depths of 10 meters on September 16, 2011

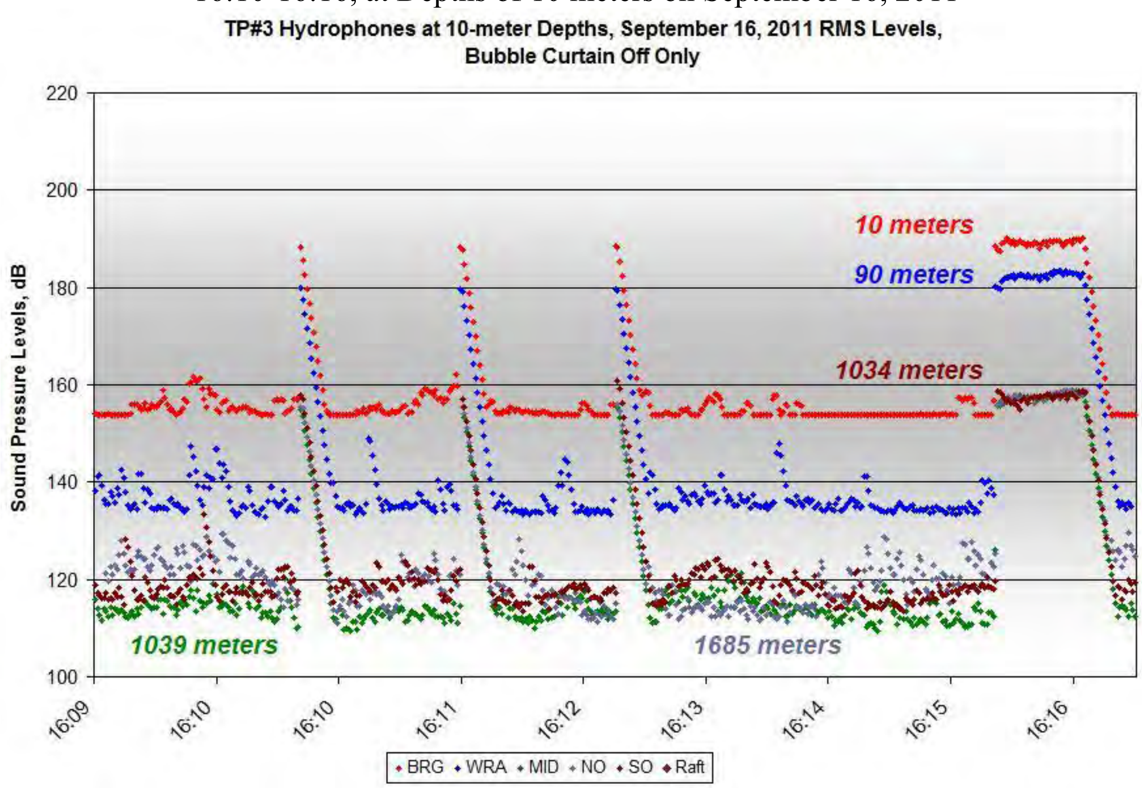

Figure B110. Impulse RMS Data for TP#3 during Bubble Off Conditions, 16:10-16:16, at Depths of 10 meters on September 16, 2011

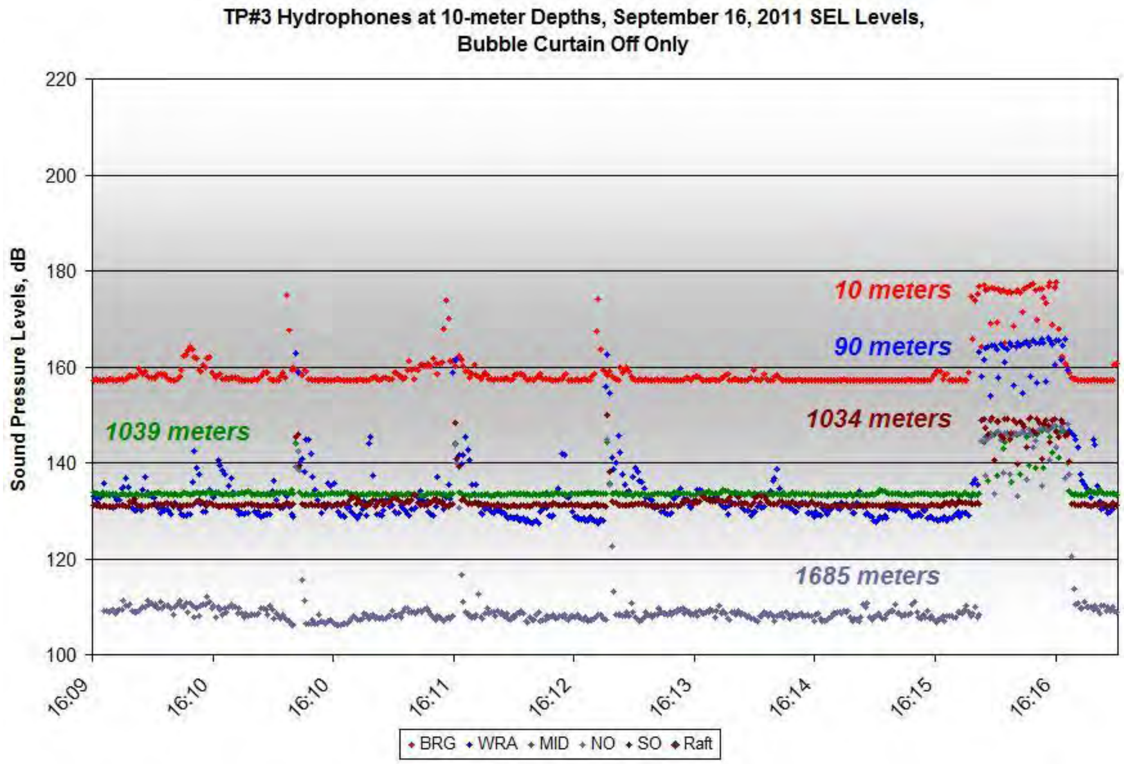

Figure B111. One-second SEL Data for TP#3 during Bubble Off Conditions, 16:10-16:16, at Depths of 10 meters on September 16, 2011

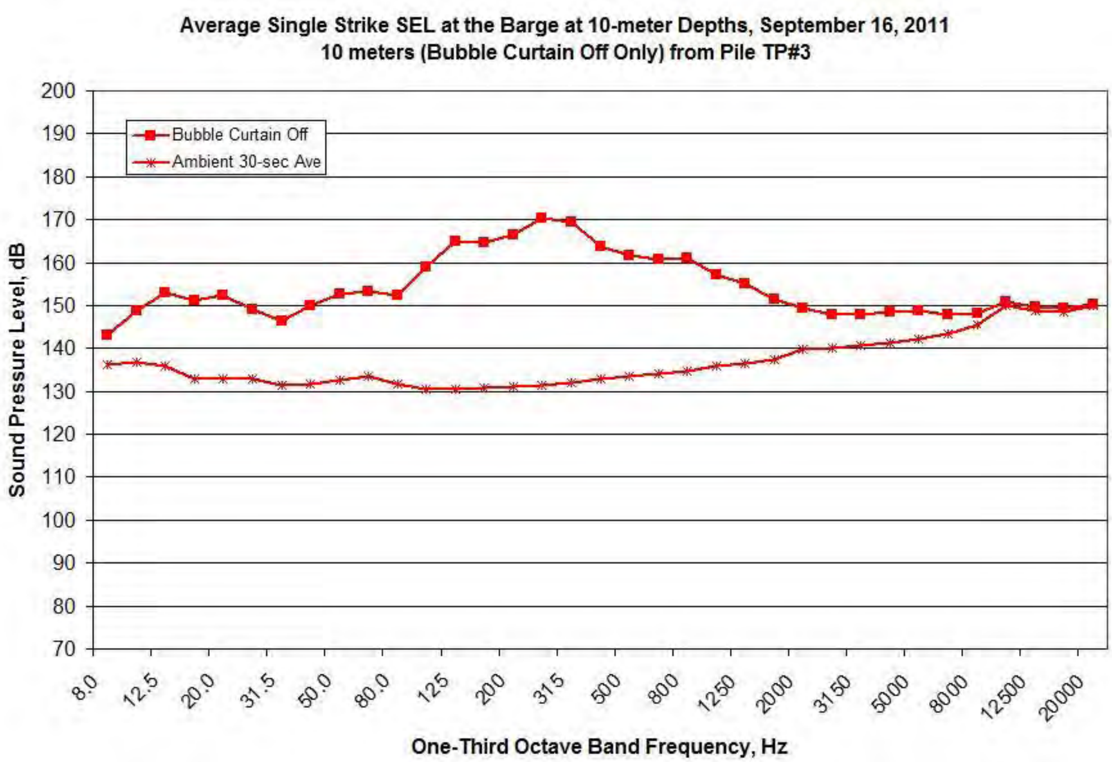

Figure B112. Average One-second SEL Spectral Data Measured at the BRG Location during TP#3, 16:10-16:16, Depths of 10 meters on September 16, 2011

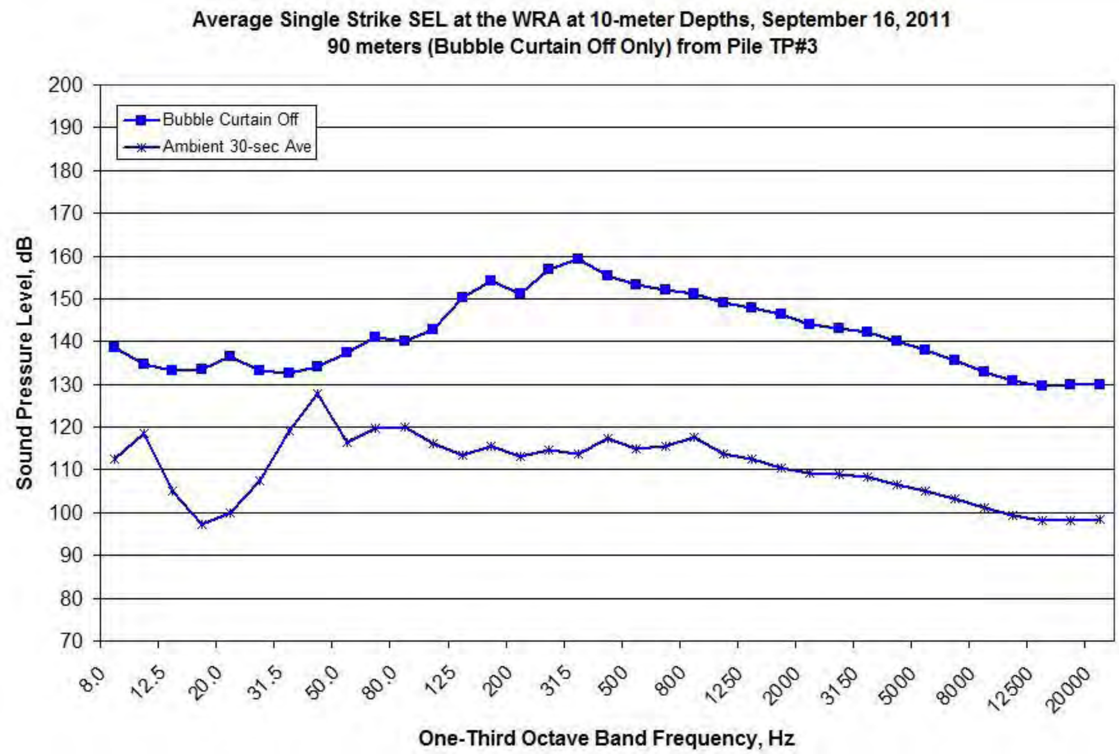

Figure B113. Average One-second SEL Spectral Data Measured at the WRA Location during TP#3, 16:10-16:16, Depths of 10 meters on September 16, 2011

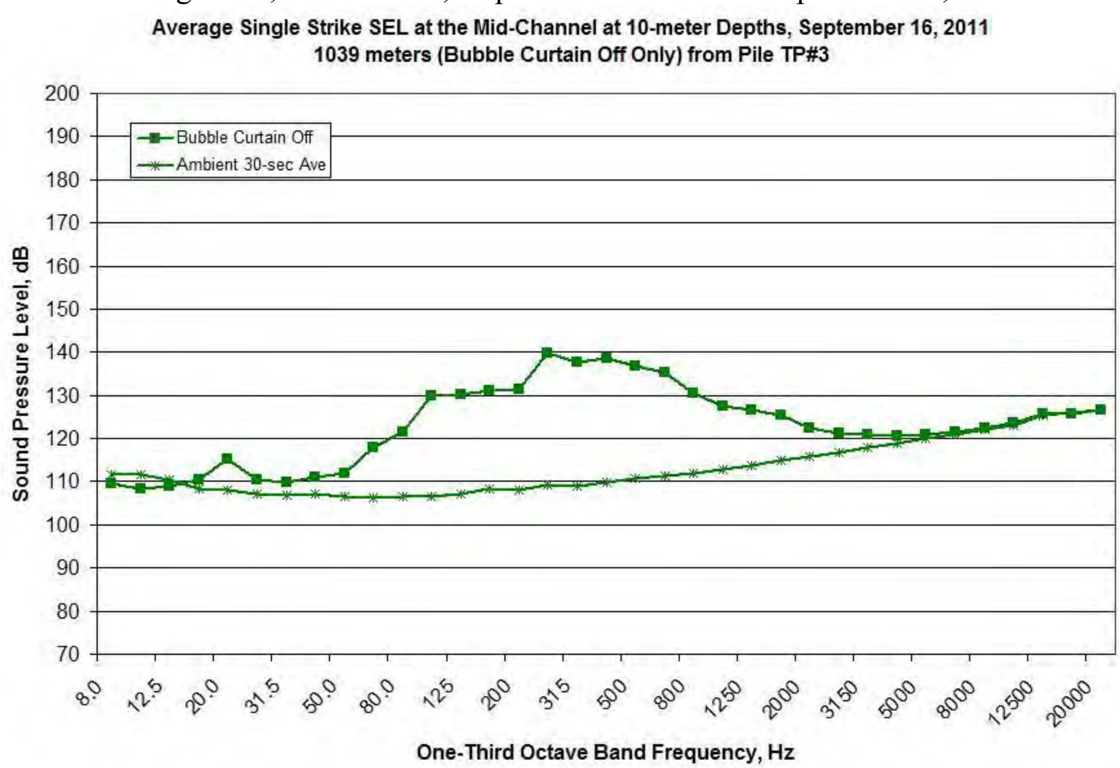

Figure B114. Average One-second SEL Spectral Data Measured at the MID Location during TP#3, 16:10-16:16, Depths of 10 meters on September 16, 2011

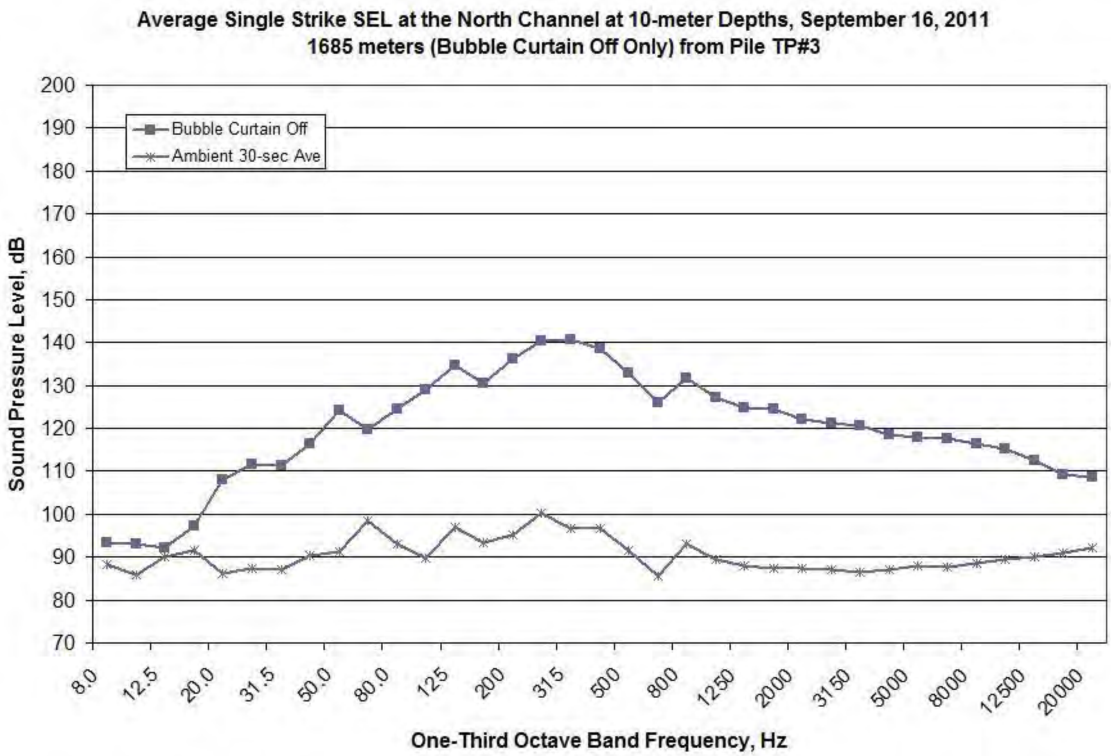

Figure B115. Average One-second SEL Spectral Data Measured at the NO Location during TP#3, 16:10-16:16, Depths of 10 meters on September 16, 2011

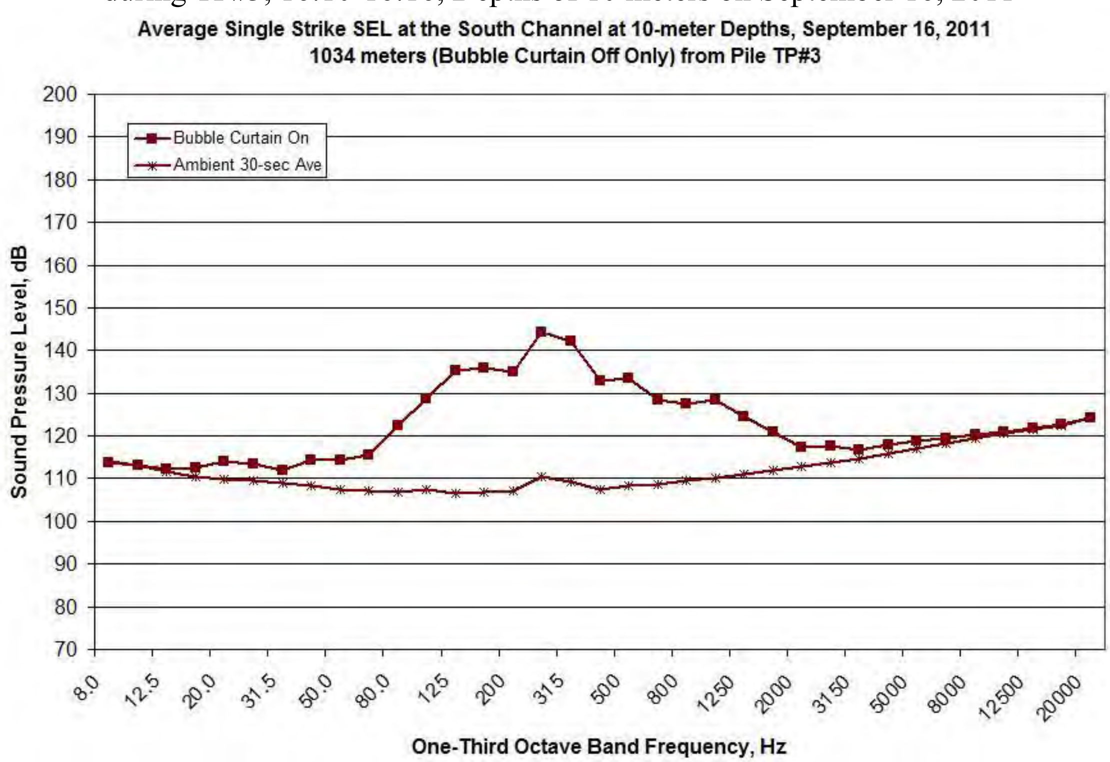

Figure B116. Average One-second SEL Spectral Data Measured at the SO Location during TP#3, 16:10-16:16, Depths of 10 meters on September 16, 2011

NO DATA AVAILABLE

Figure B117. Average One-second SEL Spectral Data Measured at the RFT Location during TP#3, 16:10-16:16, Depths of 10 meters on September 16, 2011

9/17/2011 – TP#2

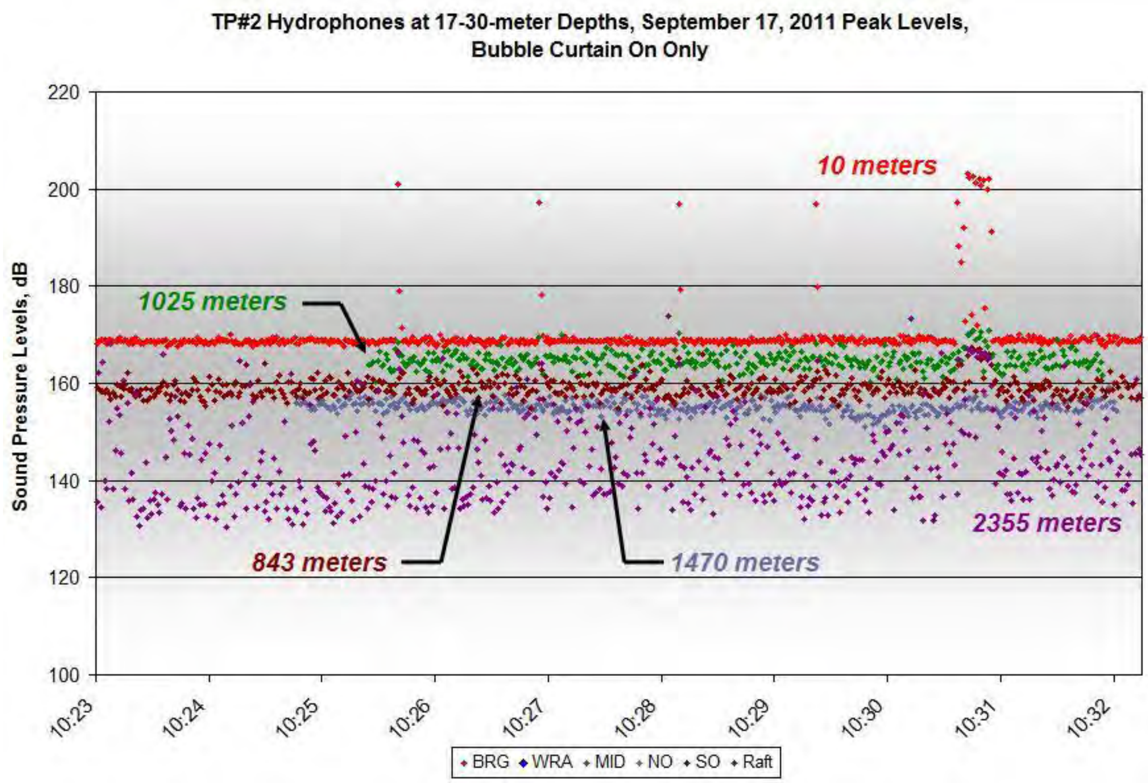

Figure B118. One-second Peak Level Data for TP#2 during Bubble On Conditions, 10:26-10:31, at Depths of 17-30 meters on September 17, 2011

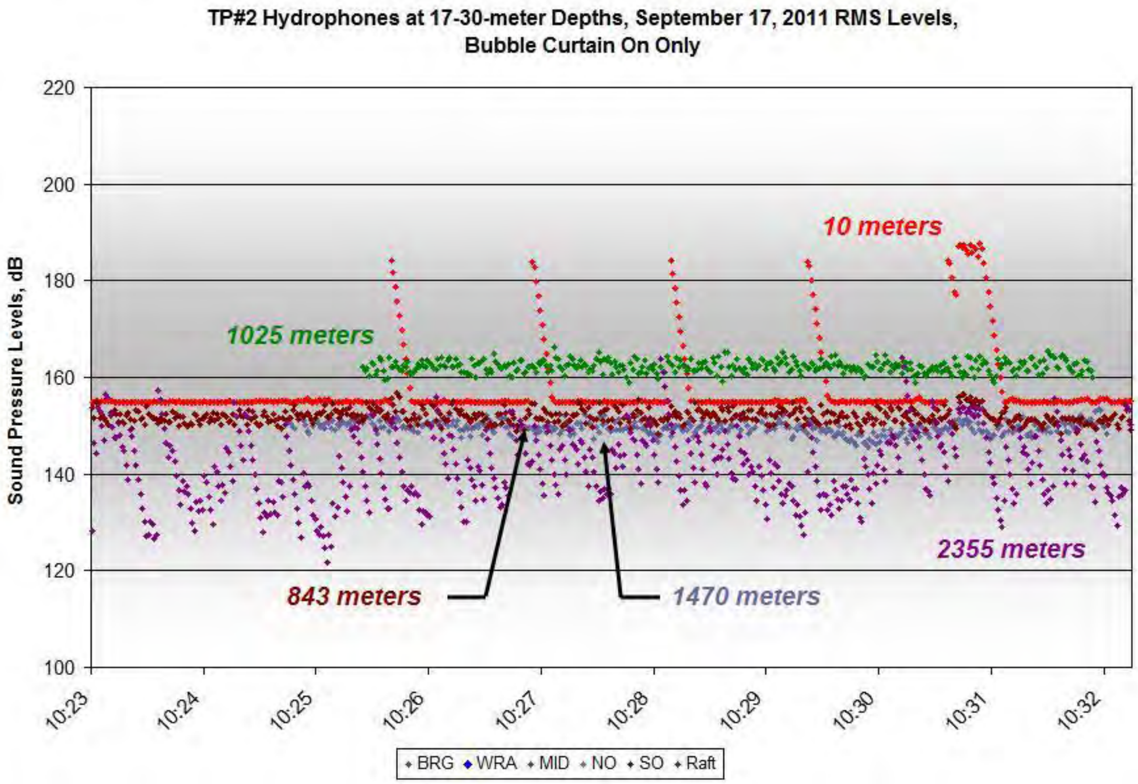

Figure B119. Impulse RMS Data for TP#2 during Bubble On Conditions, 10:26-10:31, at Depths of 17-30 meters on September 17, 2011

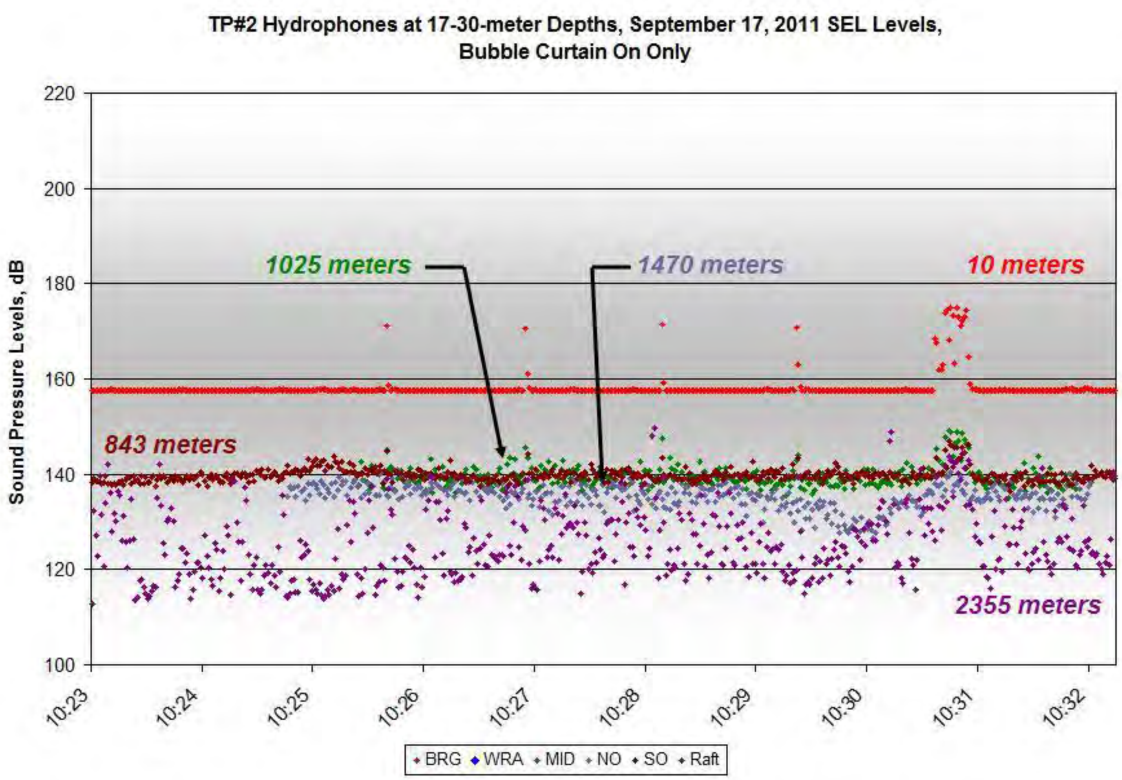

Figure B120. One-second SEL Data for TP#2 during Bubble On Conditions, 10:26-10:31, at Depths of 17-30 meters on September 17, 2011

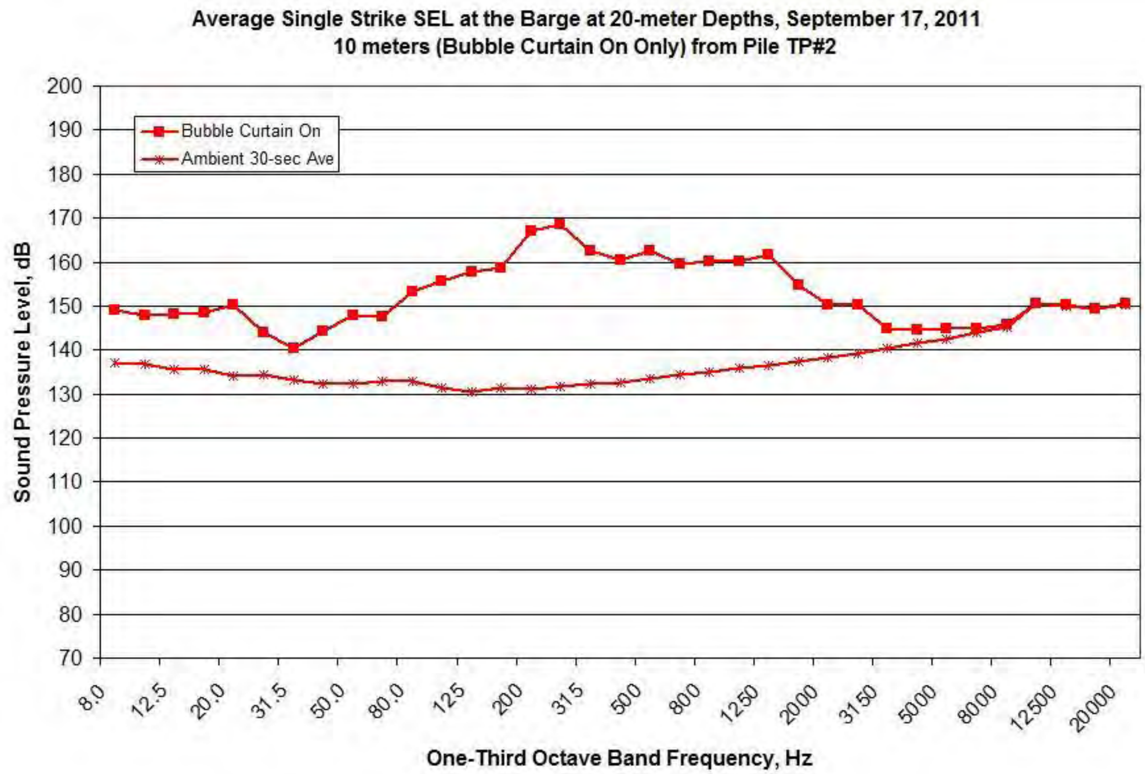

Figure B121. Average One-second SEL Spectral Data Measured at the BRG Location during TP#2, 10:26-10:31, Depths of 20 meters on September 17, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B122. Average One-second SEL Spectral Data Measured at the WRA Location during TP#2, 10:26-10:31, Depths of 30 meters on September 17, 2011

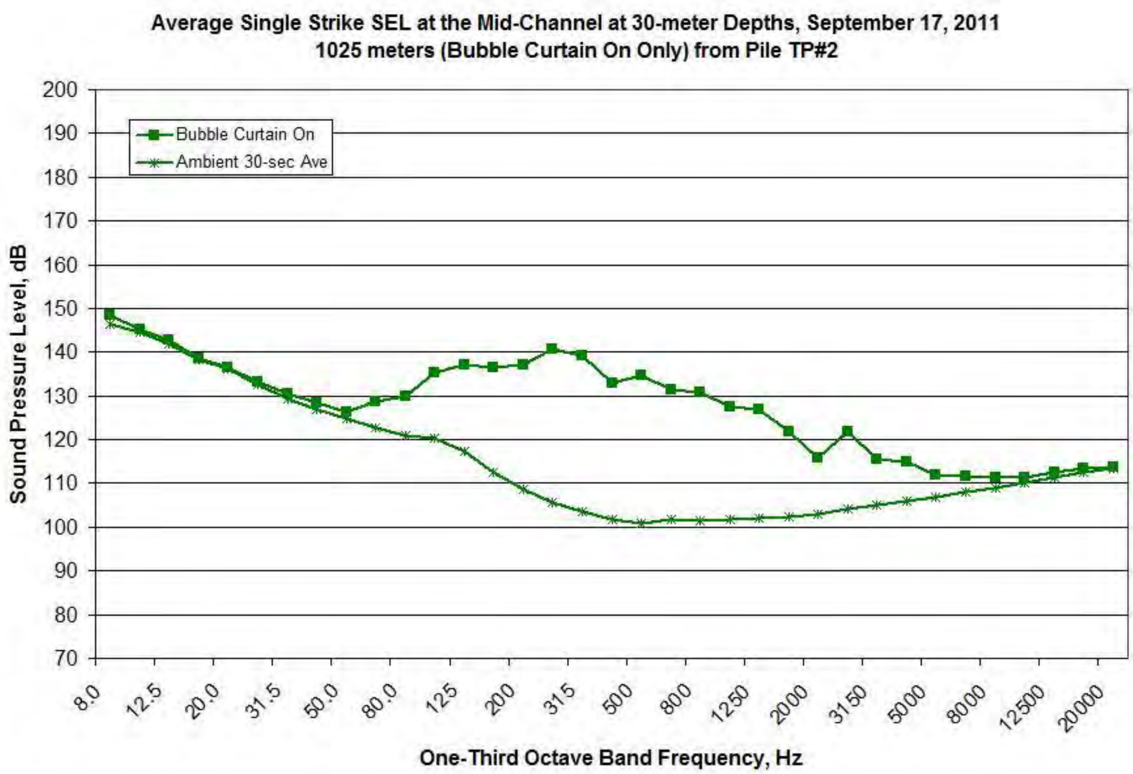

Figure B123. Average One-second SEL Spectral Data Measured at the MID Location during TP#2, 10:26-10:31, Depths of 30 meters on September 17, 2011

NO PILE DRIVING WAS PICKED UP AT THIS LOCATION

Figure B124. Average One-second SEL Spectral Data Measured at the NO Location during TP#2, 10:26-10:31, Depths of 30 meters on September 17, 2011

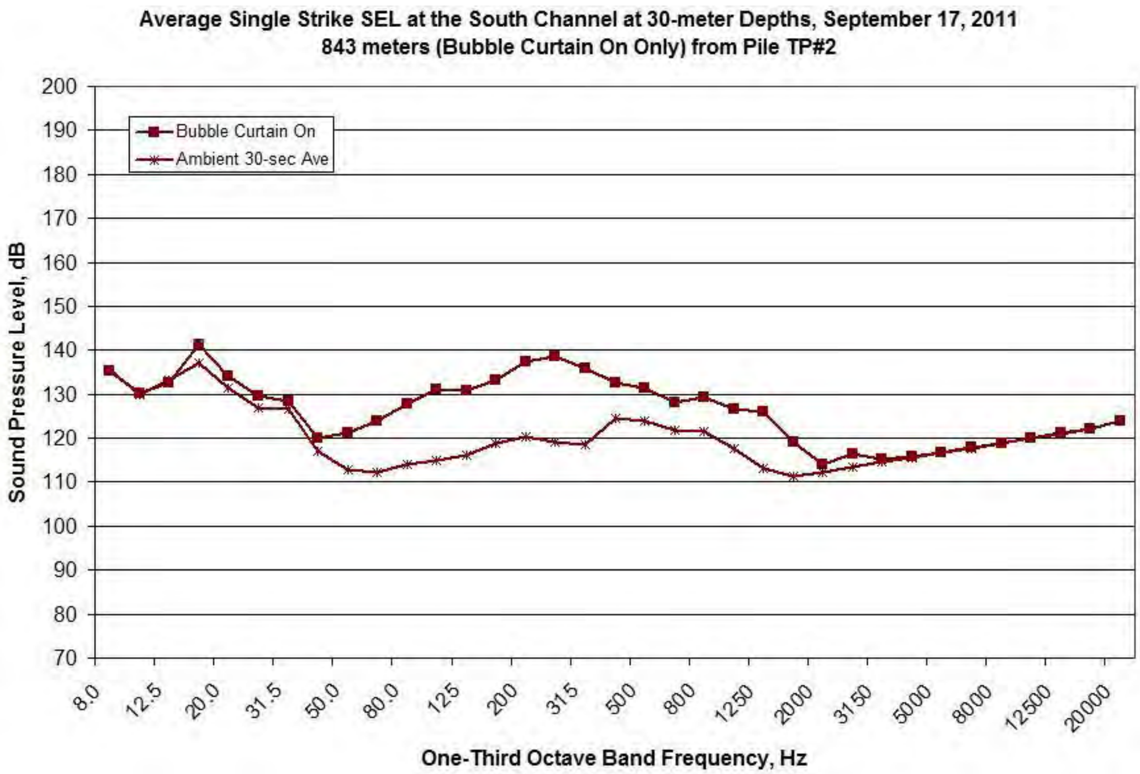

Figure B125. Average One-second SEL Spectral Data Measured at the SO Location during TP#2, 10:26-10:31, Depths of 30 meters on September 17, 2011

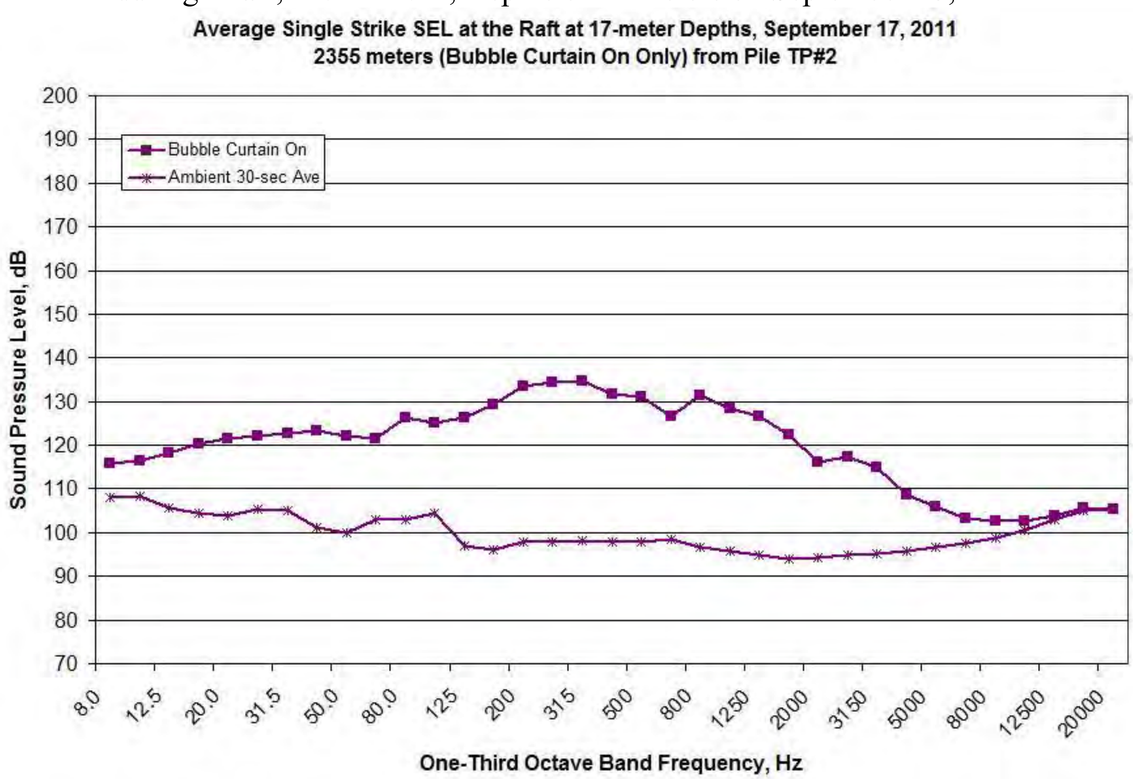

Figure B126. Average One-second SEL Spectral Data Measured at the RFT Location during TP#2, 10:26-10:31, Depths of 17 meters on September 17, 2011

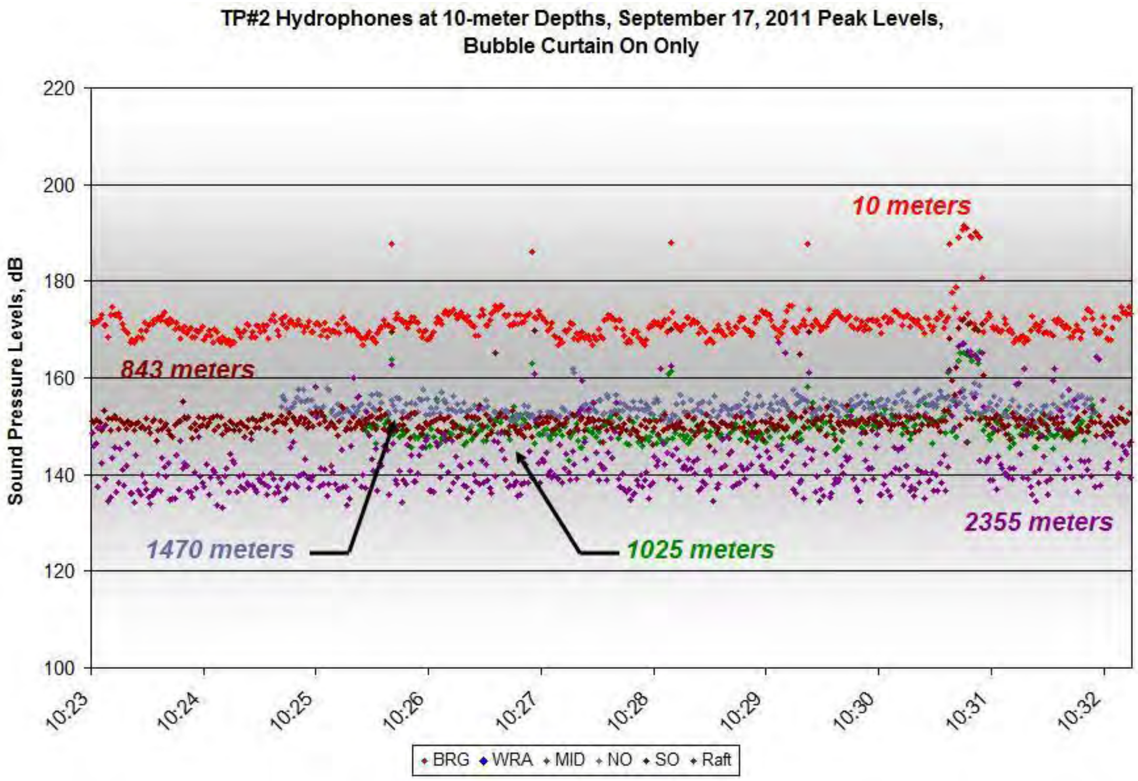

Figure B127. One-second Peak Level Data for TP#2 during Bubble On Conditions, 10:26-10:31, at Depths of 10 meters on September 17, 2011

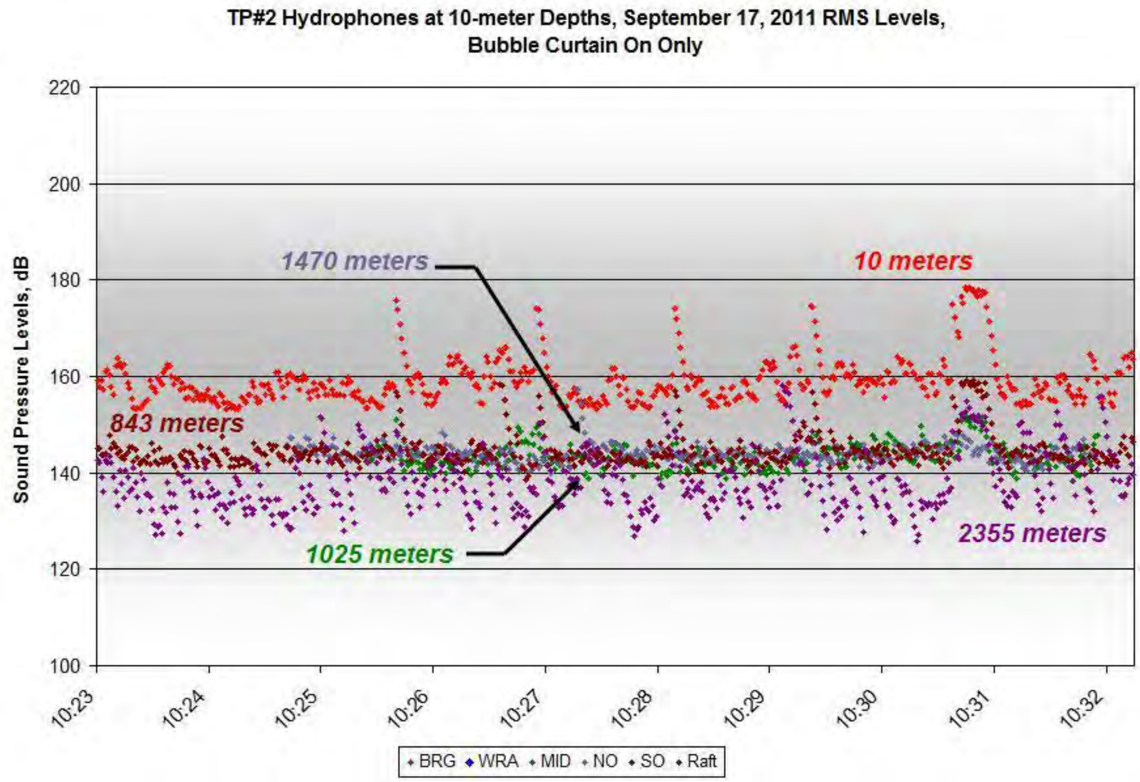

Figure B128. Impulse RMS Data for TP#2 during Bubble On Conditions, 10:26-10:31, at Depths of 10 meters on September 17, 2011

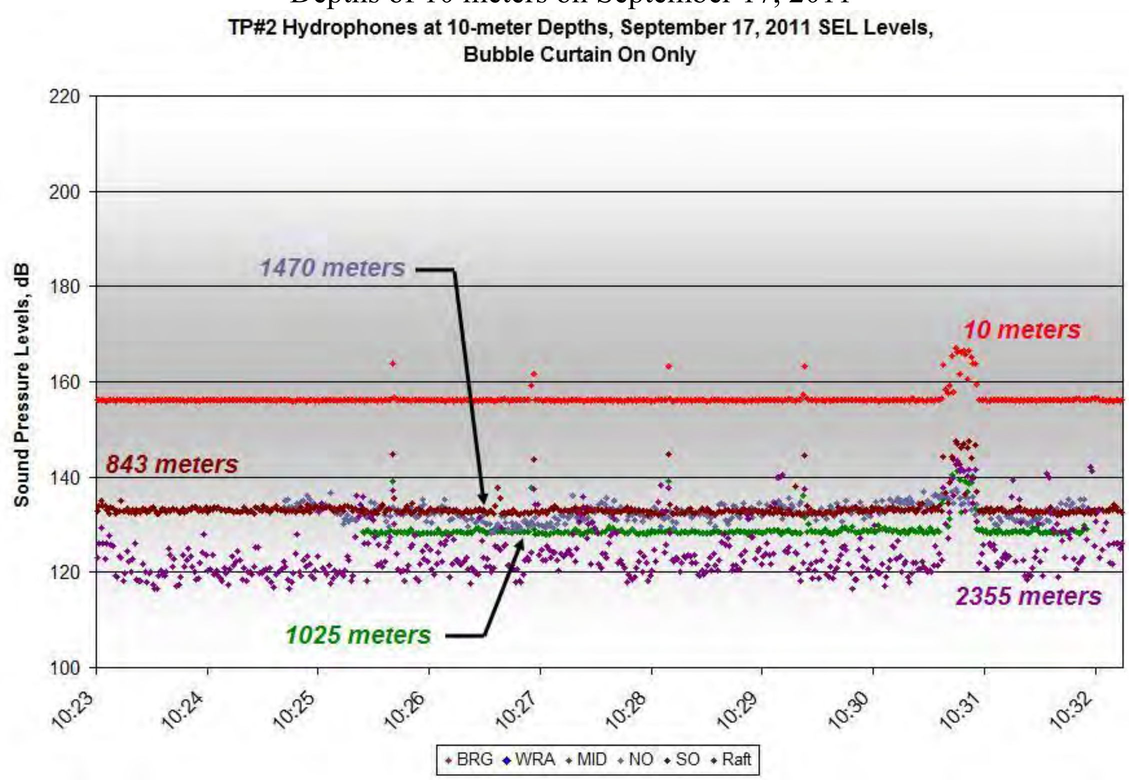

Figure B129. One-second SEL Data for TP#2 during Bubble On Conditions, 10:26-10:31, at Depths of 10 meters on September 17, 2011

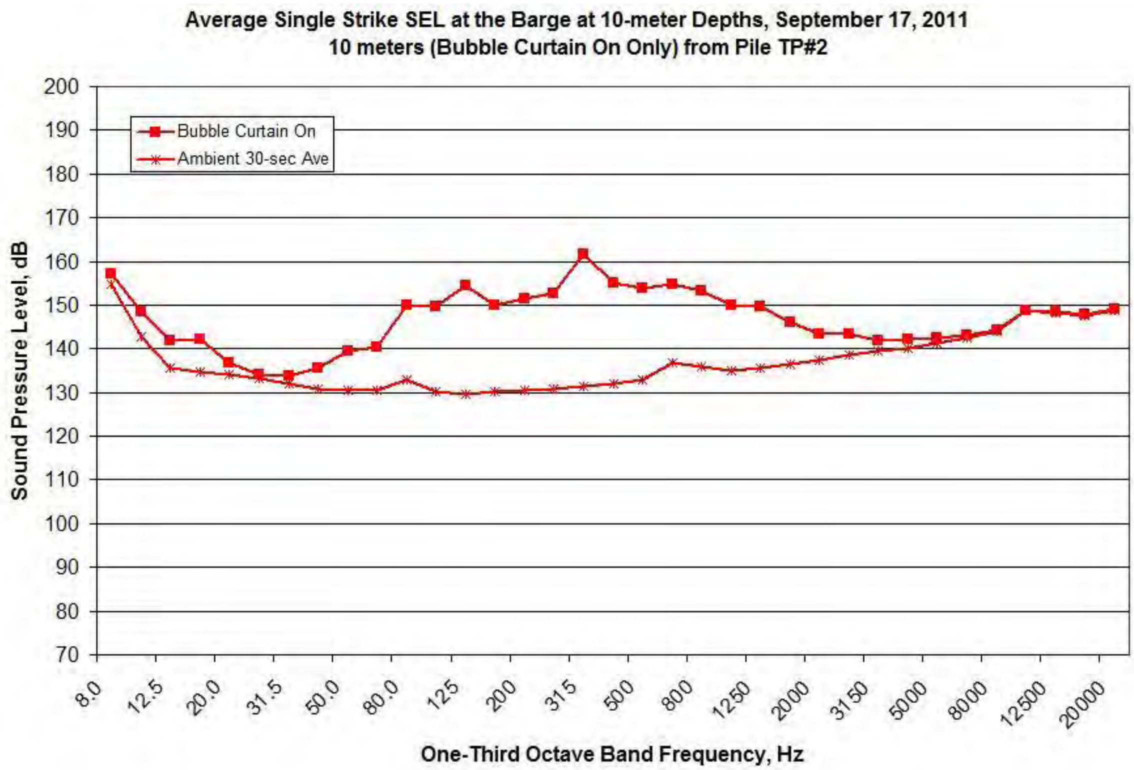

Figure B130. Average One-second SEL Spectral Data Measured at the BRG Location during TP#2, 10:26-10:31, Depths of 10 meters on September 17, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B131. Average One-second SEL Spectral Data Measured at the WRA Location during TP#2, 10:26-10:31, Depths of 10 meters on September 17, 2011

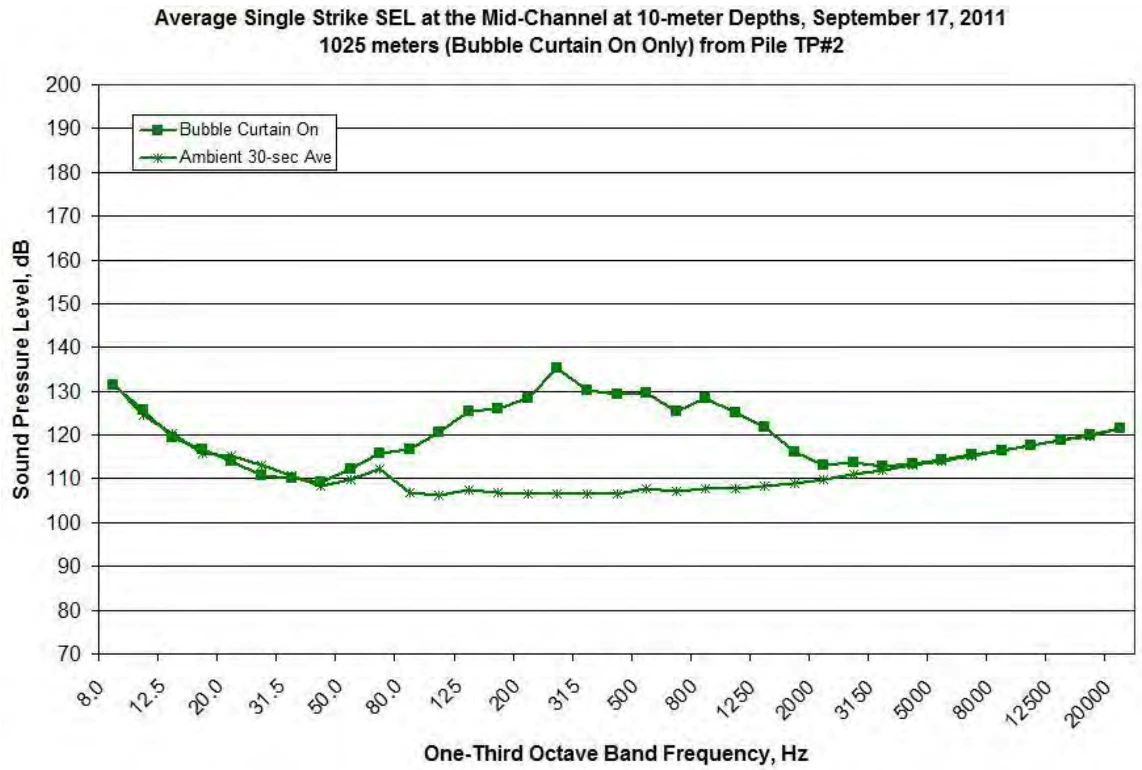

Figure B132. Average One-second SEL Spectral Data Measured at the MID Location during TP#2, 10:26-10:31, Depths of 10 meters on September 17, 2011

NO PILE DRIVING WAS PICKED UP AT THIS LOCATION

Figure B133. Average One-second SEL Spectral Data Measured at the NO Location during TP##2, 10:26-10:31, Depths of 10 meters on September 17, 2011

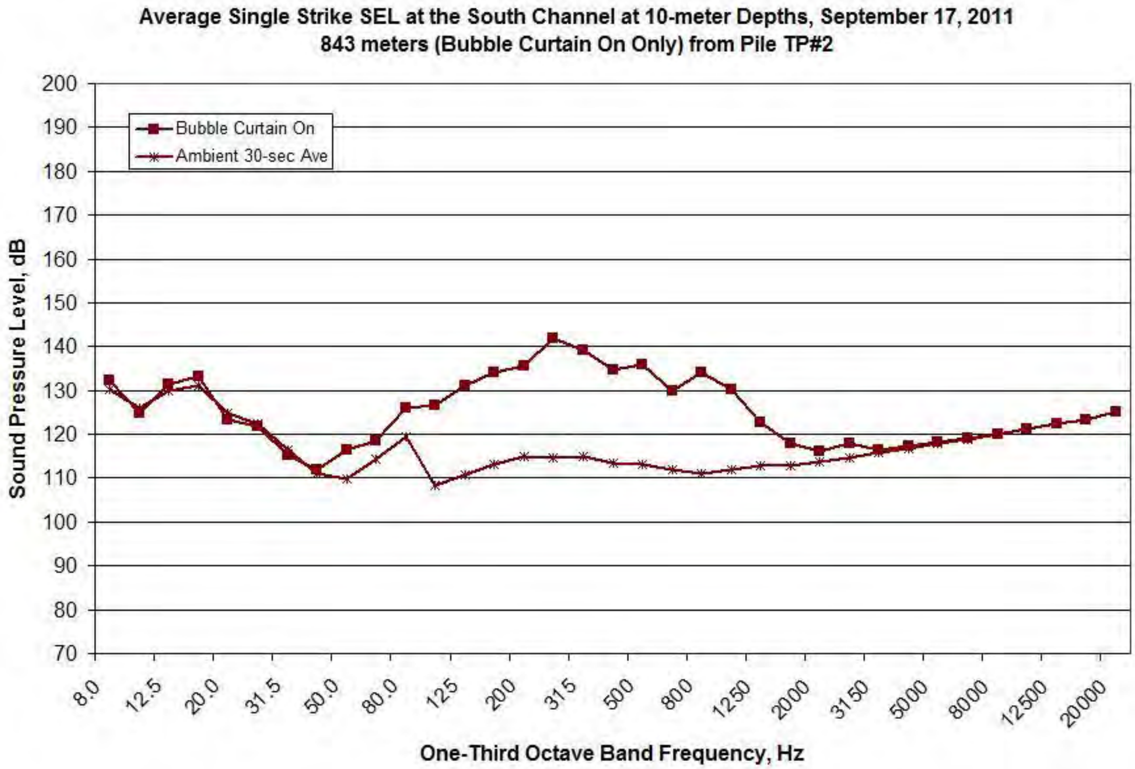

Figure B134. Average One-second SEL Spectral Data Measured at the SO Location during TP#2, 10:26-10:31, Depths of 10 meters on September 17, 2011

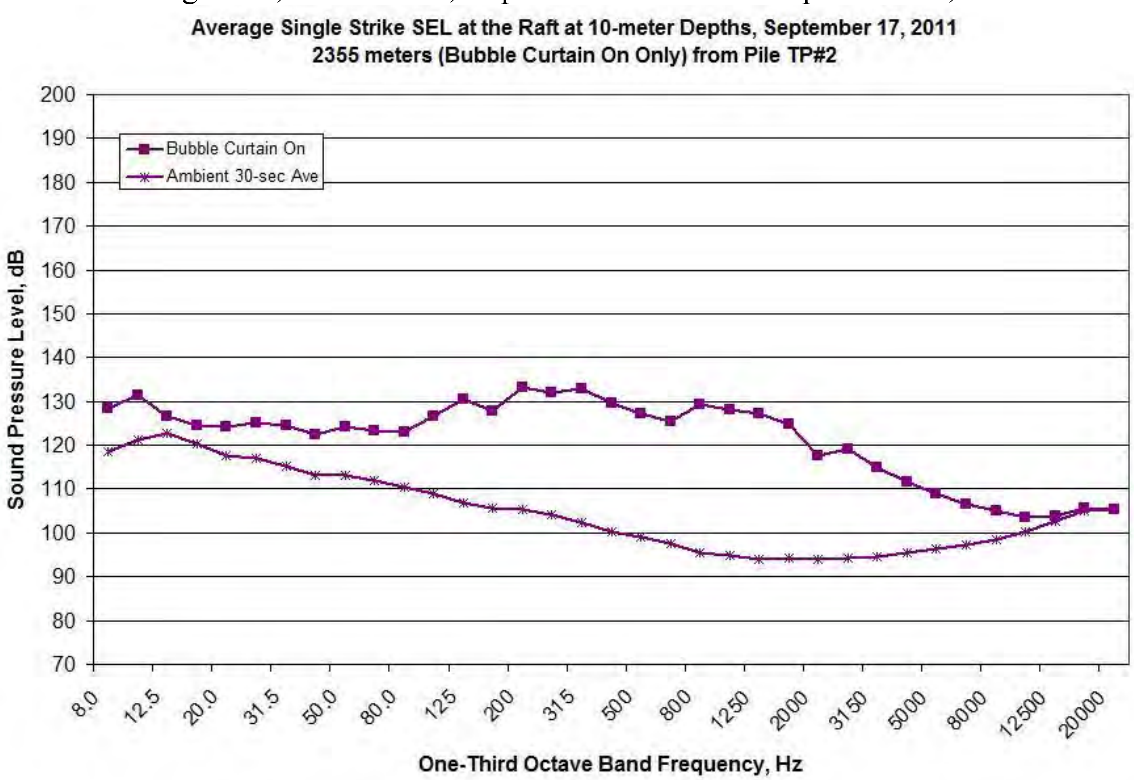

Figure B135. Average One-second SEL Spectral Data Measured at the RFT Location during TP#2, 10:26-10:31, Depths of 10 meters on September 17, 2011

9/21/2011 – TTP#3

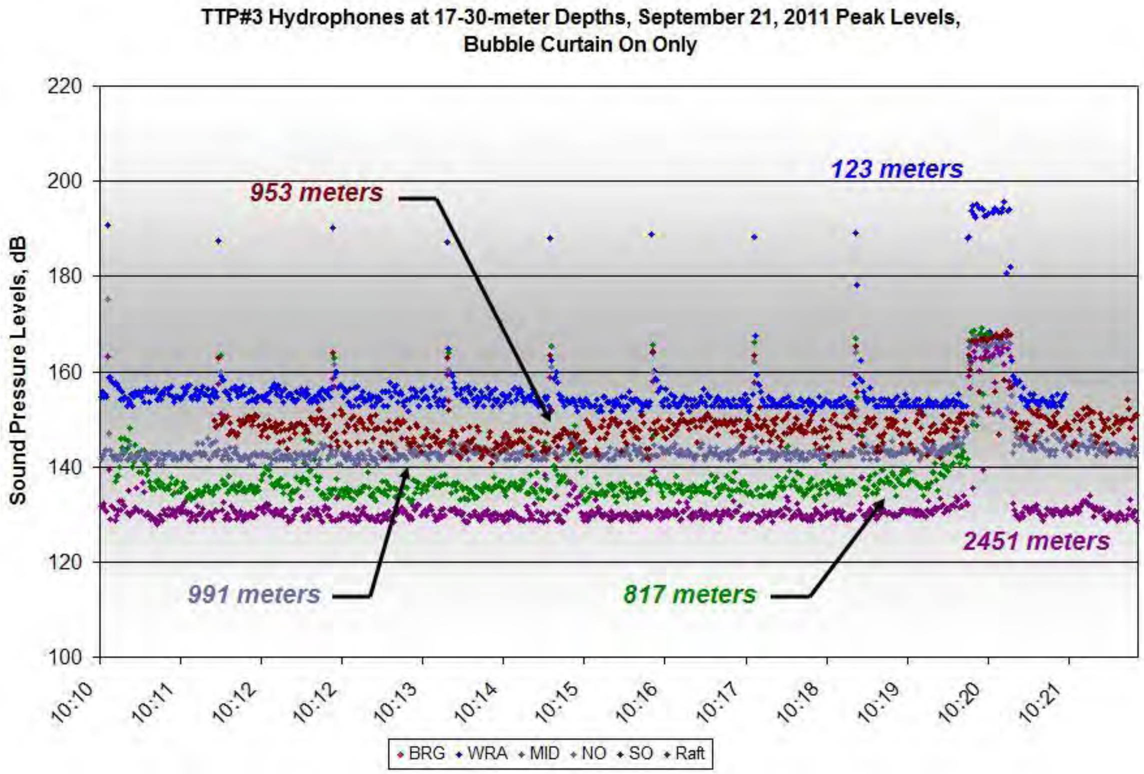

Figure B136. One-second Peak Level Data for TTP#3 during Bubble On Conditions, 10:09-10:20, at Depths of 17-30 meters on September 21, 2011

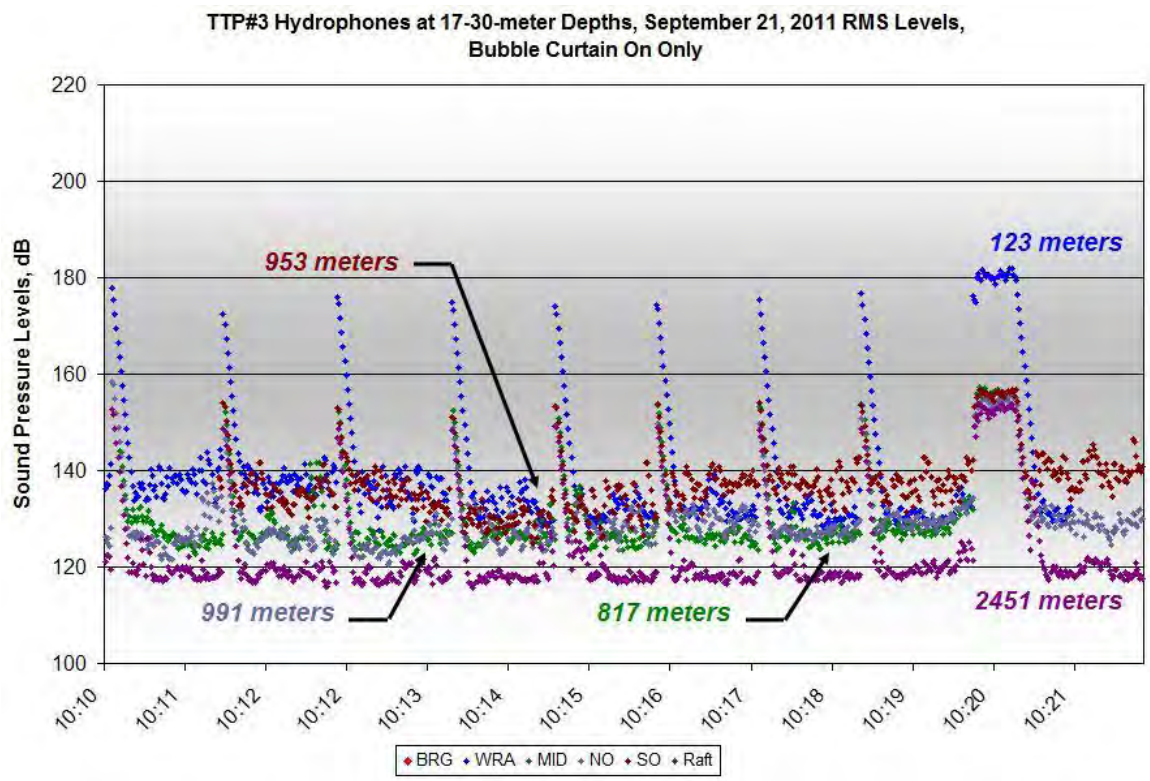

Figure B137. Impulse RMS Data for TTP#3 during Bubble On Conditions, 10:09-10:20, at Depths of 17-30 meters on September 21, 2011

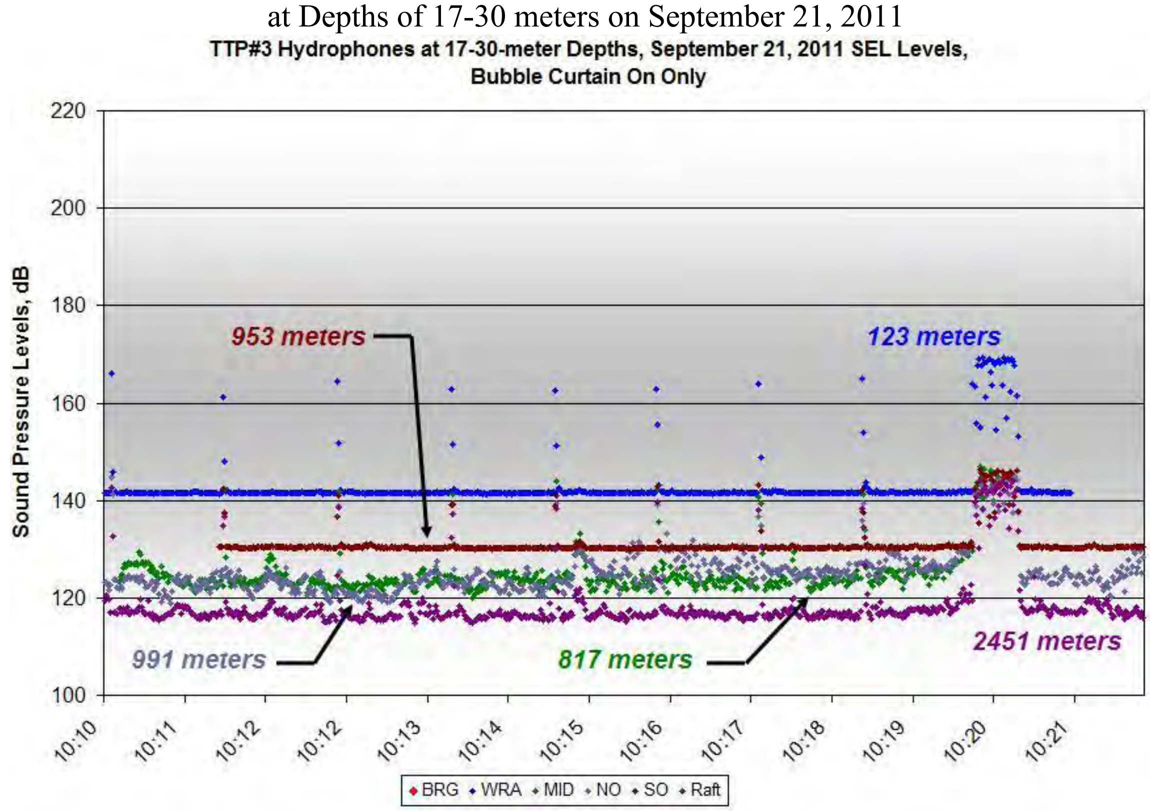

Figure B138. One-second SEL Data for TTP#3 during Bubble On Conditions, 10:09-10:20, at Depths of 17-30 meters on September 21, 2011

NO PILE DRIVING DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B139. Average One-second SEL Spectral Data Measured at the BRG Location during TTP#3, 10:09-10:20, Depths of 20 meters on September 21, 2011

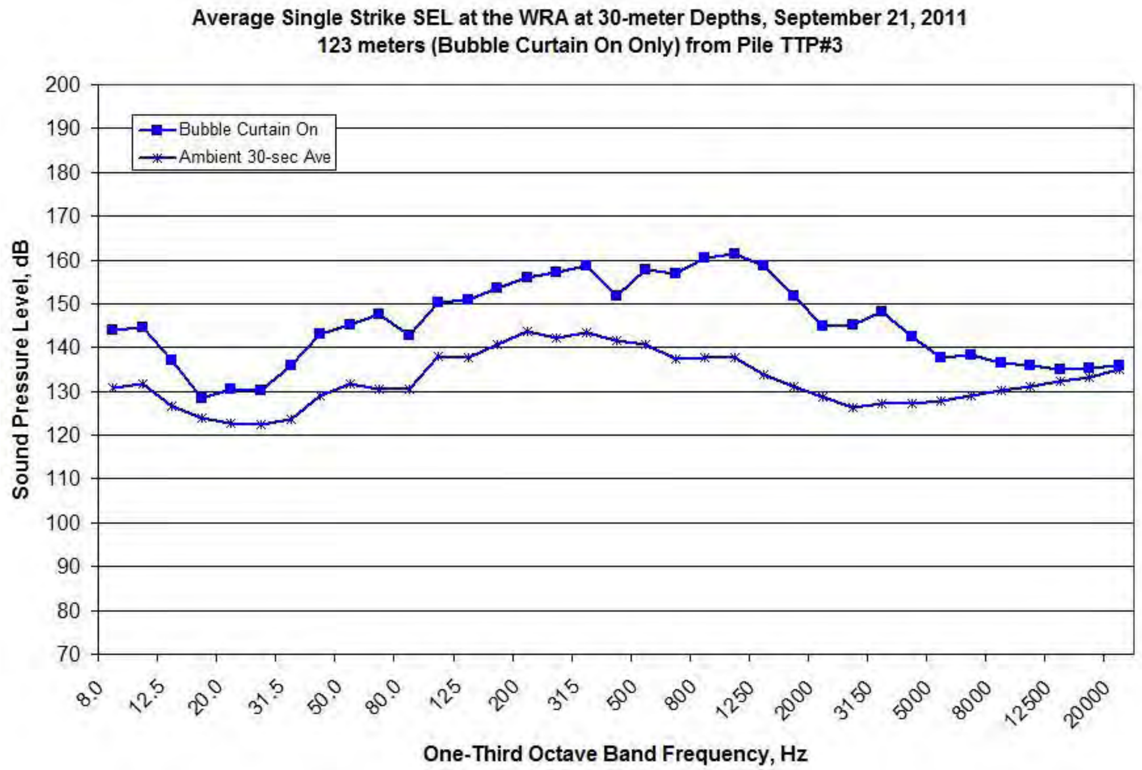

Figure B140. Average One-second SEL Spectral Data Measured at the WRA Location during TTP#3, 10:09-10:20, Depths of 30 meters on September 21, 2011

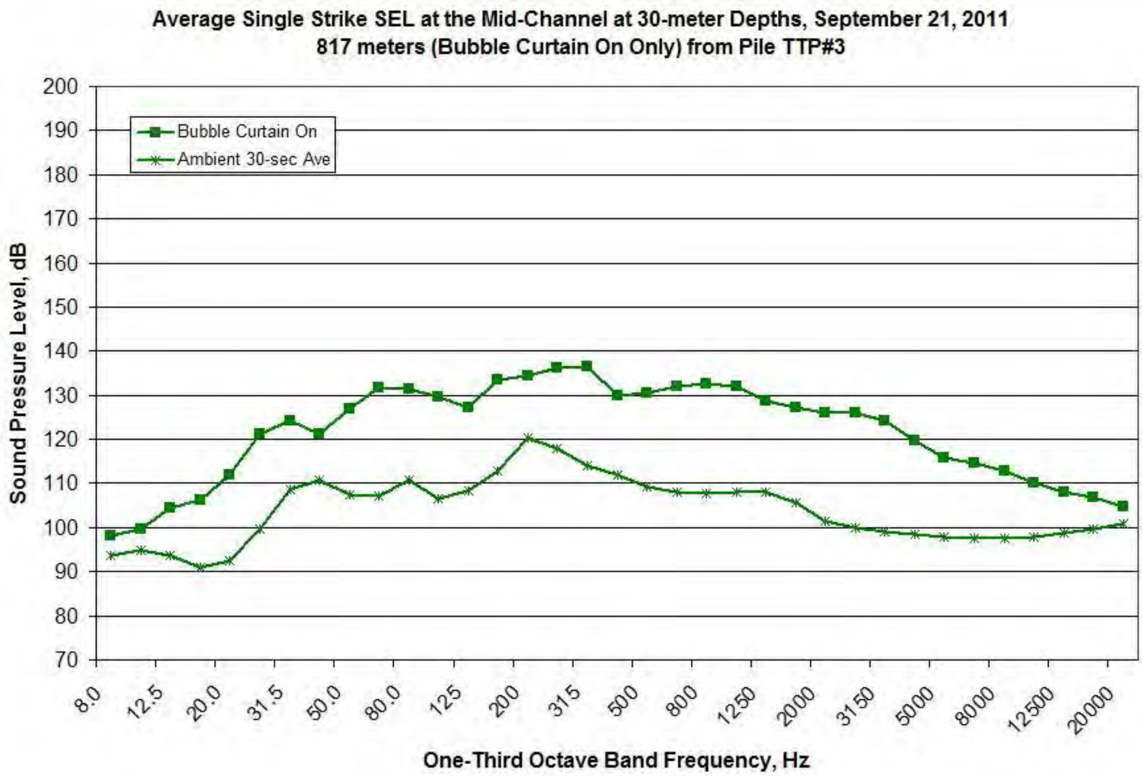

Figure B141. Average One-second SEL Spectral Data Measured at the MID Location during TTP#3, 10:09-10:20, Depths of 30 meters on September 21, 2011

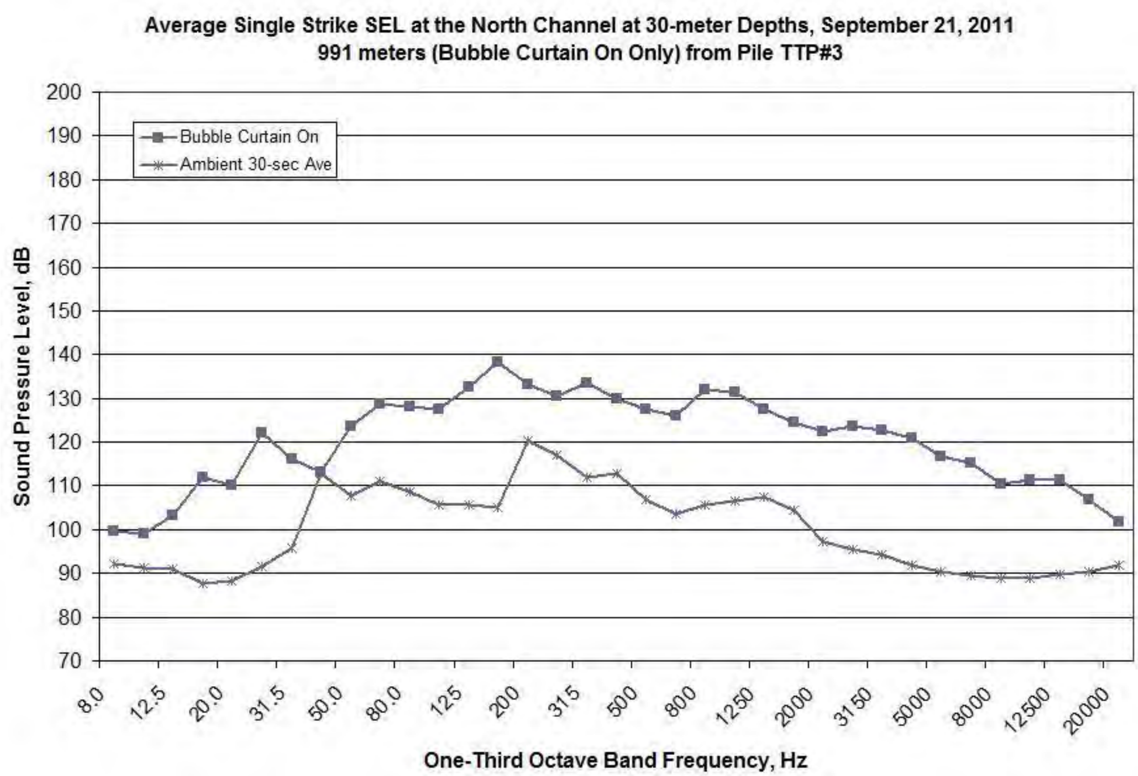

Figure B142. Average One-second SEL Spectral Data Measured at the NO Location during TTP#3, 10:09-10:20, Depths of 30 meters on September 21, 2011

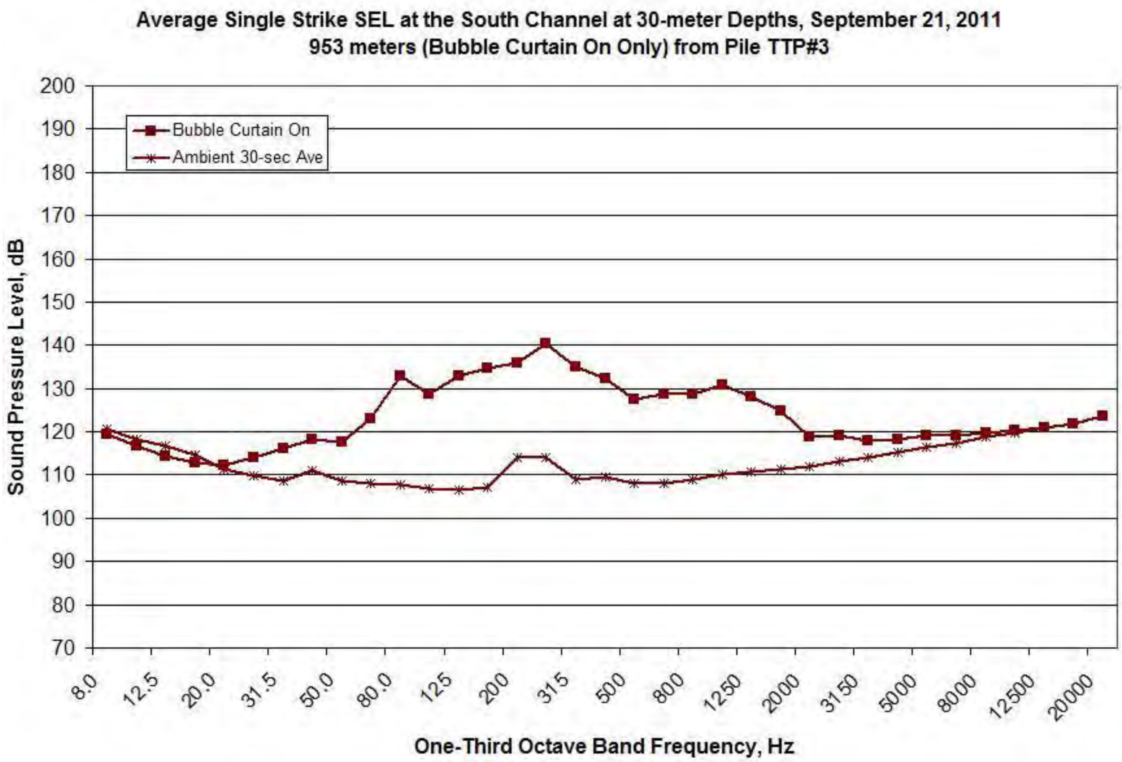

Figure B143. Average One-second SEL Spectral Data Measured at the SO Location during TTP#3, 10:09-10:20, Depths of 30 meters on September 21, 2011

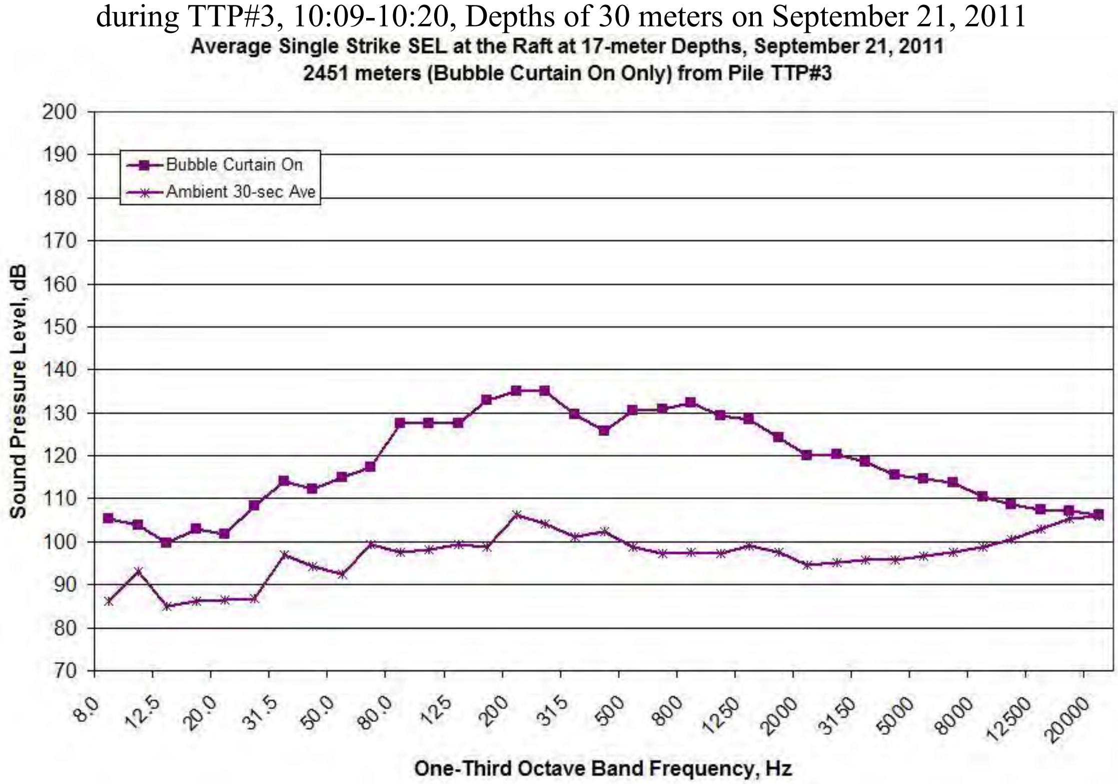

Figure B144. Average One-second SEL Spectral Data Measured at the RFT Location during TTP#3, 10:09-10:20, Depths of 17 meters on September 21, 2011

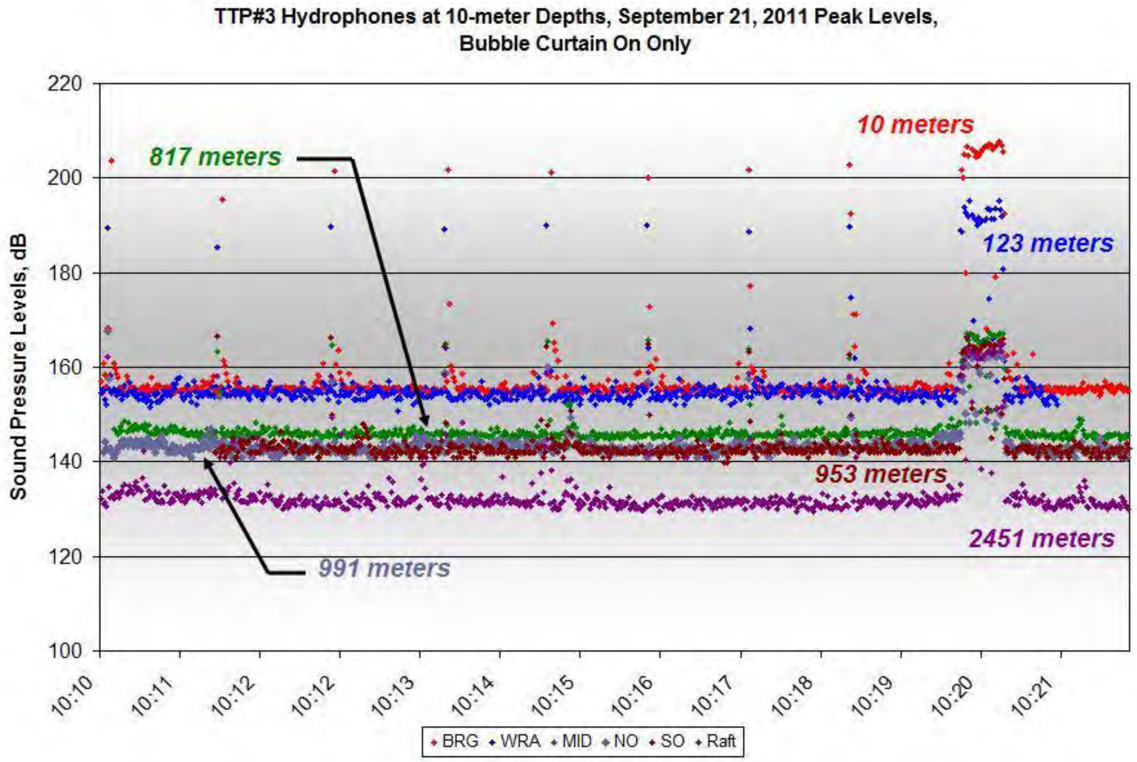

Figure B145. One-second Peak Level Data for TTP#3 during Bubble On Conditions, 10:09-10:20, at Depths of 10 meters on September 21, 2011

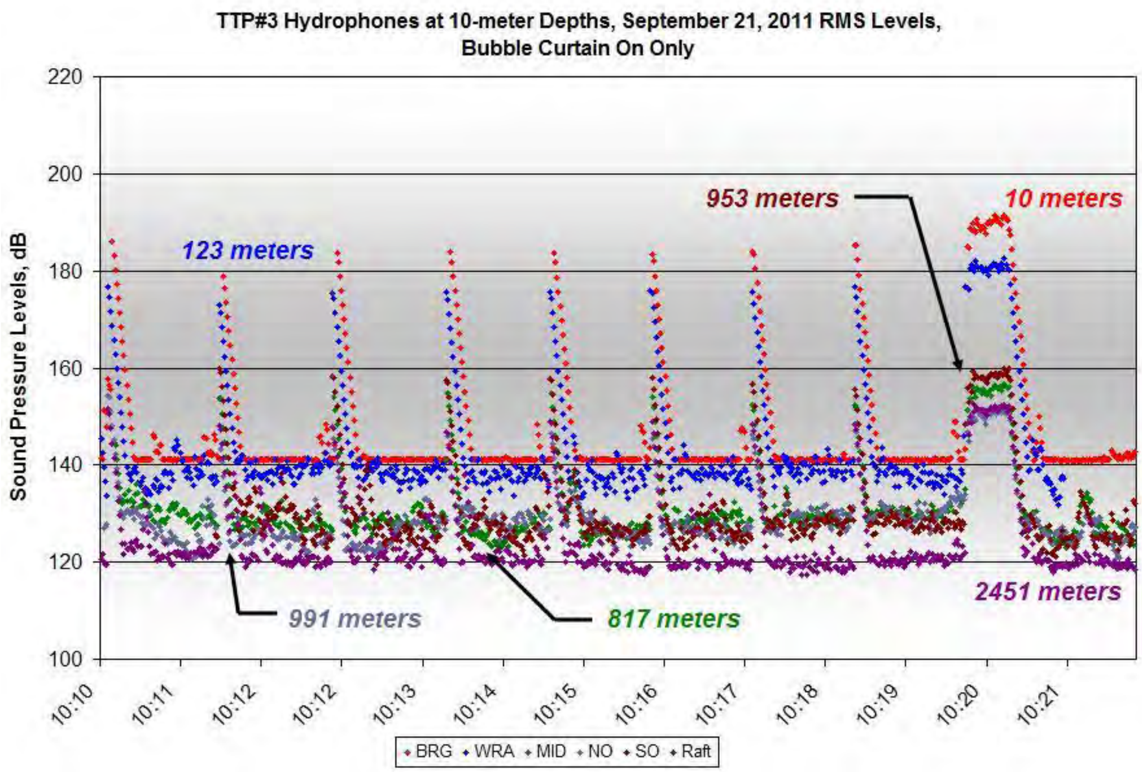

Figure B146. Impulse RMS Data for TTP#3 during Bubble On Conditions, 10:09-10:20, at Depths of 10 meters on September 21, 2011

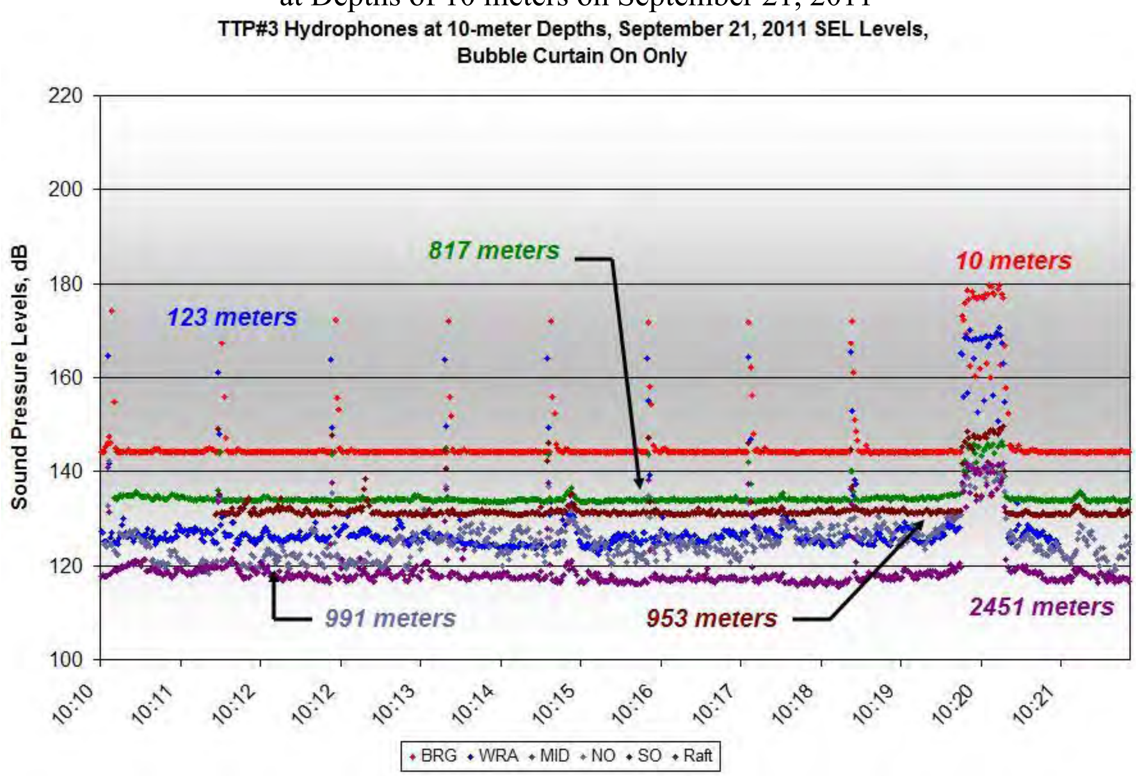

Figure B147. One-second SEL Data for TTP#3 during Bubble On Conditions, 10:09-10:20, at Depths of 10 meters on September 21, 2011

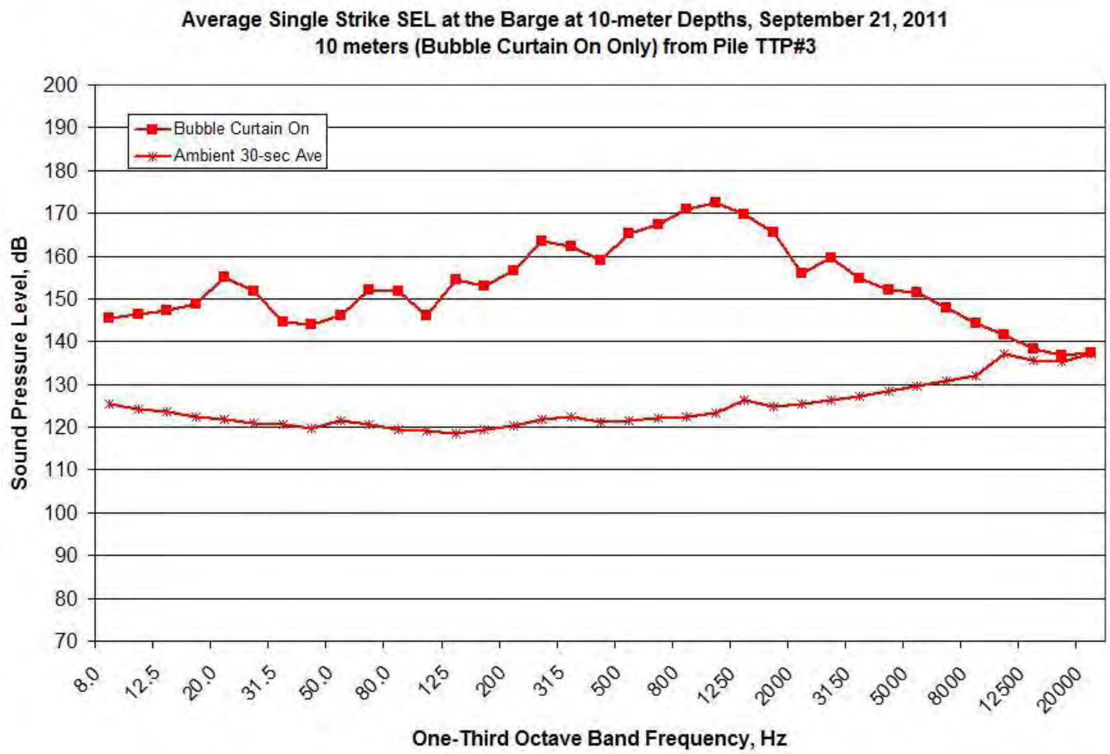

Figure B148. Average One-second SEL Spectral Data Measured at the BRG Location during TTP#3, 10:09-10:20, Depths of 10 meters on September 21, 2011

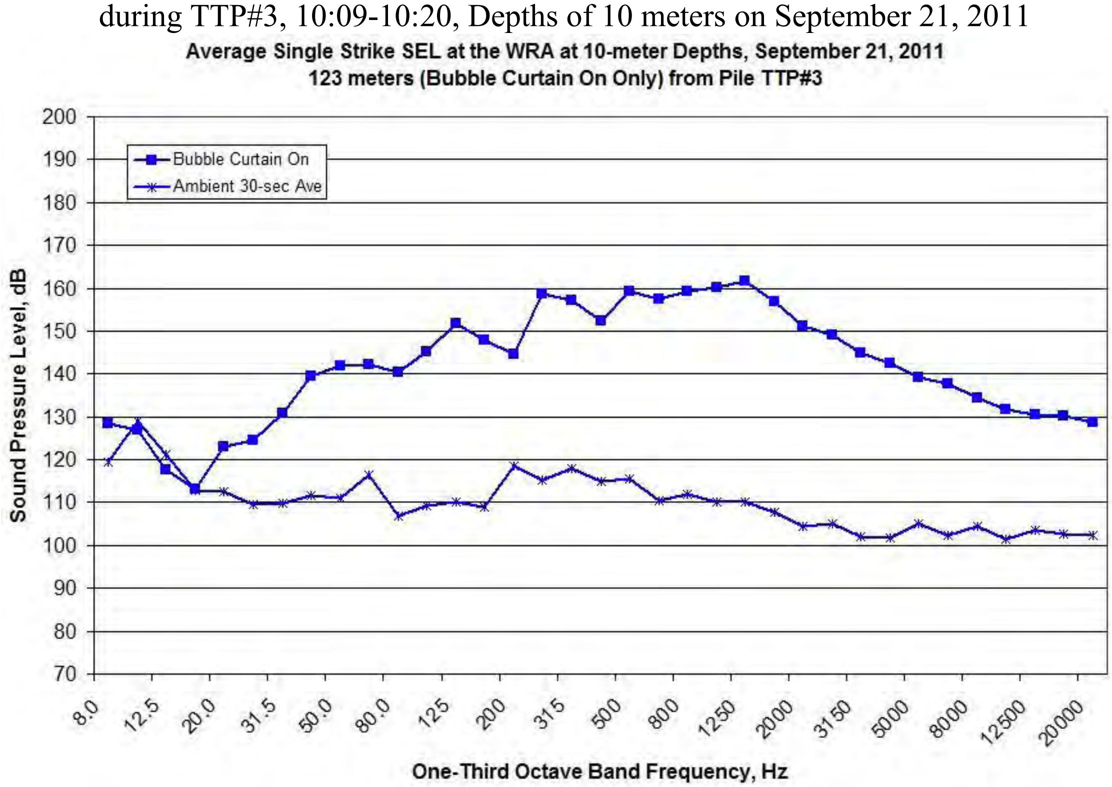

Figure B149. Average One-second SEL Spectral Data Measured at the WRA Location during TTP#3, 10:09-10:20, Depths of 10 meters on September 21, 2011

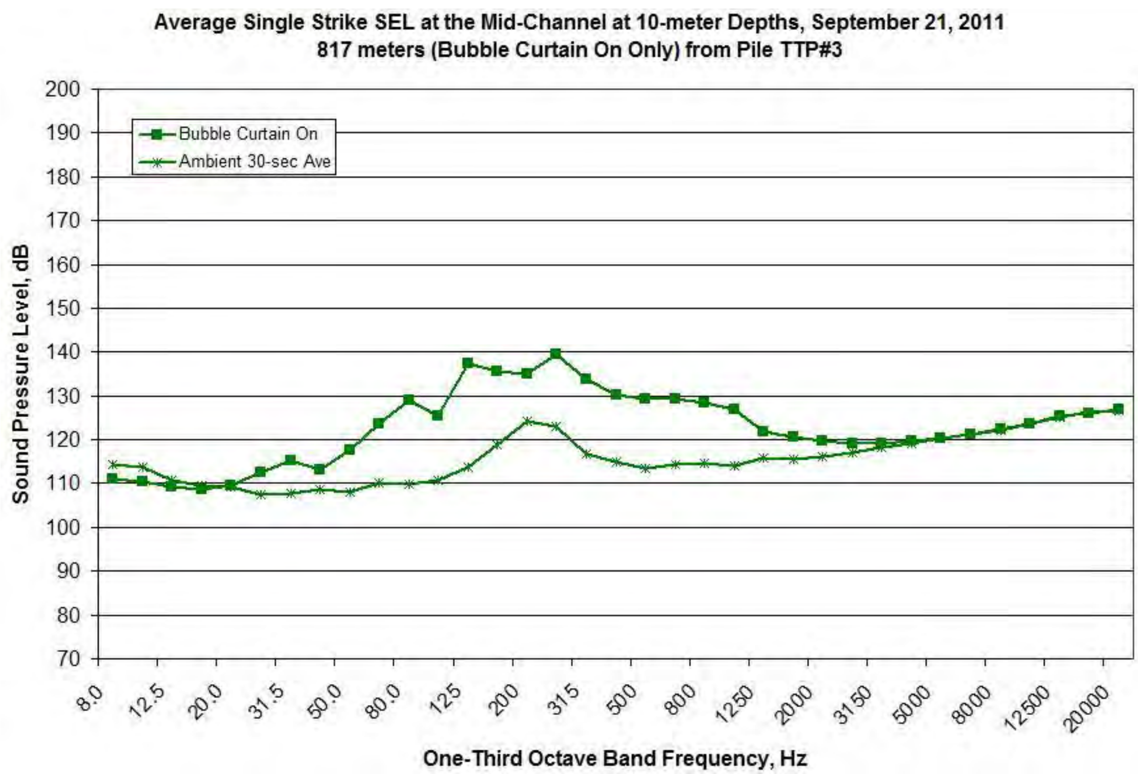

Figure B150. Average One-second SEL Spectral Data Measured at the MID Location during TTP#3, 10:09-10:20, Depths of 10 meters on September 21, 2011

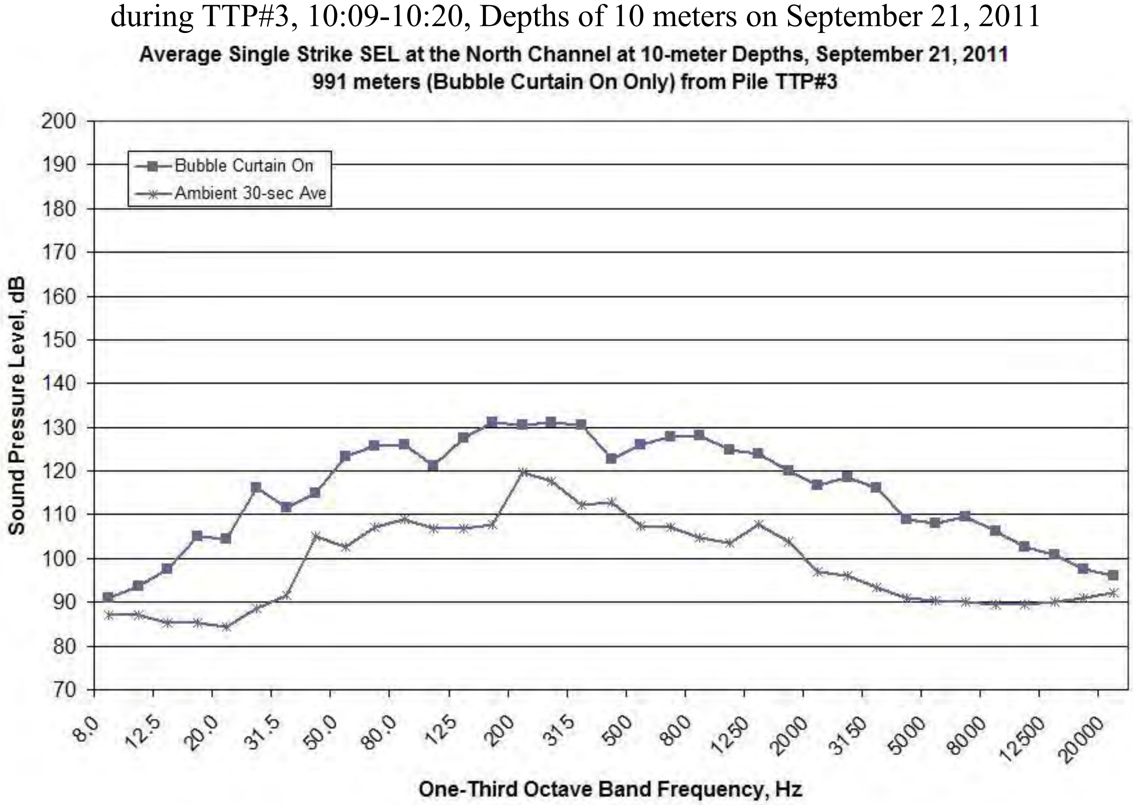

Figure B151. Average One-second SEL Spectral Data Measured at the NO Location during TTP#3, 10:09-10:20, Depths of 10 meters on September 21, 2011

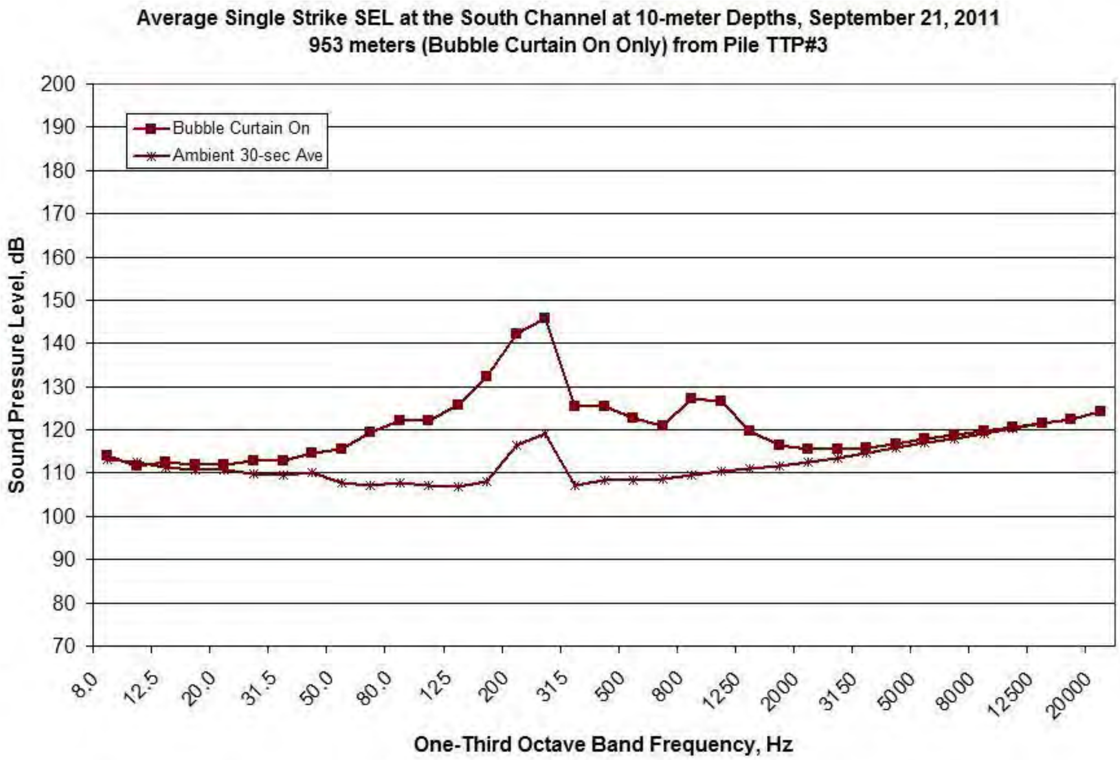

Figure B152. Average One-second SEL Spectral Data Measured at the SO Location during TTP#3, 10:09-10:20, Depths of 10 meters on September 21, 2011

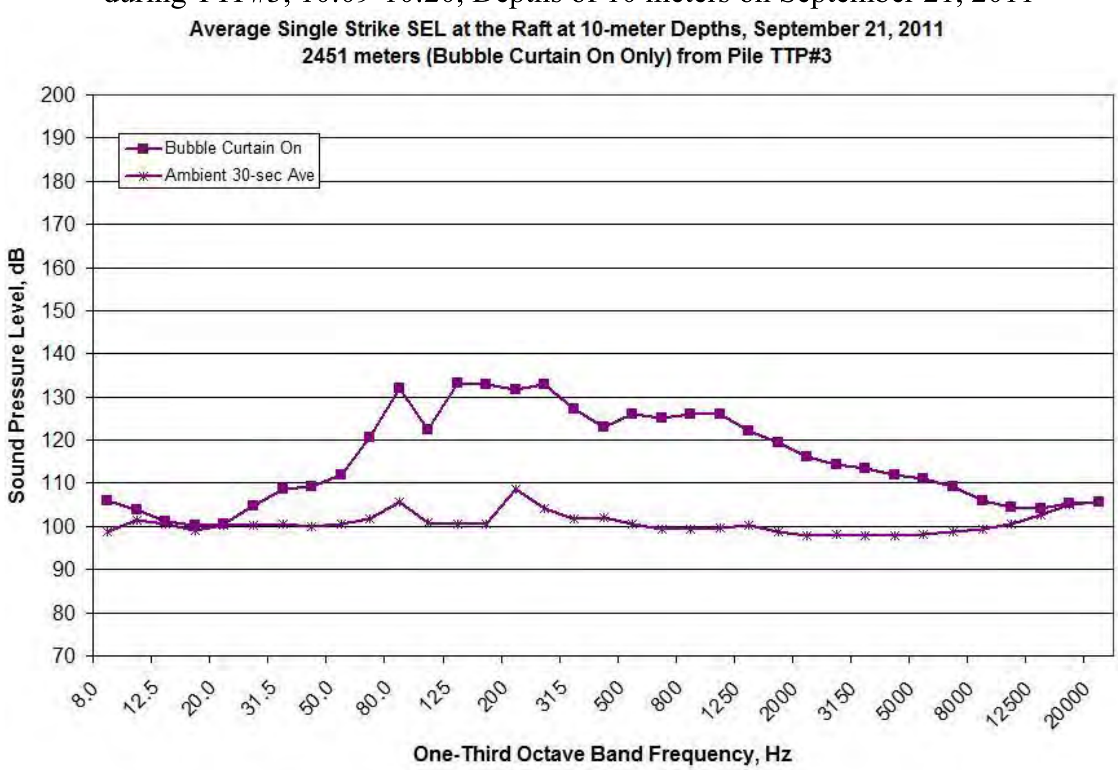

Figure B153. Average One-second SEL Spectral Data Measured at the RFT Location during TTP#3, 10:09-10:20, Depths of 10 meters on September 21, 2011

9/24/2011 – TP#10

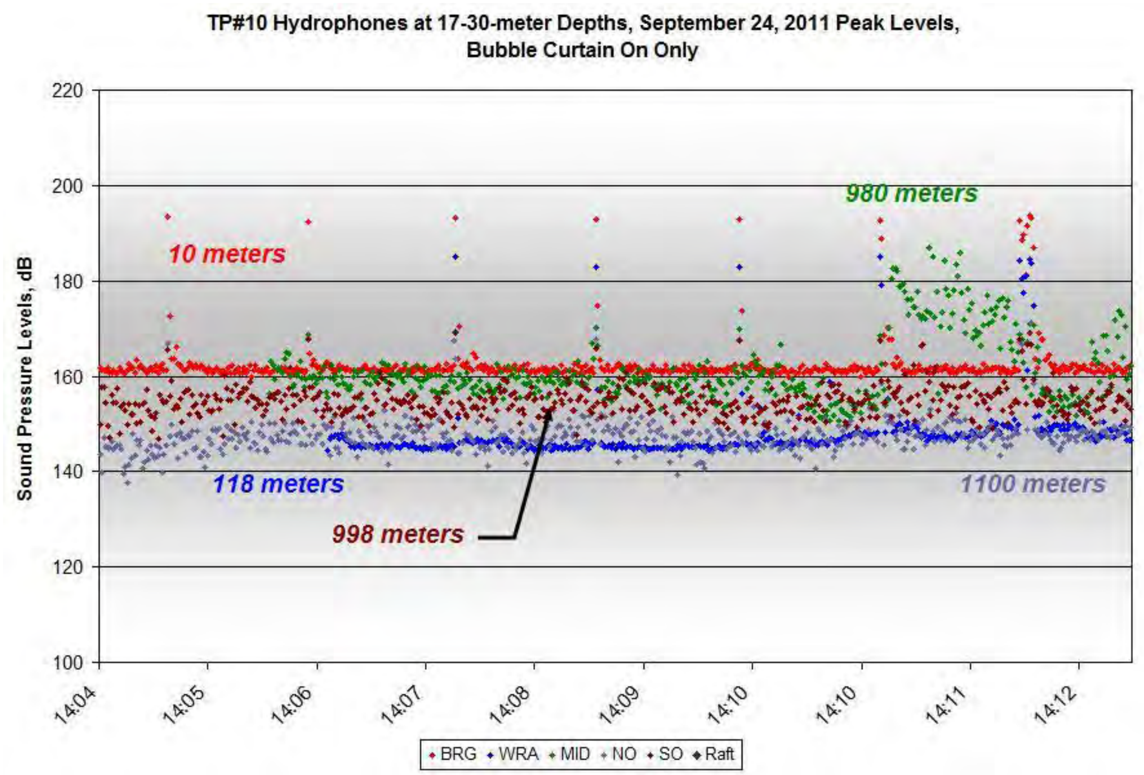

Figure B154. One-second Peak Level Data for TP#10 during Bubble On Conditions, 14:05-14:12, at Depths of 17-30 meters on September 24, 2011

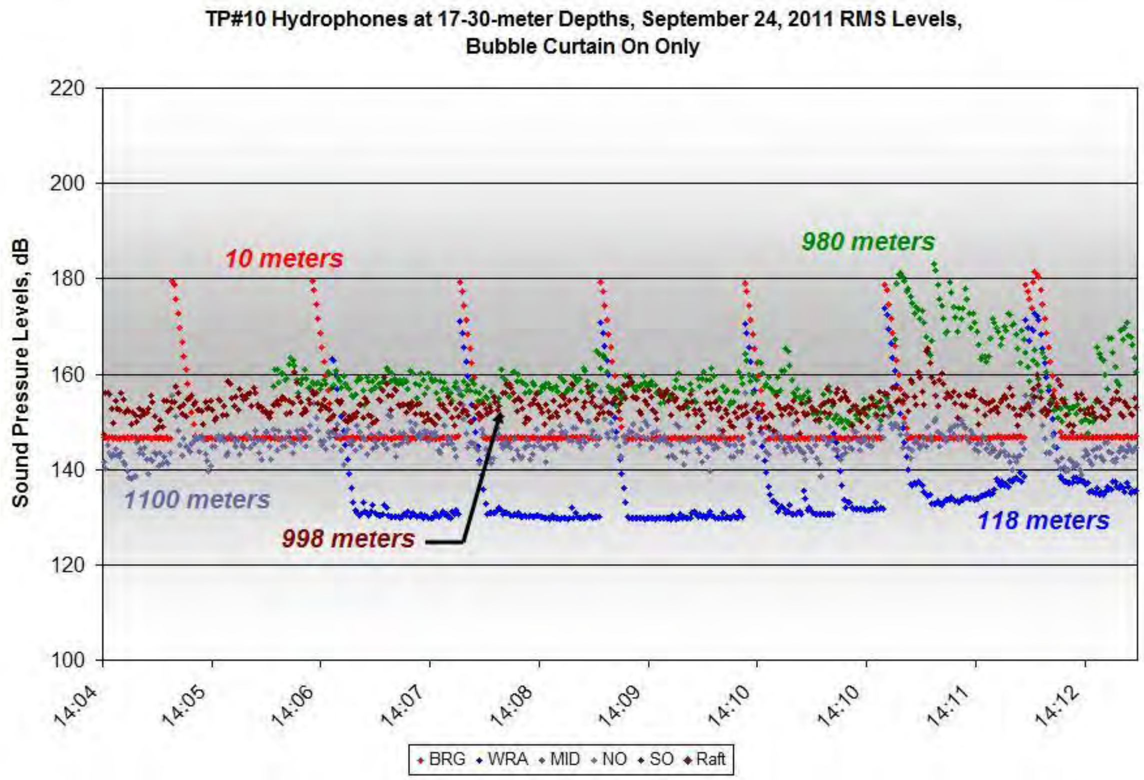

Figure B155. Impulse RMS Data for TP#10 during Bubble On Conditions, 14:05-14:12, at Depths of 17-30 meters on September 21, 2011

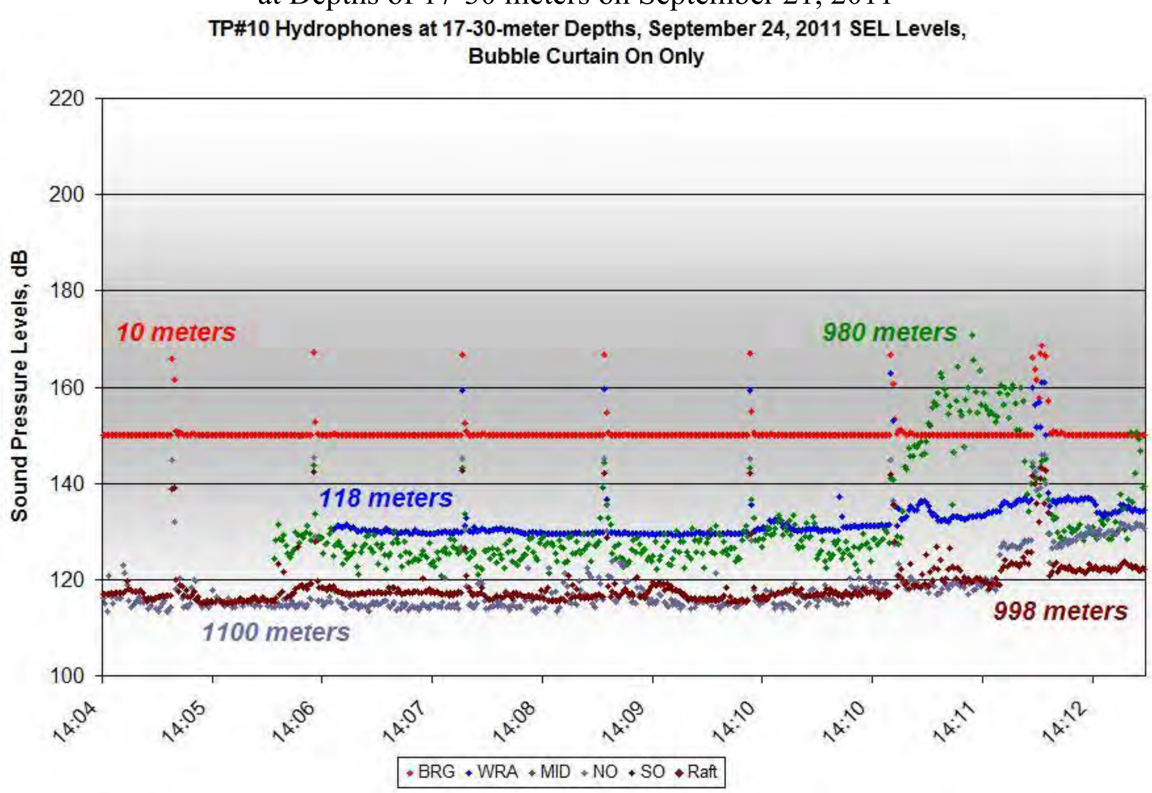

Figure B156. One-second SEL Data for TP#10 during Bubble On Conditions, 14:05-14:12, at Depths of 17-30 meters on September 24, 2011

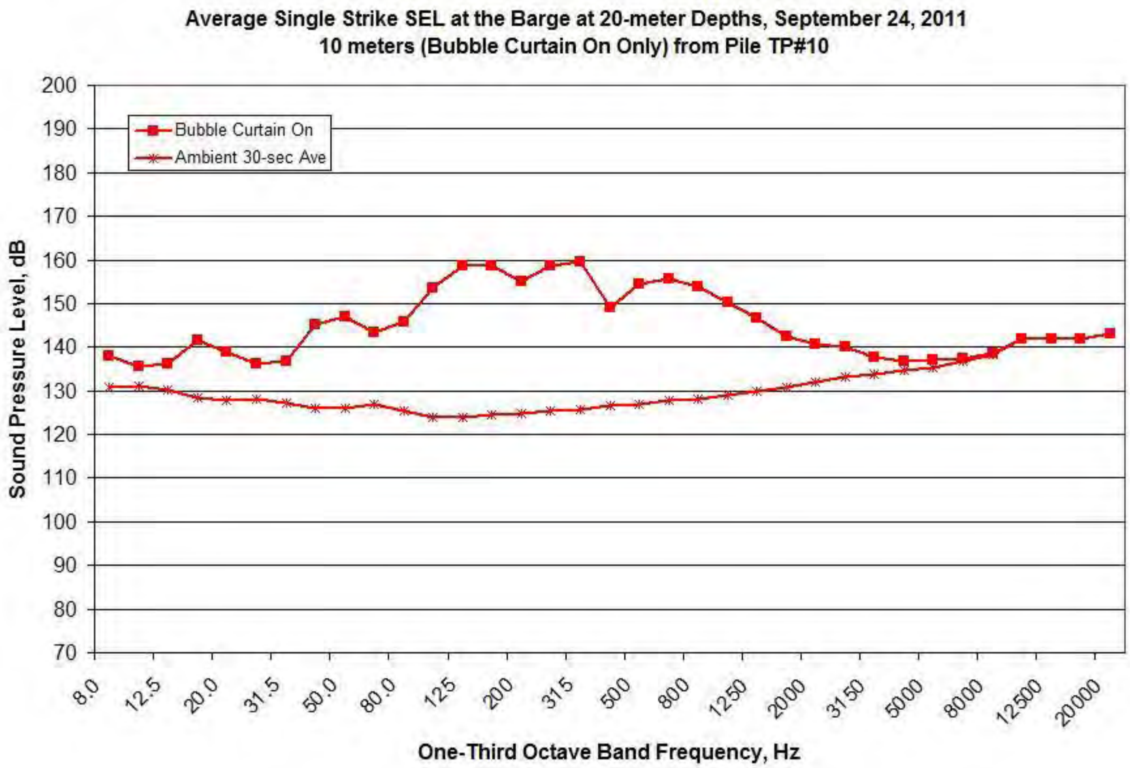

Figure B157. Average One-second SEL Spectral Data Measured at the BRG Location during TP#10, 14:05-14:12, Depths of 20 meters on September 24, 2011

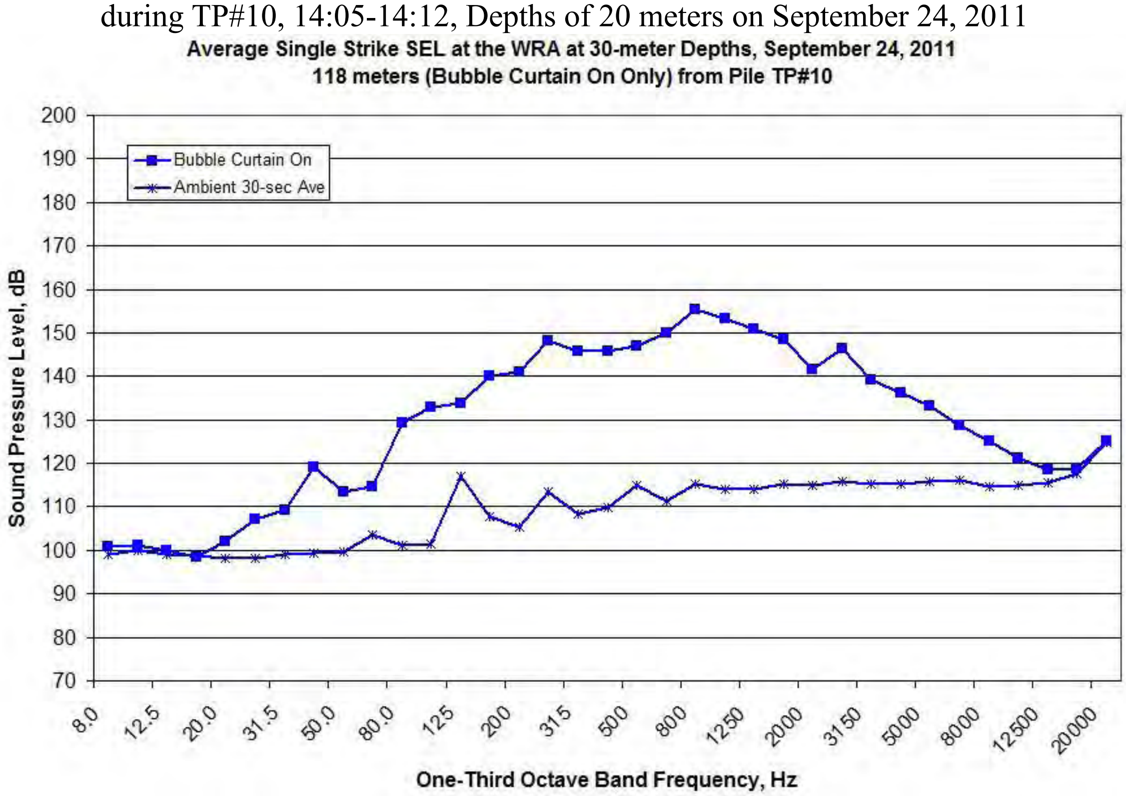

Figure B158. Average One-second SEL Spectral Data Measured at the WRA Location during TP#10, 14:05-14:12, Depths of 30 meters on September 24, 2011

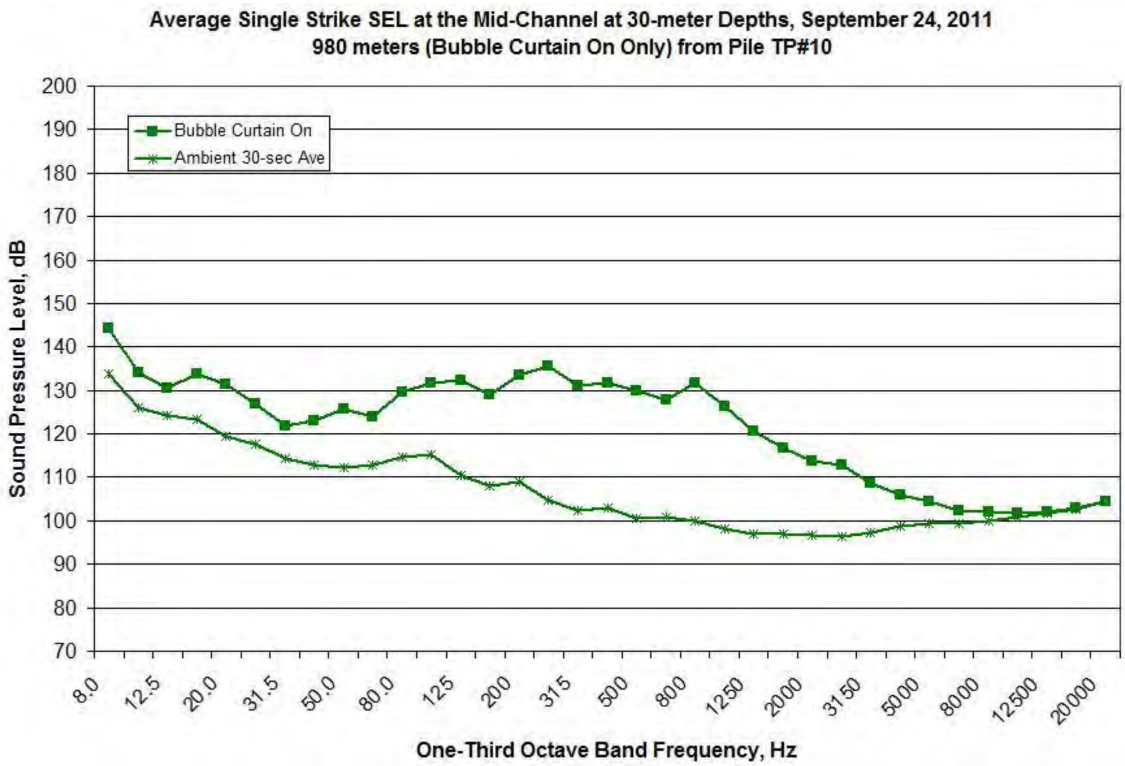

Figure B159. Average One-second SEL Spectral Data Measured at the MID Location during TP#10, 14:05-14:12, Depths of 30 meters on September 24, 2011

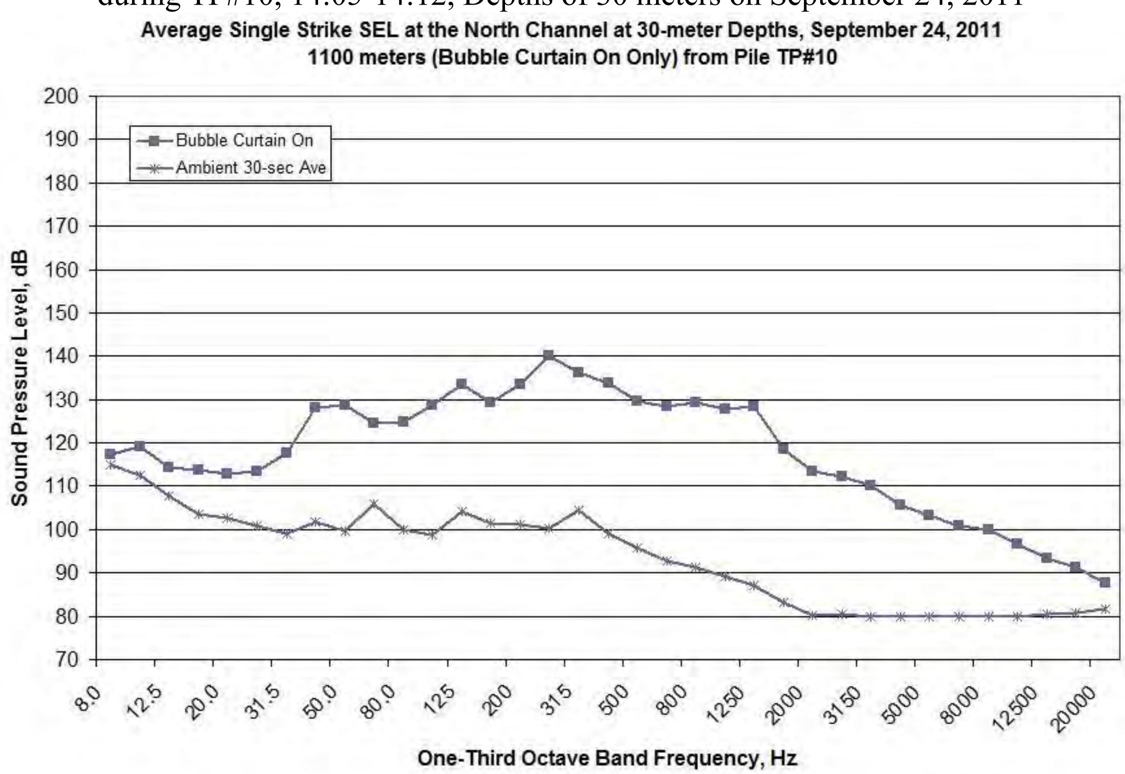

Figure B160. Average One-second SEL Spectral Data Measured at the NO Location during TP#10, 14:05-14:12, Depths of 30 meters on September 24, 2011

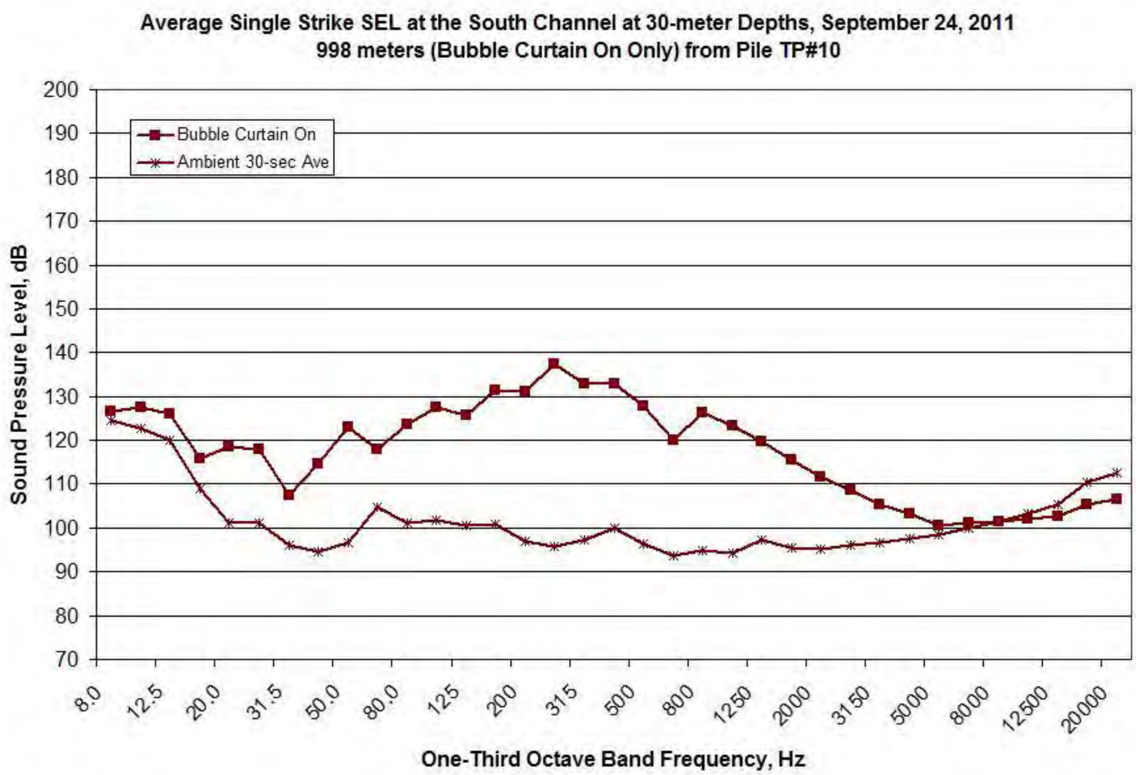

Figure B161. Average One-second SEL Spectral Data Measured at the SO Location during TP#10, 14:05-14:12, Depths of 30 meters on September 24, 2011

NO DATA AVAILABLE – TOO MUCH INTERFERENCE

Figure B162. Average One-second SEL Spectral Data Measured at the RFT Location during TP#10, 14:05-14:12, Depths of 17 meters on September 24, 2011

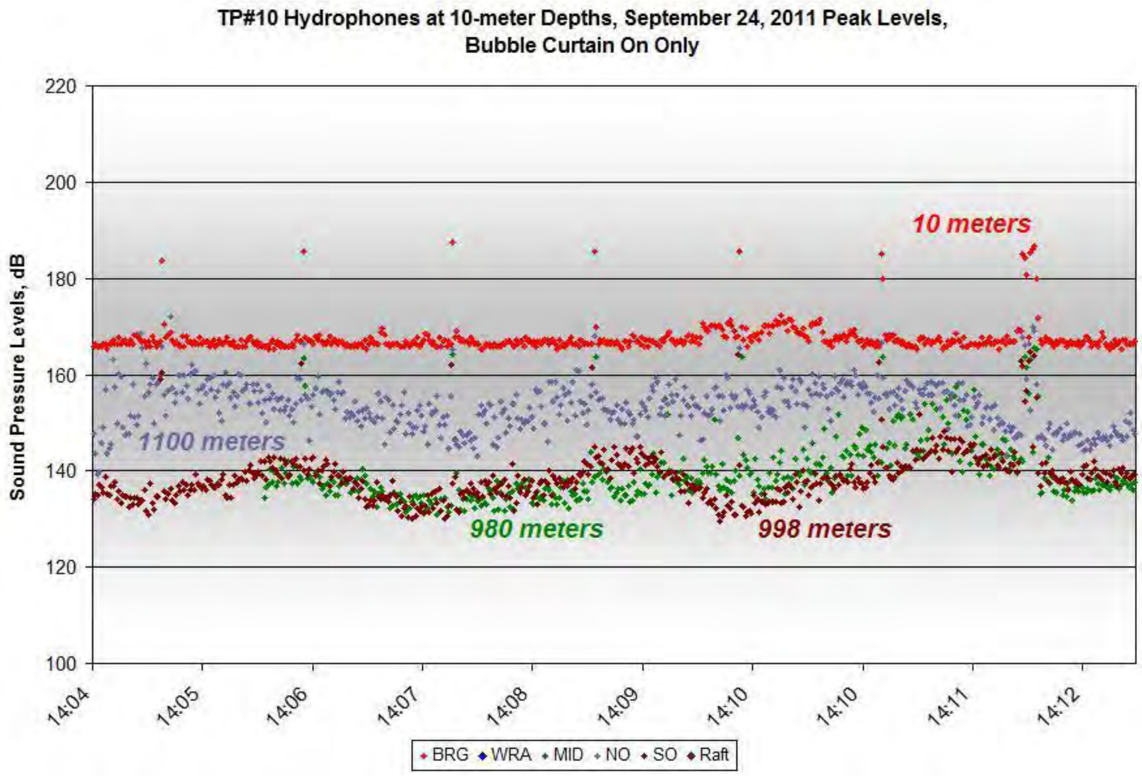

Figure B163. One-second Peak Level Data for TP#10 during Bubble On Conditions, 14:05-14:12, at Depths of 10 meters on September 24, 2011

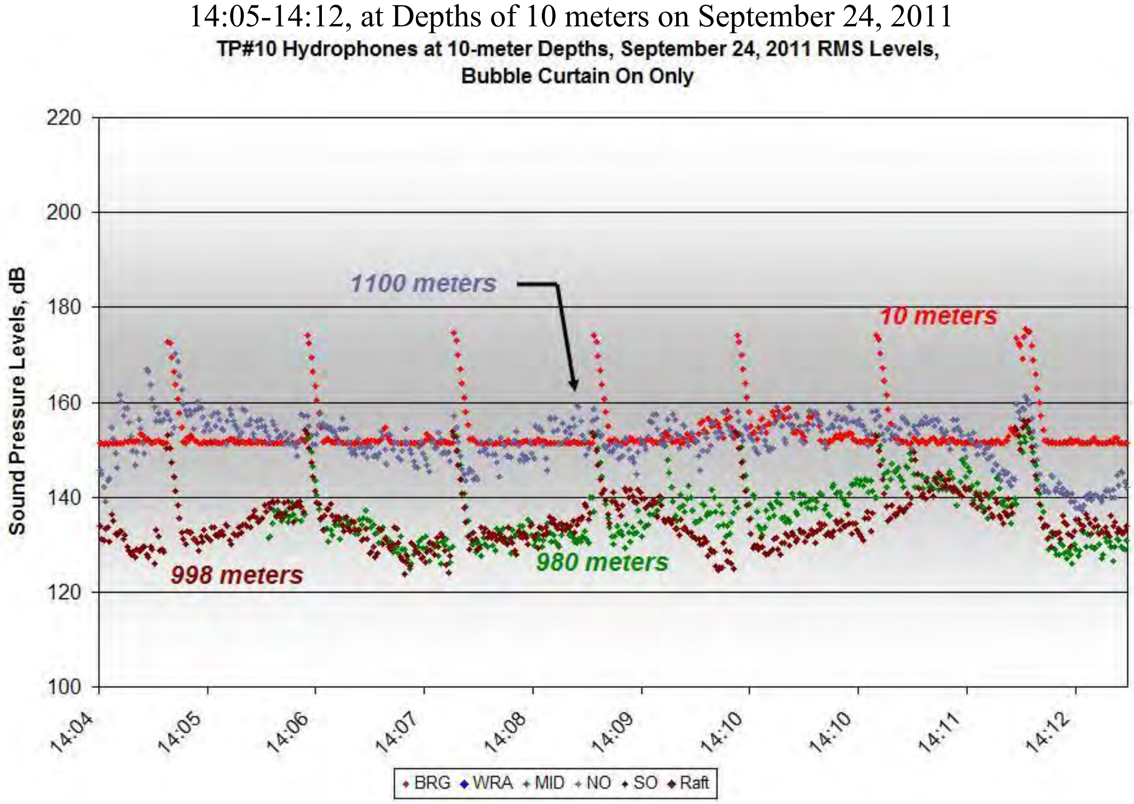

Figure B164. Impulse RMS Data for TP#10 during Bubble On Conditions, 14:05-14:12, at Depths of 10 meters on September 24, 2011

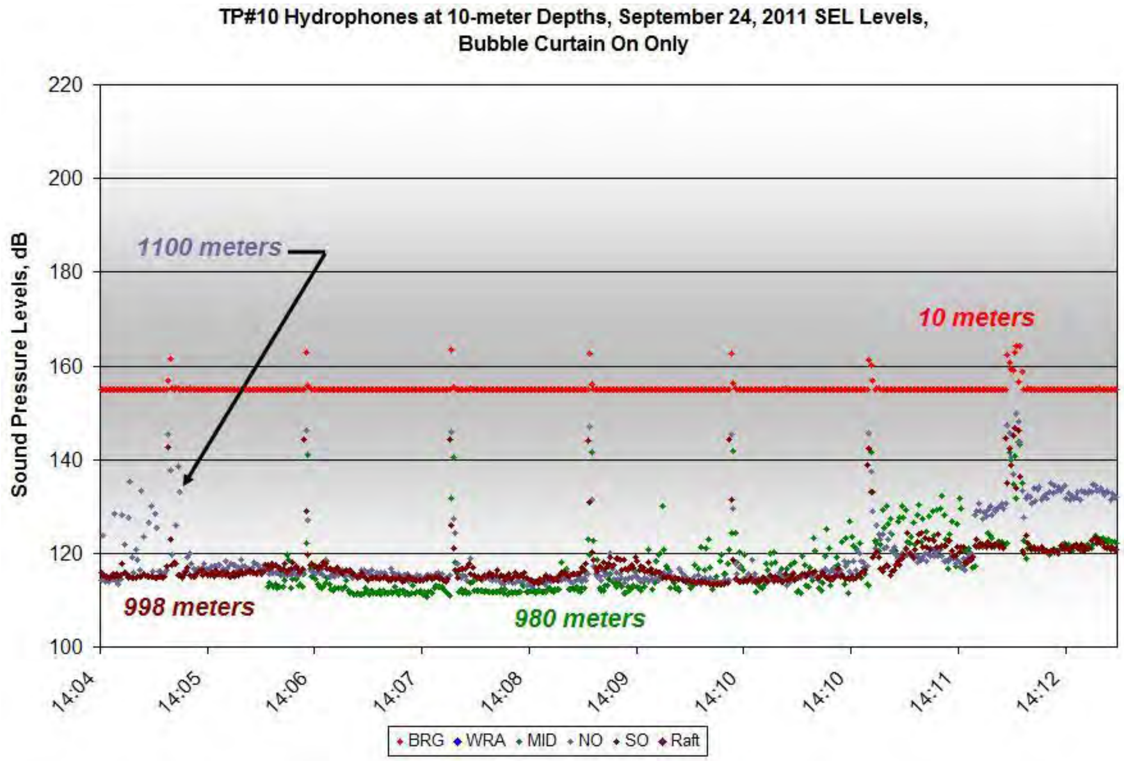

Figure B165. One-second SEL Data for TP#10 during Bubble On Conditions, 14:05-14:12, at Depths of 10 meters on September 24, 2011

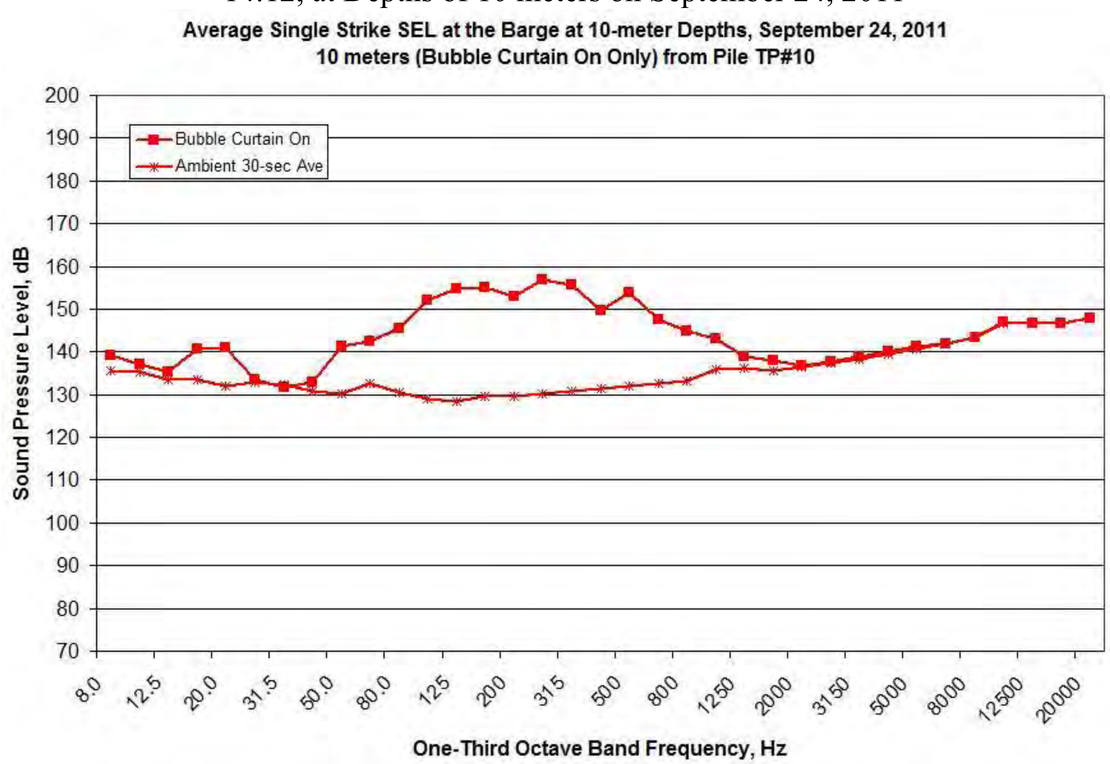

Figure B166. Average One-second SEL Spectral Data Measured at the BRG Location during TP#10, 14:05-14:12, Depths of 10 meters on September 24, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B167. Average One-second SEL Spectral Data Measured at the WRA Location during TP#10, 14:05-14:12, Depths of 10 meters on September 24, 2011

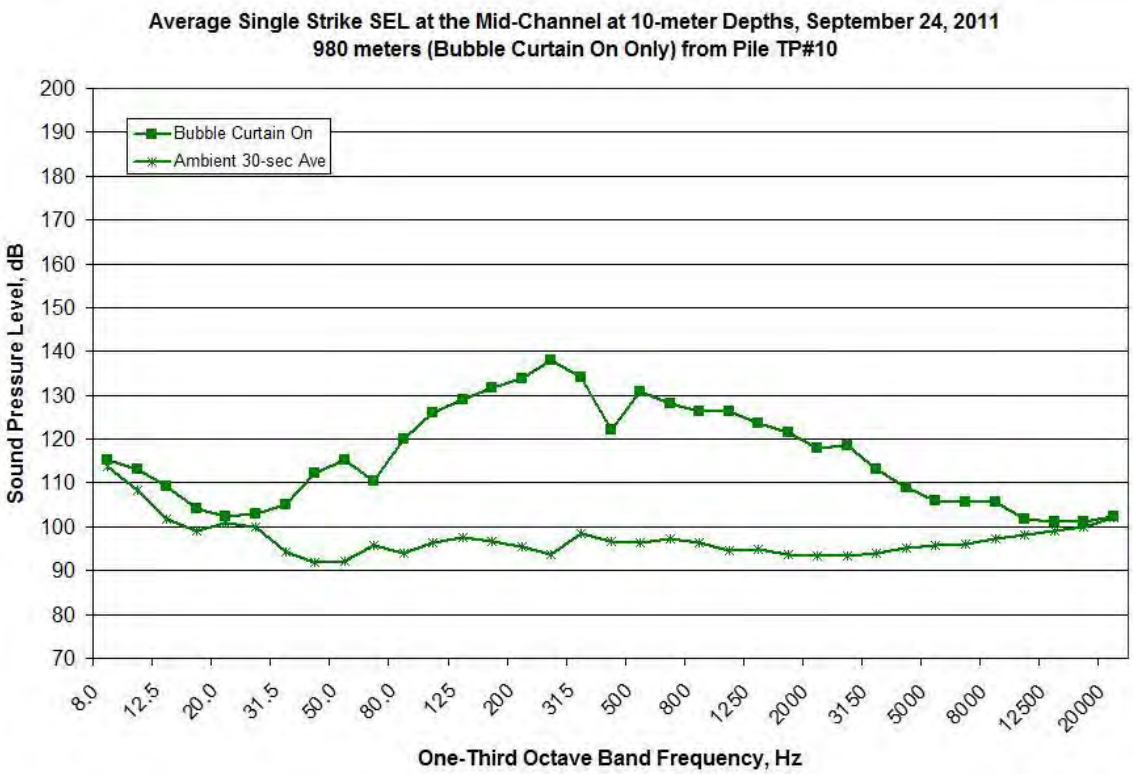

Figure B168. Average One-second SEL Spectral Data Measured at the MID Location during TP#10, 14:05-14:12, Depths of 10 meters on September 24, 2011

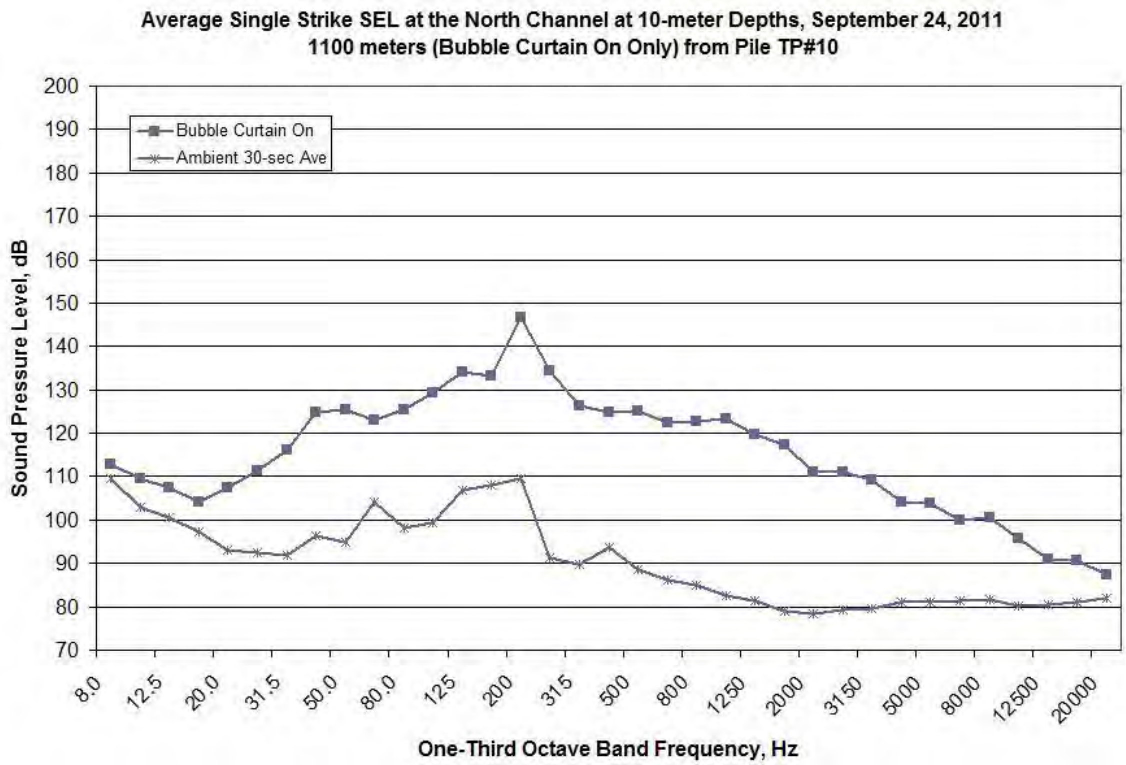

Figure B169. Average One-second SEL Spectral Data Measured at the NO Location during TP#10, 14:05-14:12, Depths of 10 meters on September 24, 2011

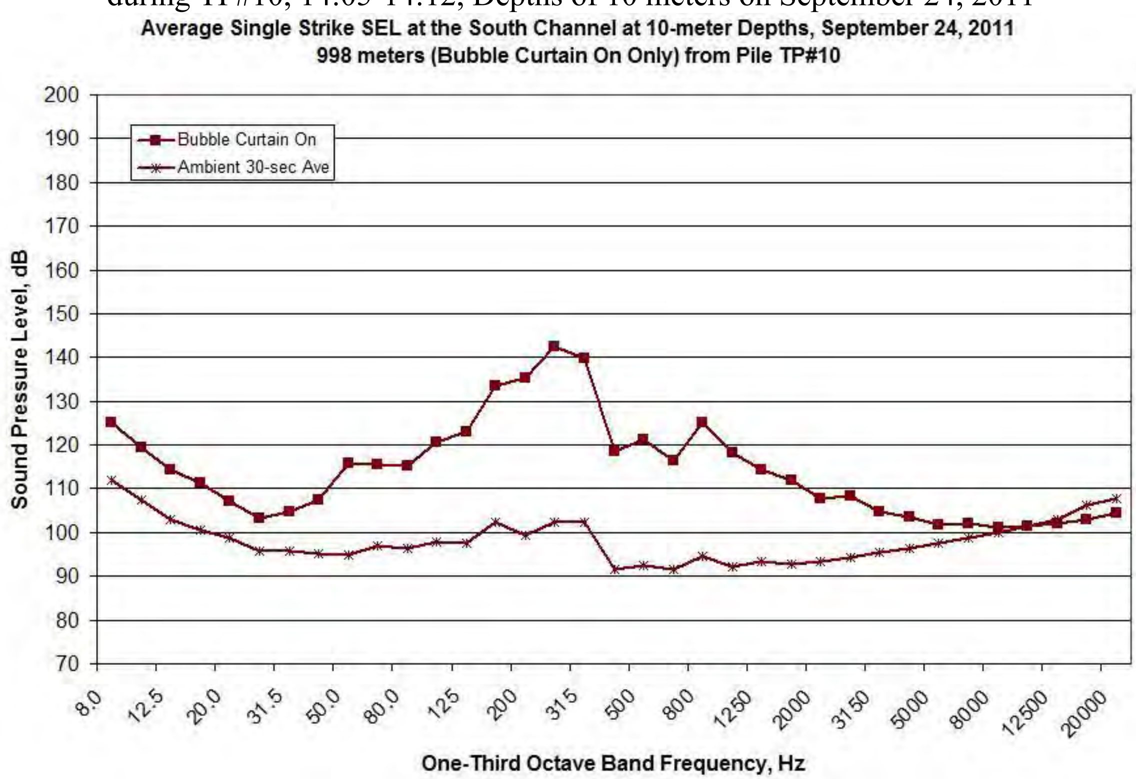

Figure B170. Average One-second SEL Spectral Data Measured at the SO Location during TP#10, 14:05-14:12, Depths of 10 meters on September 24, 2011

NO DATA AVAILABLE – TOO MUCH INTERFERENCE

Figure B171. Average One-second SEL Spectral Data Measured at the RFT Location during TP#10, 14:05-14:12, Depths of 10 meters on September 24, 2011

9/26/2011 – TP#8

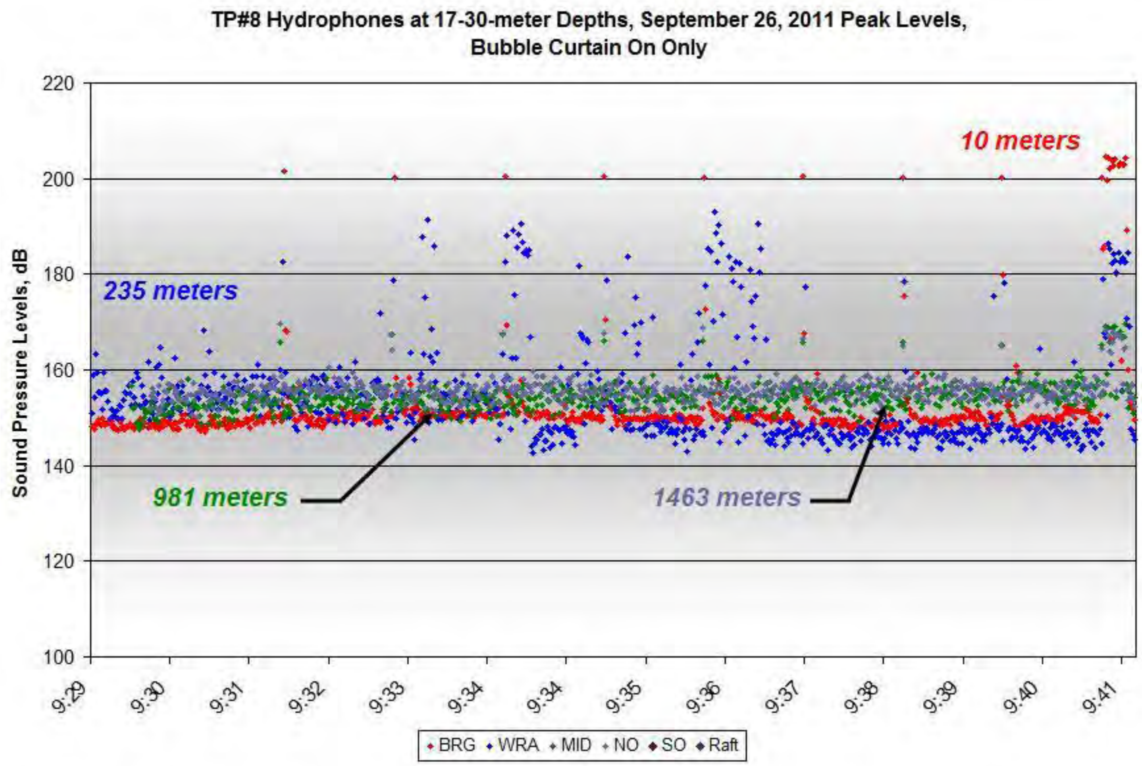

Figure B172. One-second Peak Level Data for TP#8 during Bubble On Conditions, 9:31-9:41, at Depths of 17-30 meters on September 26, 2011

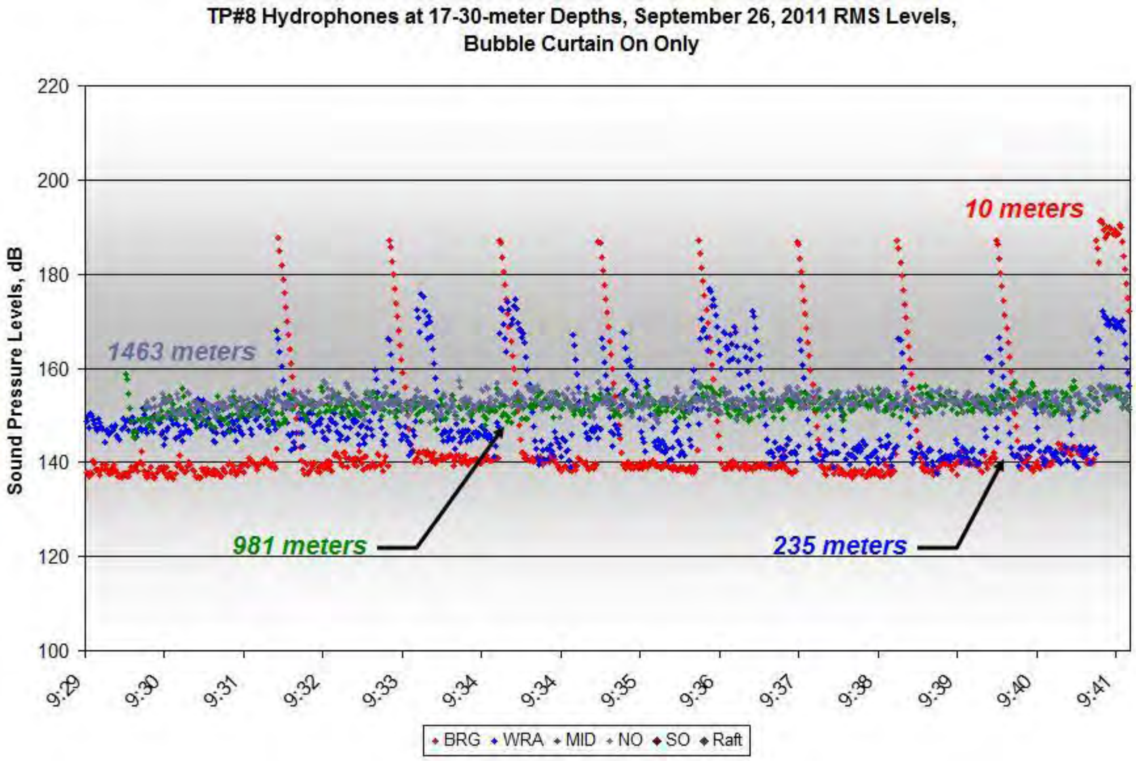

Figure B173. Impulse RMS Data for TP#8 during Bubble On Conditions, 9:31-9:41, at Depths of 17-30 meters on September 26, 2011

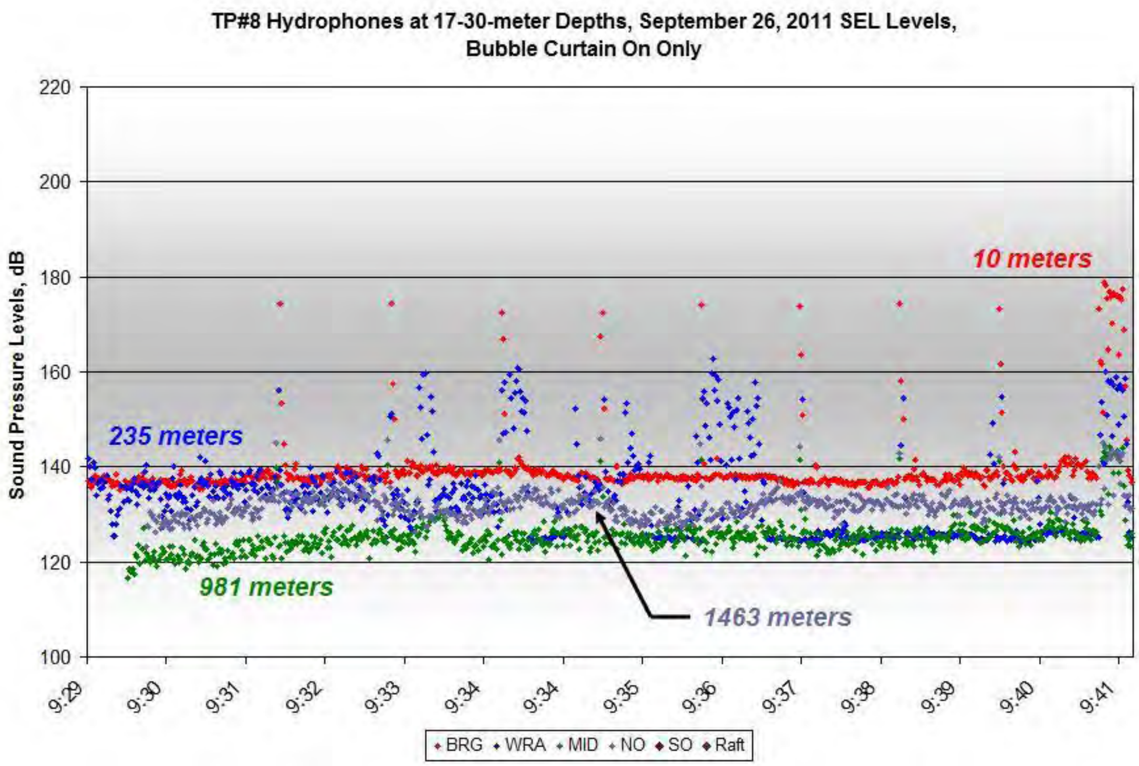

Figure B174. One-second SEL Data for TP#8 during Bubble On Conditions, 9:31-9:41, at Depths of 17-30 meters on September 26, 2011

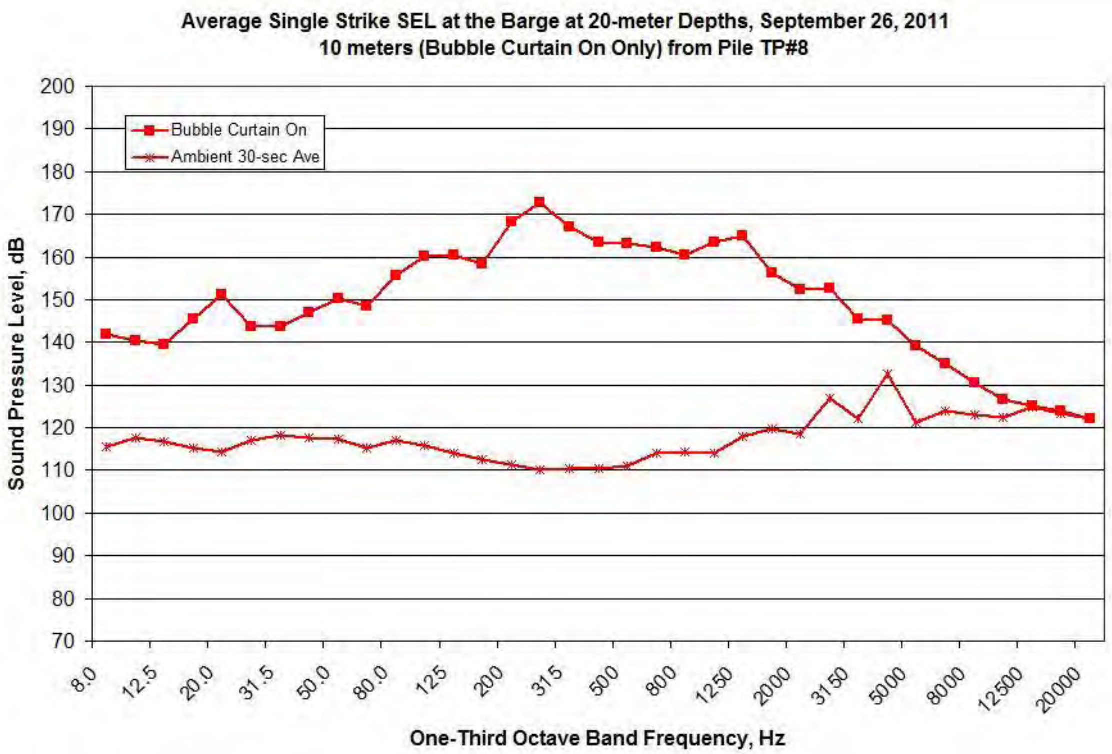

Figure B175. Average One-second SEL Spectral Data Measured at the BRG Location during TP#8, 9:31-9:41, Depths of 20 meters on September 26, 2011

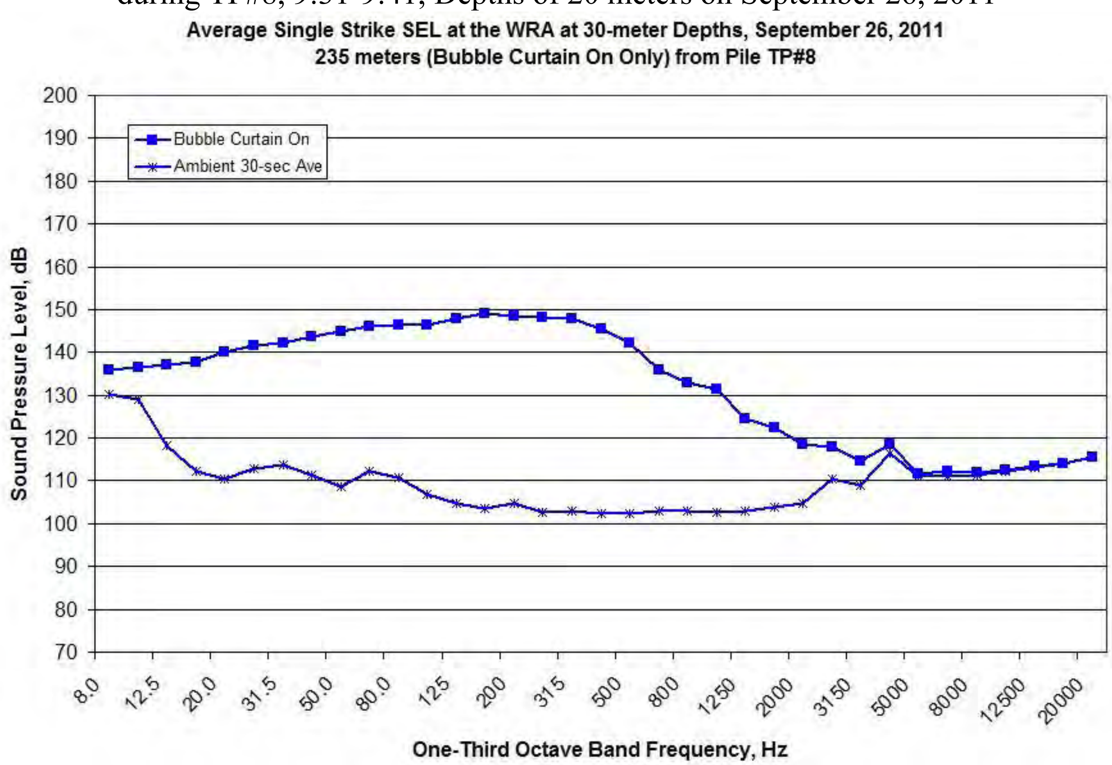

Figure B176. Average One-second SEL Spectral Data Measured at the WRA Location during TP#8, 9:31-9:41, Depths of 30 meters on September 26, 2011

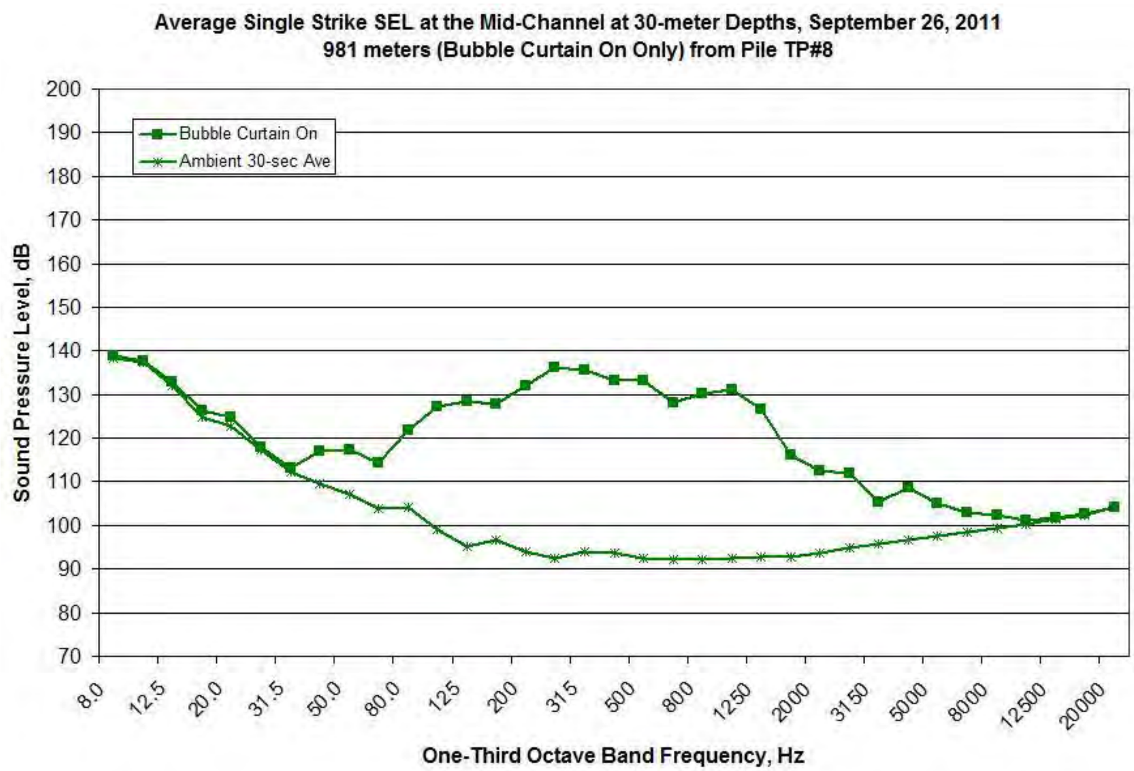

Figure B177. Average One-second SEL Spectral Data Measured at the MID Location during TP#8, 9:31-9:41, Depths of 30 meters on September 26, 2011

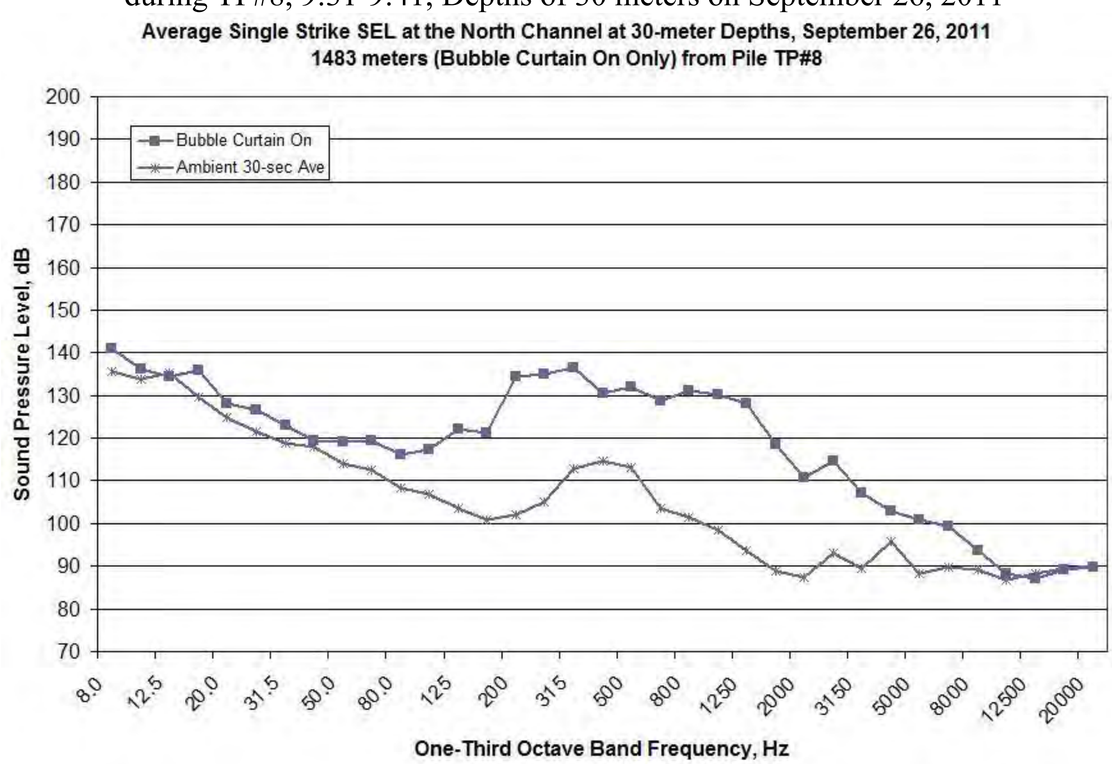

Figure B178. Average One-second SEL Spectral Data Measured at the NO Location during TP#8, 9:31-9:41, Depths of 30 meters on September 26, 2011

NO DATA AVAILABLE – EQIPMENT MALFUNCTION

Figure B179. Average One-second SEL Spectral Data Measured at the SO Location during TP#8, 9:31-9:41, Depths of 30 meters on September 26, 2011

NO DATA AVAILABLE – EQIPMENT MALFUNCTION

Figure B180. Average One-second SEL Spectral Data Measured at the RFT Location during TP#8, 9:31-9:41, Depths of 17 meters on September 26, 2011

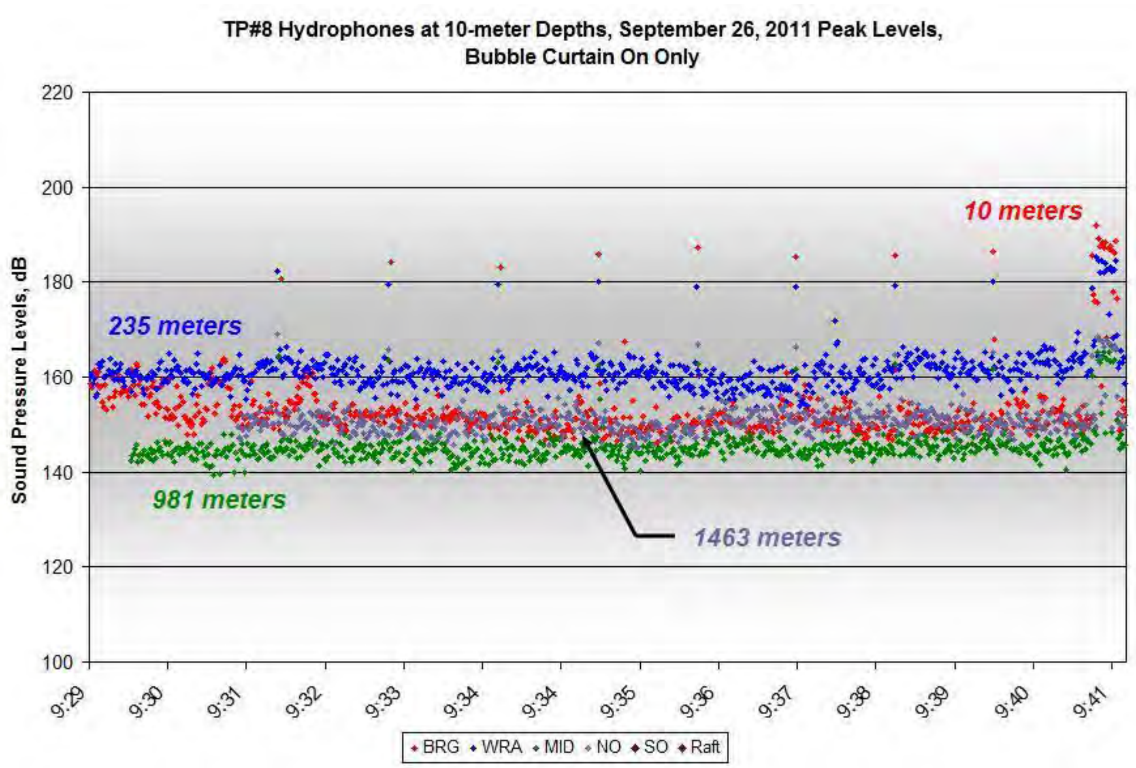

Figure B181. One-second Peak Level Data for TP#8 during Bubble On Conditions, 9:31-9:41, at Depths of 10 meters on September 26, 2011

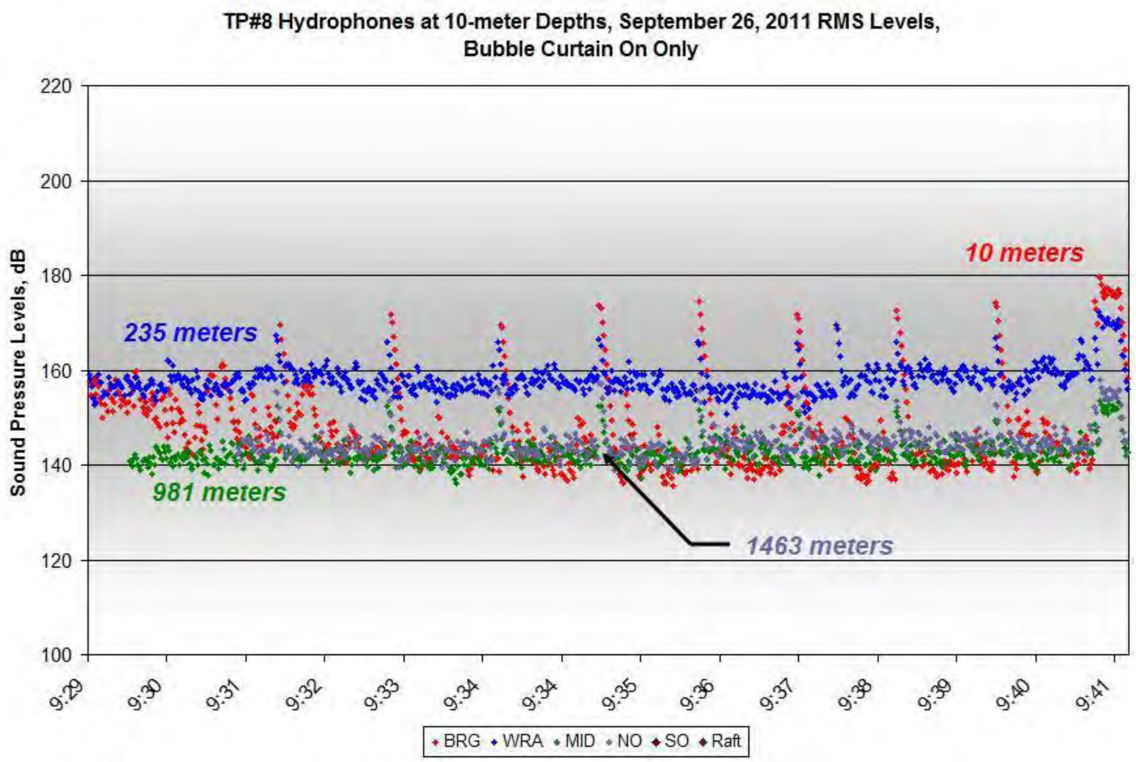

Figure B182. Impulse RMS Data for TP#8 during Bubble On Conditions, 9:31-9:41, at Depths of 10 meters on September 26, 2011

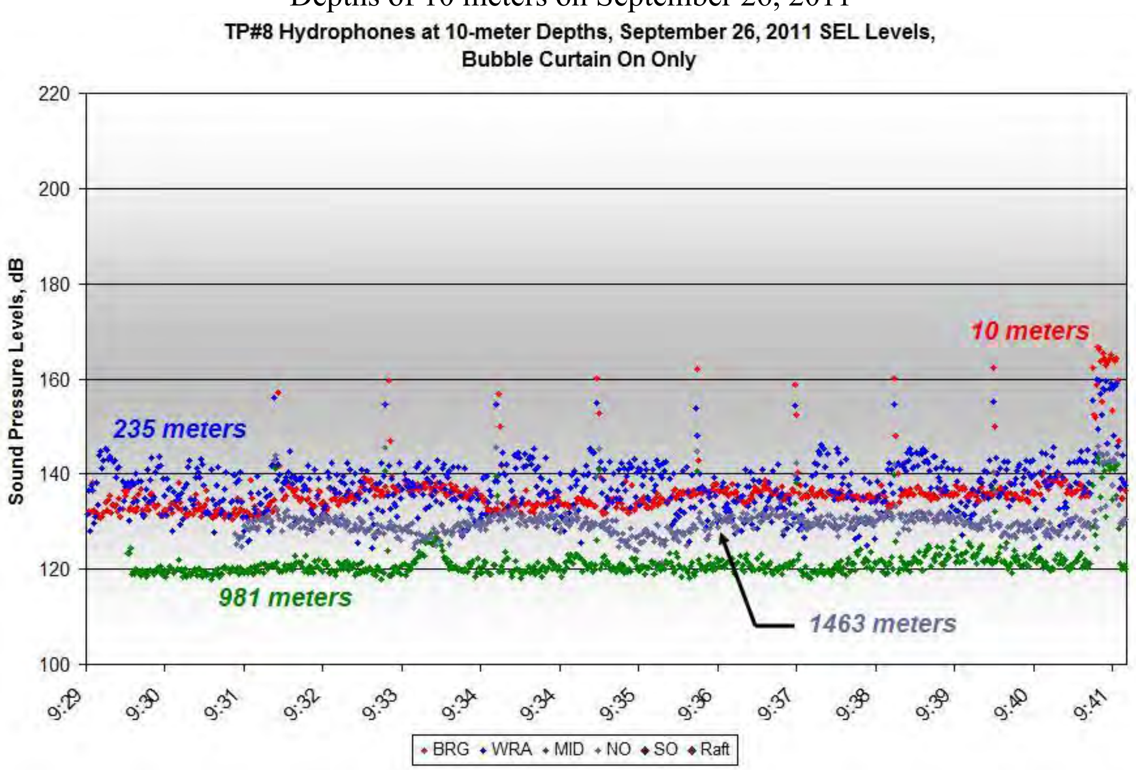

Figure B183. One-second SEL Data for TP#8 during Bubble On Conditions, 9:31-9:41, at Depths of 10 meters on September 26, 2011

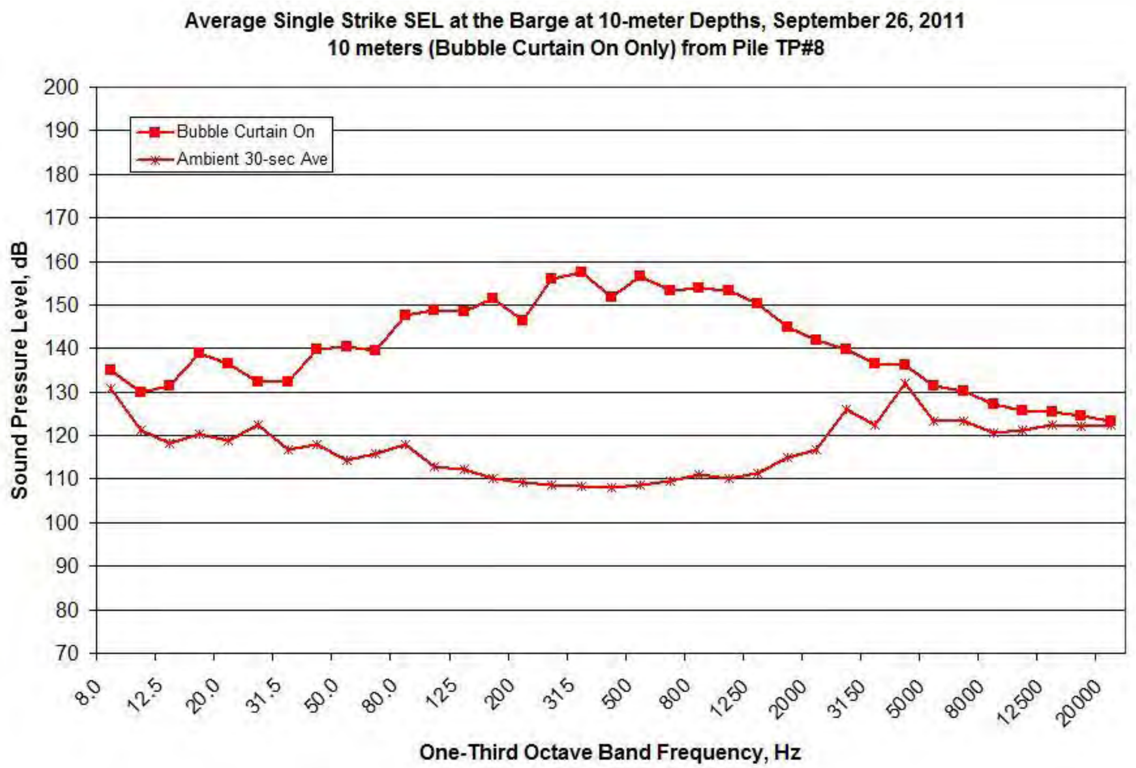

Figure B184. Average One-second SEL Spectral Data Measured at the BRG Location during TP#8, 9:31-9:41, Depths of 10 meters on September 26, 2011

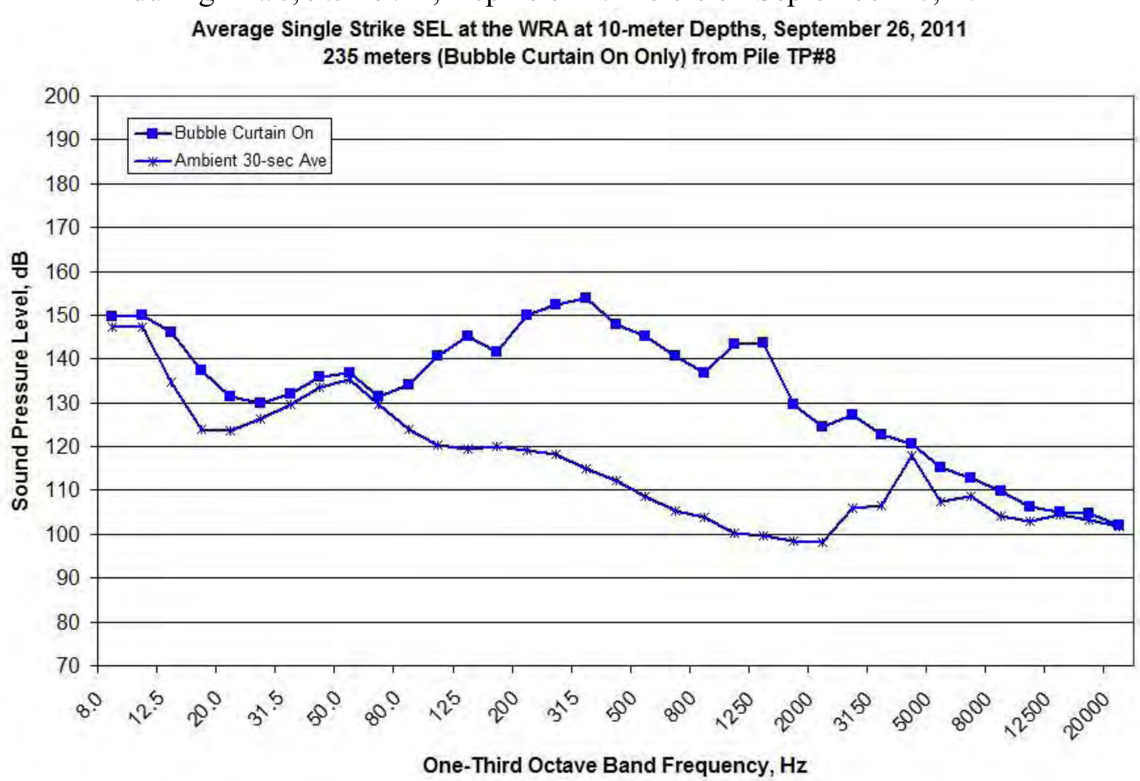

Figure B185. Average One-second SEL Spectral Data Measured at the WRA Location during TP#8, 9:31-9:41, Depths of 10 meters on September 26, 2011

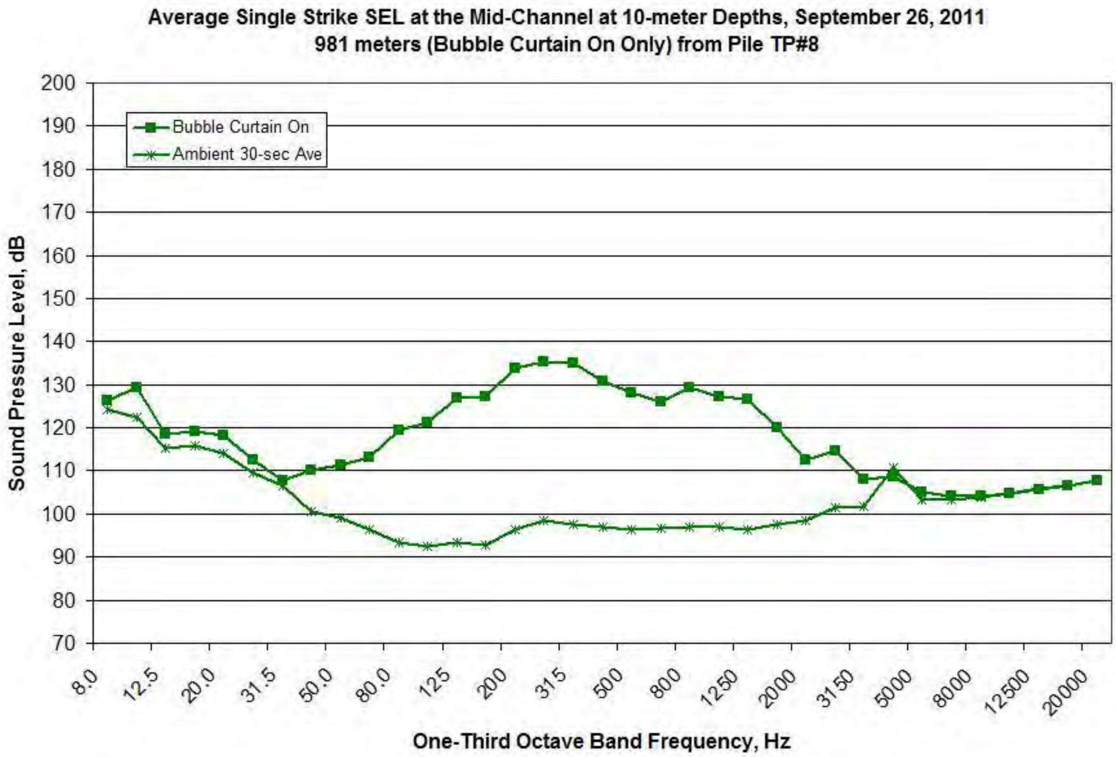

Figure B186. Average One-second SEL Spectral Data Measured at the MID Location during TP#8, 9:31-9:41, Depths of 10 meters on September 26, 2011

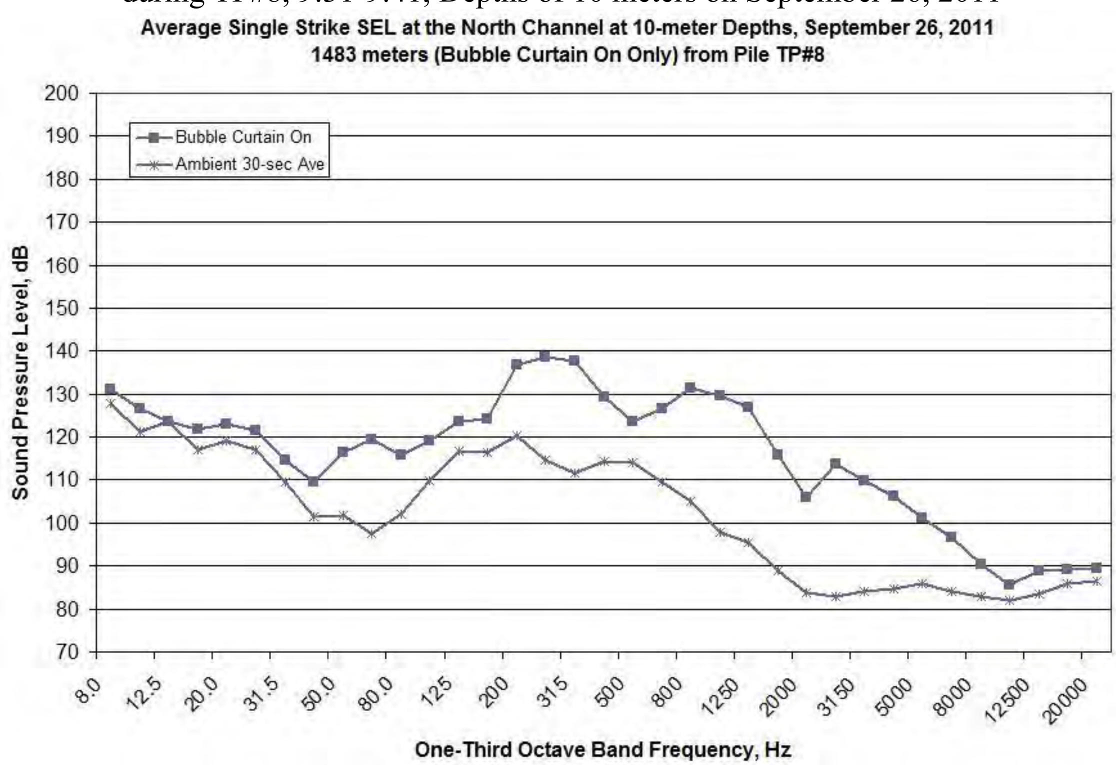

Figure B187. Average One-second SEL Spectral Data Measured at the NO Location during TP#8, 9:31-9:41, Depths of 10 meters on September 26, 2011

NO DATA AVAILABLE – TOO MUCH INTERFERENCE

Figure B188. Average One-second SEL Spectral Data Measured at the SO Location during TP#8, 9:31-9:41, Depths of 10 meters on September 26, 2011

NO DATA AVAILABLE – TOO MUCH INTERFERENCE

Figure B189. Average One-second SEL Spectral Data Measured at the RFT Location during TP#8, 9:31-9:41, Depths of 10 meters on September 26, 2011

9/29/2011 – TP#12

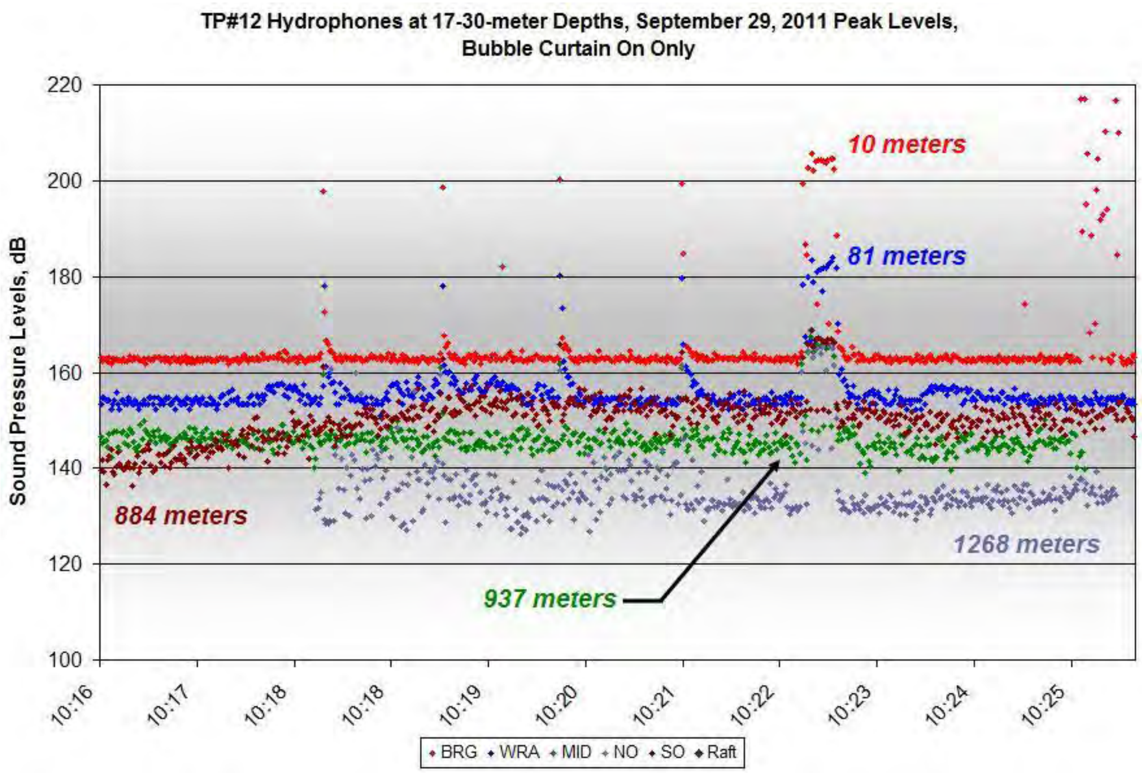

Figure B190. One-second Peak Level Data for TP#12 during Bubble On Conditions, 10:18-10:23, at Depths of 17-30 meters on September 29, 2011

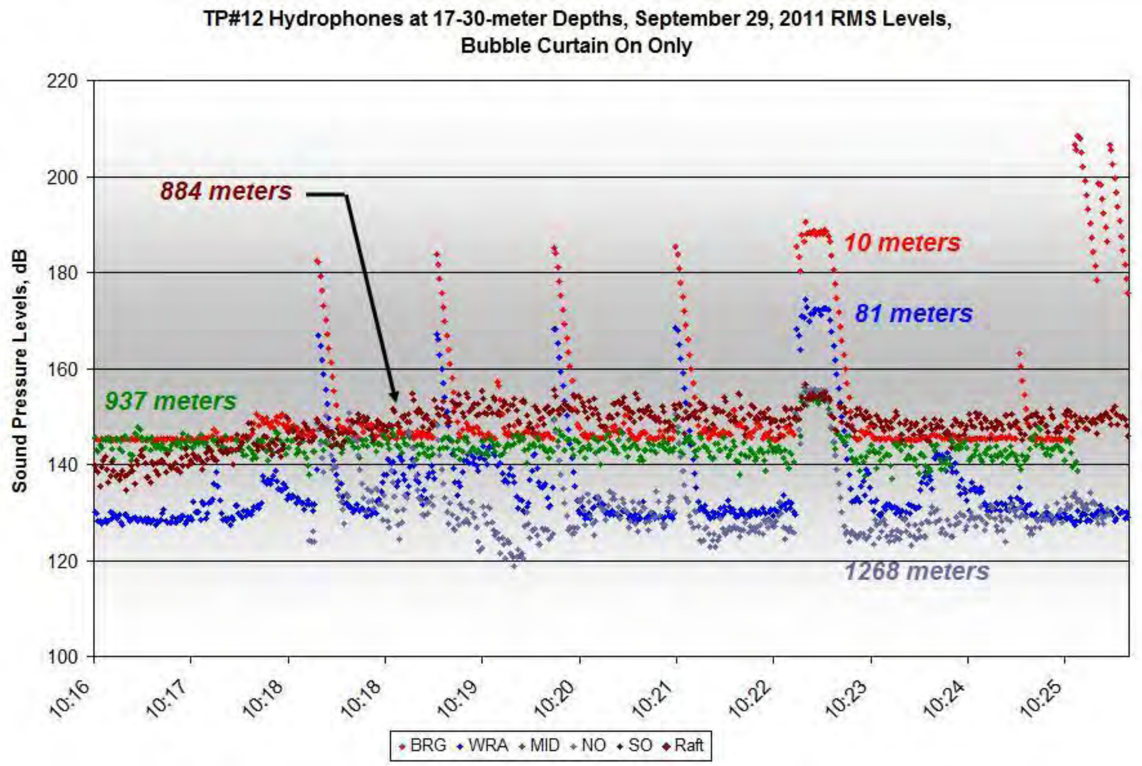

Figure B191. Impulse RMS Data for TP#12 during Bubble On Conditions, 10:18-10:23, at Depths of 17-30 meters on September 29, 2011

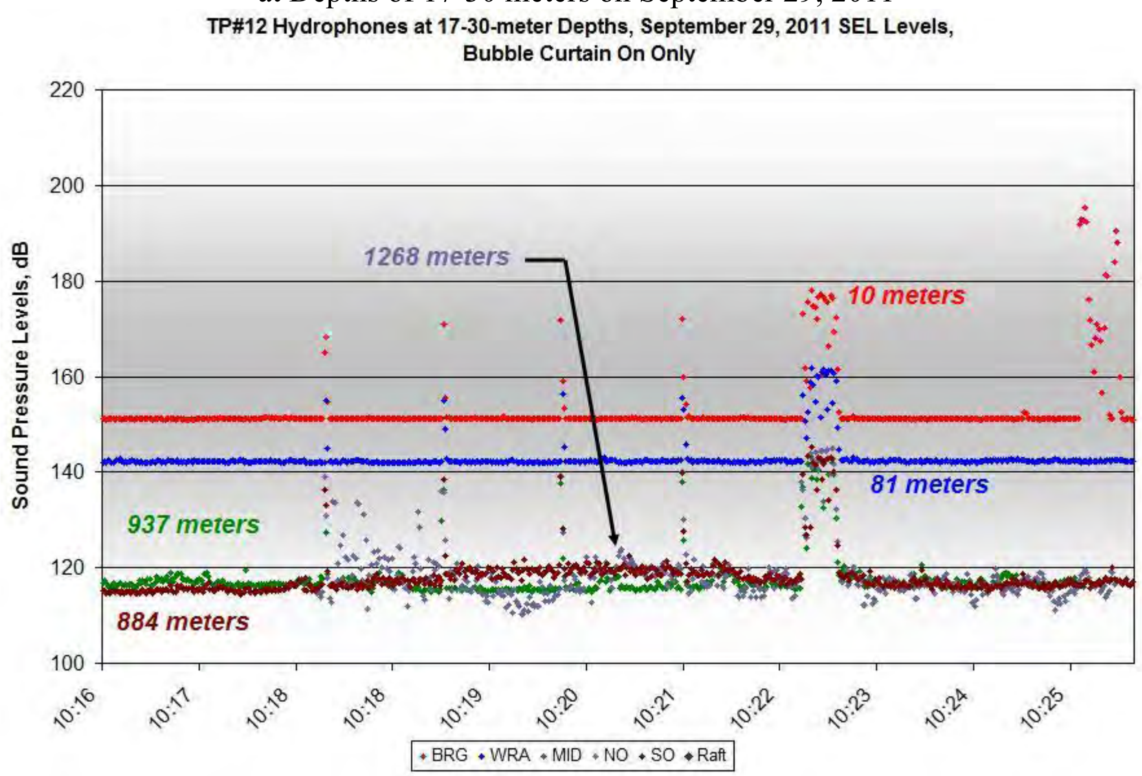

Figure B192. One-second SEL Data for TP#12 during Bubble On Conditions, 10:18-10:23, at Depths of 17-30 meters on September 29, 2011

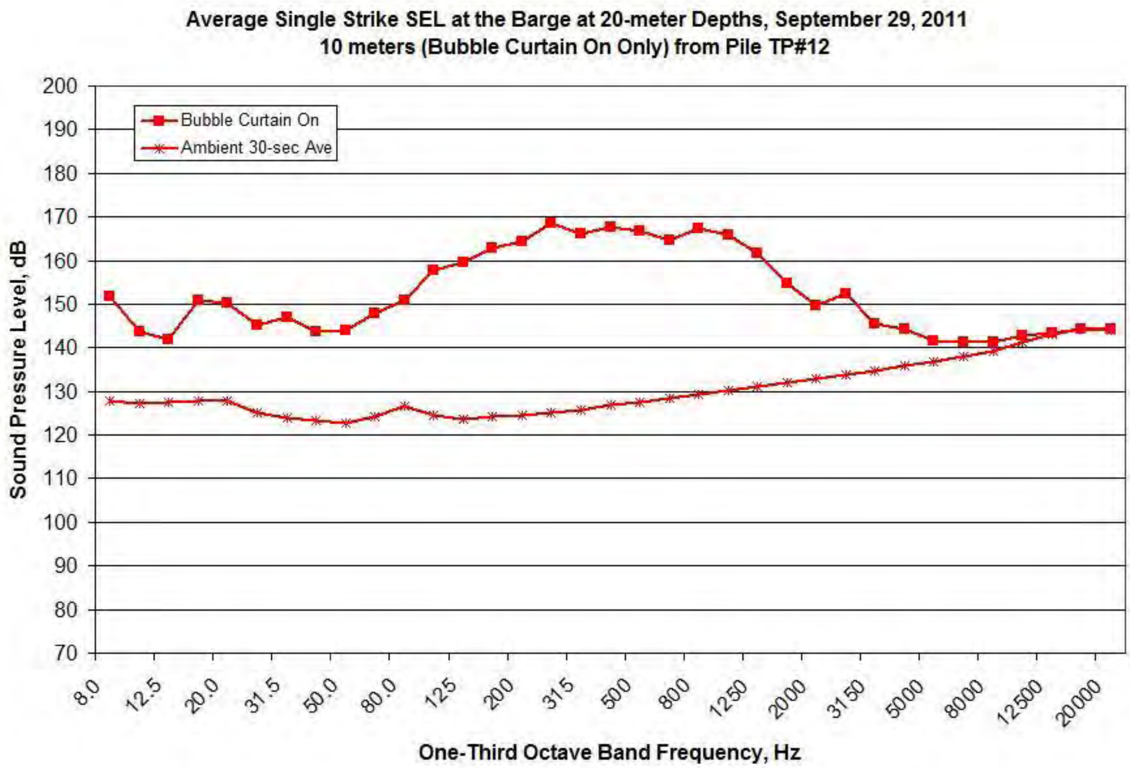

Figure B193. Average One-second SEL Spectral Data Measured at the BRG Location during TP#12, 10:18-10:23, Depths of 20 meters on September 29, 2011

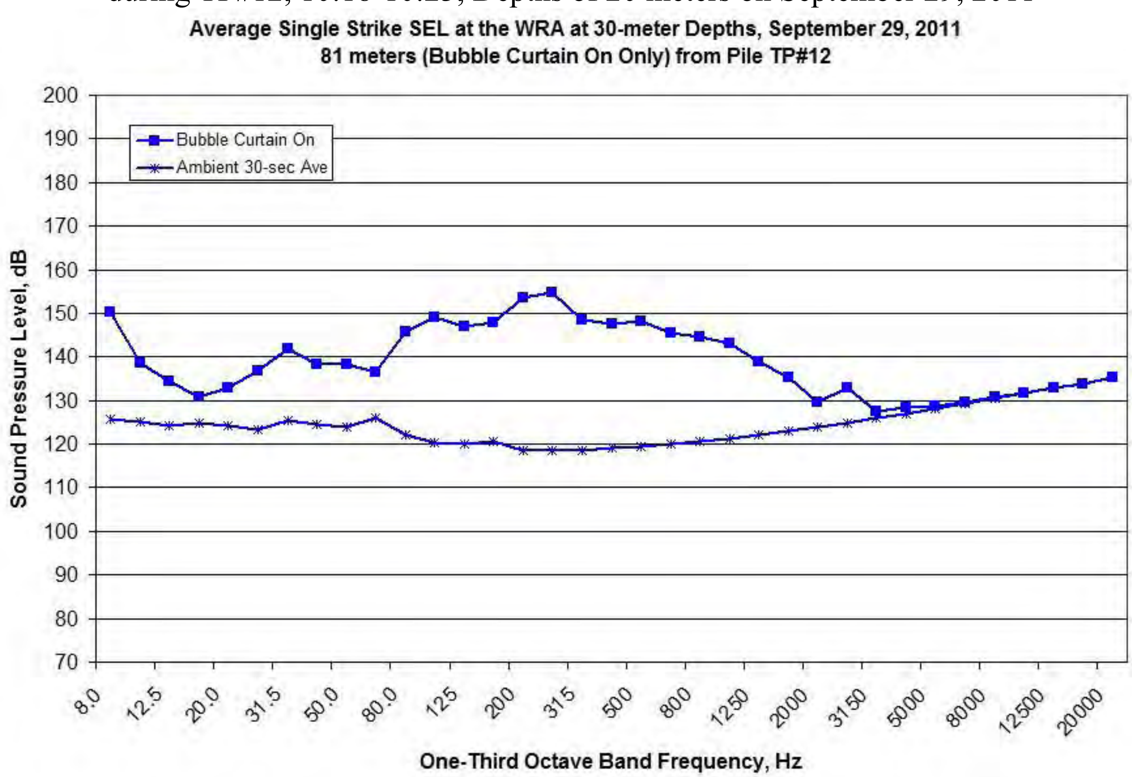

Figure B194. Average One-second SEL Spectral Data Measured at the WRA Location during TP#12, 10:18-10:23, Depths of 30 meters on September 29, 2011

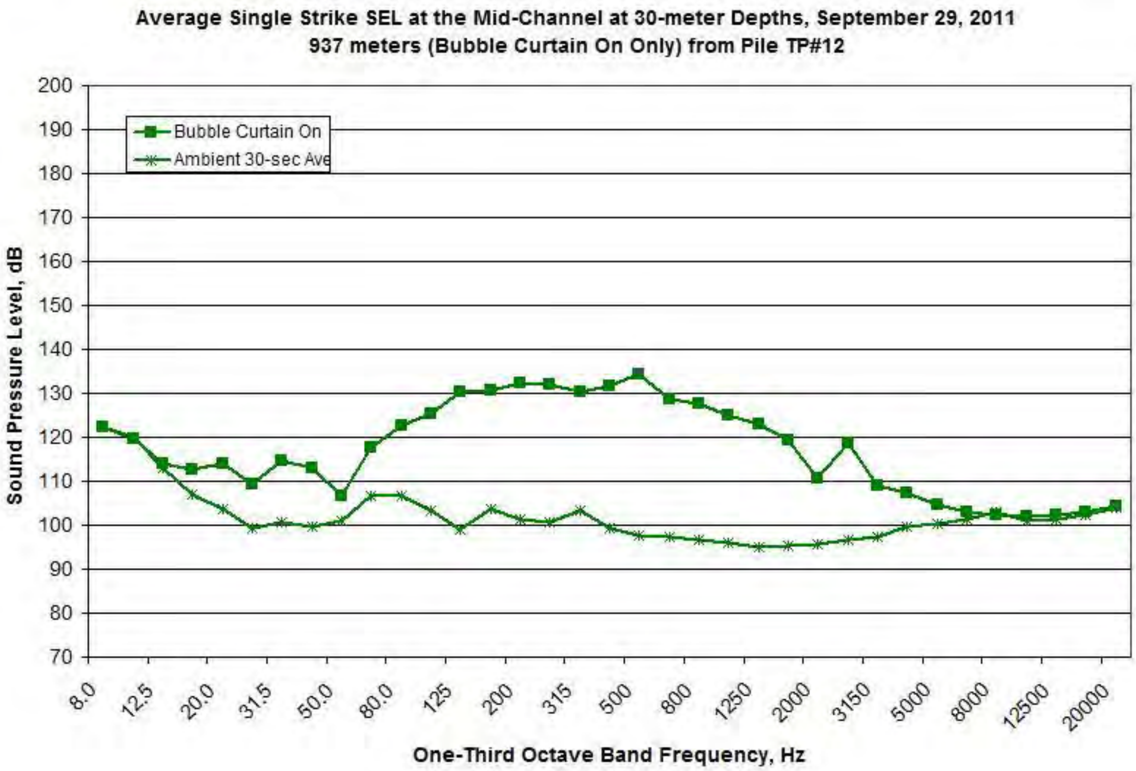

Figure B195. Average One-second SEL Spectral Data Measured at the MID Location during TP#12, 10:18-10:23, Depths of 30 meters on September 29, 2011

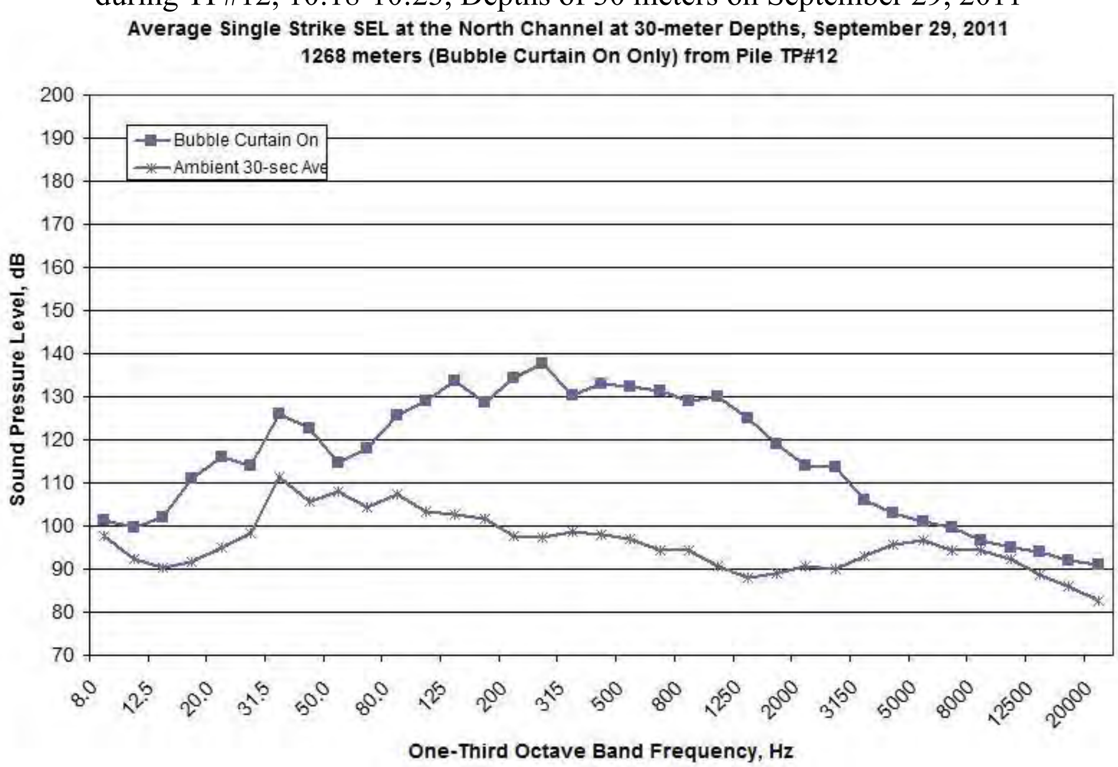

Figure B196. Average One-second SEL Spectral Data Measured at the NO Location during TP#12, 10:18-10:23, Depths of 30 meters on September 29, 2011

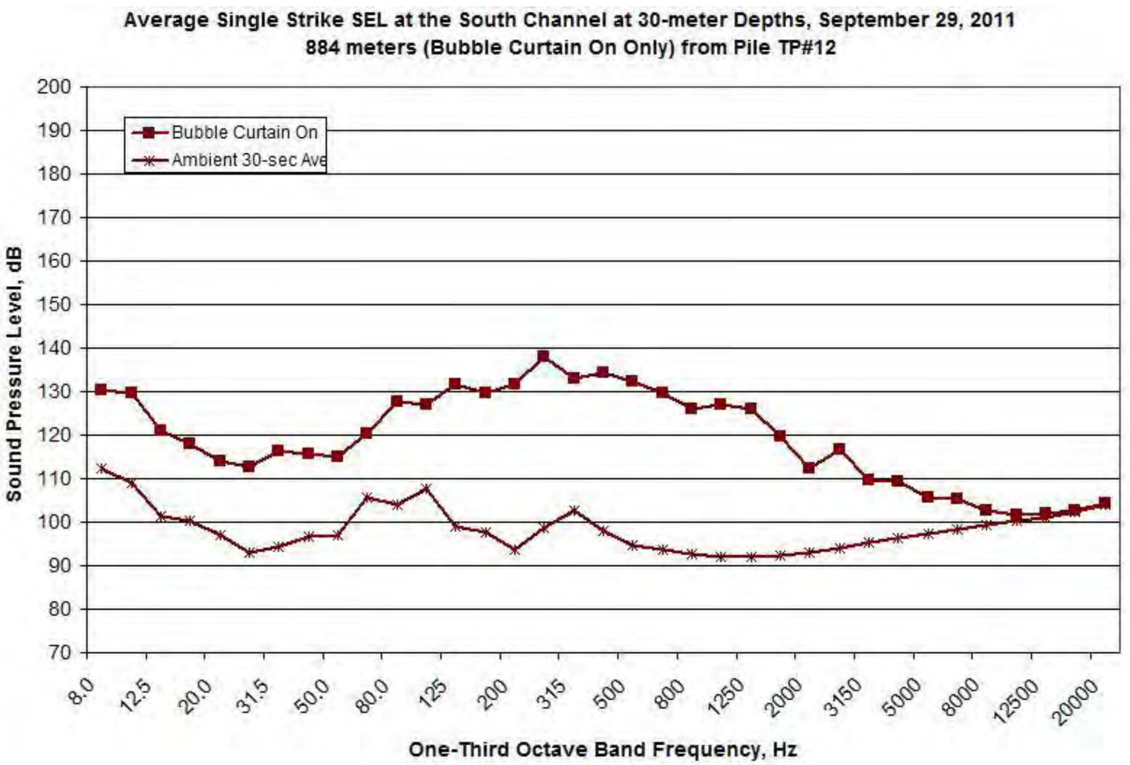

Figure B197. Average One-second SEL Spectral Data Measured at the SO Location during TP#12, 10:18-10:23, Depths of 30 meters on September 29, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B198. Average One-second SEL Spectral Data Measured at the RFT Location during TP#12, 10:18-10:23, Depths of 17 meters on September 29, 2011

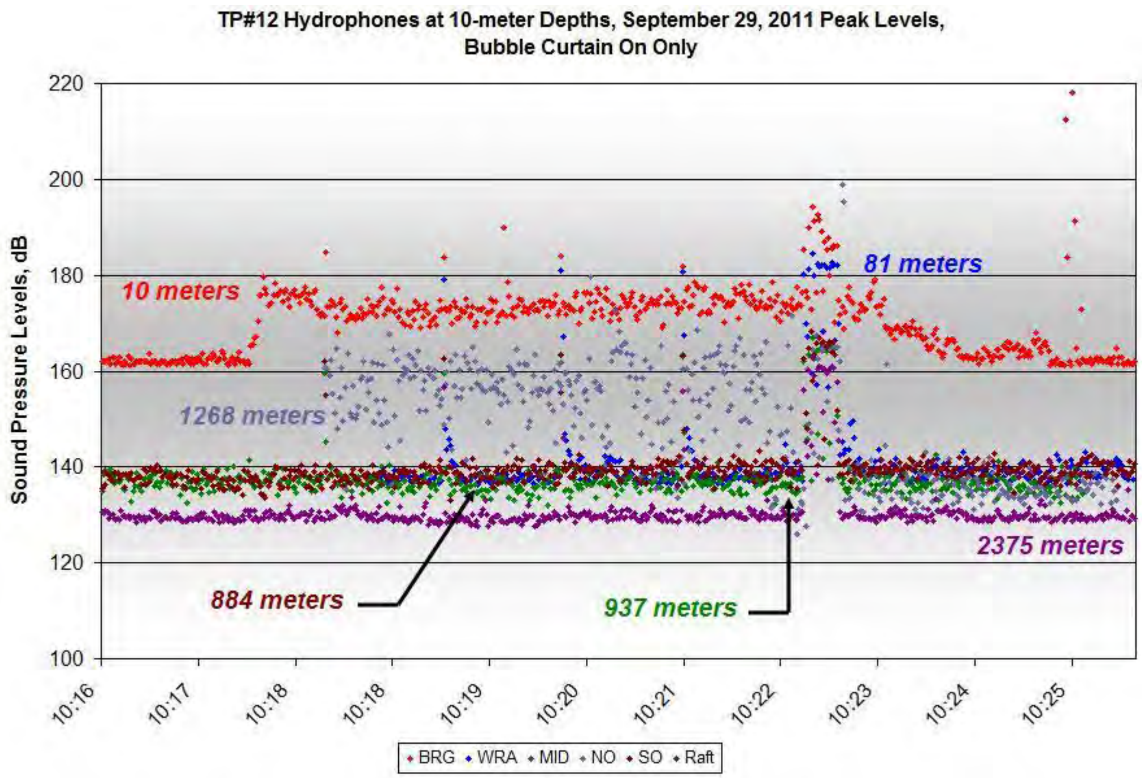

Figure B199. One-second Peak Level Data for TP#12 during Bubble On Conditions, 10:18-10:23, at Depths of 10 meters on September 29, 2011

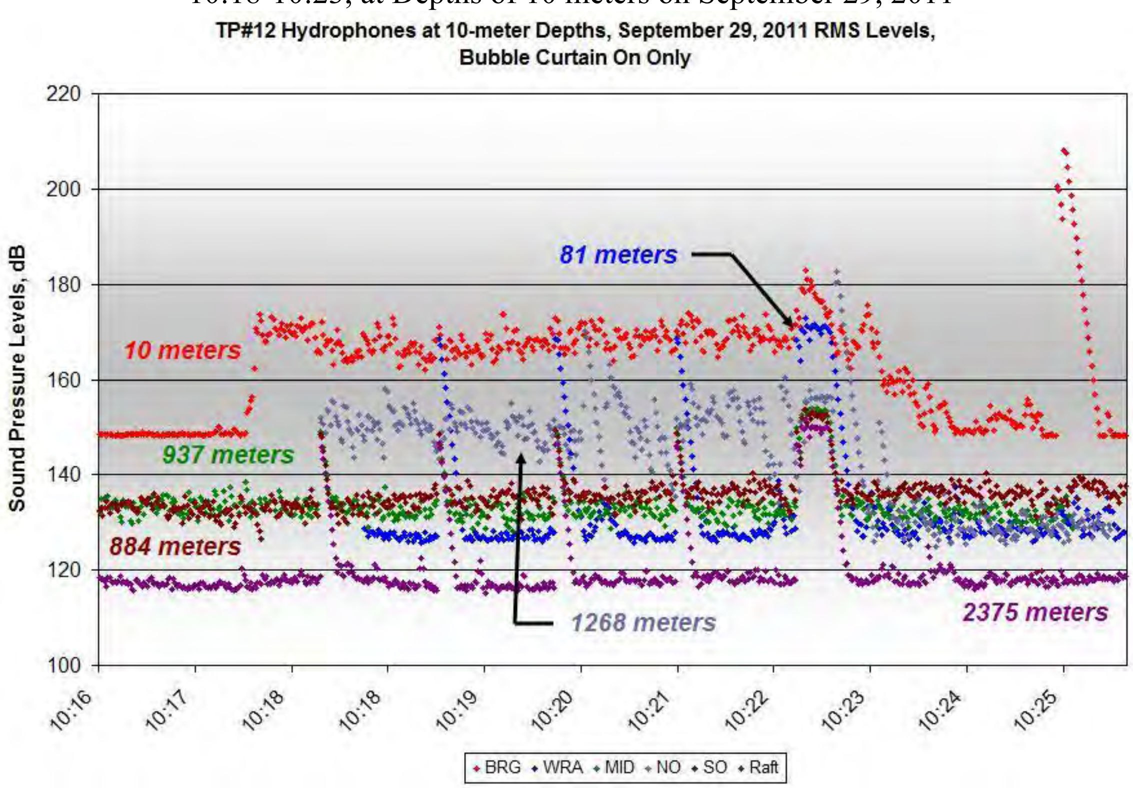

Figure B200. Impulse RMS Data for TP#12 during Bubble On Conditions, 10:18-10:23, at Depths of 10 meters on September 29, 2011

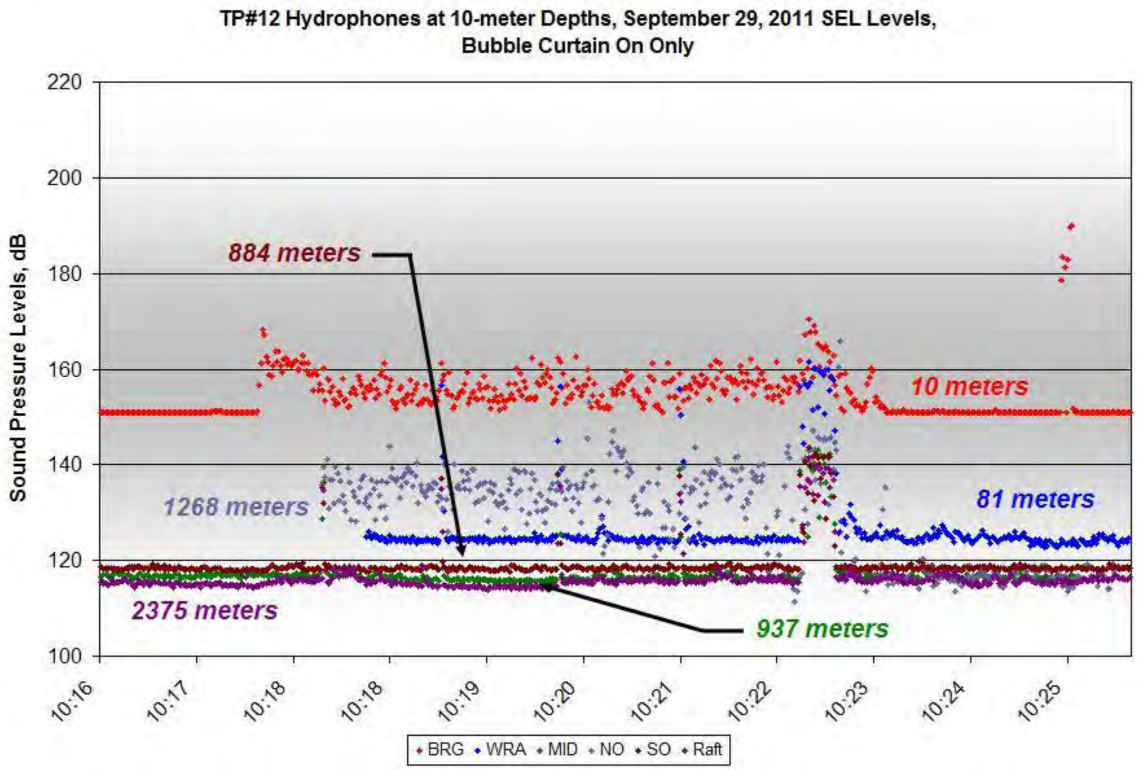

Figure B201. One-second SEL Data for TP#12 during Bubble On Conditions, 10:18-10:23, at Depths of 10 meters on September 29, 2011

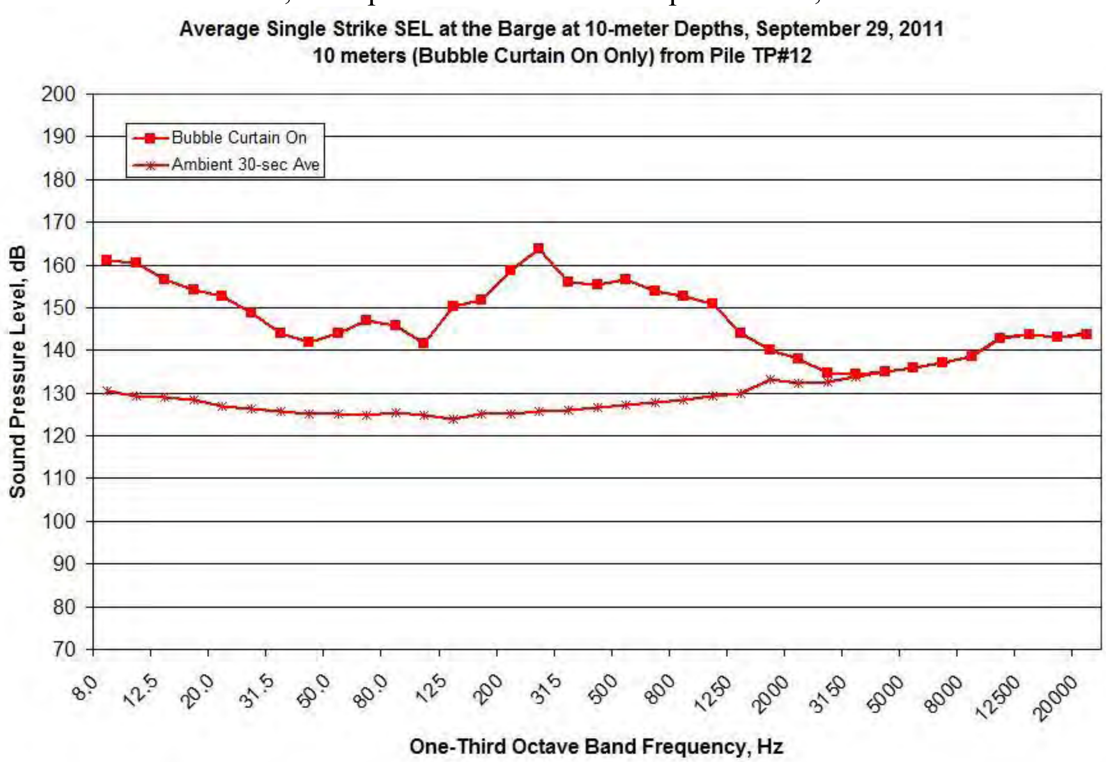

Figure B202. Average One-second SEL Spectral Data Measured at the BRG Location during TP#12, 10:18-10:23, Depths of 10 meters on September 29, 2011

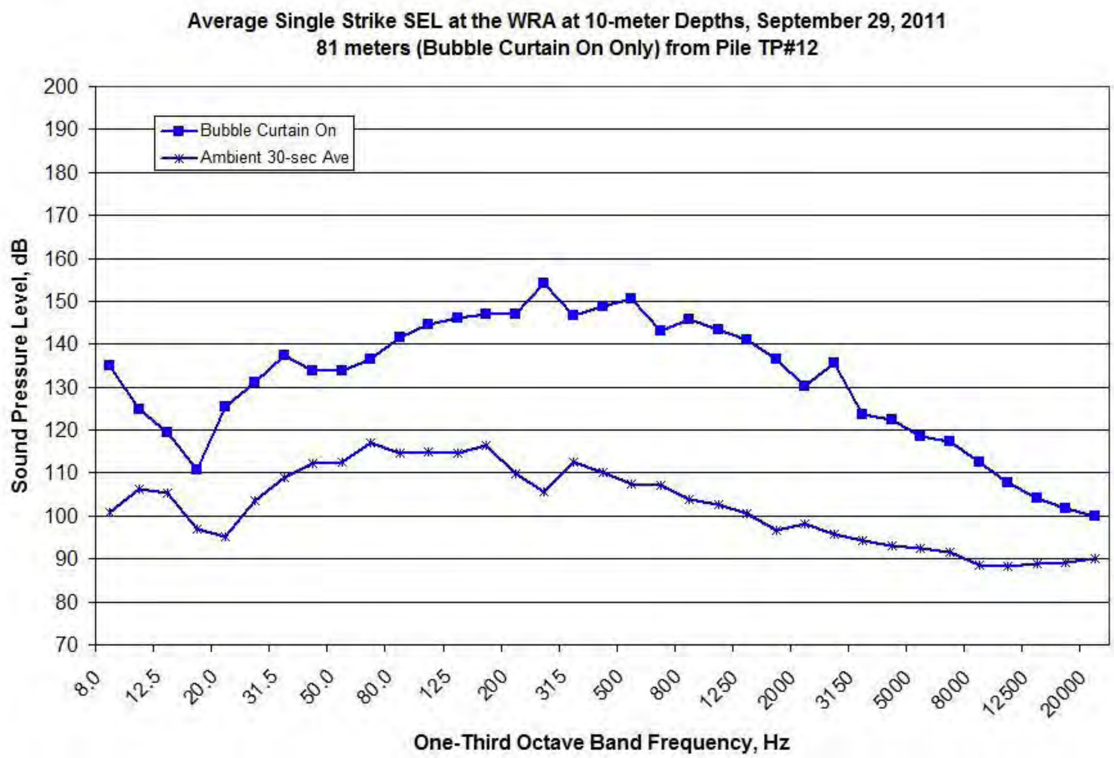

Figure B203. Average One-second SEL Spectral Data Measured at the WRA Location during TP#12, 10:18-10:23, Depths of 10 meters on September 29, 2011

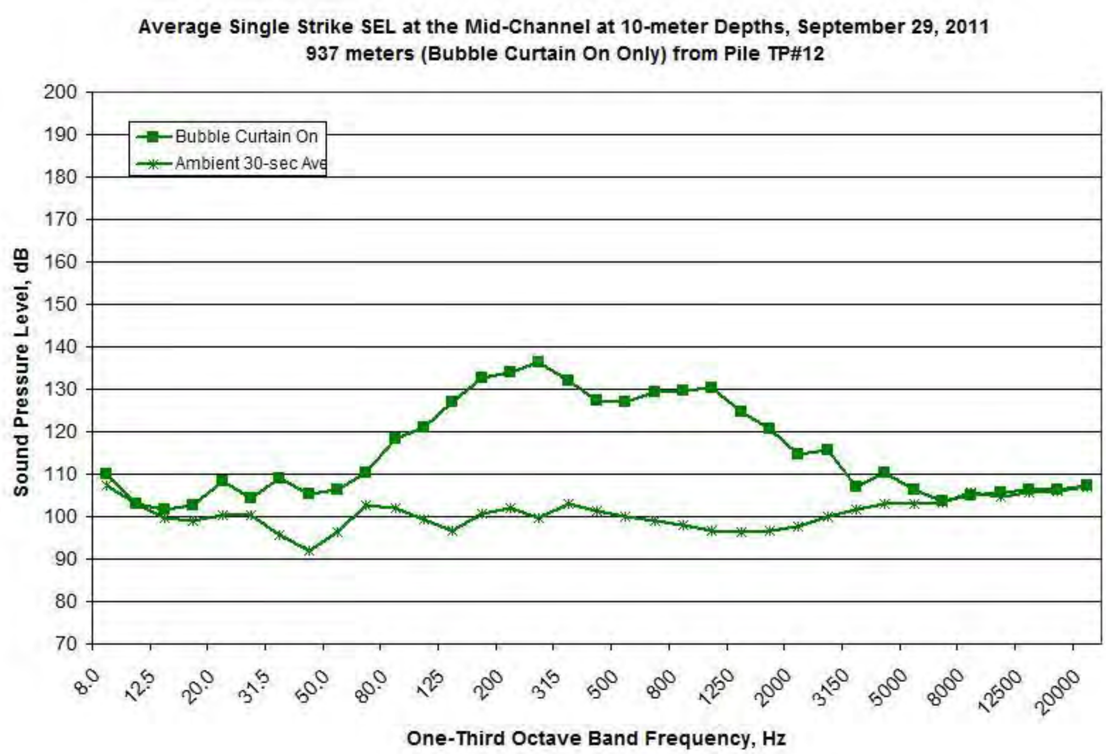

Figure B204. Average One-second SEL Spectral Data Measured at the MID Location during TP#12, 10:18-10:23, Depths of 10 meters on September 29, 2011

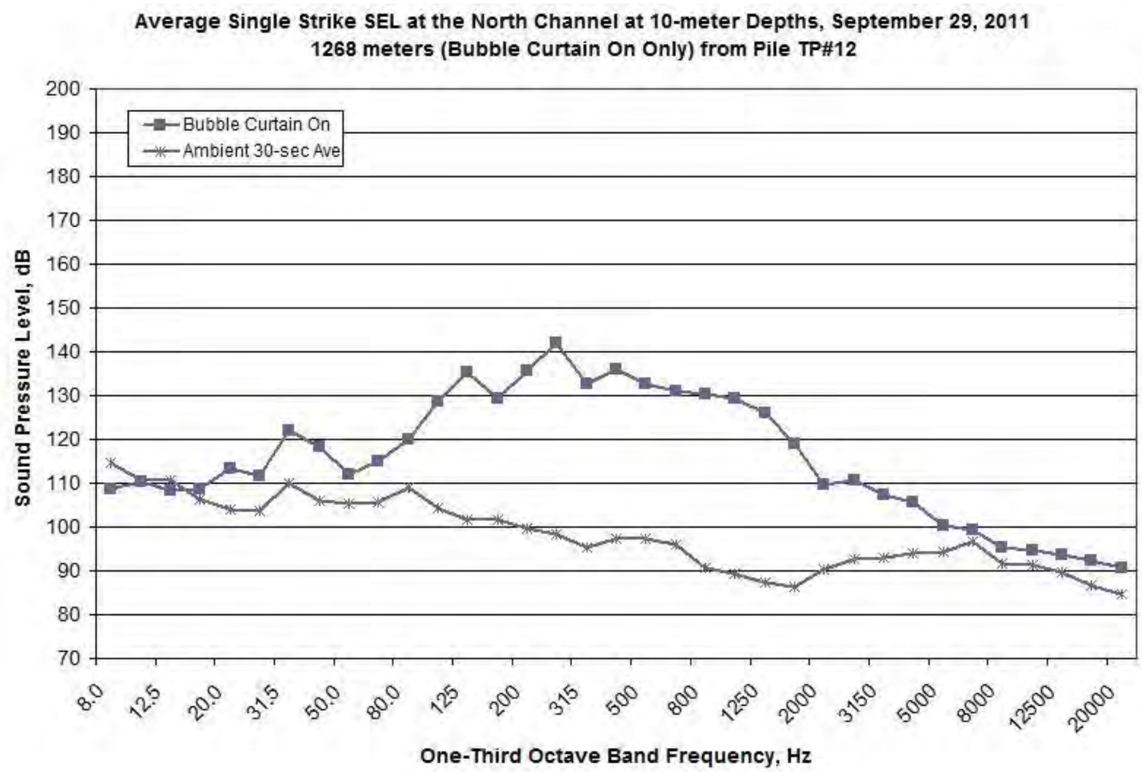

Figure B205. Average One-second SEL Spectral Data Measured at the NO Location during TP#12, 10:18-10:23, Depths of 10 meters on September 29, 2011

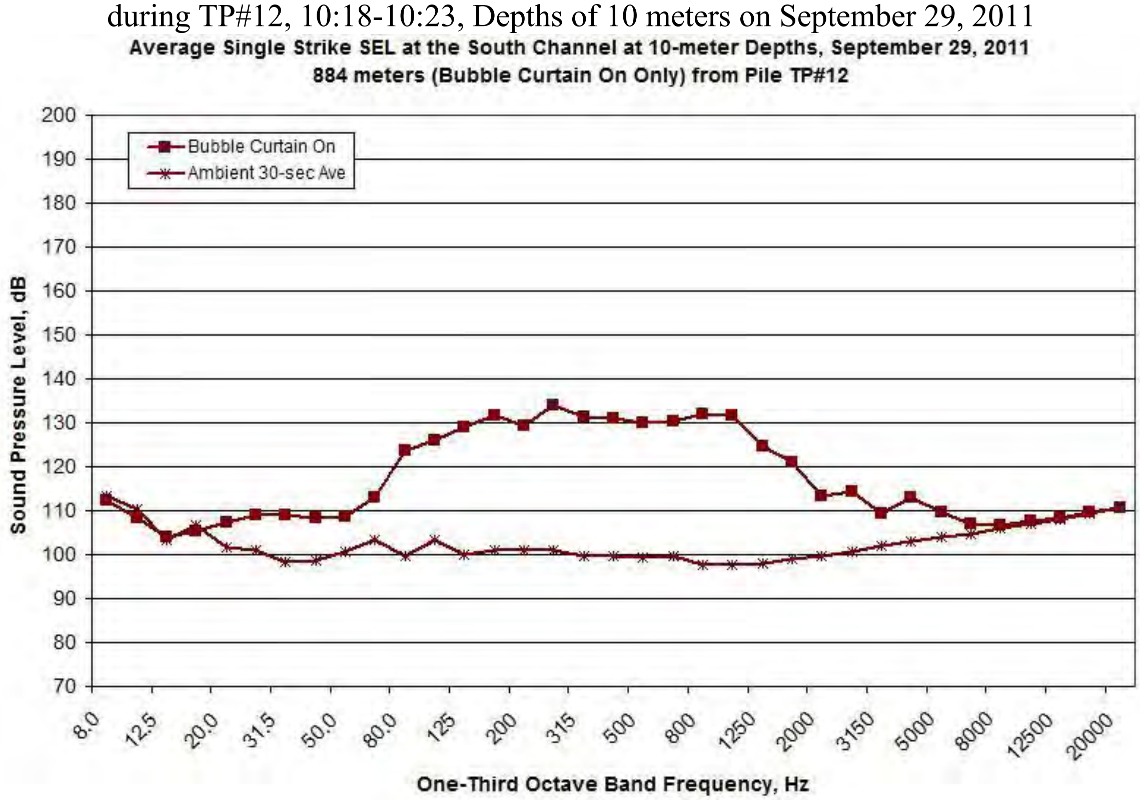

Figure B206. Average One-second SEL Spectral Data Measured at the SO Location during TP#12, 10:18-10:23, Depths of 10 meters on September 29, 2011

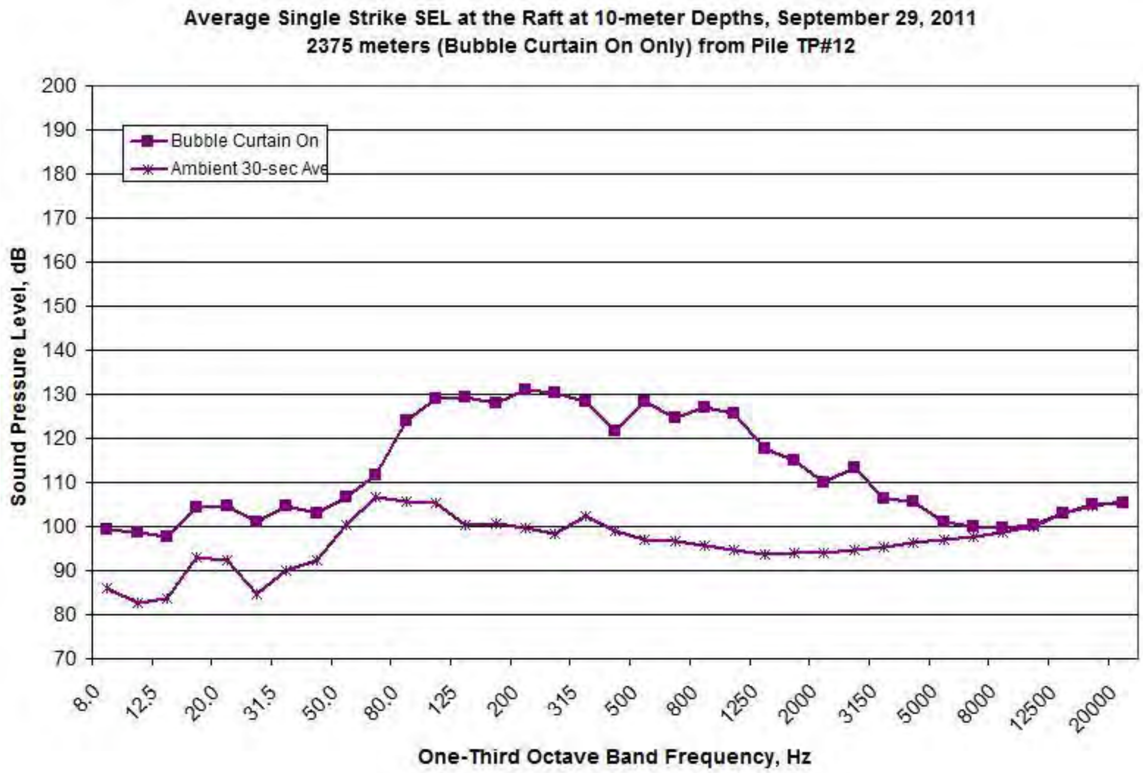

Figure B207. Average One-second SEL Spectral Data Measured at the RFT Location during TP#12, 10:18-10:23, Depths of 10 meters on September 29, 2011

TP#11

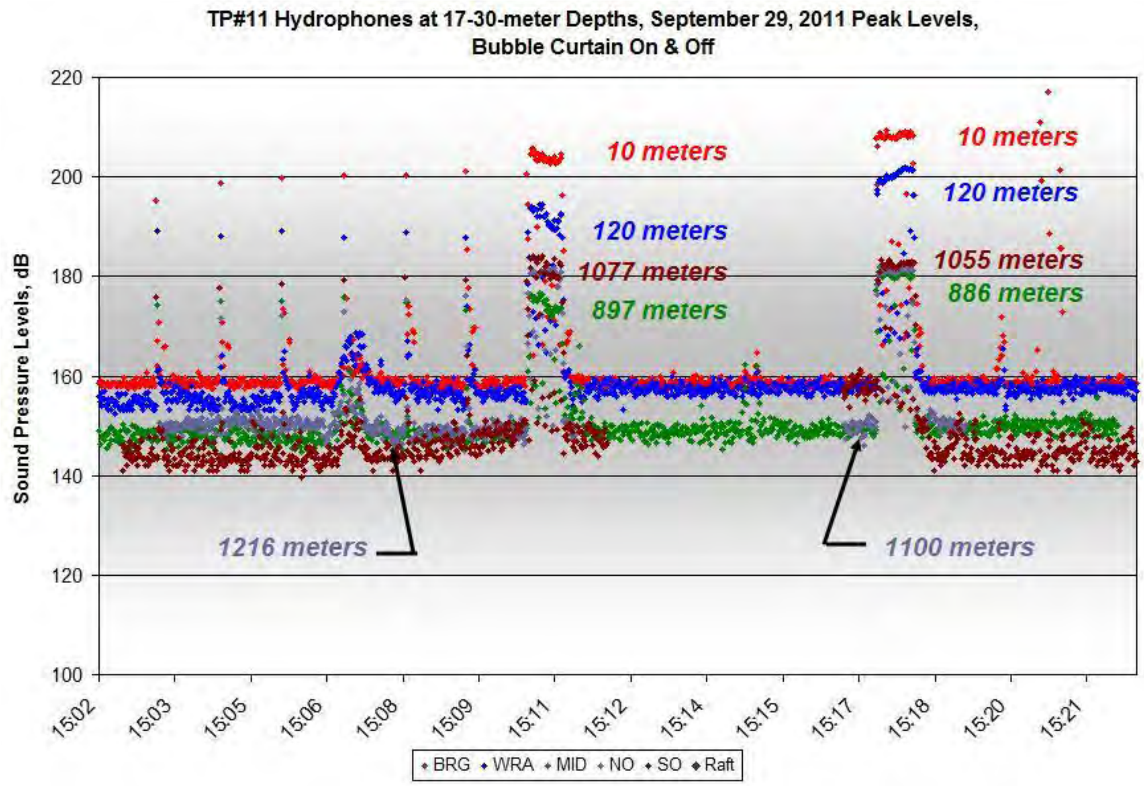

Figure B208. One-second Peak Level Data for TP#11 during Bubble On and Off Conditions, 15:03-15:18, at Depths of 17-30 meters on September 29, 2011

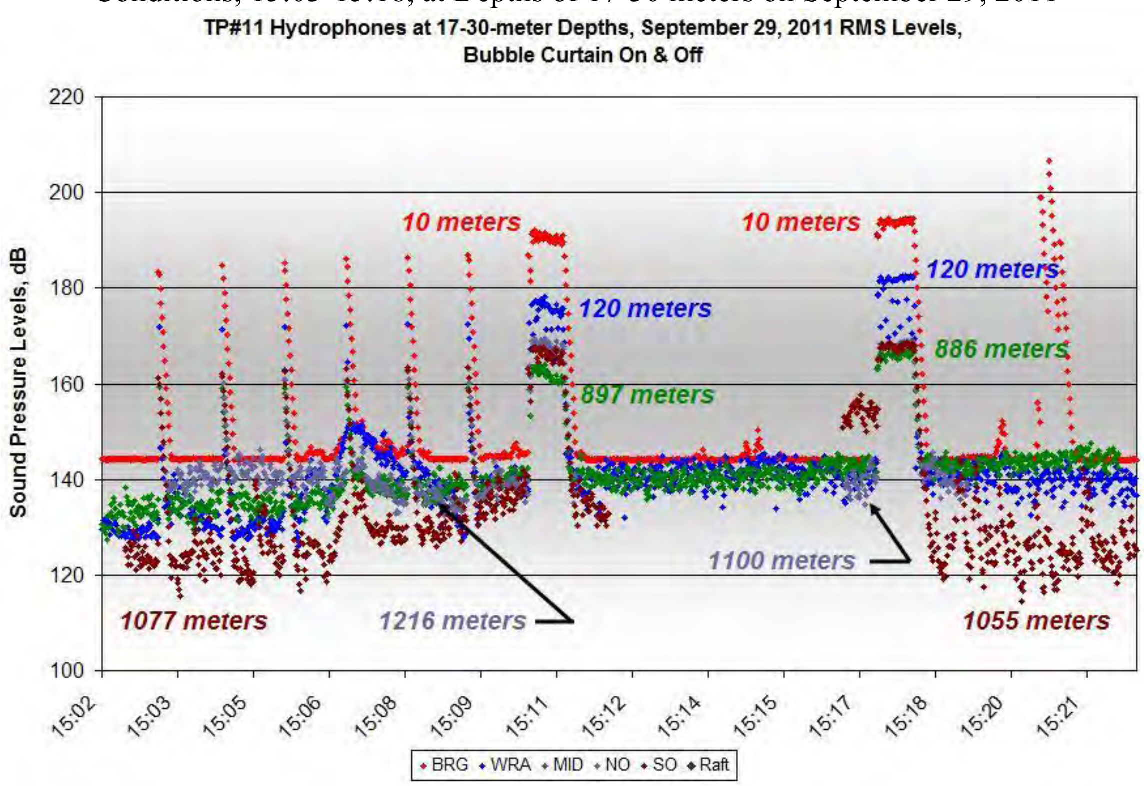

Figure B209. Impulse RMS Data for TP#11 during Bubble On and Off Conditions, 15:03-15:18, at Depths of 17-30 meters on September 29, 2011

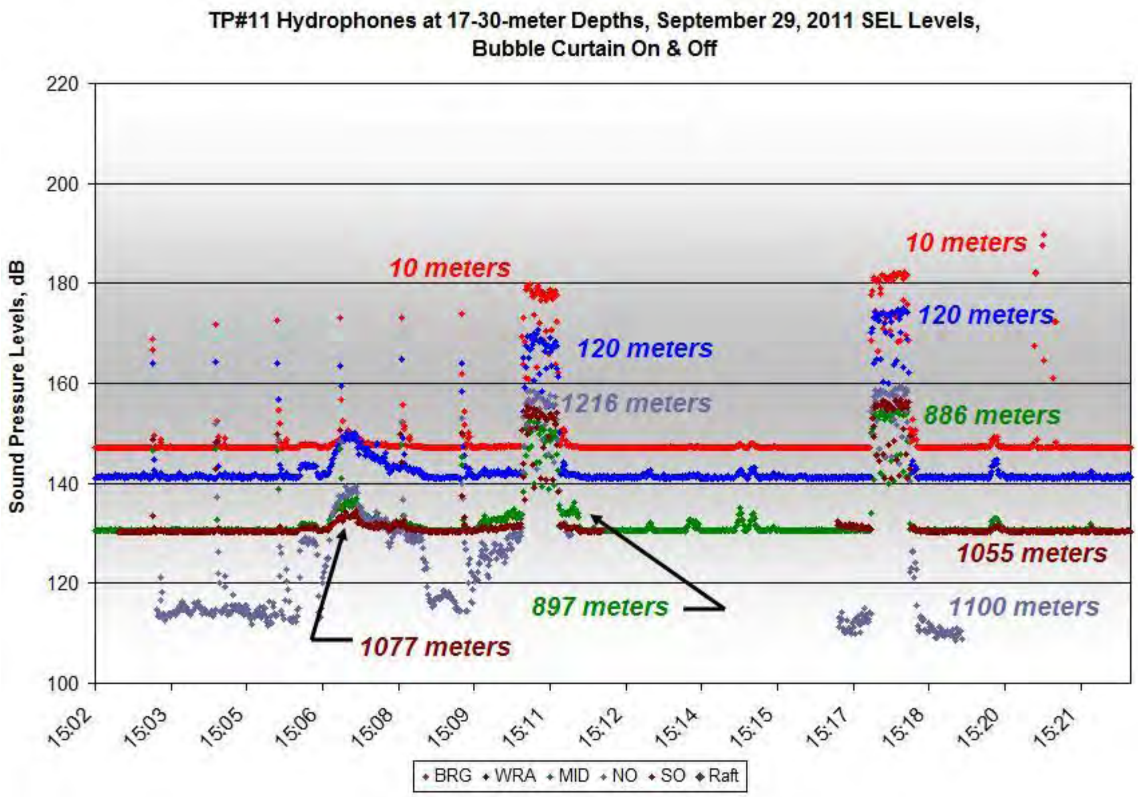

Figure B210. One-second SEL Data for TP#11 during Bubble On and Off Conditions, 15:03-15:18, at Depths of 17-30 meters on September 29, 2011

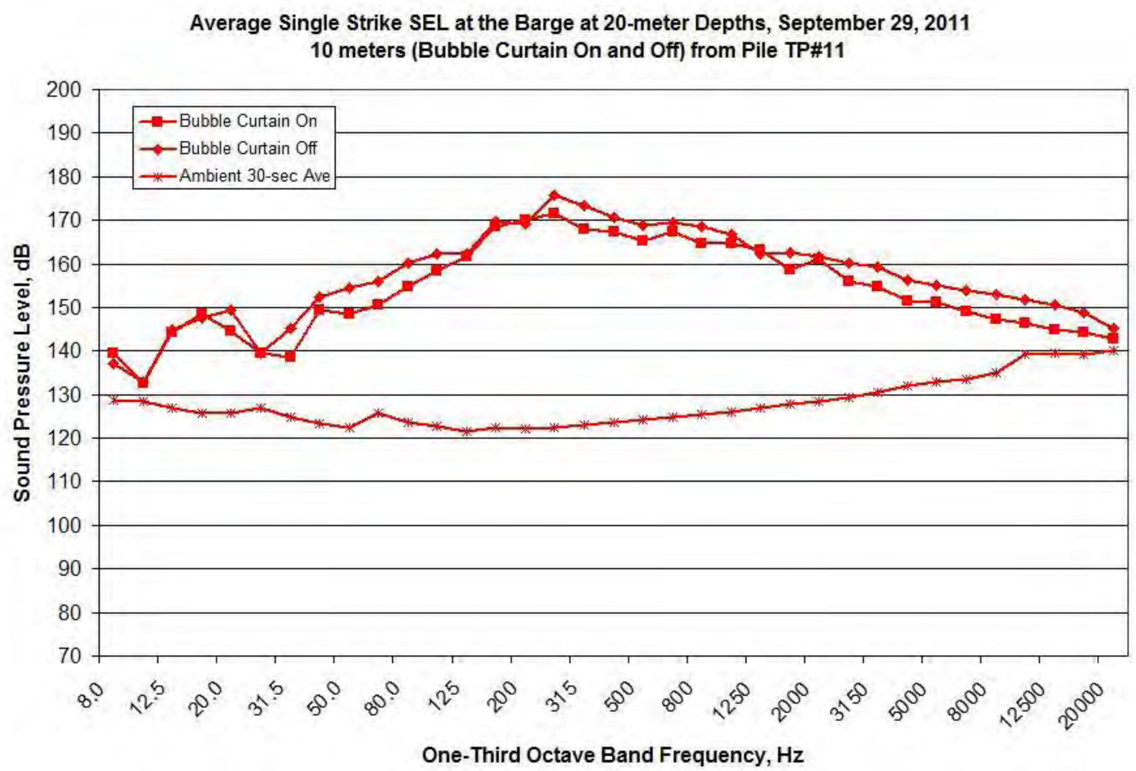

Figure B211. Average One-second SEL Spectral Data Measured at the BRG Location during TP#11, 15:03-15:18, Depths of 20 meters on September 29, 2011

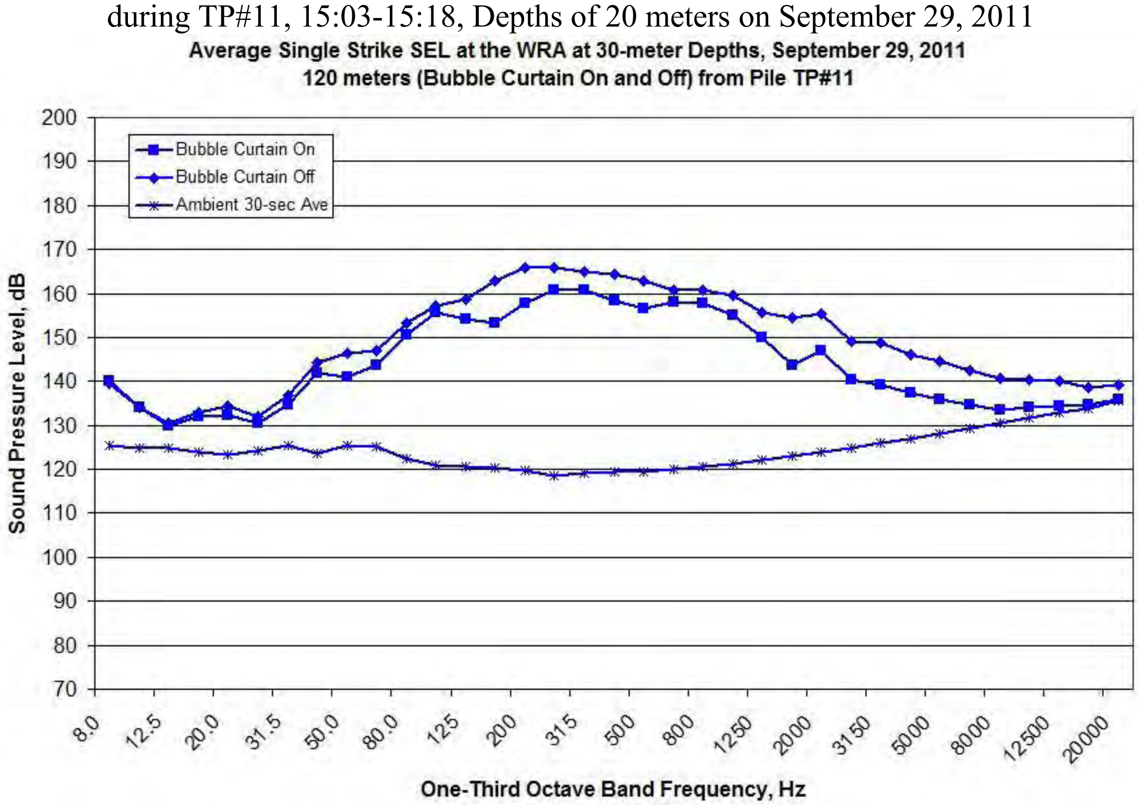

Figure B212. Average One-second SEL Spectral Data Measured at the WRA Location during TP#11, 15:03-15:18, Depths of 30 meters on September 29, 2011

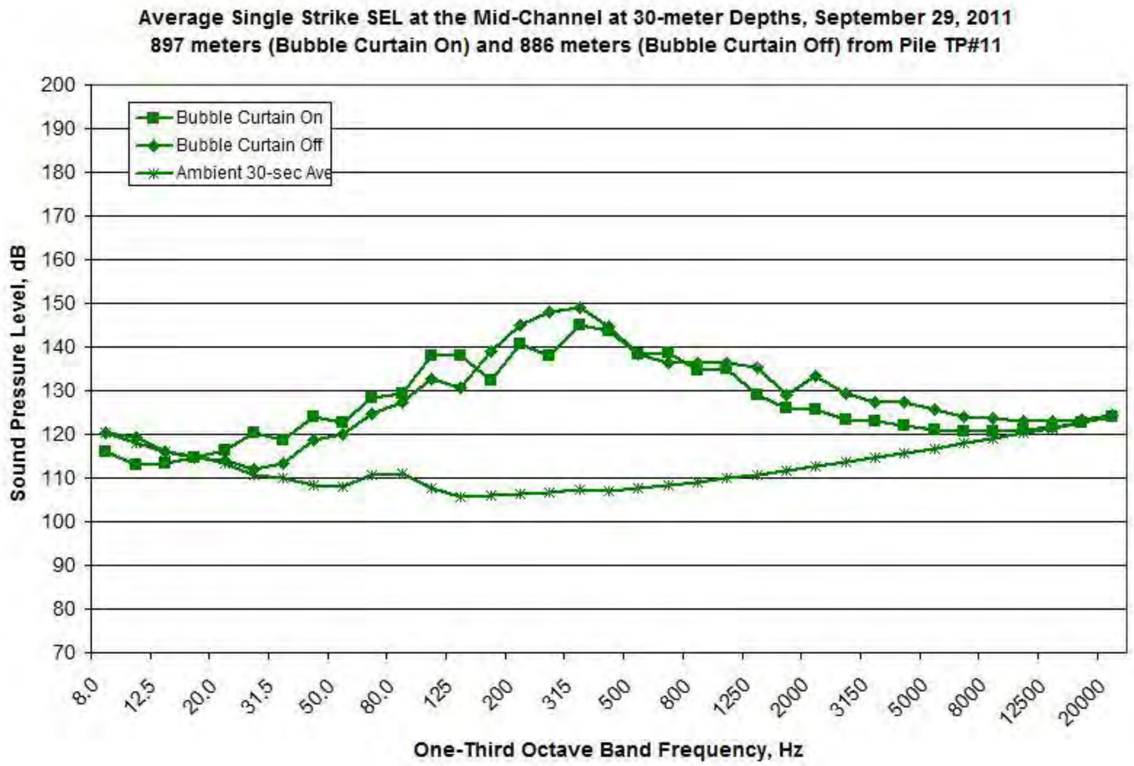

Figure B213. Average One-second SEL Spectral Data Measured at the MID Location during TP#11, 15:03-15:18, Depths of 30 meters on September 29, 2011

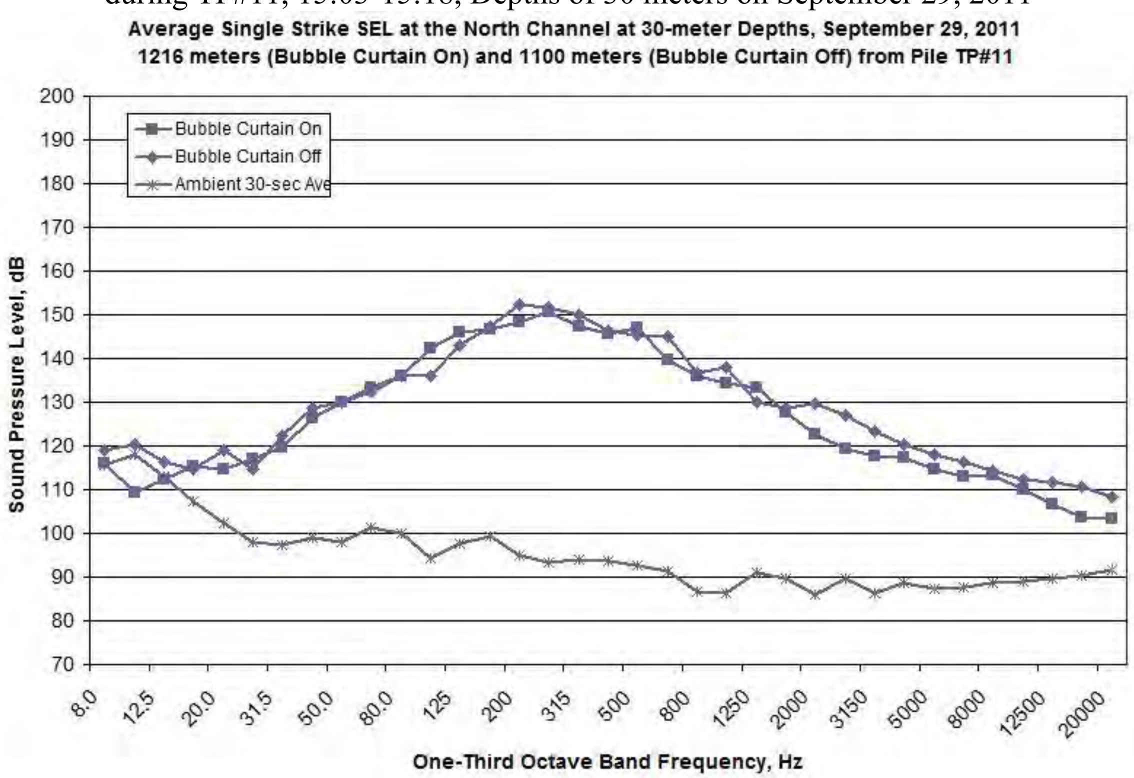

Figure B214. Average One-second SEL Spectral Data Measured at the NO Location during TP#11, 15:03-15:18, Depths of 30 meters on September 29, 2011

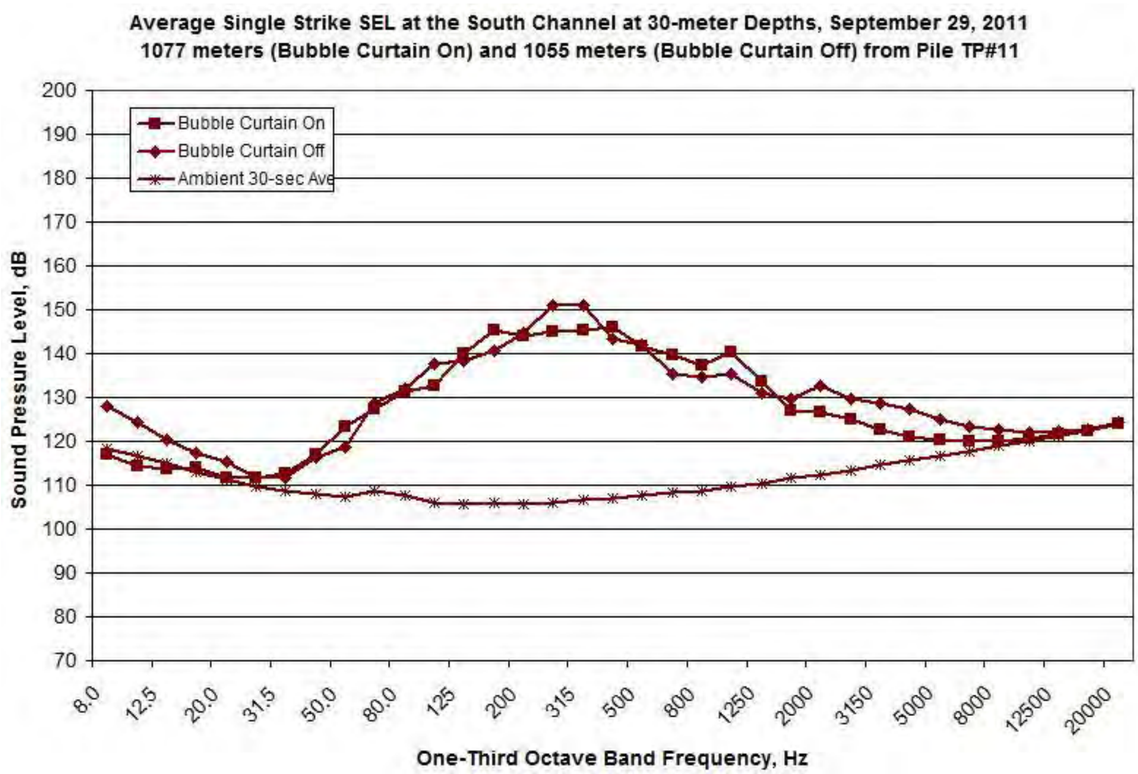

Figure B215. Average One-second SEL Spectral Data Measured at the SO Location during TP#11, 15:03-15:18, Depths of 30 meters on September 29, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B216. Average One-second SEL Spectral Data Measured at the RFT Location during TP#11, 15:03-15:18, Depths of 17 meters on September 29, 2011

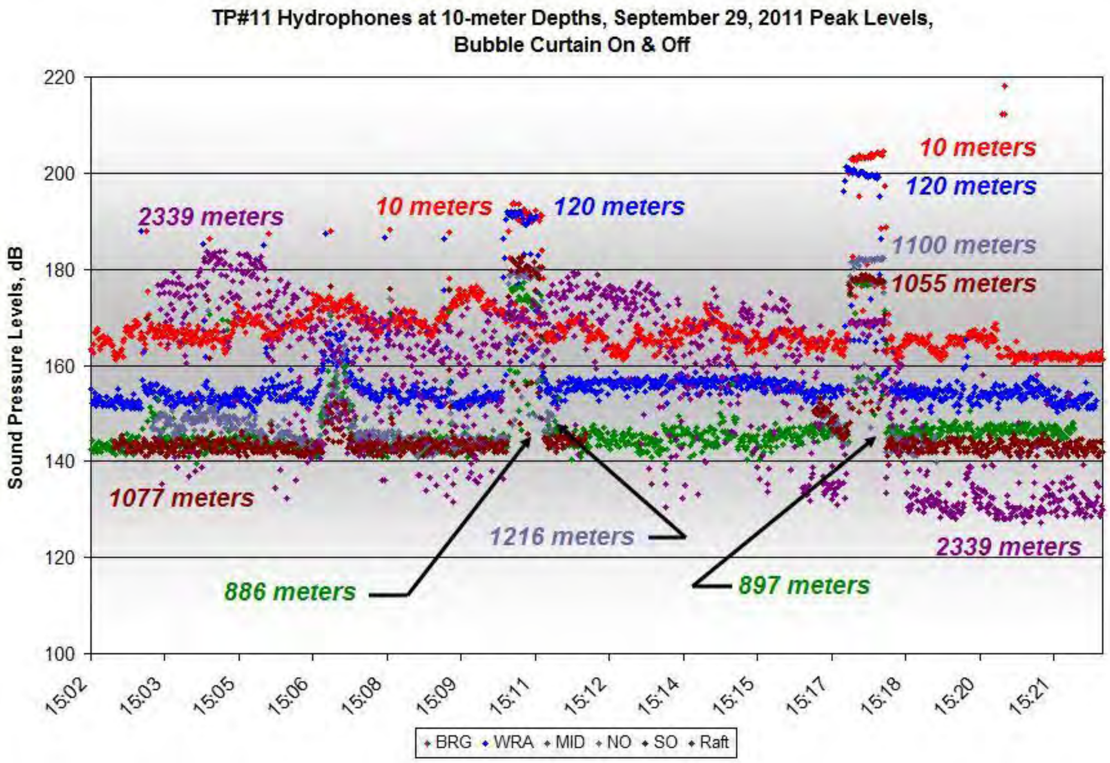

Figure B217. One-second Peak Level Data for TP#11 during Bubble On and Off Conditions, 15:03-15:18, at Depths of 10 meters on September 29, 2011

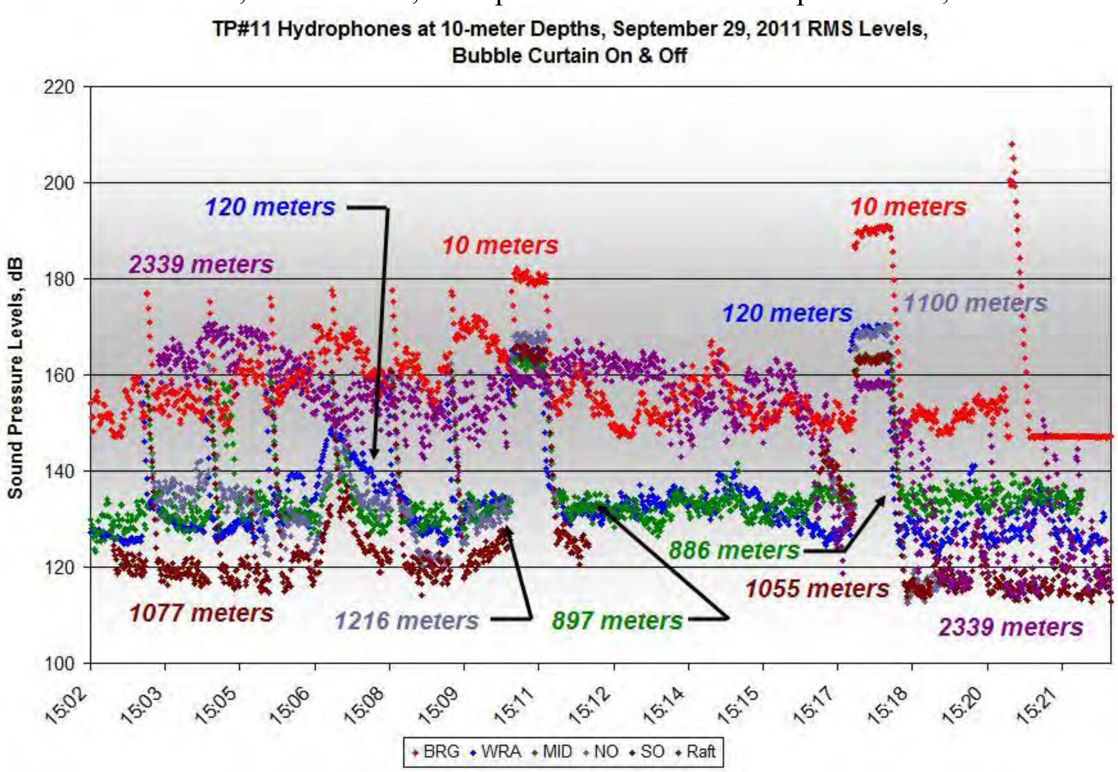

Figure B218. Impulse RMS Data for TP#11 during Bubble On and Off Conditions, 15:03-15:18, at Depths of 10 meters on September 29, 2011

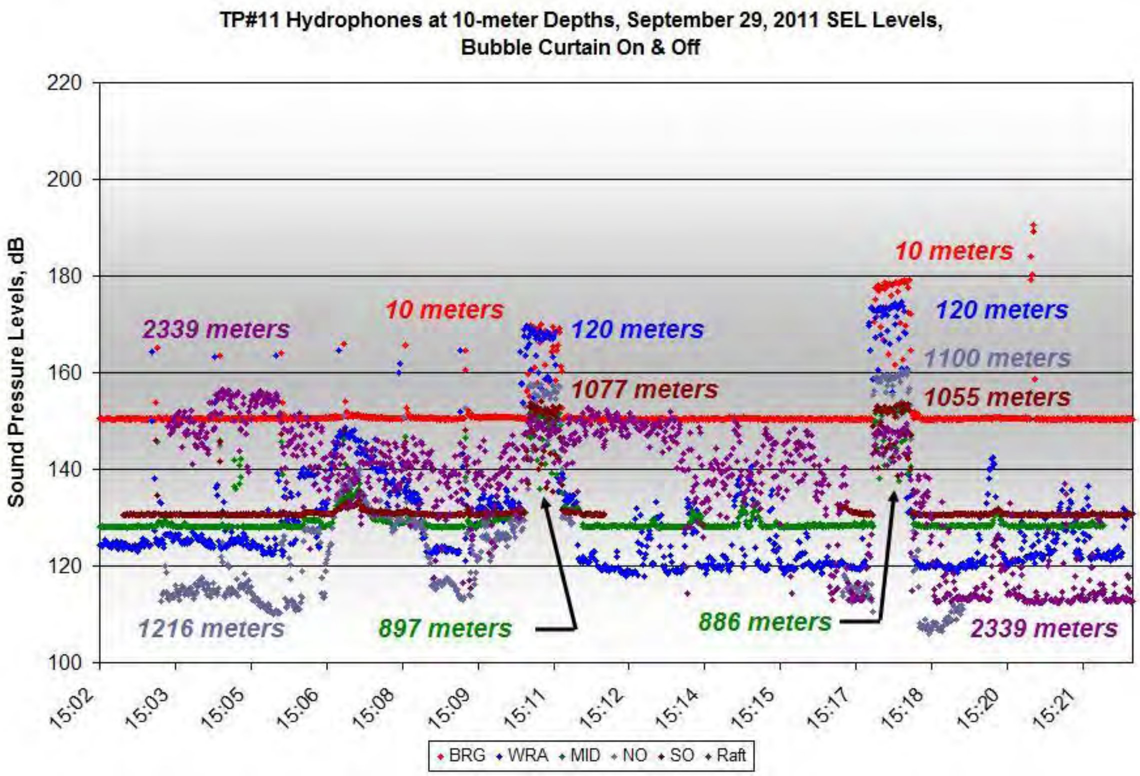

Figure B219. One-second SEL Data for TP#11 during Bubble On and Off Conditions, 15:03-15:18, at Depths of 10 meters on September 29, 2011

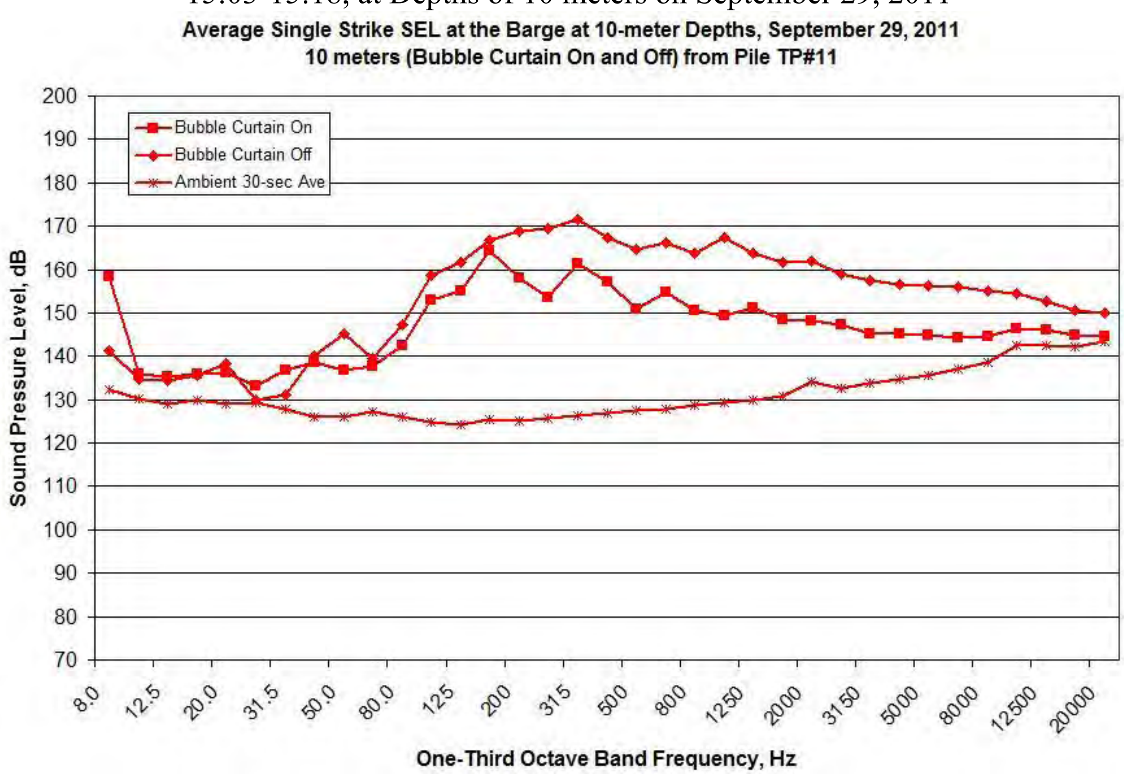

Figure B220. Average One-second SEL Spectral Data Measured at the BRG Location during TP#11, 15:03-15:18, Depths of 10 meters on September 29, 2011

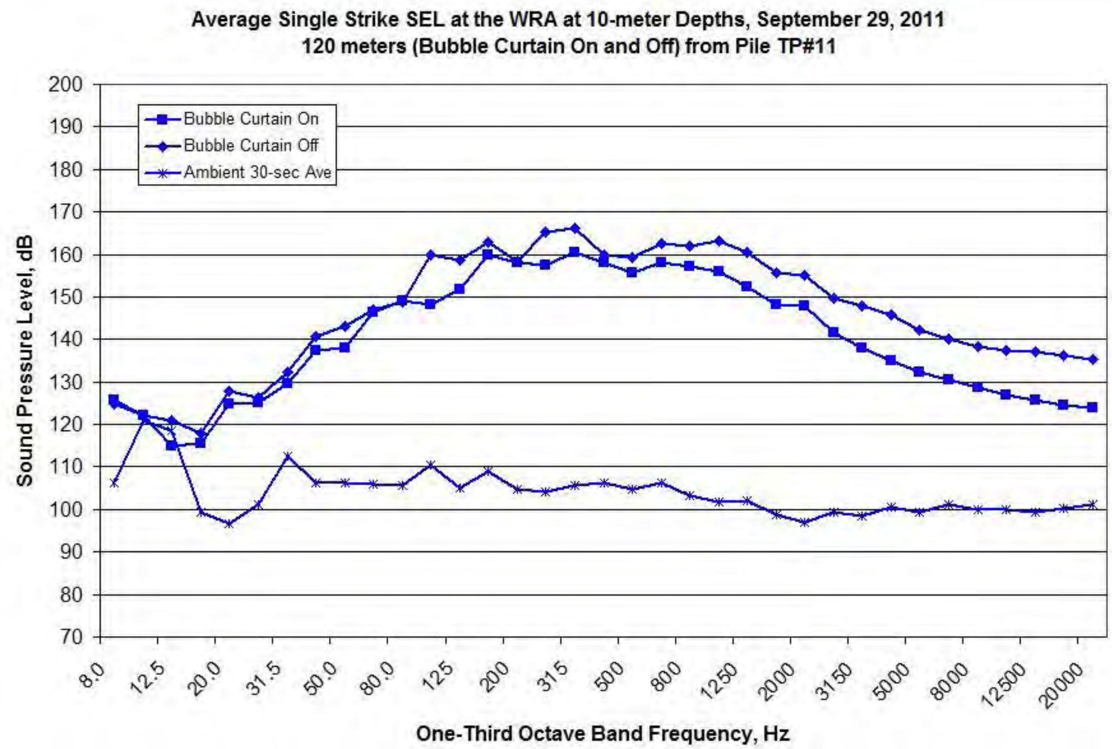

Figure B221. Average One-second SEL Spectral Data Measured at the WRA Location during TP#11, 15:03-15:18, Depths of 10 meters on September 29, 2011

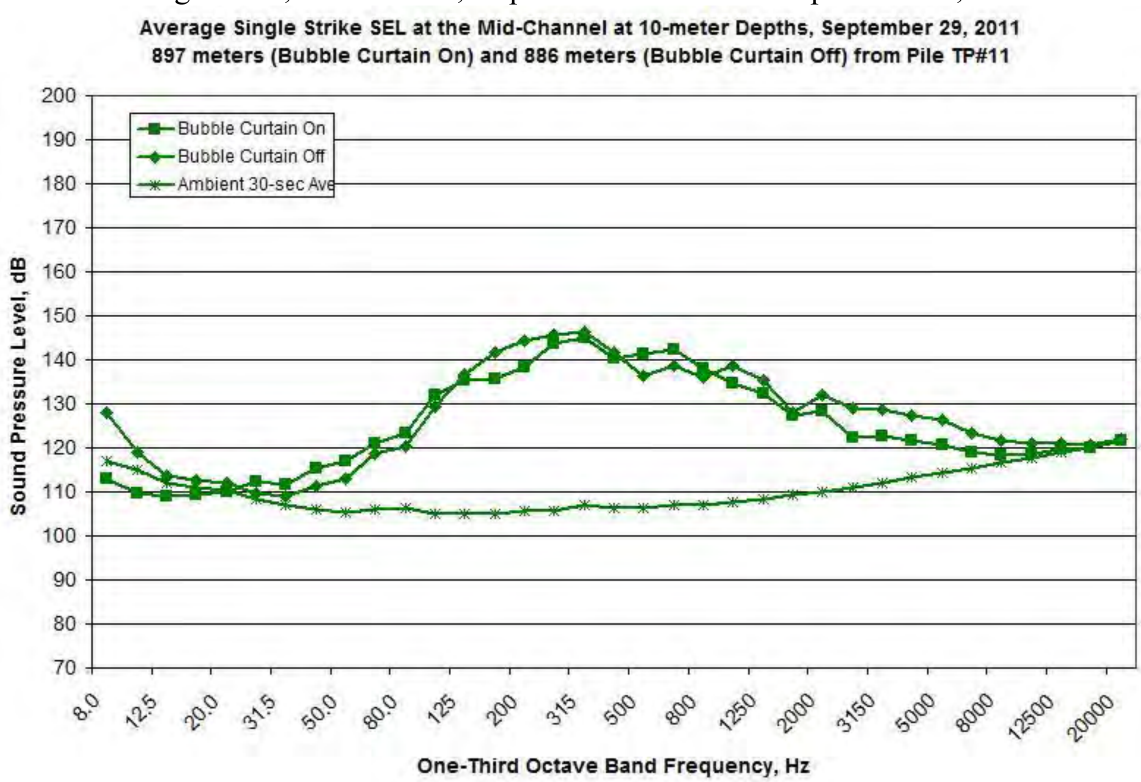

Figure B222. Average One-second SEL Spectral Data Measured at the MID Location during TP#11, 15:03-15:18, Depths of 10 meters on September 29, 2011

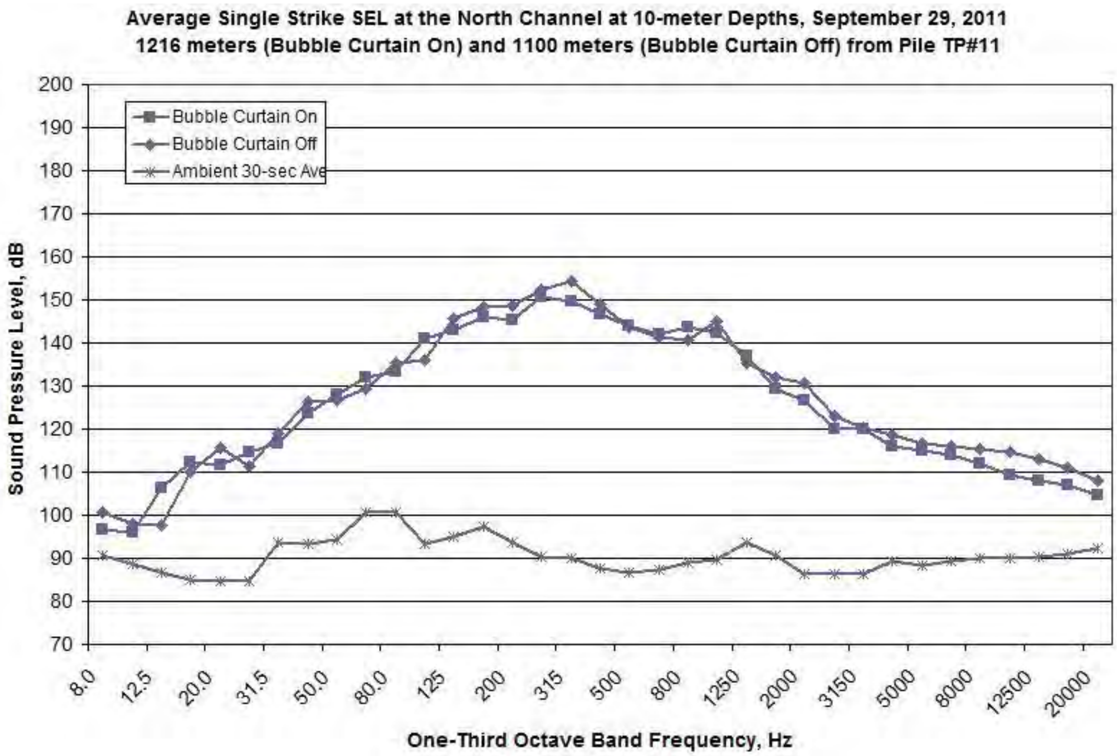

Figure B223. Average One-second SEL Spectral Data Measured at the NO Location during TP#11, 15:03-15:18, Depths of 10 meters on September 29, 2011

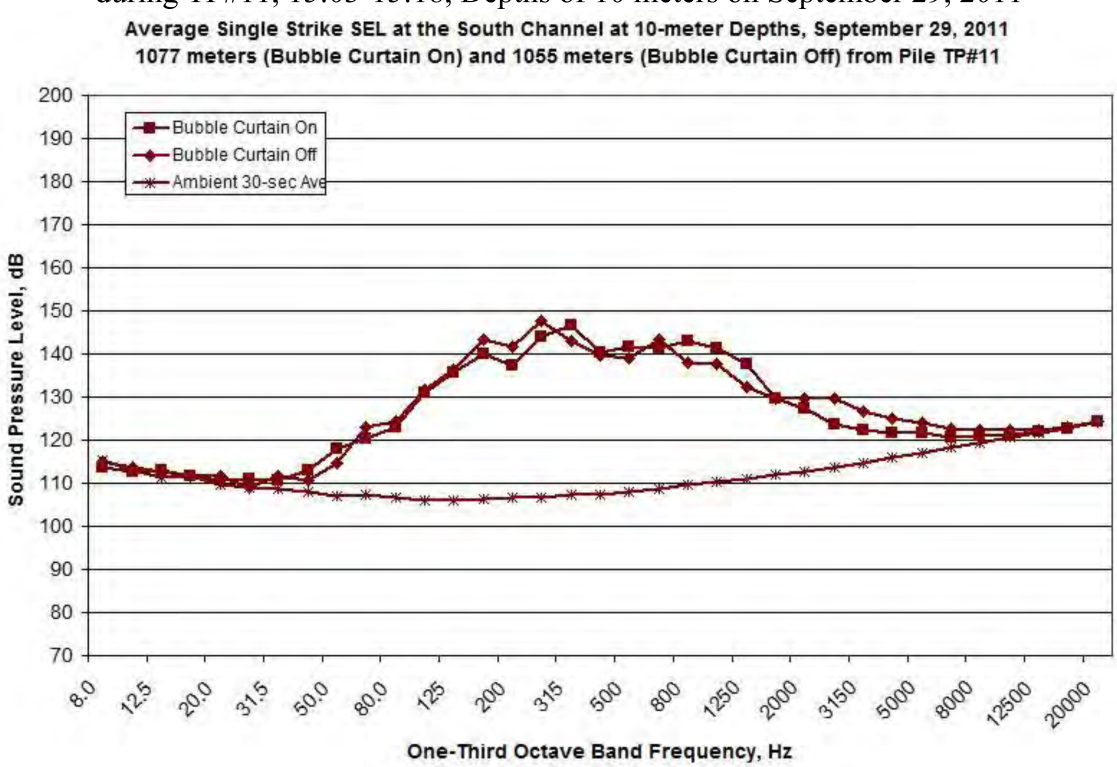

Figure B224. Average One-second SEL Spectral Data Measured at the SO Location during TP#11, 15:03-15:18, Depths of 10 meters on September 29, 2011

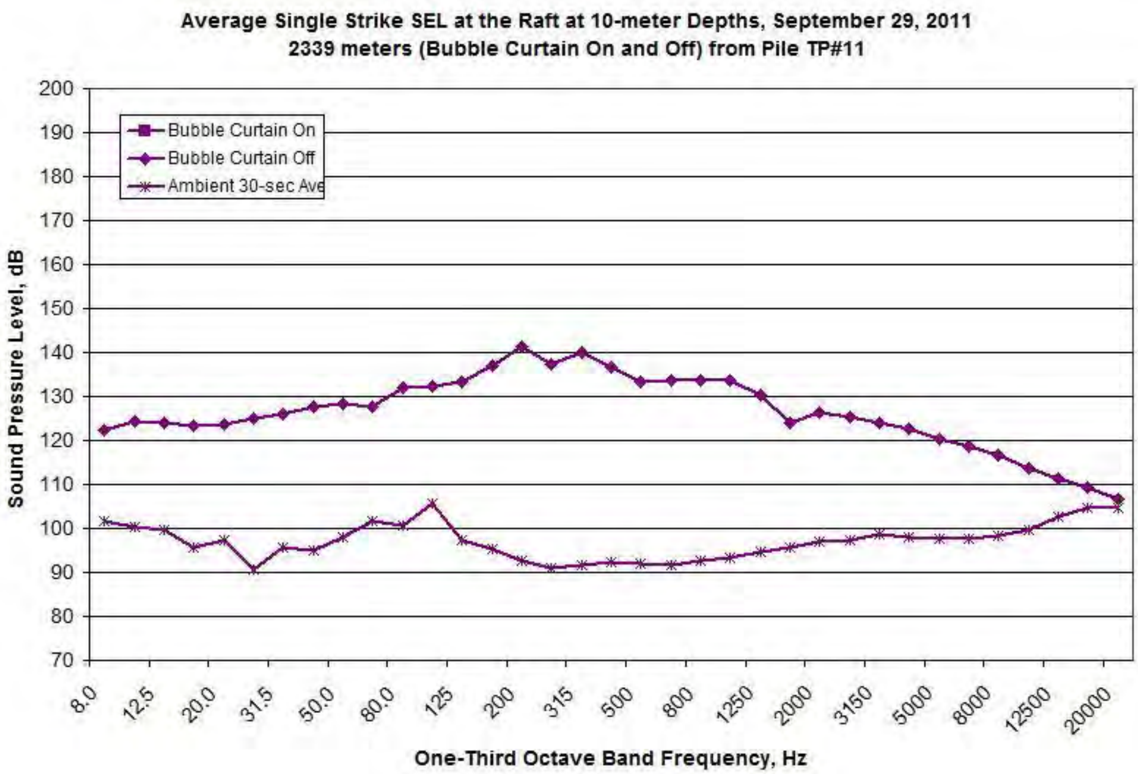

Figure B225. Average One-second SEL Spectral Data Measured at the RFT Location during TP#11, 15:03-15:18, Depths of 10 meters on September 29, 2011

9/30/2011 – TP#13

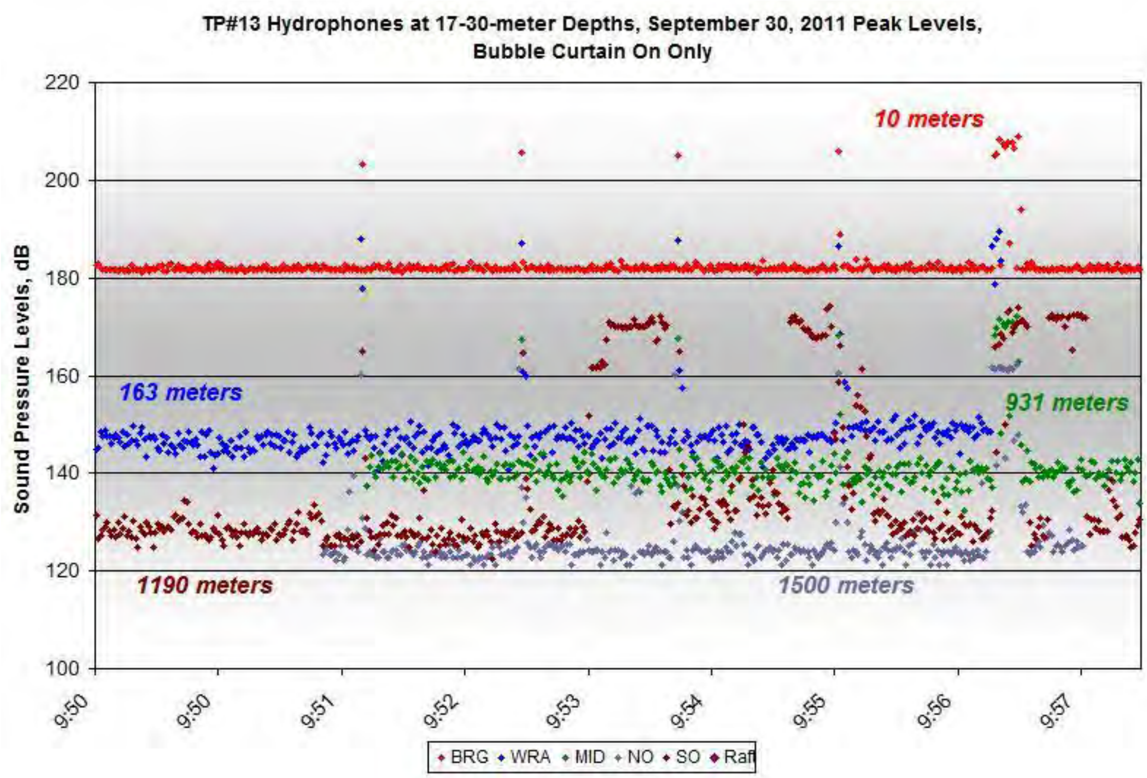

Figure B226. One-second Peak Level Data for TP#13 during Bubble On Conditions, 9:52-9:56, at Depths of 17-30 meters on September 30, 2011

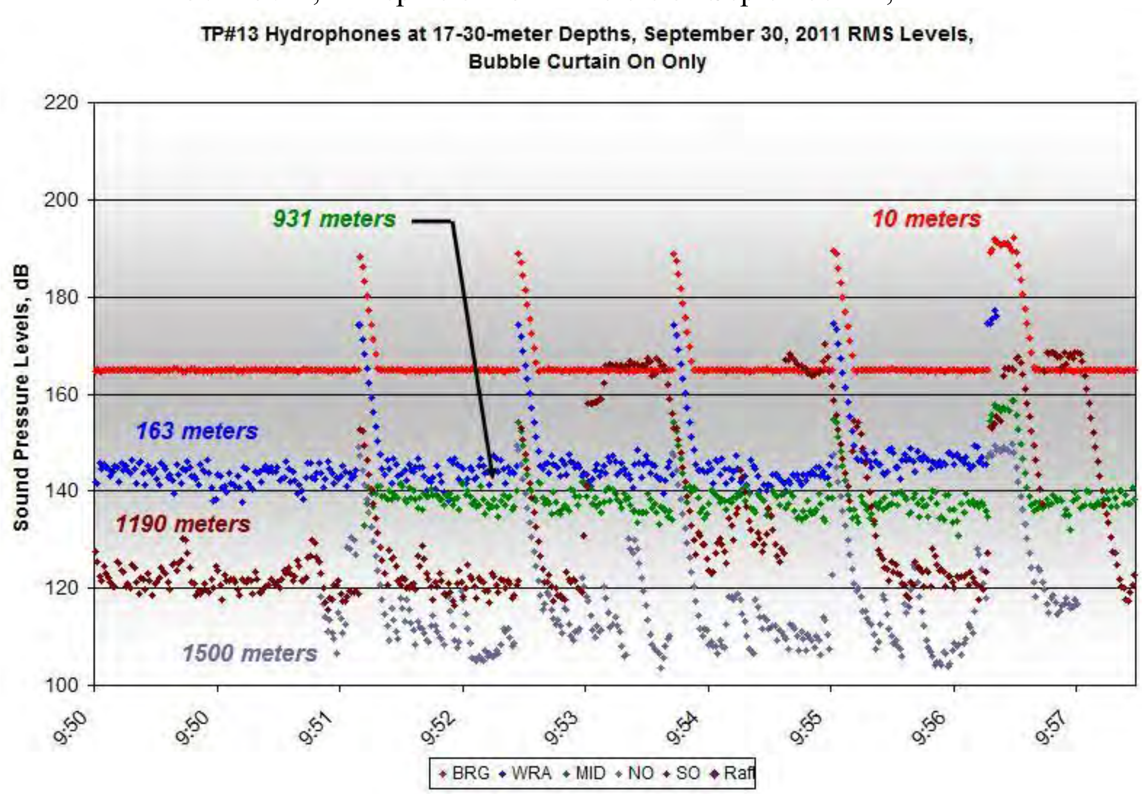

Figure B227. Impulse RMS Data for TP#13 during Bubble On Conditions, 9:52-9:56, at Depths of 17-30 meters on September 30, 2011

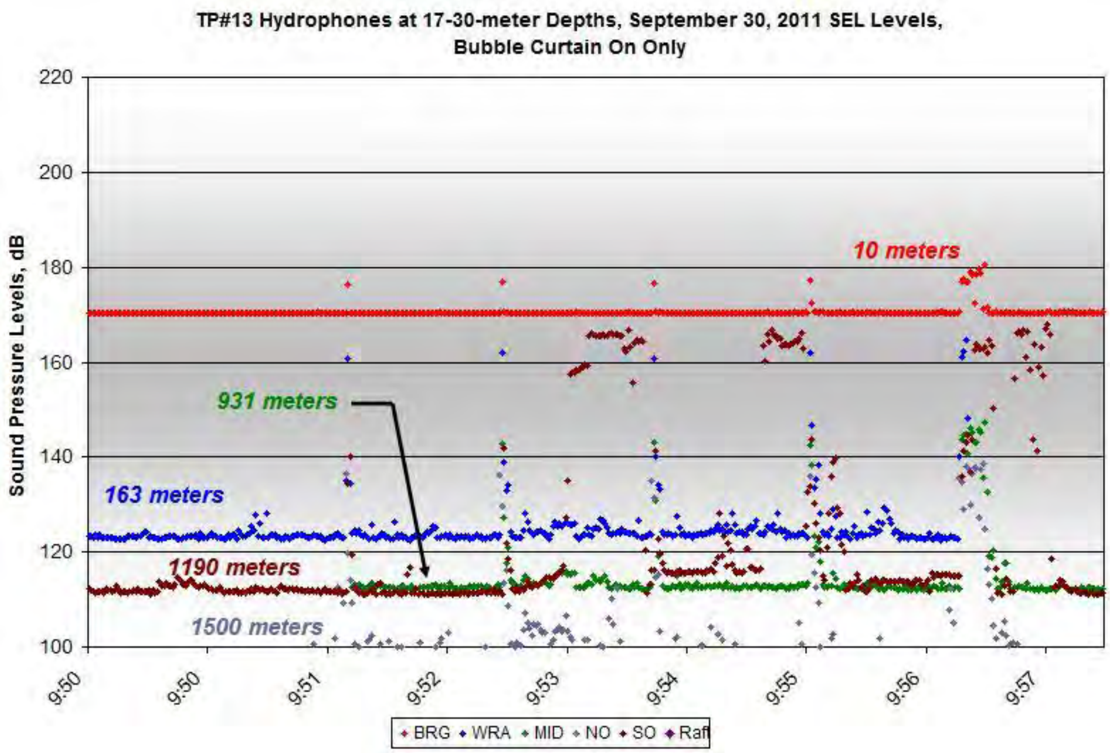

Figure B228. One-second SEL Data for TP#13 during Bubble On Conditions, 9:52-9:56, at Depths of 17-30 meters on September 30, 2011

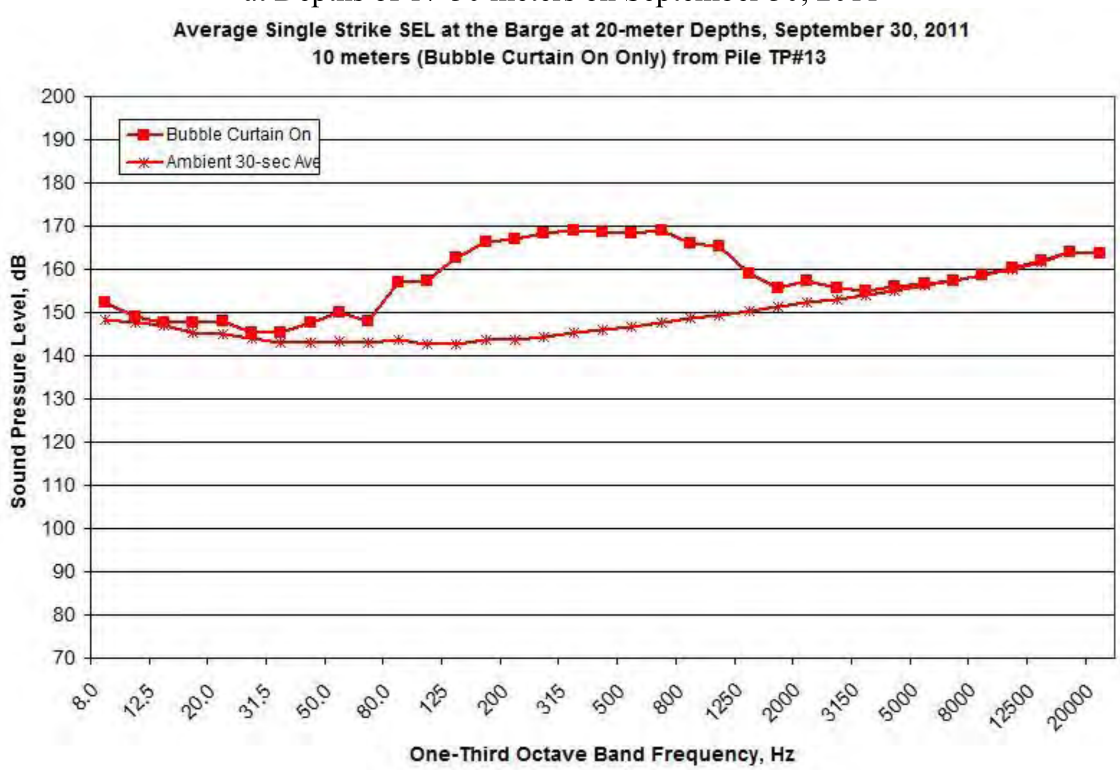

Figure B229. Average One-second SEL Spectral Data Measured at the BRG Location during TP#13, 9:52-9:56, Depths of 20 meters on September 30, 2011

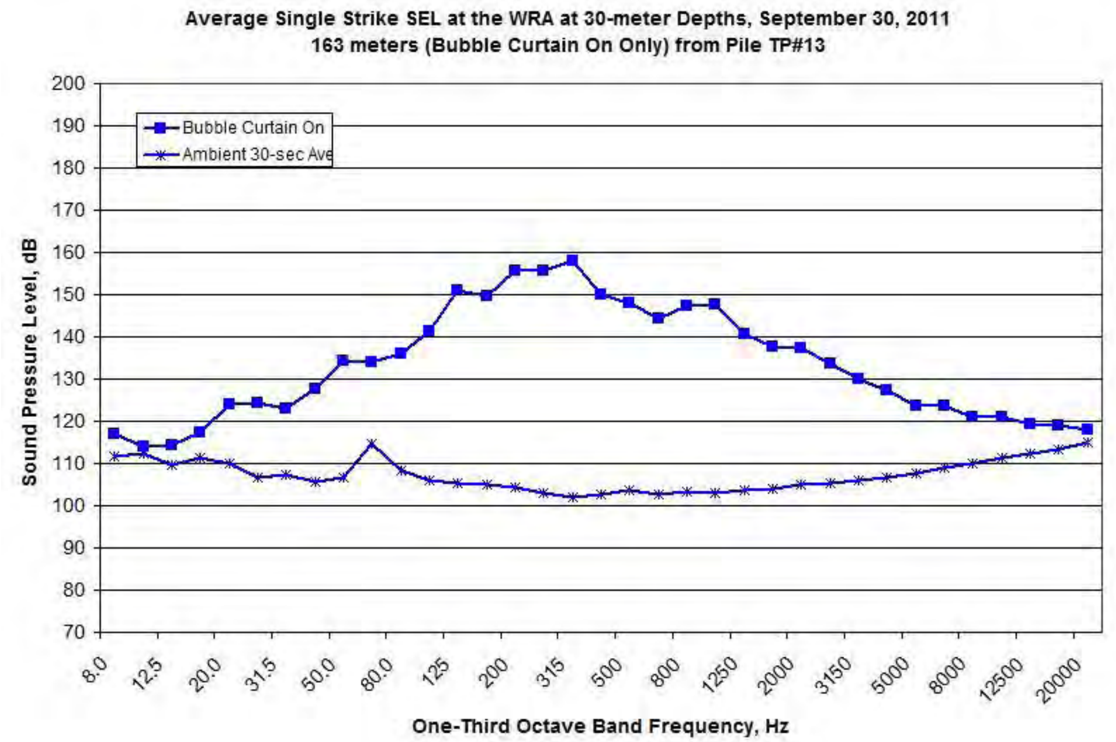

Figure B230. Average One-second SEL Spectral Data Measured at the WRA Location during TP#13, 9:52-9:56, Depths of 30 meters on September 30, 2011

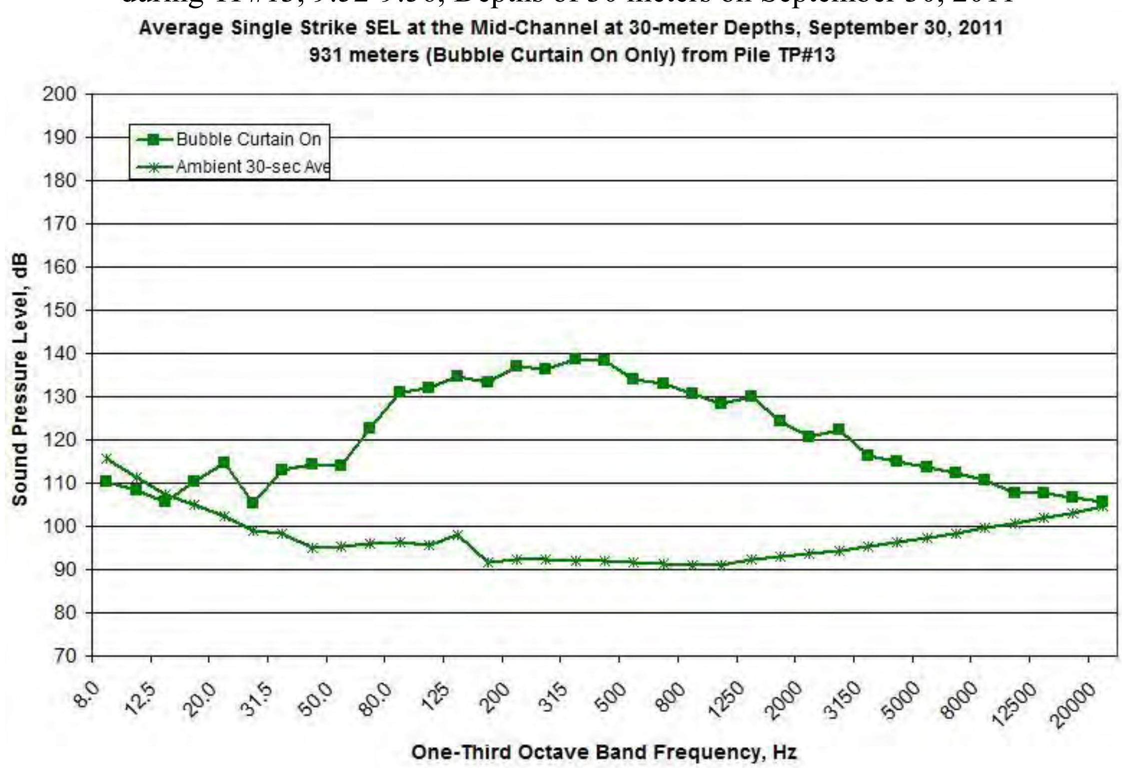

Figure B231. Average One-second SEL Spectral Data Measured at the MID Location during TP#13, 9:52-9:56, Depths of 30 meters on September 30, 2011

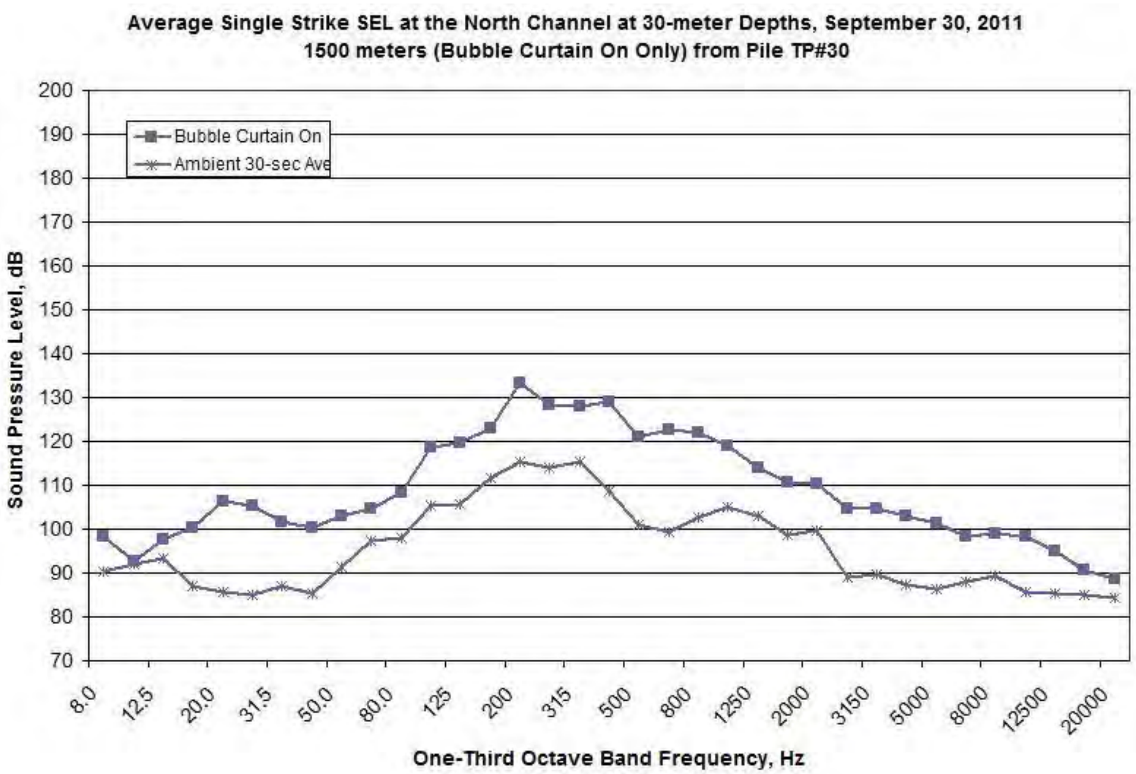

Figure B232. Average One-second SEL Spectral Data Measured at the NO Location during TP#13, 9:52-9:56, Depths of 30 meters on September 30, 2011

PILE DRIVING NOT DISCERNIBLE

Figure B233. Average One-second SEL Spectral Data Measured at the SO Location during TP#13, 9:52-9:56, Depths of 30 meters on September 30, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B234. Average One-second SEL Spectral Data Measured at the RFT Location during TP#13, 9:52-9:56, Depths of 17 meters on September 30, 2011

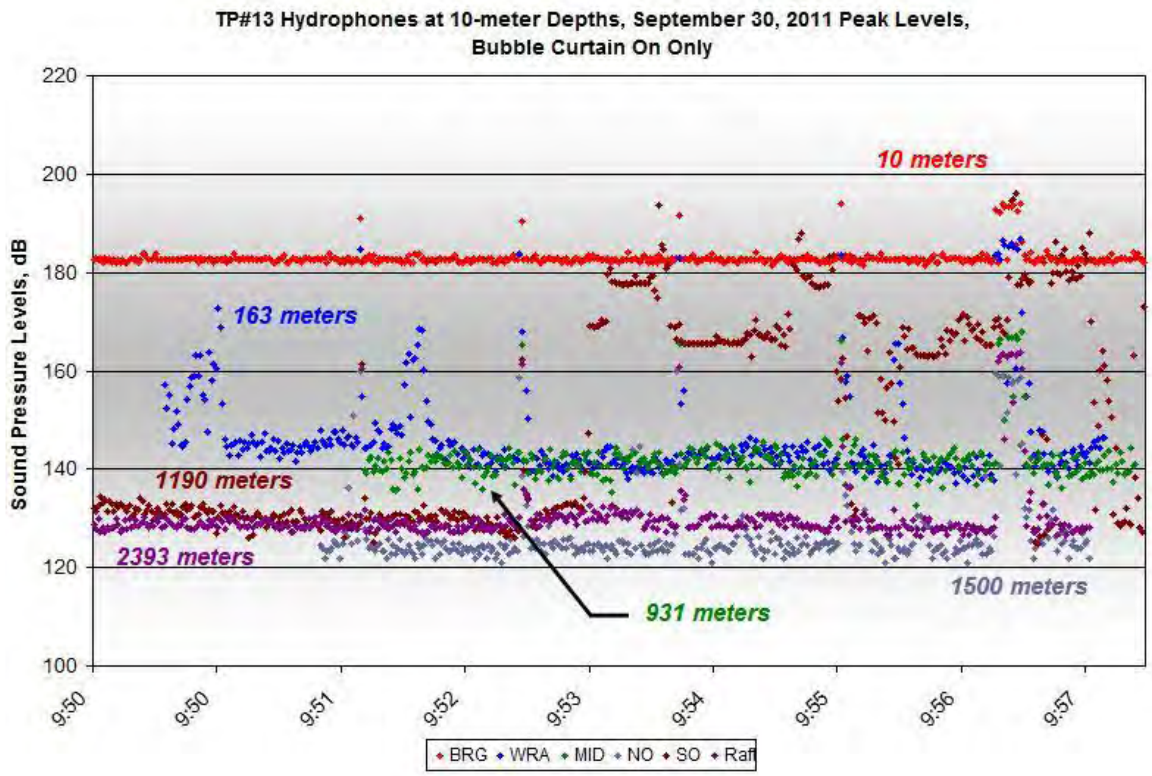

Figure B235. One-second Peak Level Data for TP#13 during Bubble On Conditions, 9:52-9:56, at Depths of 10 meters on September 30, 2011

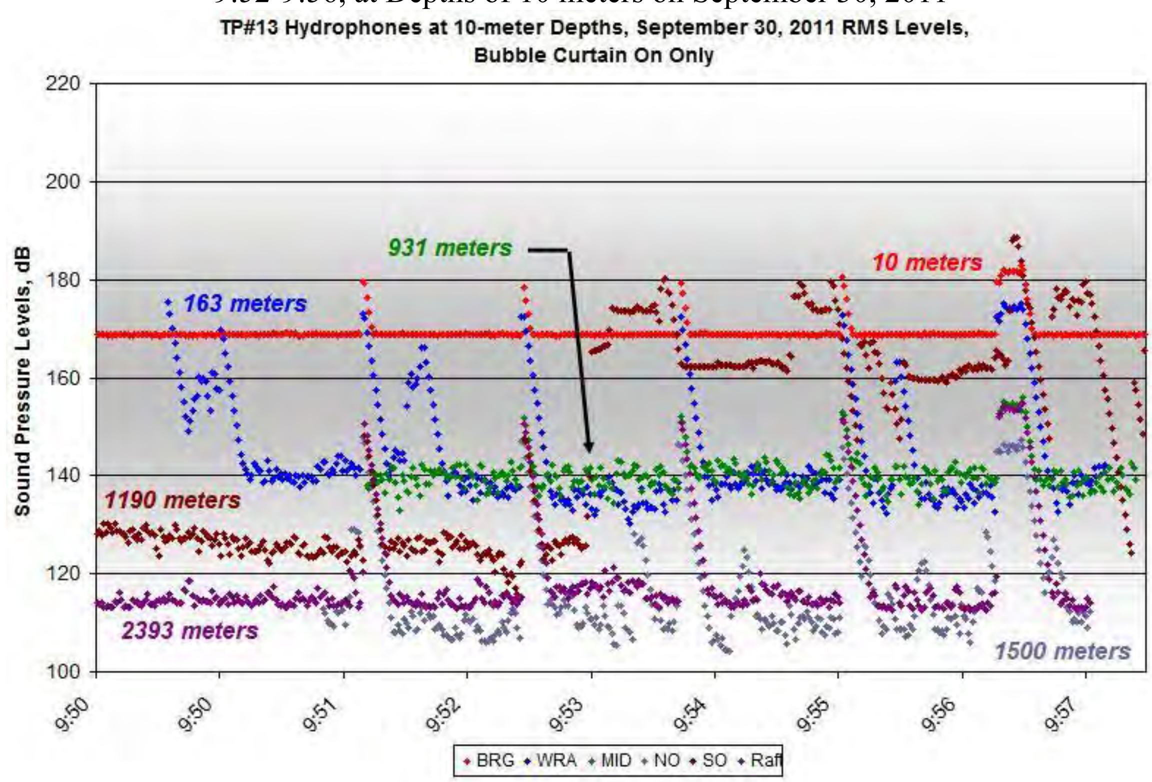

Figure B236. Impulse RMS Data for TP#13 during Bubble On Conditions, 9:52-9:56, at Depths of 10 meters on September 30, 2011

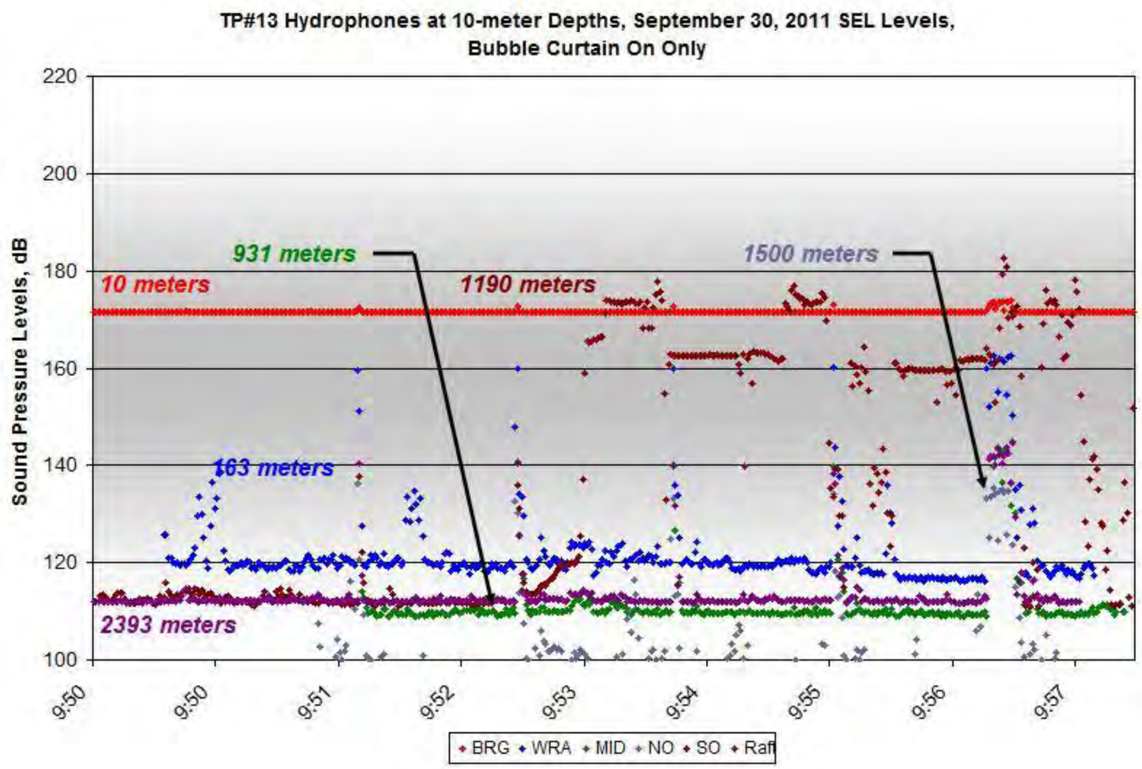

Figure B237. One-second SEL Data for TP#13 during Bubble On Conditions, 9:52-9:56, at Depths of 10 meters on September 30, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B238. Average One-second SEL Spectral Data Measured at the BRG Location during TP#13, 9:52-9:56, Depths of 10 meters on September 30, 2011

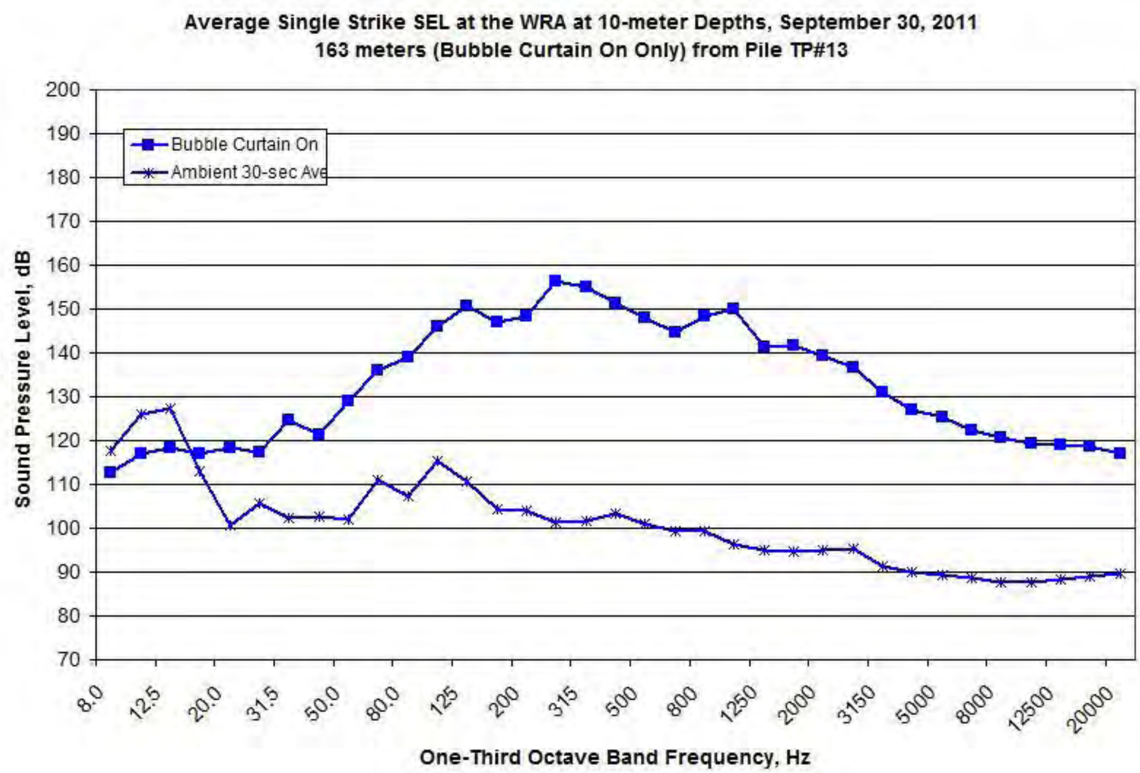

Figure B239. Average One-second SEL Spectral Data Measured at the WRA Location during TP#13, 9:52-9:56, Depths of 10 meters on September 30, 2011

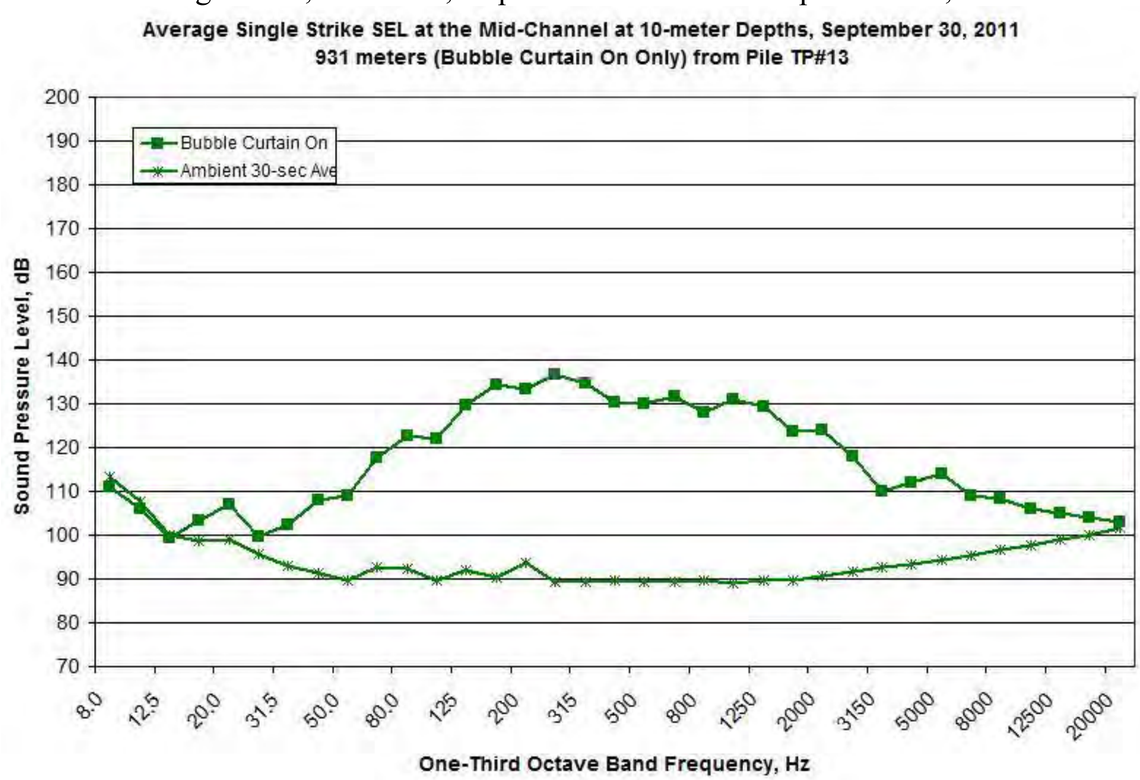

Figure B240. Average One-second SEL Spectral Data Measured at the MID Location during TP#13, 9:52-9:56, Depths of 10 meters on September 30, 2011

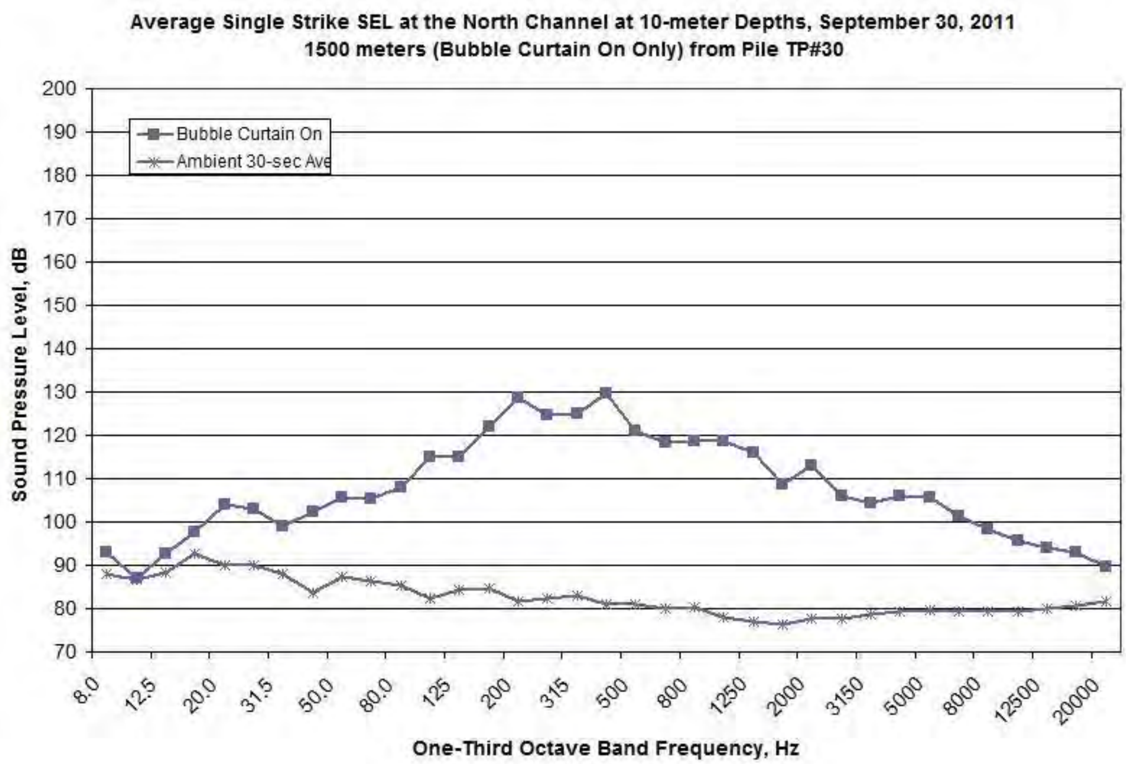

Figure B241. Average One-second SEL Spectral Data Measured at the NO Location during TP#13, 9:52-9:56, Depths of 10 meters on September 30, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B242. Average One-second SEL Spectral Data Measured at the SO Location during TP#13, 9:52-9:56, Depths of 10 meters on September 30, 2011

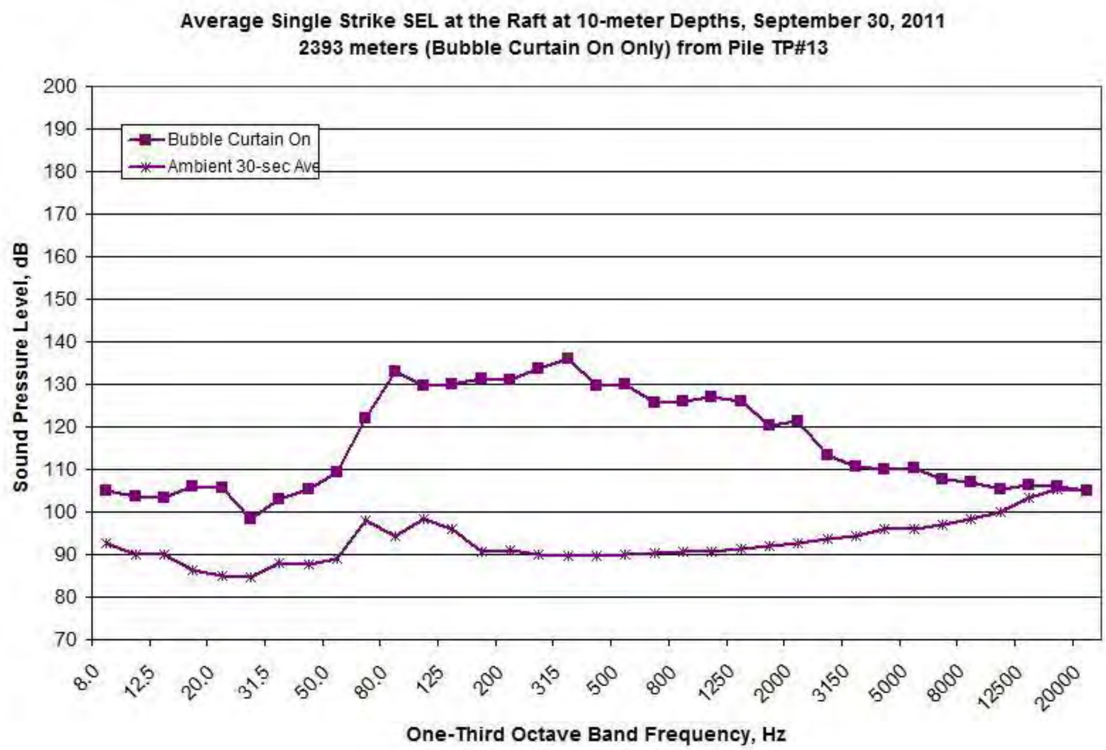

Figure B243. Average One-second SEL Spectral Data Measured at the RFT Location during TP#13, 9:52-9:56, Depths of 10 meters on September 30, 2011

TP#5

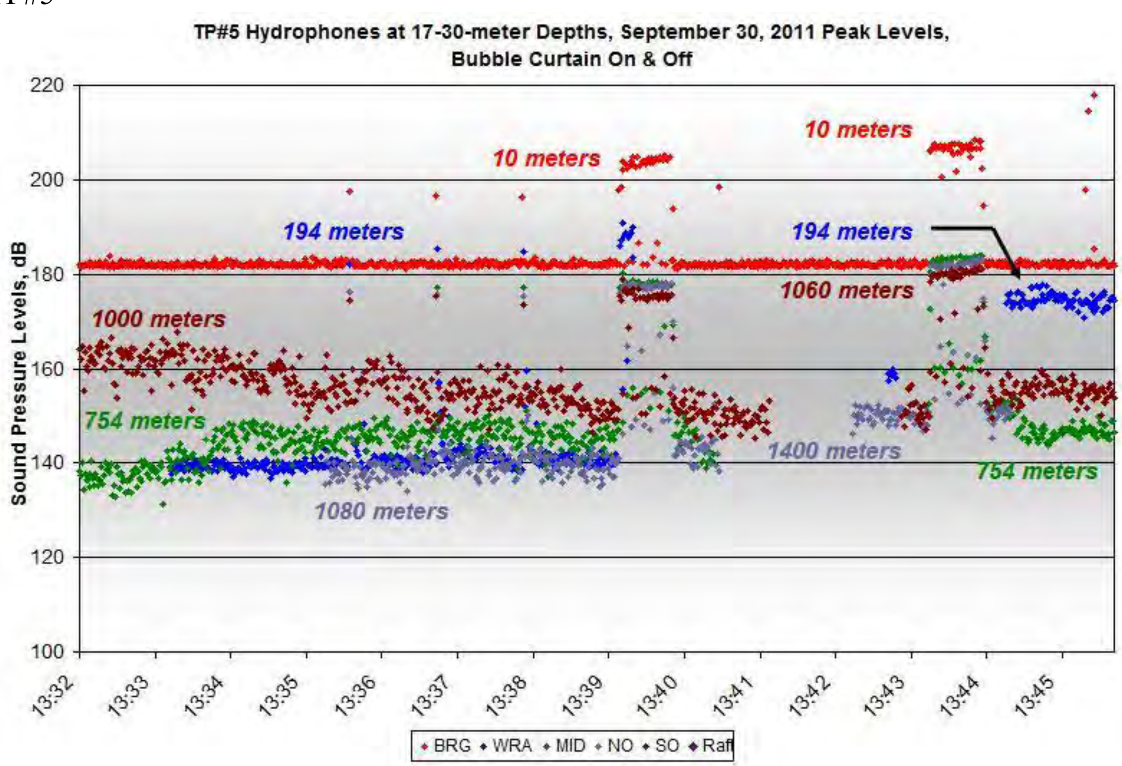

Figure B244. One-second Peak Level Data for TP#5 during Bubble On and Off Conditions, 13:36-13:44, at Depths of 17-30 meters on September 30, 2011

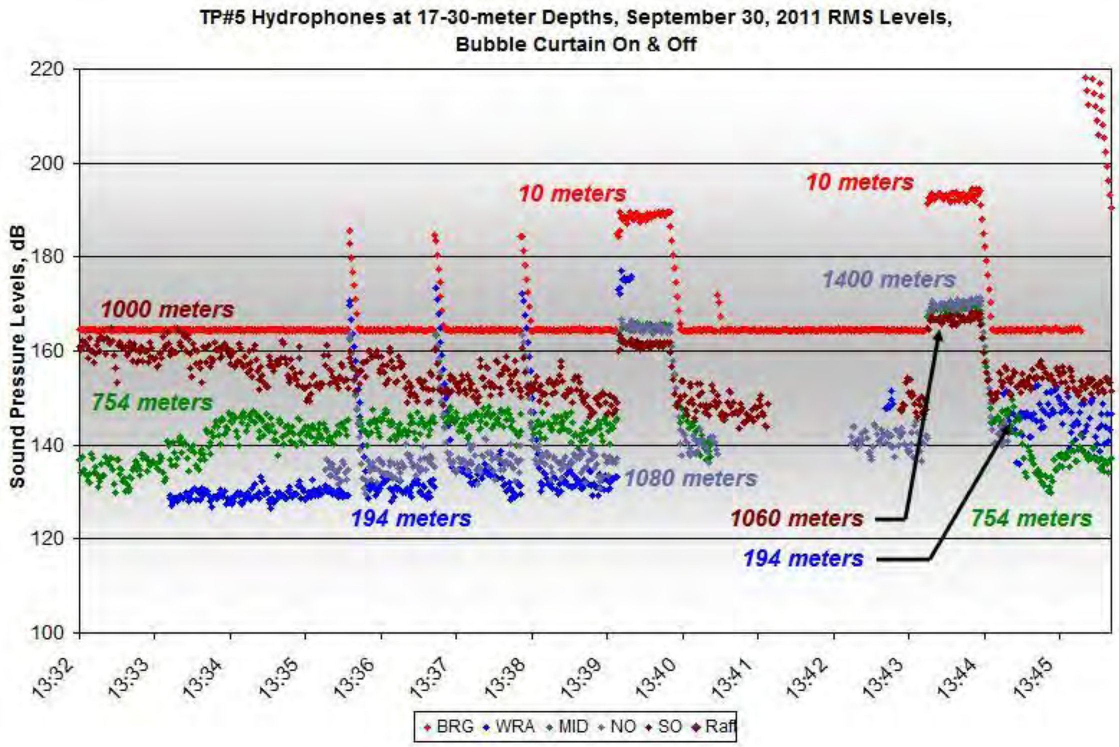

Figure B245. Impulse RMS Data for TP#5 during Bubble On and Off Conditions, 13:36-13:44, at Depths of 17-30 meters on September 30, 2011

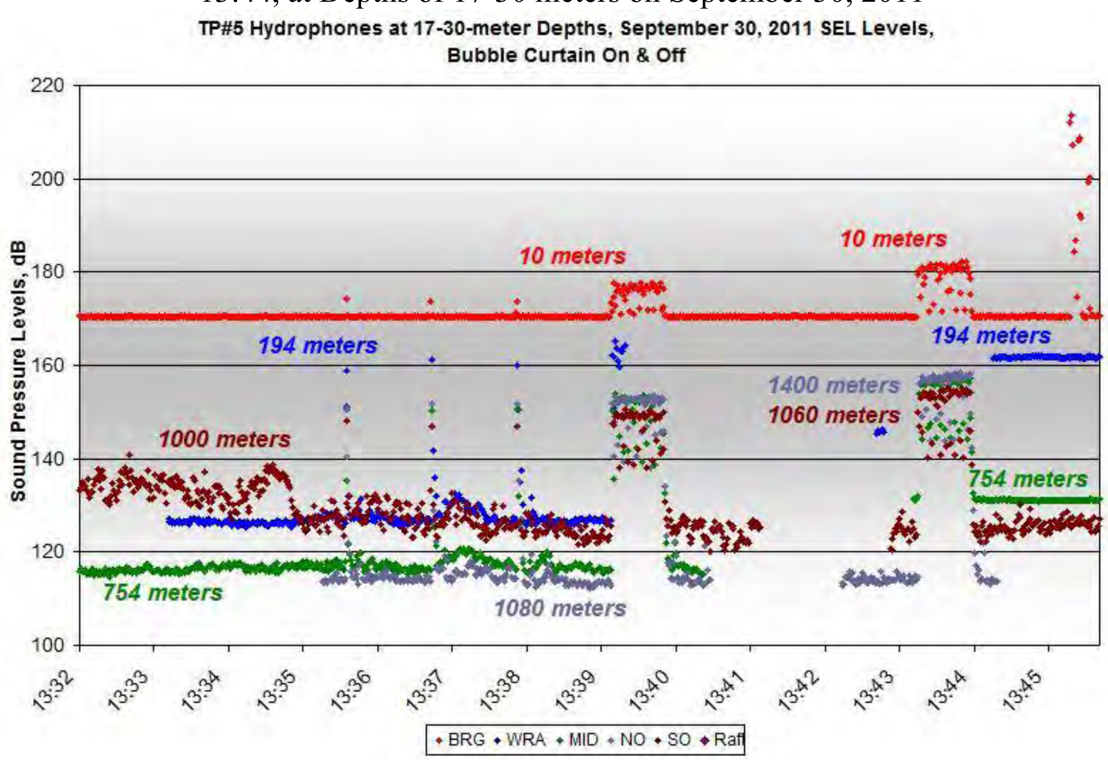

Figure B246. One-second SEL Data for TP#5 during Bubble On and Off Conditions, 13:36-13:44, at Depths of 17-30 meters on September 30, 2011

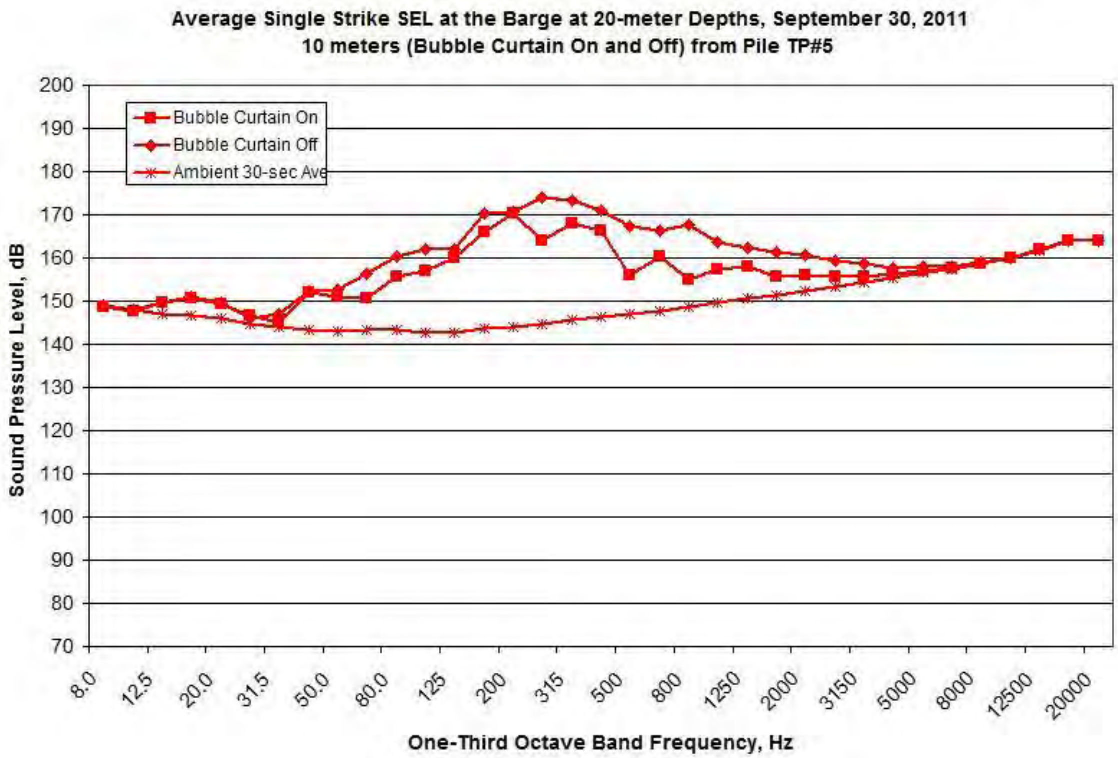

Figure B247. Average One-second SEL Spectral Data Measured at the BRG Location during TP#5, 13:36-13:44, Depths of 20 meters on September 30, 2011

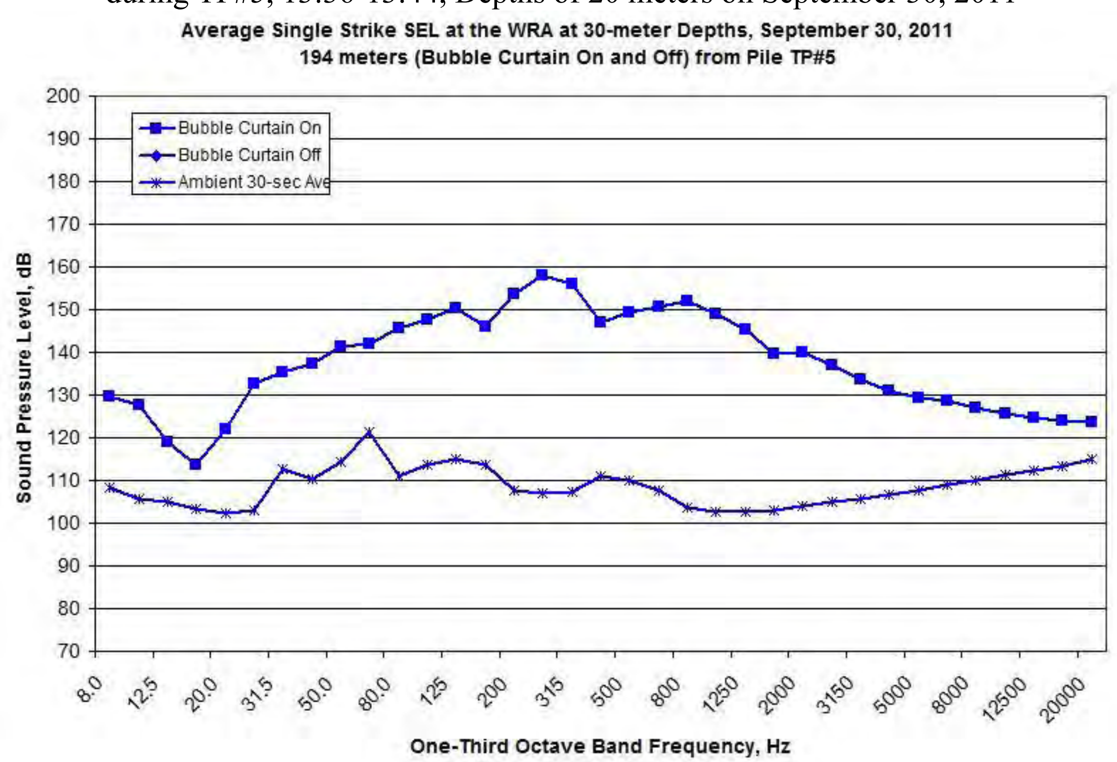

Figure B248. Average One-second SEL Spectral Data Measured at the WRA Location during TP#5, 13:36-13:44, Depths of 30 meters on September 30, 2011

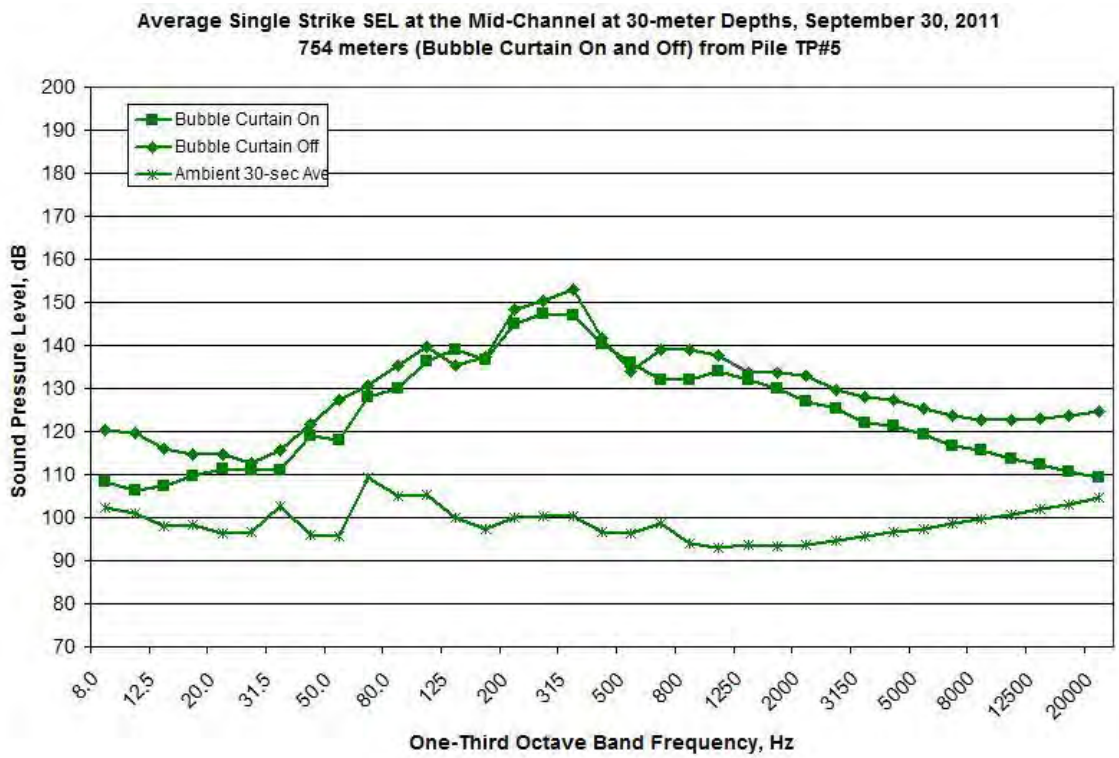

Figure B249. Average One-second SEL Spectral Data Measured at the MID Location during TP#5, 13:36-13:44, Depths of 30 meters on September 30, 2011

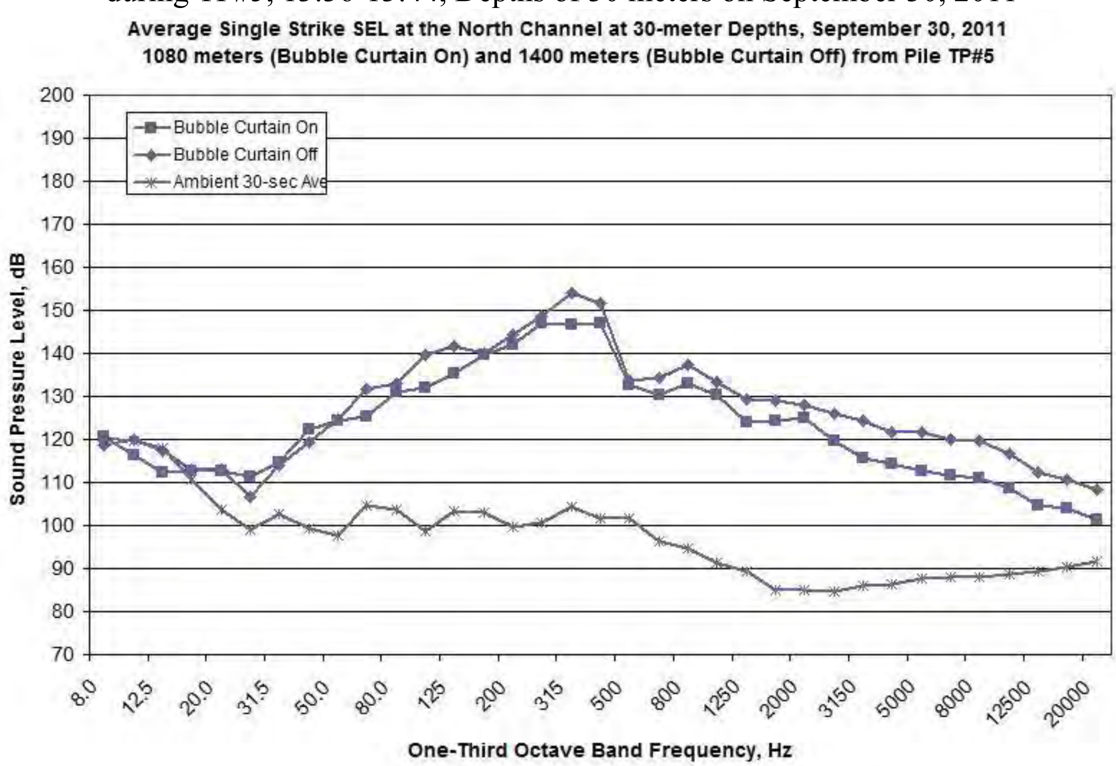

Figure B250. Average One-second SEL Spectral Data Measured at the NO Location during TP#5, 13:36-13:44, Depths of 30 meters on September 30, 2011

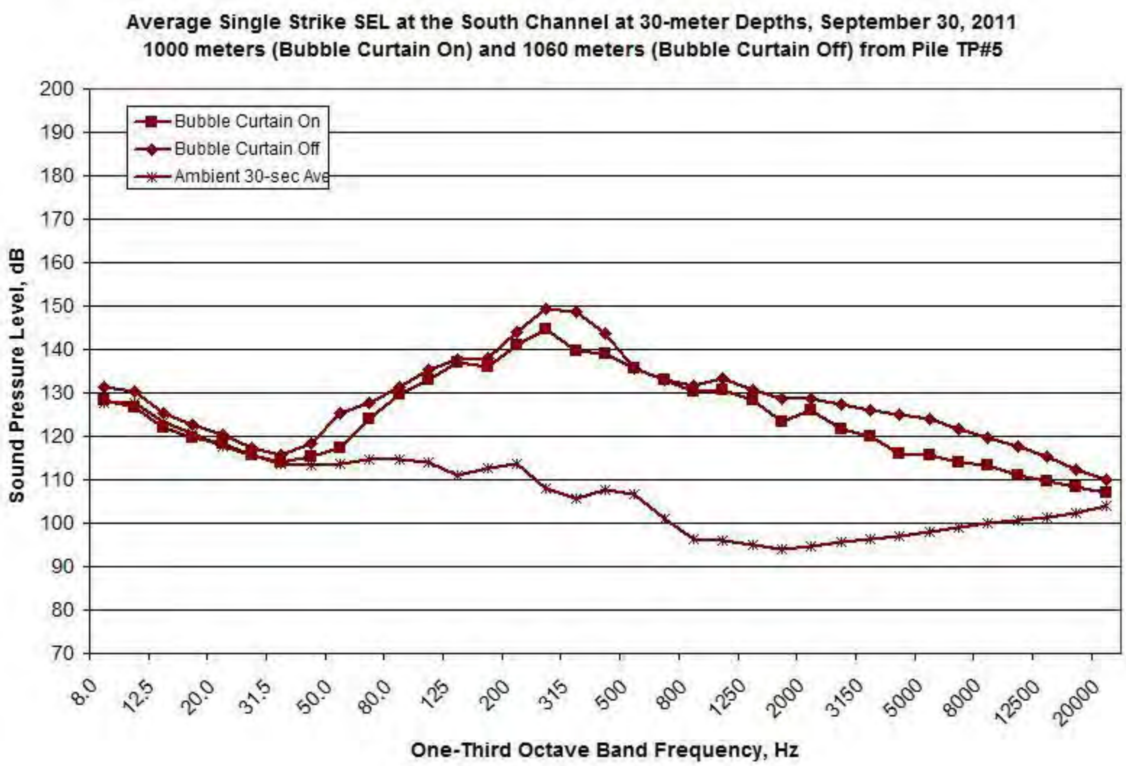

Figure B251. Average One-second SEL Spectral Data Measured at the SO Location during TP#5, 13:36-13:44, Depths of 30 meters on September 30, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B252. Average One-second SEL Spectral Data Measured at the RFT Location during TP#5, 13:36-13:44, Depths of 17 meters on September 30, 2011

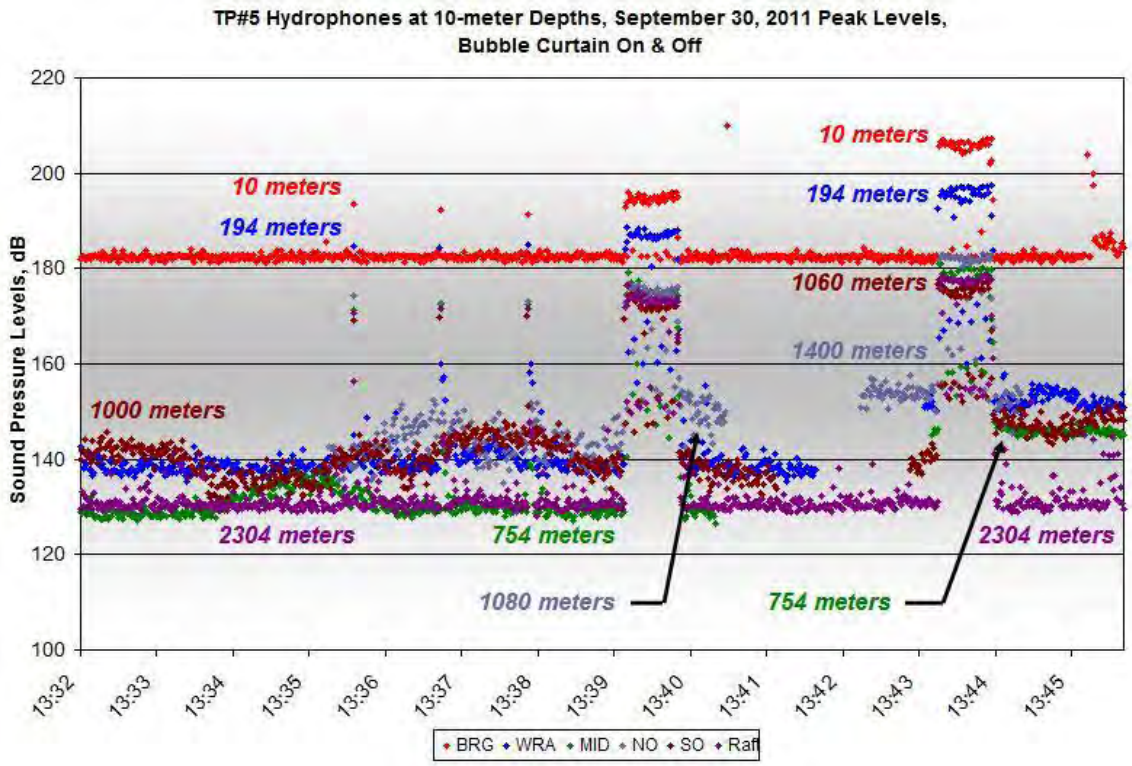

Figure B253. One-second Peak Level Data for TP#5 during Bubble On and Off Conditions, 13:36-13:44, at Depths of 10 meters on September 30, 2011

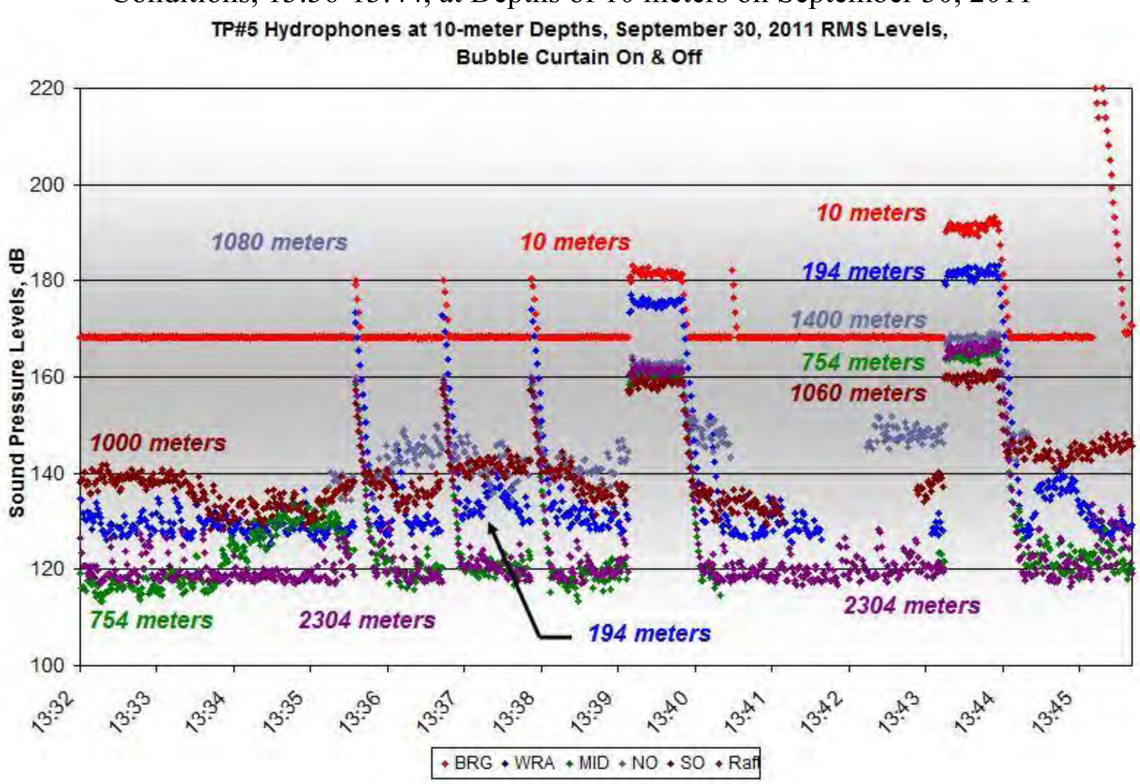

Figure B254. Impulse RMS Data for TP#5 during Bubble On and Off Conditions, 13:36-13:44, at Depths of 10 meters on September 30, 2011

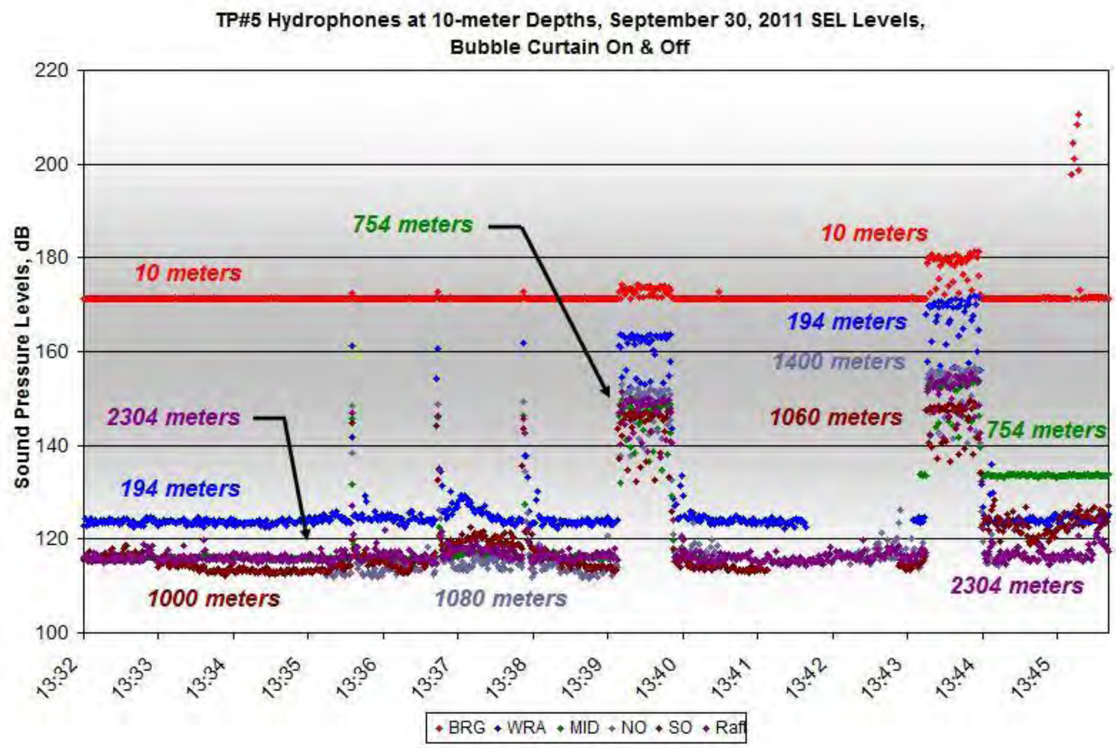

Figure B255. One-second SEL Data for TP#5 during Bubble On and Off Conditions, 13:36-13:44, at Depths of 10 meters on September 30, 2011

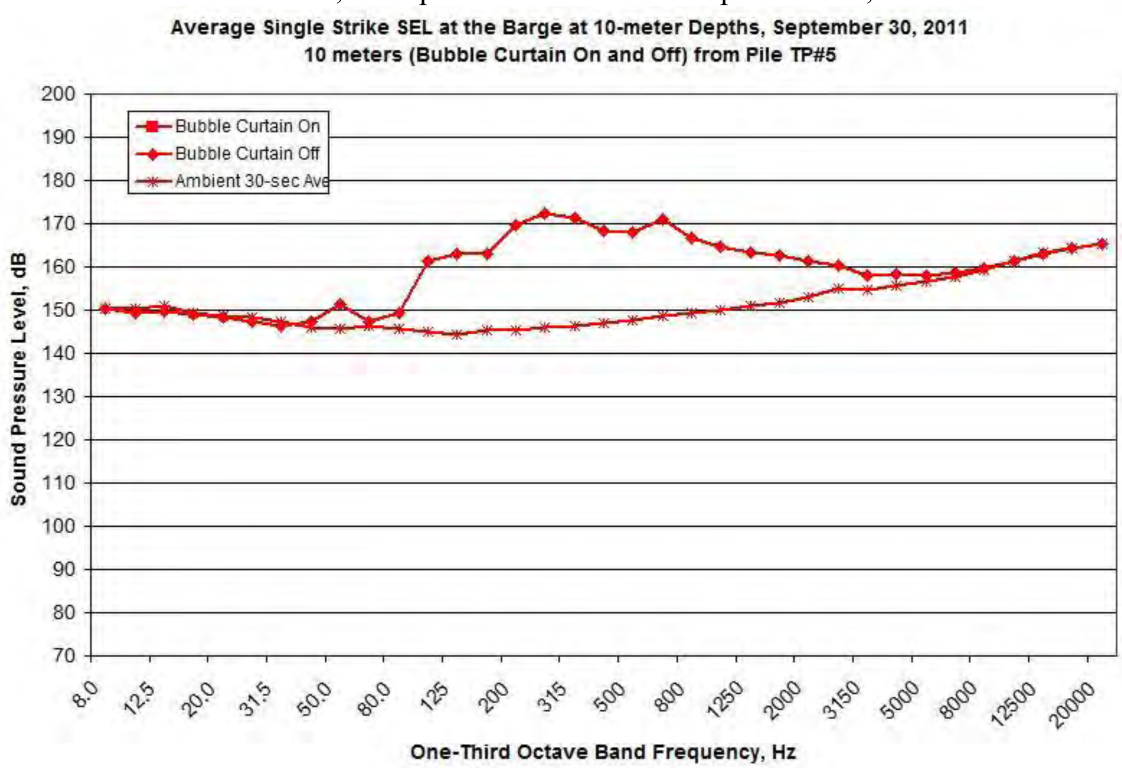

Figure B256. Average One-second SEL Spectral Data Measured at the BRG Location during TP#5, 13:36-13:44, Depths of 10 meters on September 30, 2011

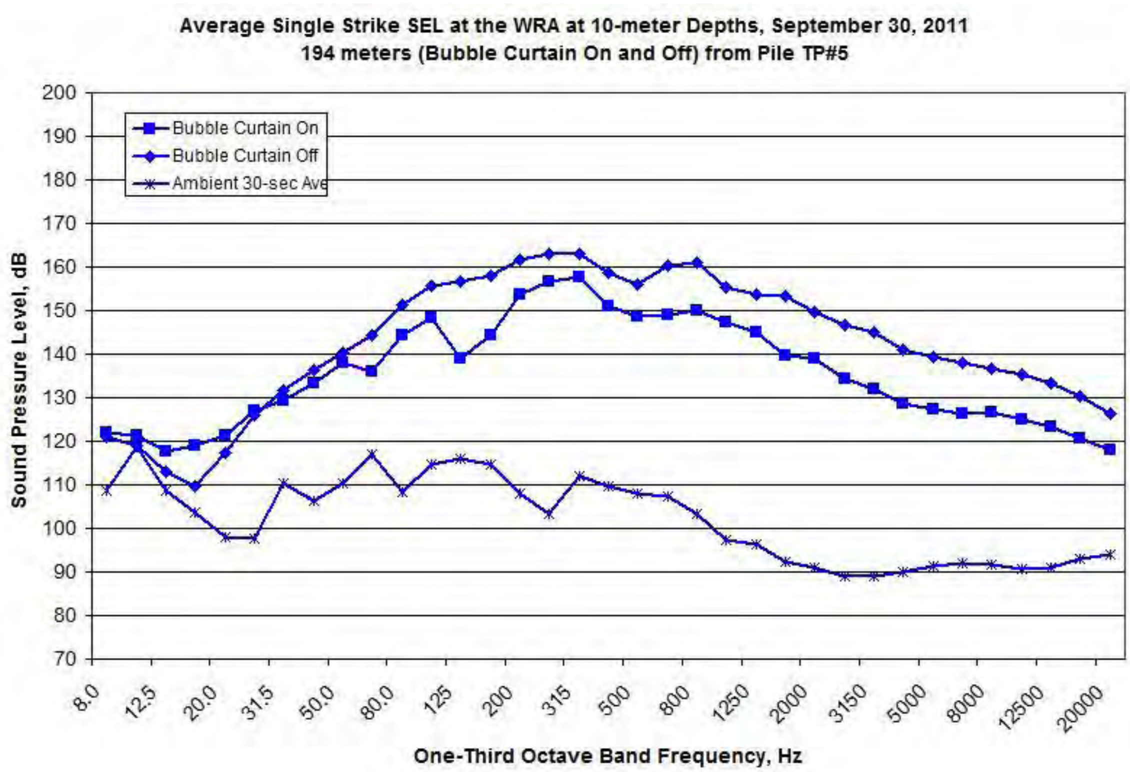

Figure B257. Average One-second SEL Spectral Data Measured at the WRA Location during TP#5, 13:36-13:44, Depths of 10 meters on September 30, 2011

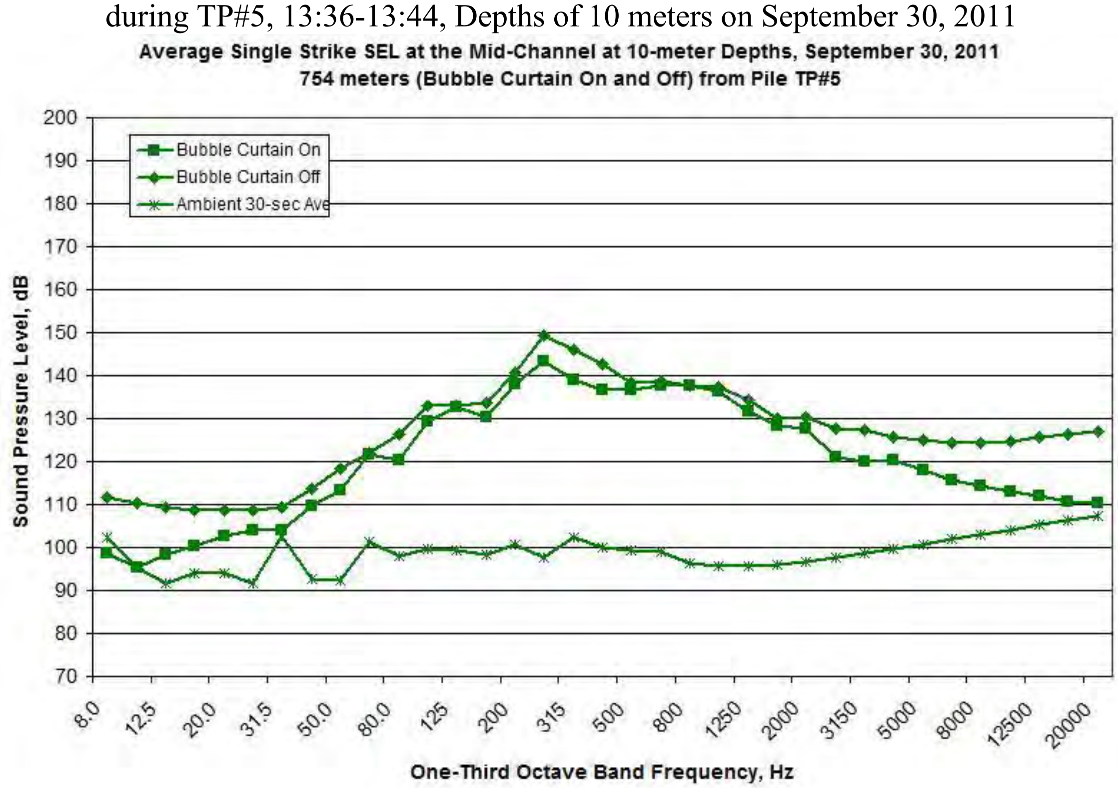

Figure B258. Average One-second SEL Spectral Data Measured at the MID Location during TP#5, 13:36-13:44, Depths of 10 meters on September 30, 2011

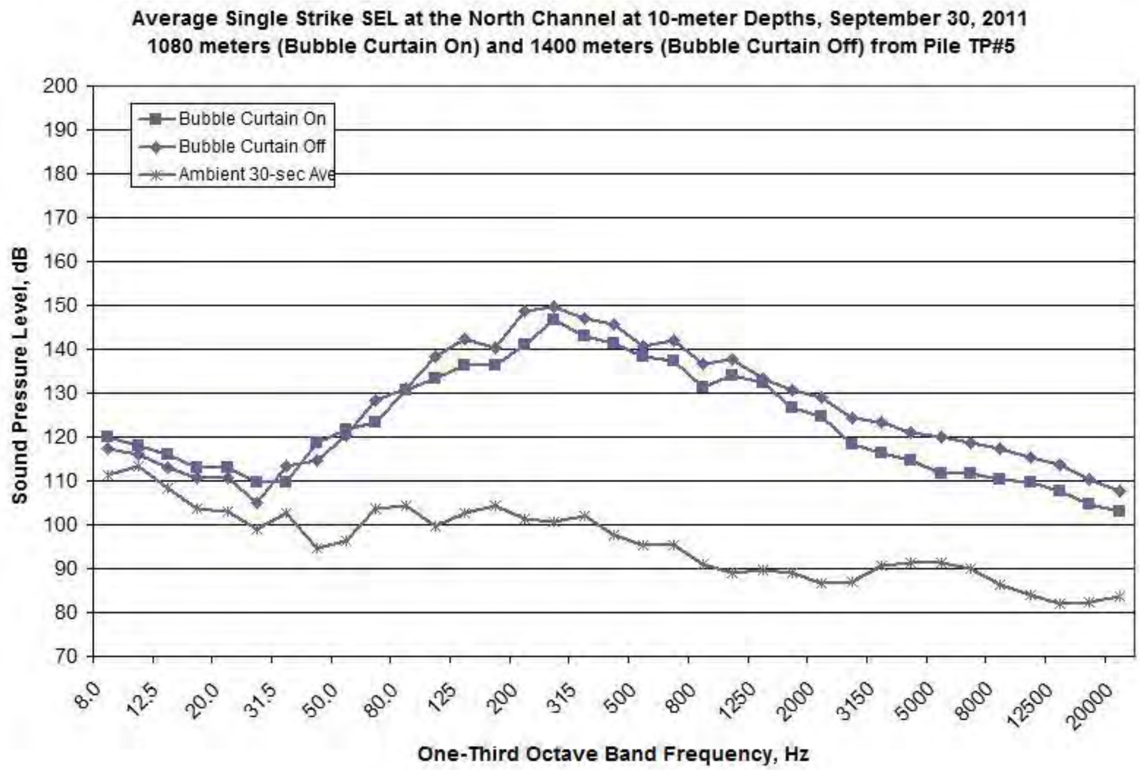

Figure B259. Average One-second SEL Spectral Data Measured at the NO Location during TP#5, 13:36-13:44, Depths of 10 meters on September 30, 2011

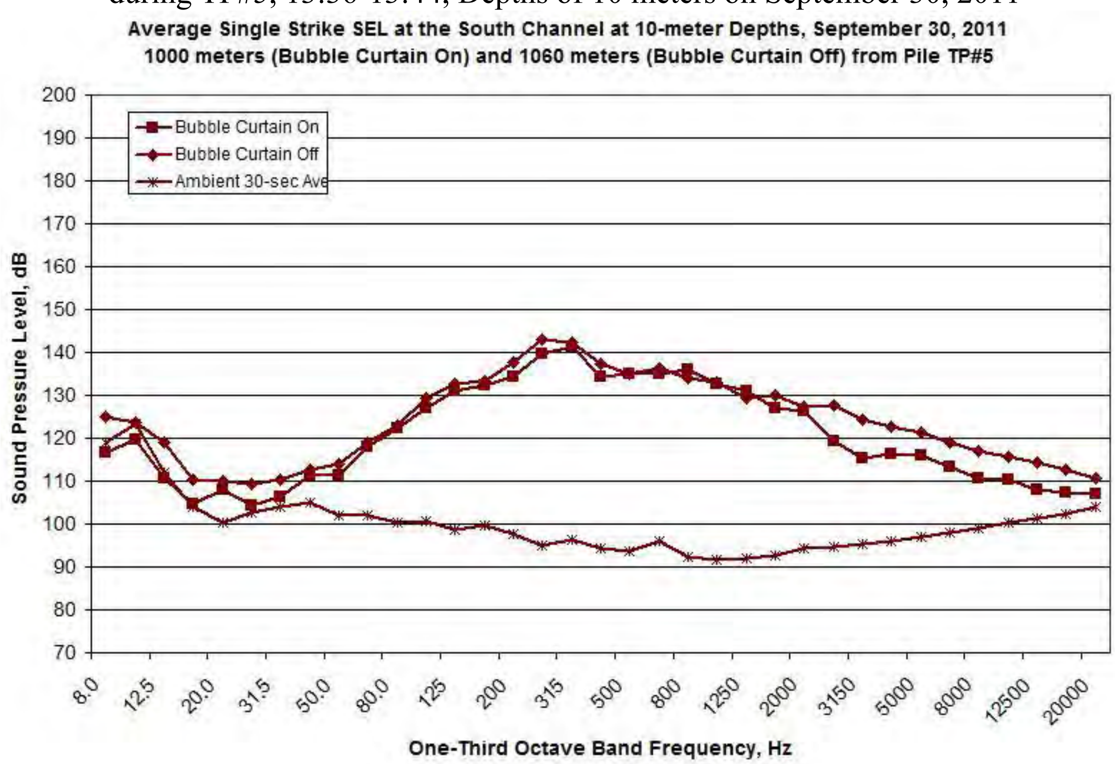

Figure B260. Average One-second SEL Spectral Data Measured at the SO Location during TP#5, 13:36-13:44, Depths of 10 meters on September 30, 2011

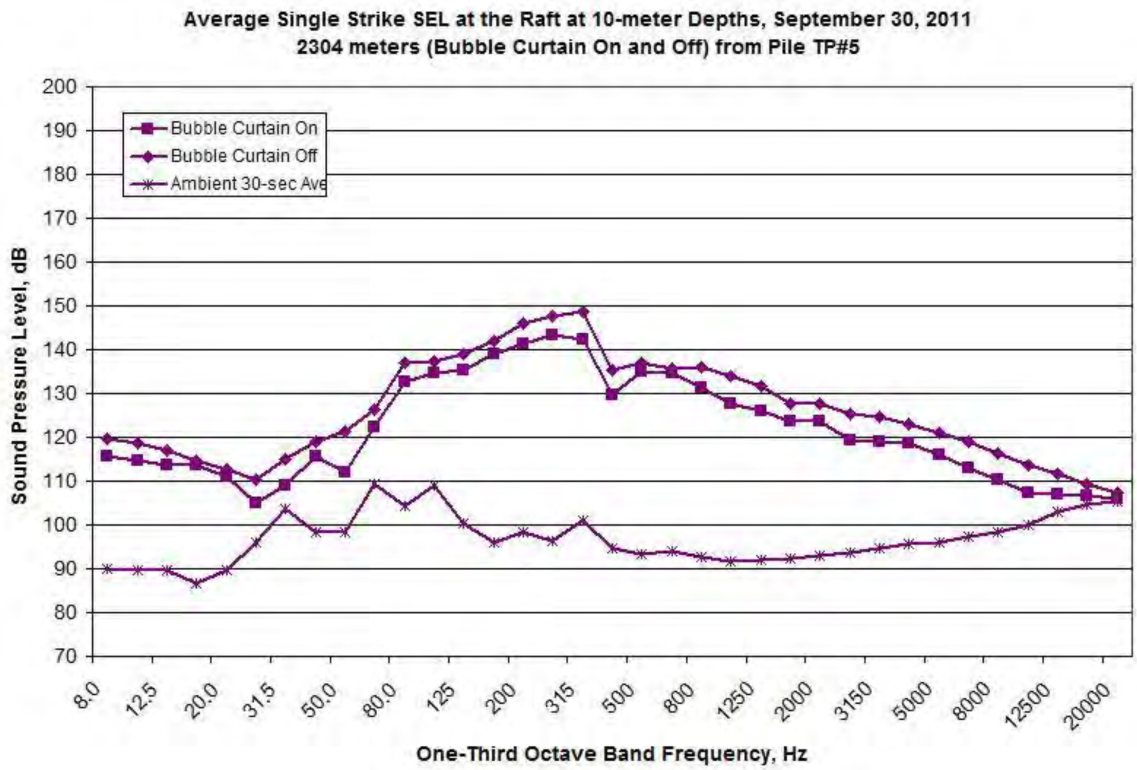

Figure B261. Average One-second SEL Spectral Data Measured at the RFT Location during TP#5, 13:36-13:44, Depths of 10 meters on September 30, 2011

10/1/2011 – TP#9 RP#3

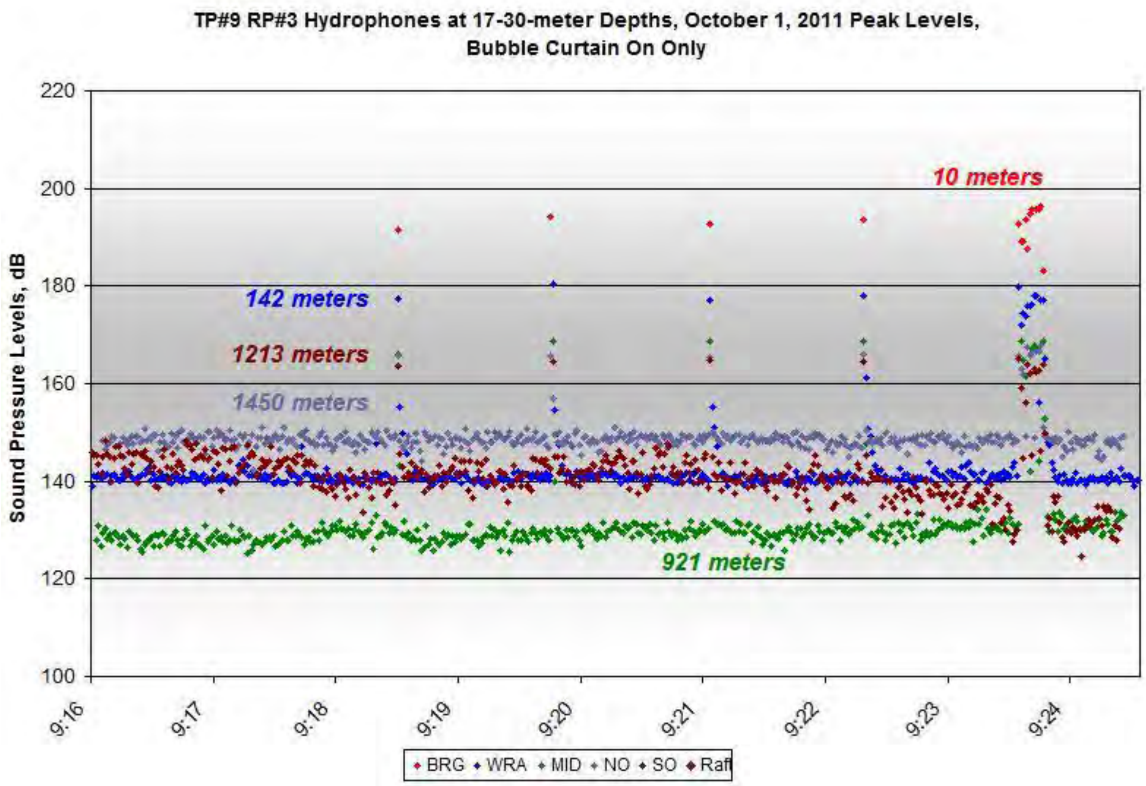

Figure B262. One-second Peak Level Data for TP#9 RP#3 during Bubble On Conditions, 9:19-9:24, at Depths of 17-30 meters on October 1, 2011

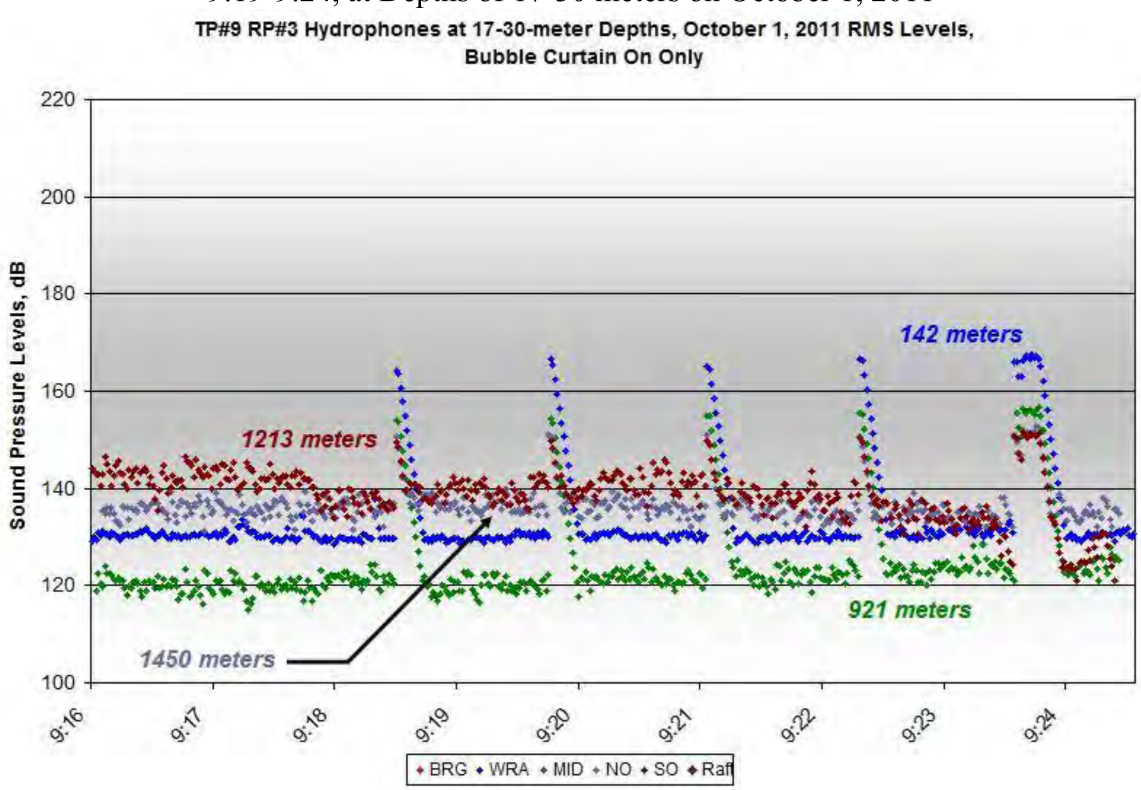

Figure B263. Impulse RMS Data for TP#9 RP#3 during Bubble On Conditions, 9:19-9:24, at Depths of 17-30 meters on October 1, 2011

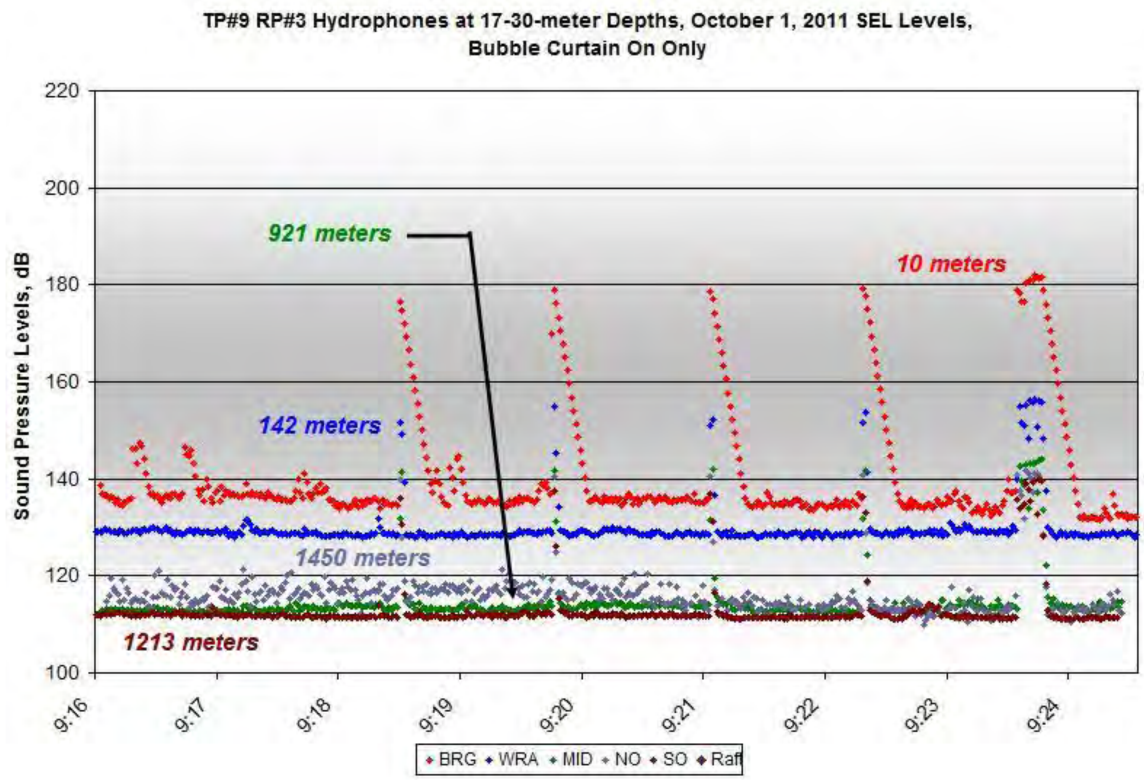

Figure B264. One-second SEL Data for TP#9 RP#3 during Bubble On Conditions, 9:19-9:24, at Depths of 17-30 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B265. Average One-second SEL Spectral Data Measured at the BRG Location during TP#9 RP#3, 9:19-9:24, Depths of 20 meters on October 1, 2011

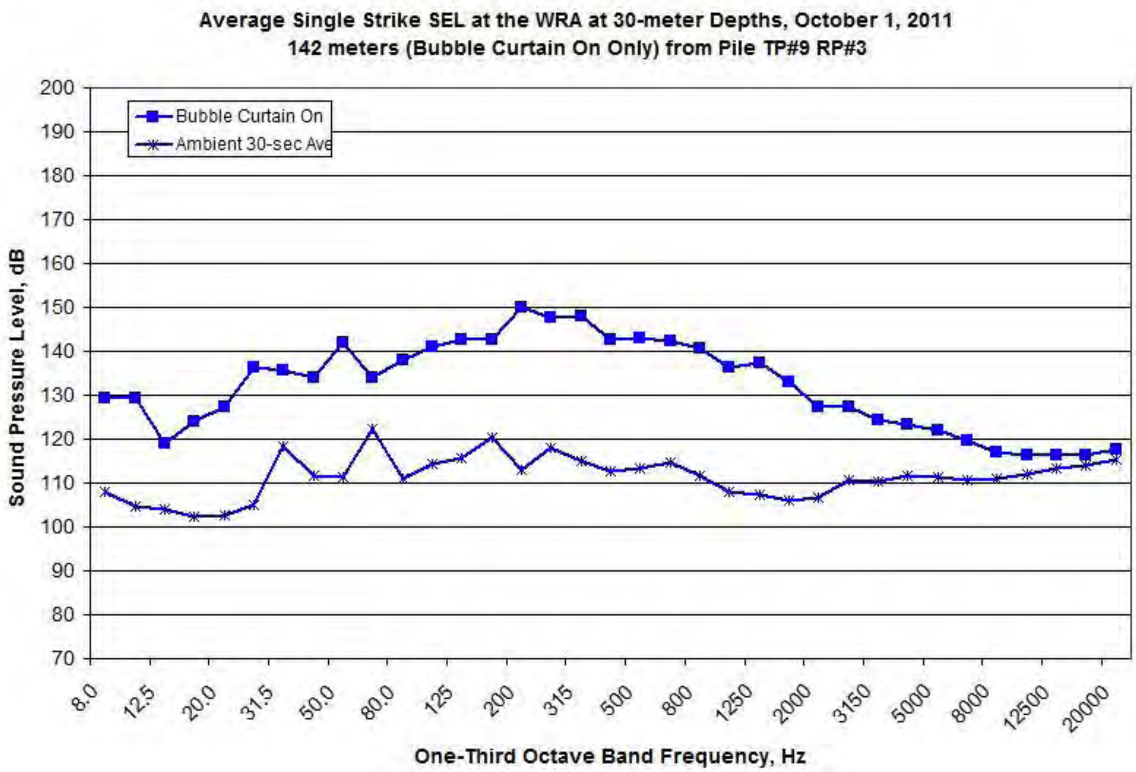

Figure B266. Average One-second SEL Spectral Data Measured at the WRA Location during TP#9 RP#3, 9:19-9:24, Depths of 30 meters on October 1, 2011

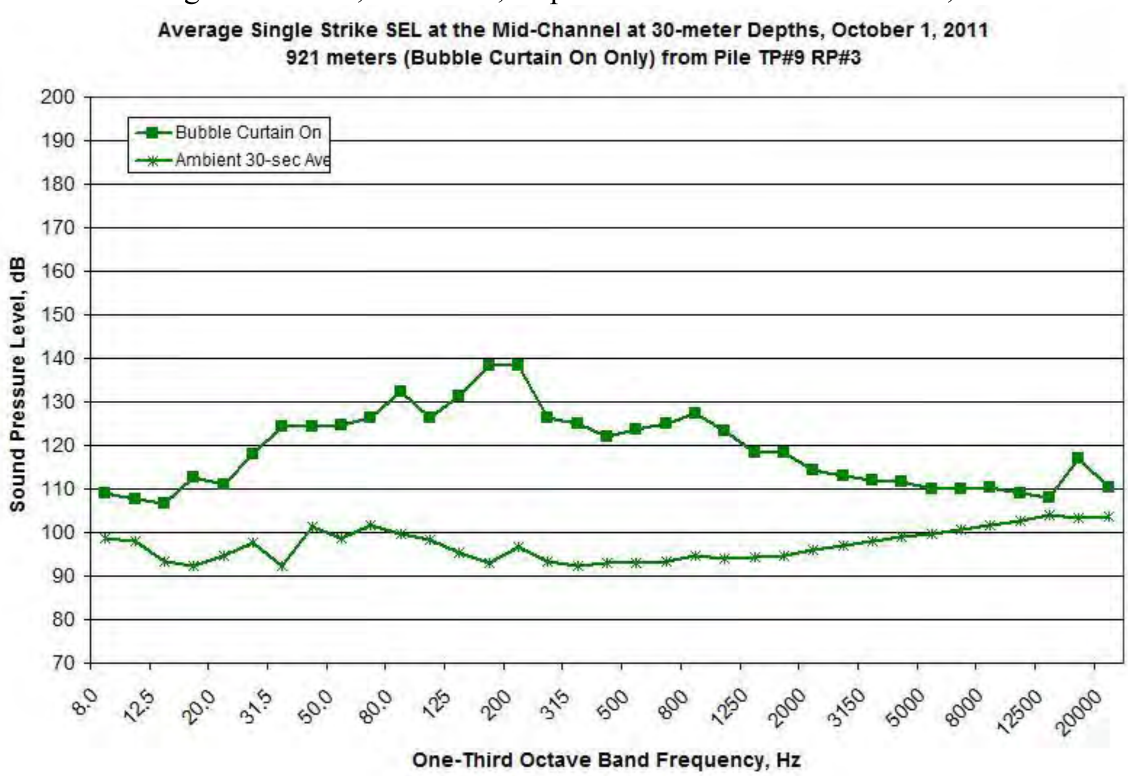

Figure B267. Average One-second SEL Spectral Data Measured at the MID Location during TP#9 RP#3, 9:19-9:24, Depths of 30 meters on October 1, 2011

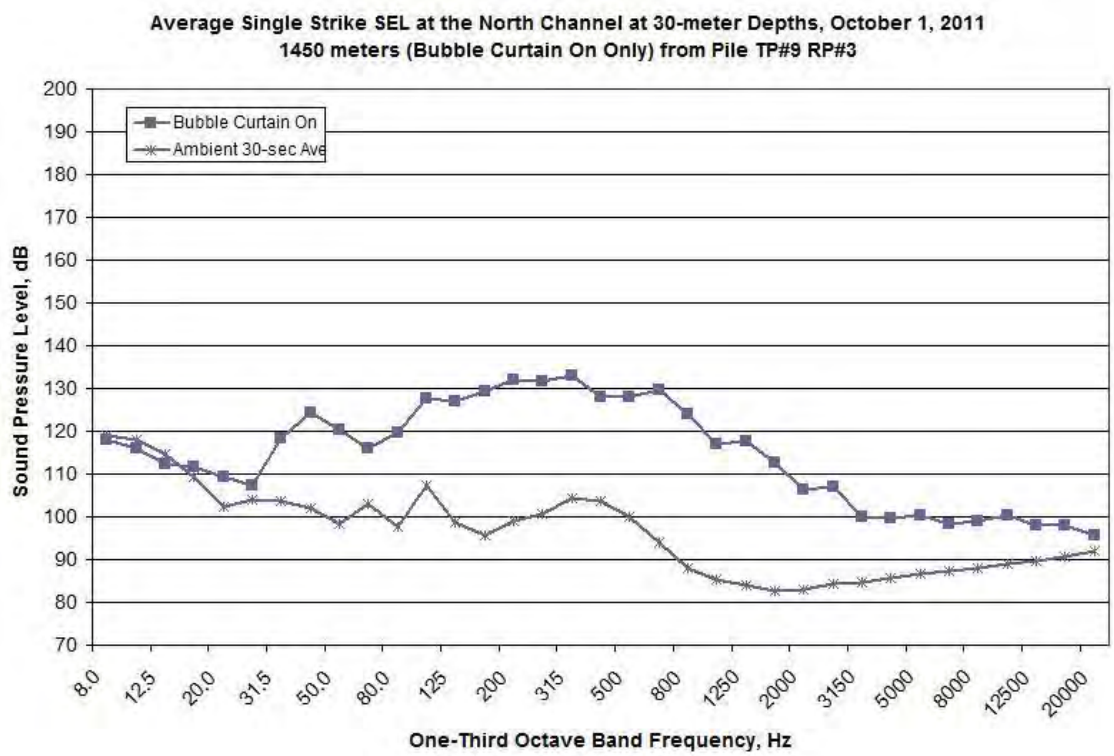

Figure B268. Average One-second SEL Spectral Data Measured at the NO Location during TP#9 RP#3, 9:19-9:24, Depths of 30 meters on October 1, 2011

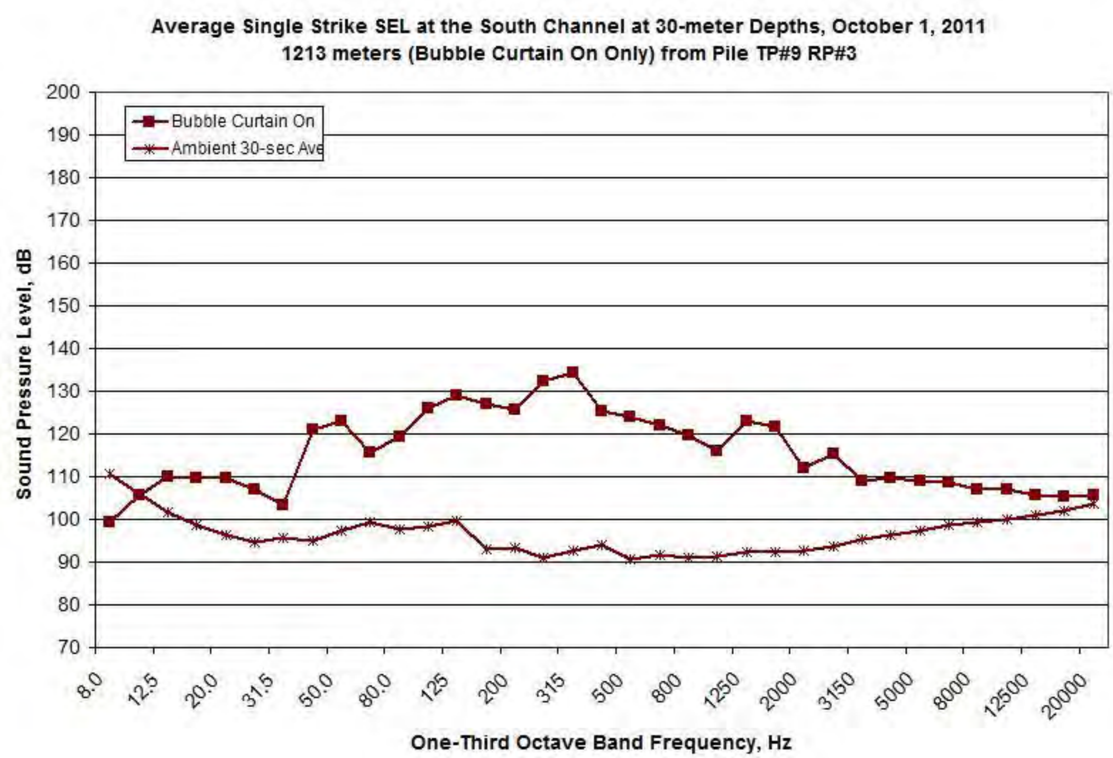

Figure B269. Average One-second SEL Spectral Data Measured at the SO Location during TP#9 RP#3, 9:19-9:24, Depths of 30 meters on October 1, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B270. Average One-second SEL Spectral Data Measured at the RFT Location during TP#9 RP#3, 9:19-9:24, Depths of 17 meters on October 1, 2011

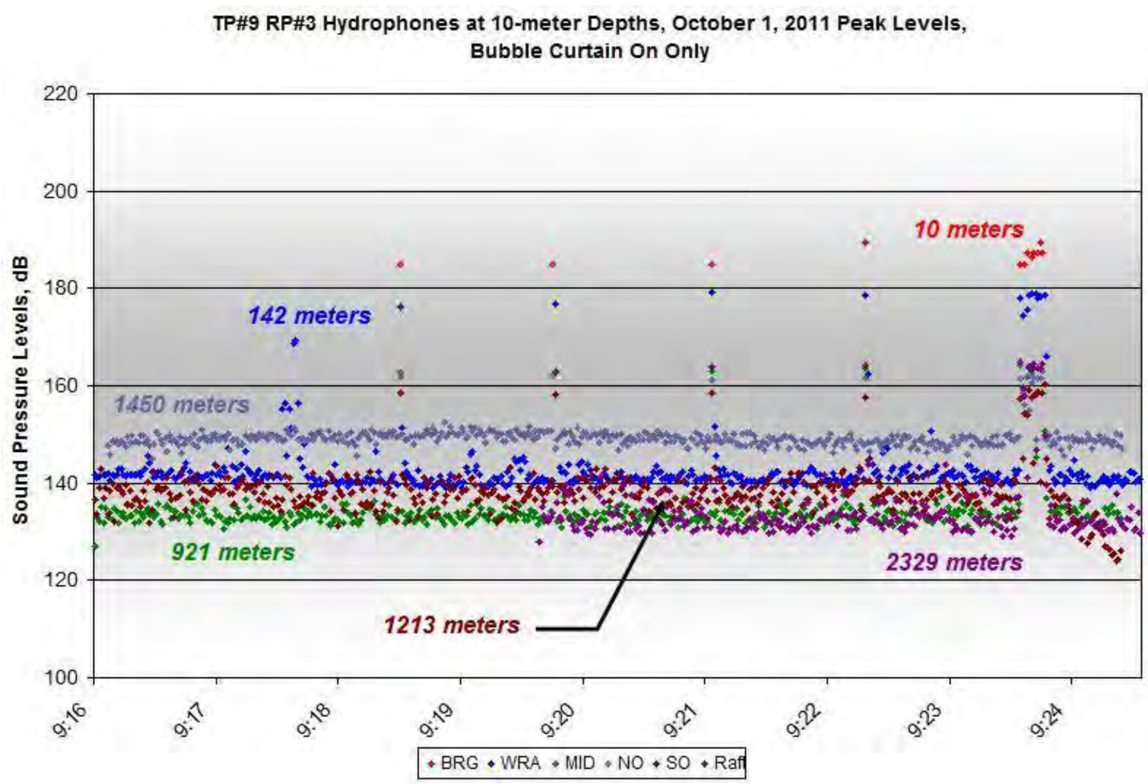

Figure B271. One-second Peak Level Data for TP#9 RP#3 during Bubble On Conditions, 9:19-9:24, at Depths of 10 meters on October 1, 2011

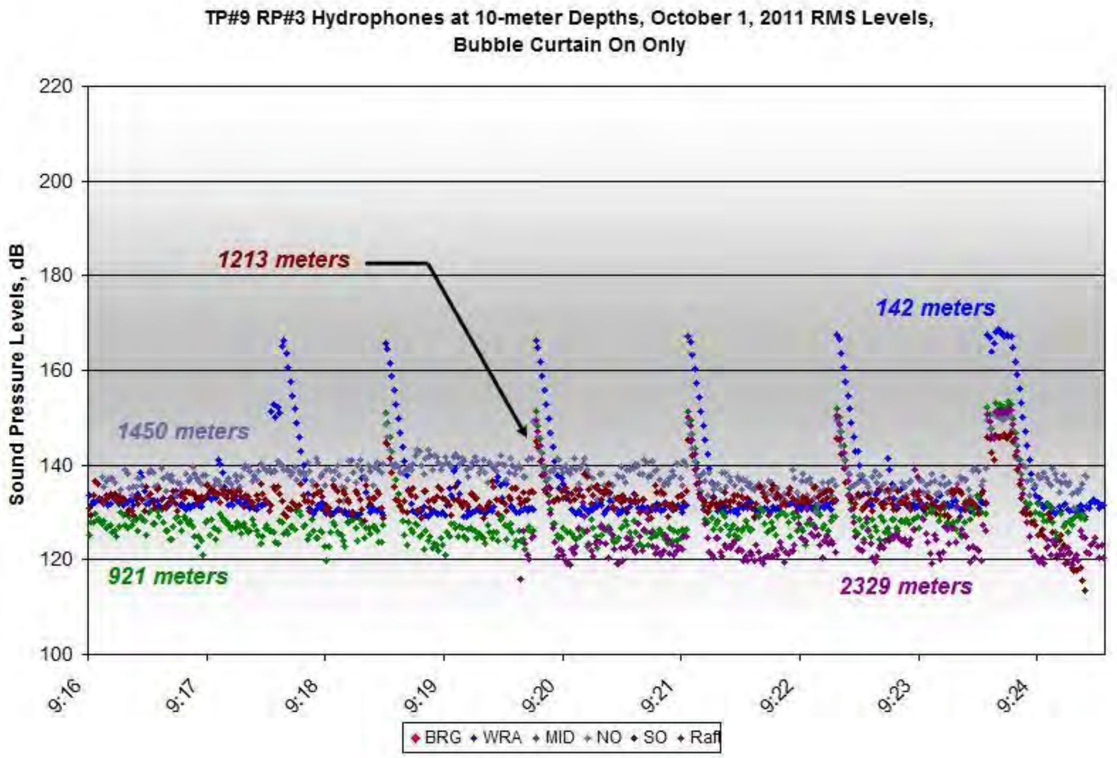

Figure B272. Impulse RMS Data for TP#9 RP#3 during Bubble On Conditions, 9:19-9:24, at Depths of 10 meters on October 1, 2011

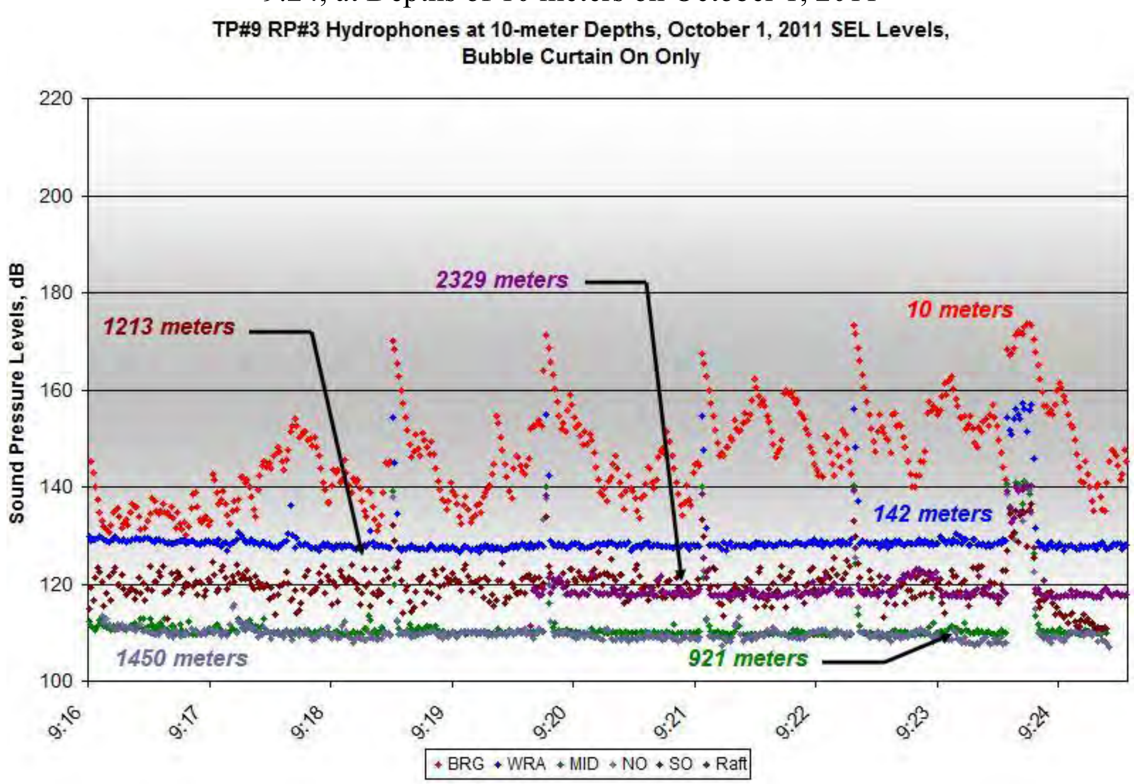

Figure B273. One-second SEL Data for TP#9 RP#3 during Bubble On Conditions, 9:19-9:24, at Depths of 10 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B274. Average One-second SEL Spectral Data Measured at the BRG Location during TP#9 RP#3, 9:19-9:24, Depths of 10 meters on October 1, 2011

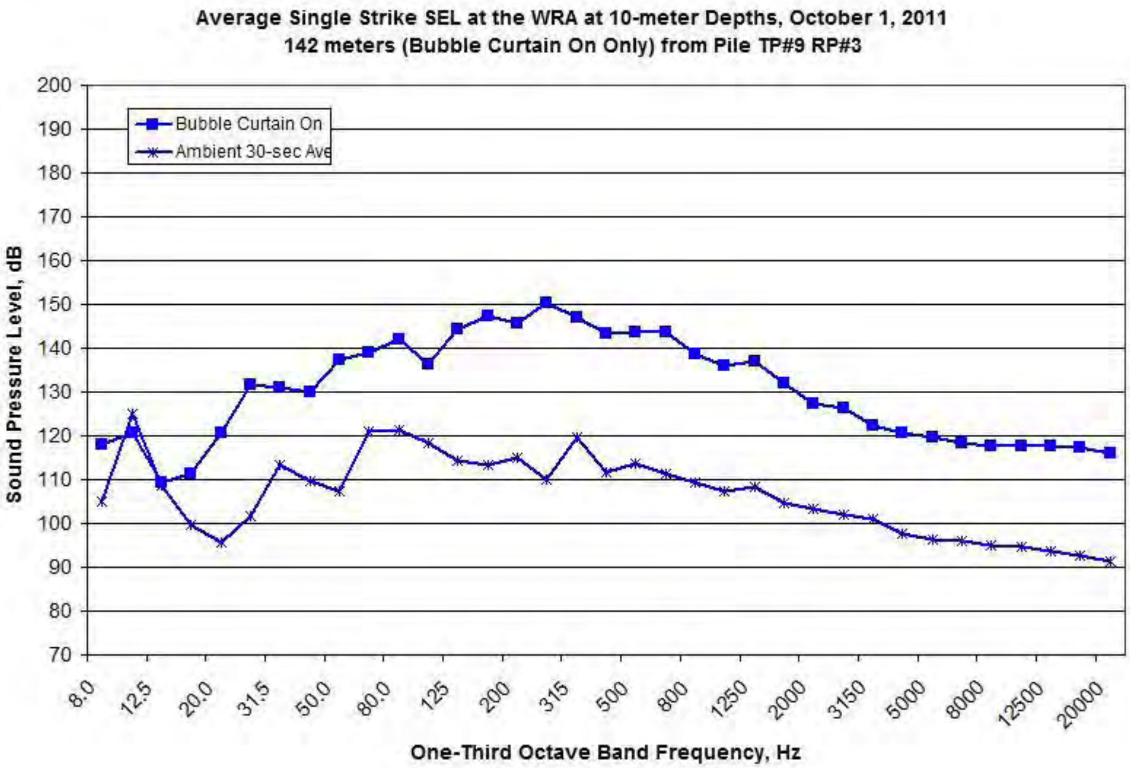

Figure B275. Average One-second SEL Spectral Data Measured at the WRA Location during TP#9 RP#3, 9:19-9:24, Depths of 10 meters on October 1, 2011

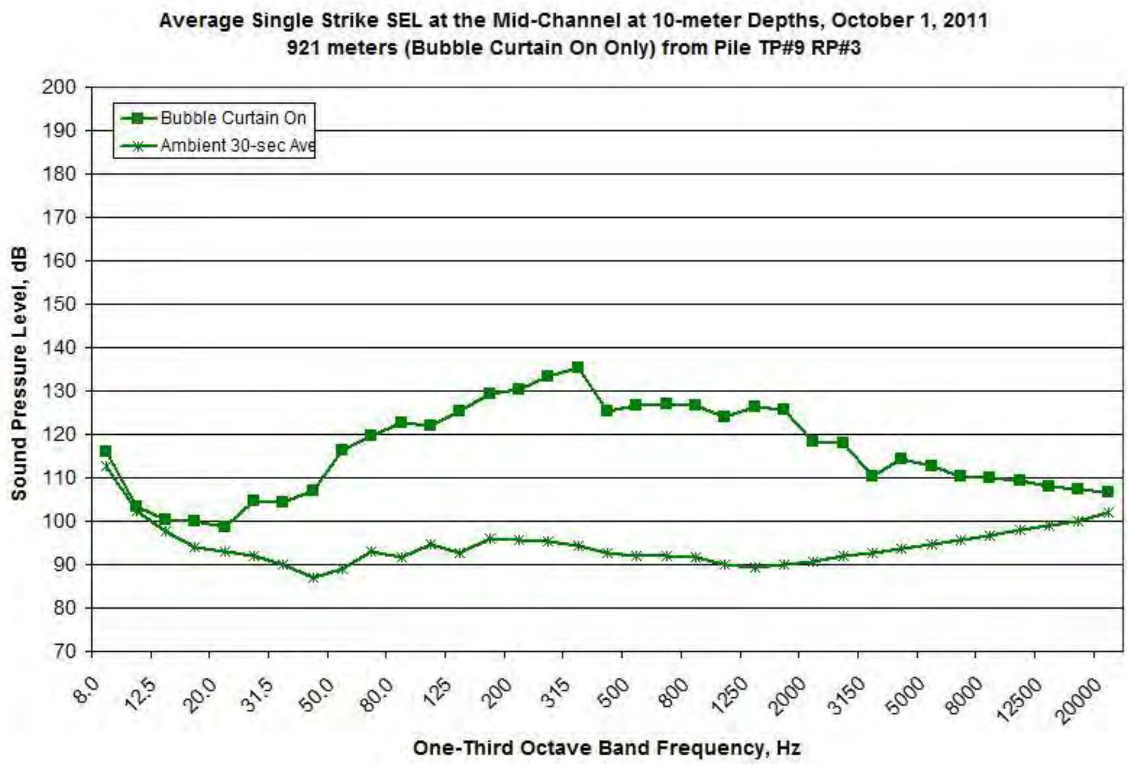

Figure B276. Average One-second SEL Spectral Data Measured at the MID Location during TP#9 RP#3, 9:19-9:24, Depths of 10 meters on October 1, 2011

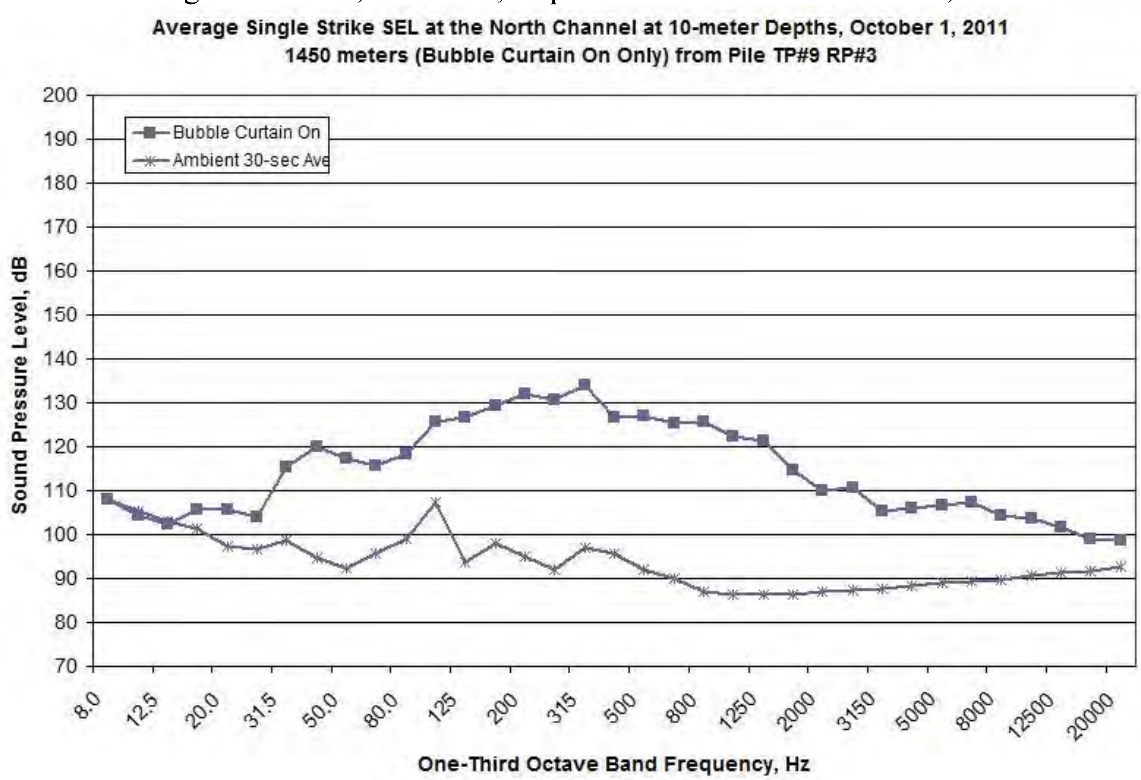

Figure B277. Average One-second SEL Spectral Data Measured at the NO Location during TP#9 RP#3, 9:19-9:24, Depths of 10 meters on October 1, 2011

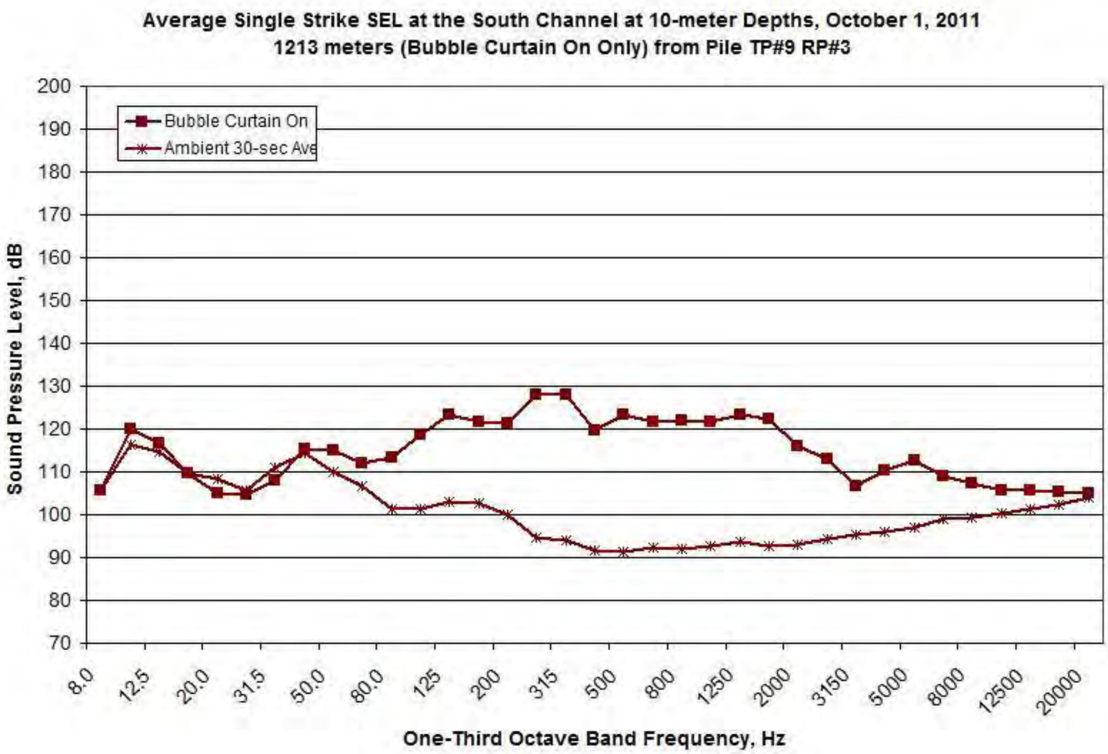

Figure B278. Average One-second SEL Spectral Data Measured at the SO Location during TP#9 RP#3, 9:19-9:24, Depths of 10 meters on October 1, 2011

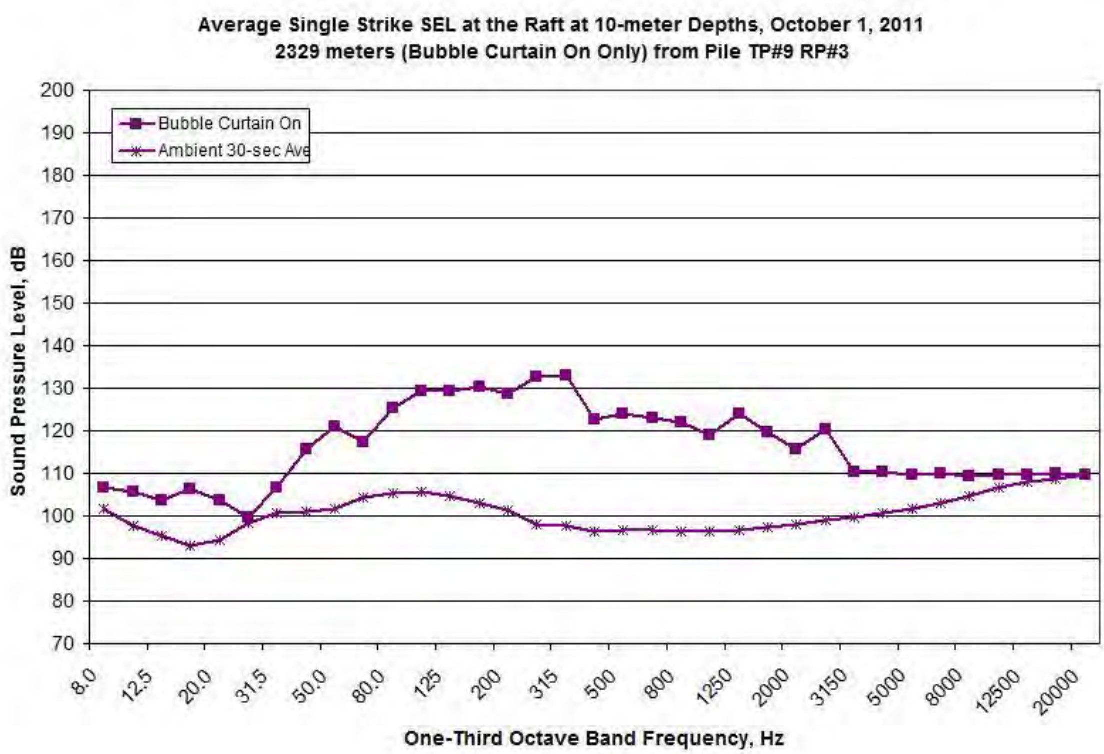

Figure B279. Average One-second SEL Spectral Data Measured at the RFT Location during TP#9 RP#3, 9:19-9:24, Depths of 10 meters on October 1, 2011

TP#9 RP#2

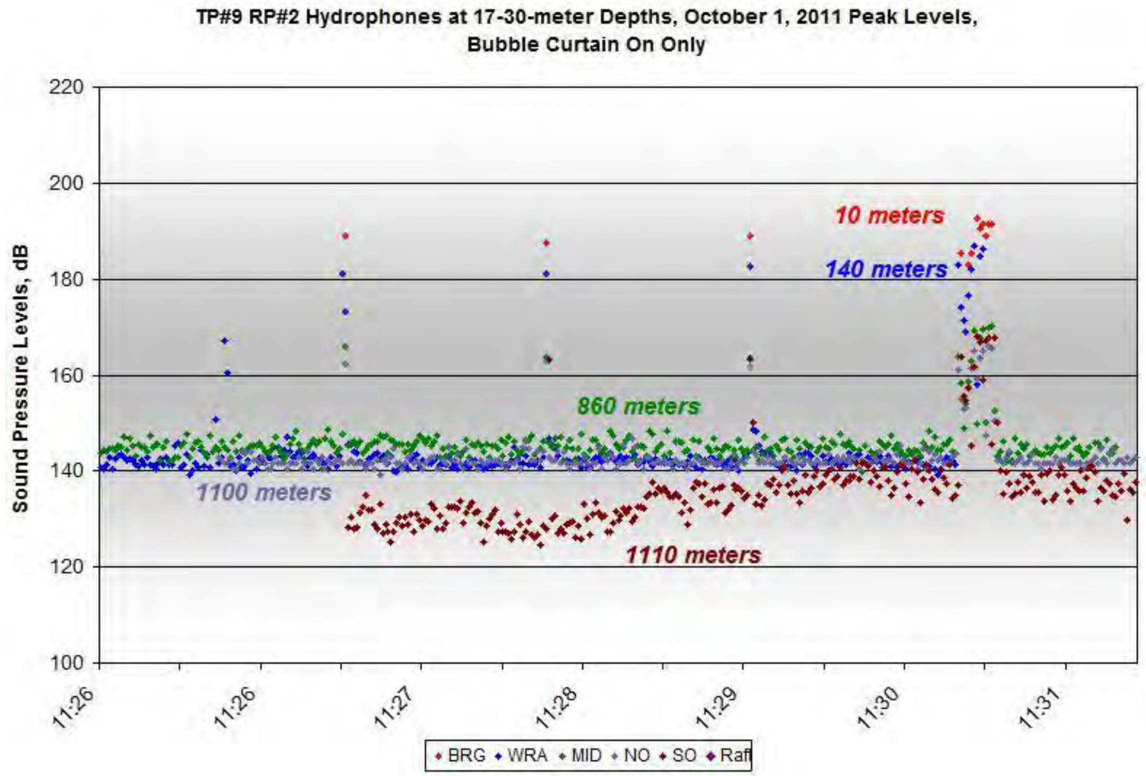

Figure B280. One-second Peak Level Data for TP#9 RP#2 during Bubble On Conditions, 11:27-11:31, at Depths of 17-30 meters on October 1, 2011

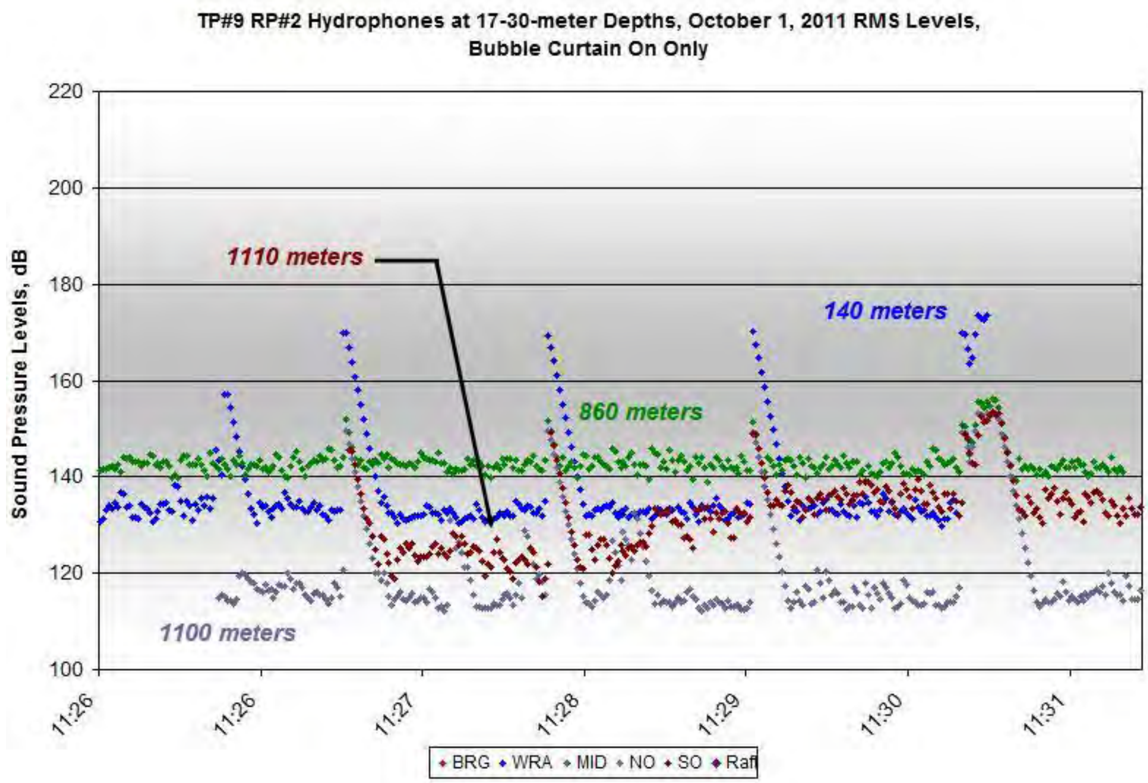

Figure B281. Impulse RMS Data for TP#9 RP#2 during Bubble On Conditions, 11:27-11:31, at Depths of 17-30 meters on October 1, 2011

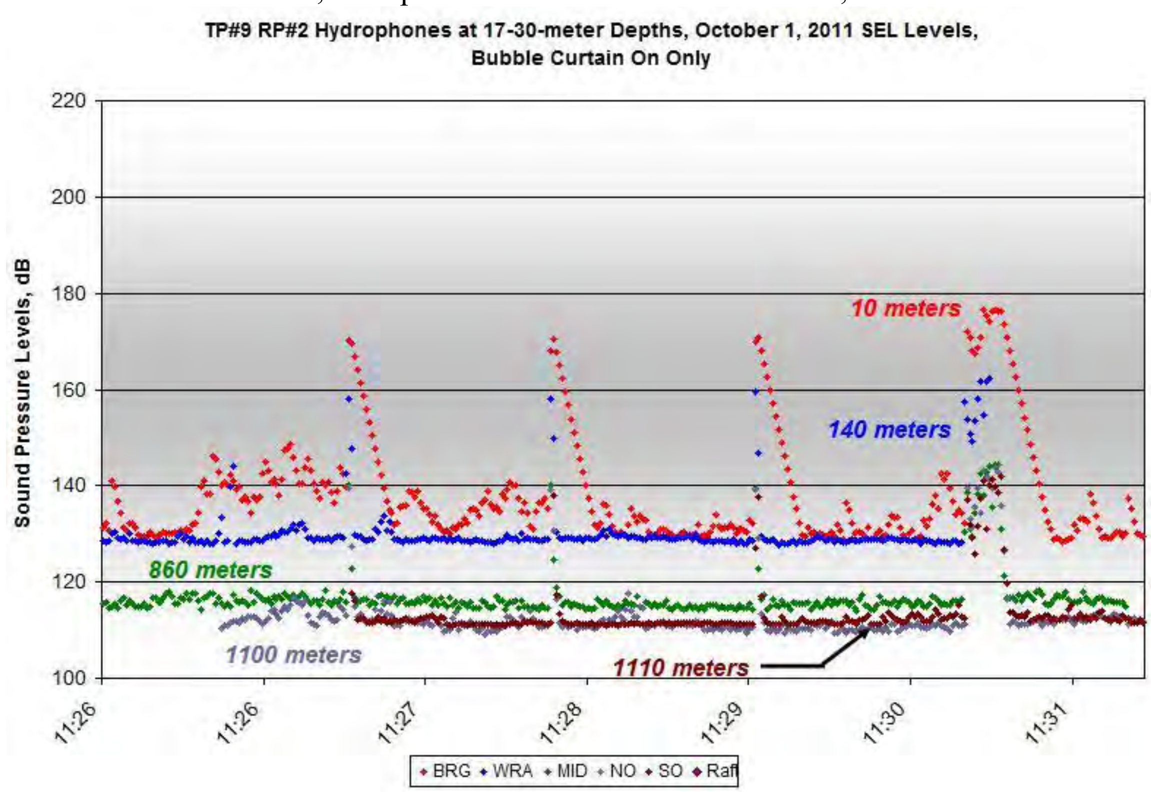

Figure B282. One-second SEL Data for TP#9 RP#2 during Bubble On Conditions, 11:27-11:31, at Depths of 17-30 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B283. Average One-second SEL Spectral Data Measured at the BRG Location during TP#9 RP#2, 11:27-11:31, Depths of 20 meters on October 1, 2011

Figure B284. Average One-second SEL Spectral Data Measured at the WRA Location during TP#9 RP#2, 11:27-11:31, Depths of 30 meters on October 1, 2011

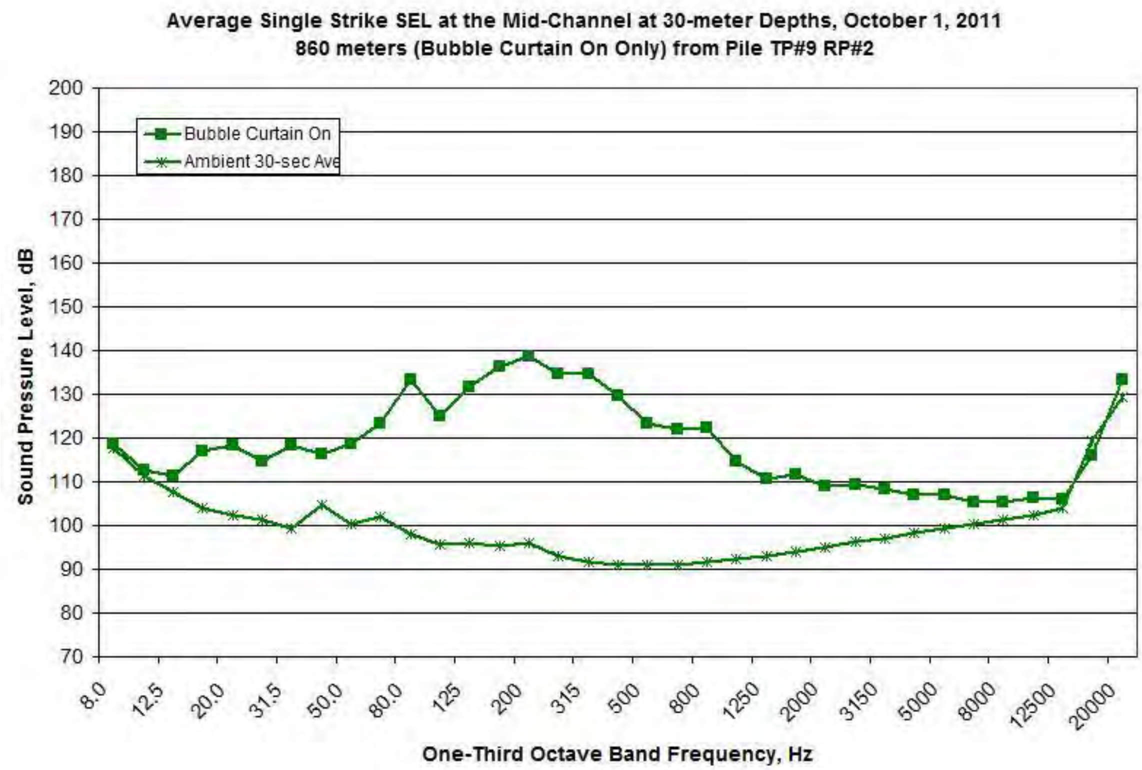

Figure B285. Average One-second SEL Spectral Data Measured at the MID Location during TP#9 RP#2, 11:27-11:31, Depths of 30 meters on October 1, 2011

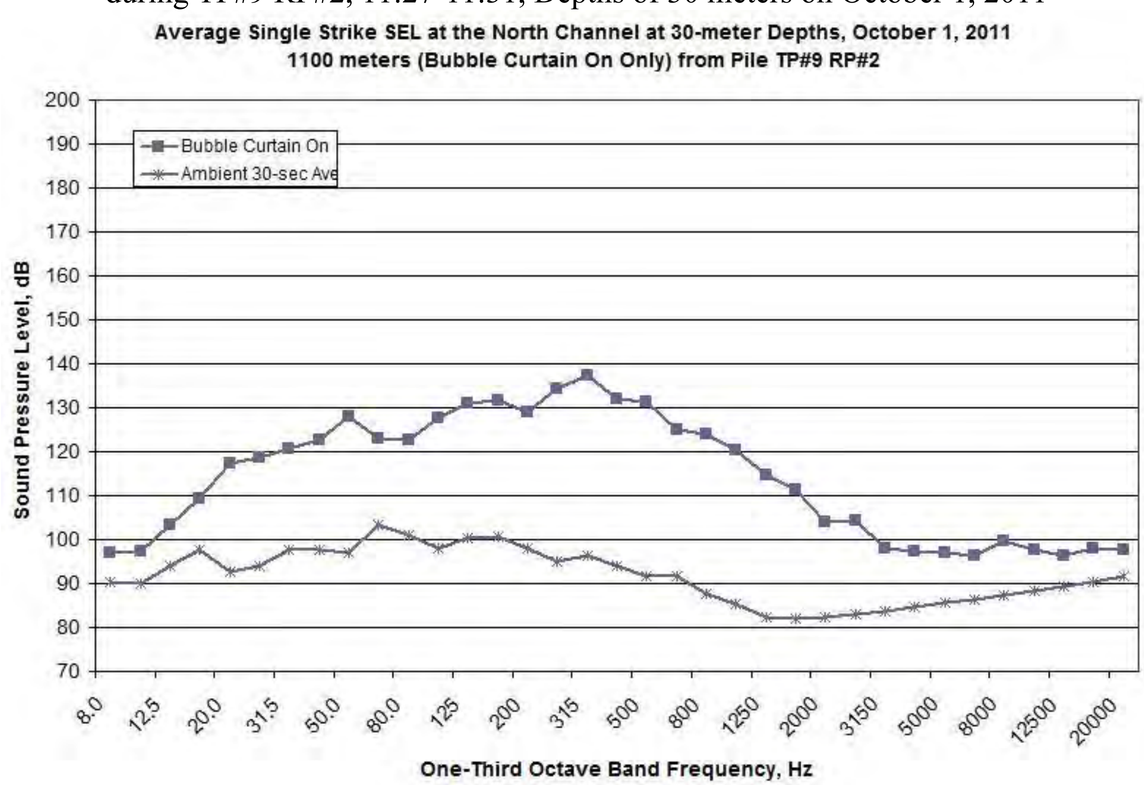

Figure B286. Average One-second SEL Spectral Data Measured at the NO Location during TP#9 RP#2, 11:27-11:31, Depths of 30 meters on October 1, 2011

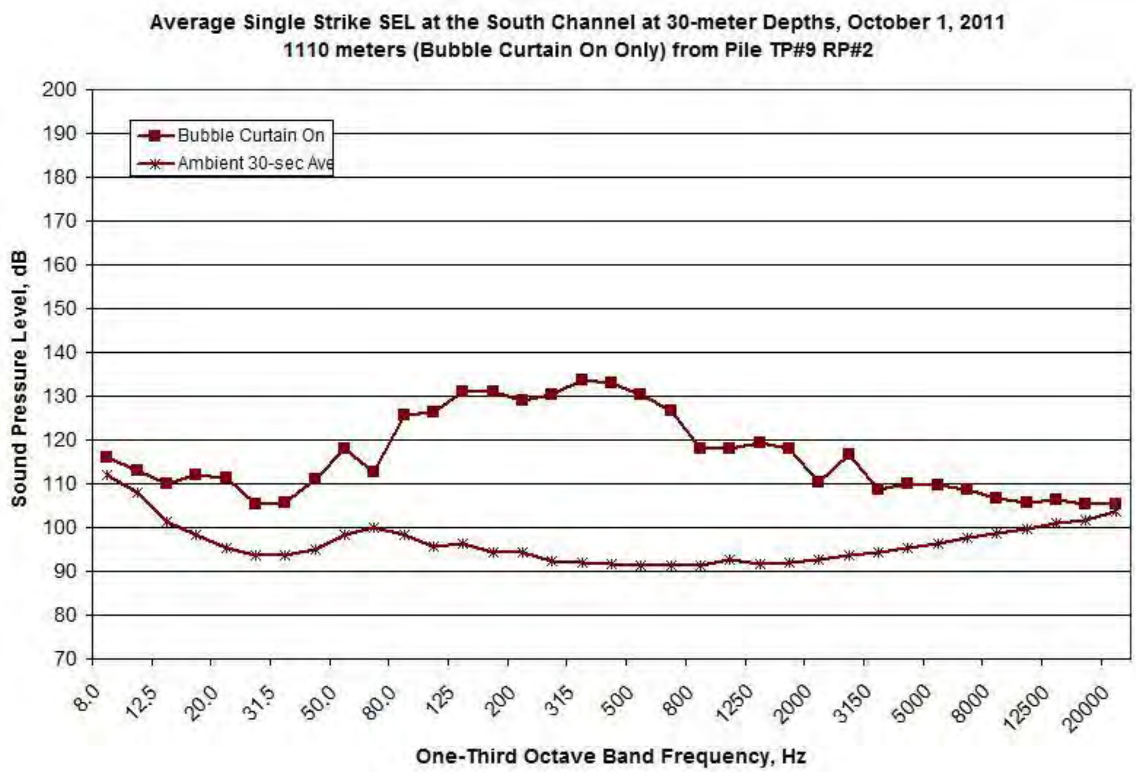

Figure B287. Average One-second SEL Spectral Data Measured at the SO Location during TP#9 RP#2, 11:27-11:31, Depths of 30 meters on October 1, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B288. Average One-second SEL Spectral Data Measured at the RFT Location during TP#9 RP#2, 11:27-11:31, Depths of 17 meters on October 1, 2011

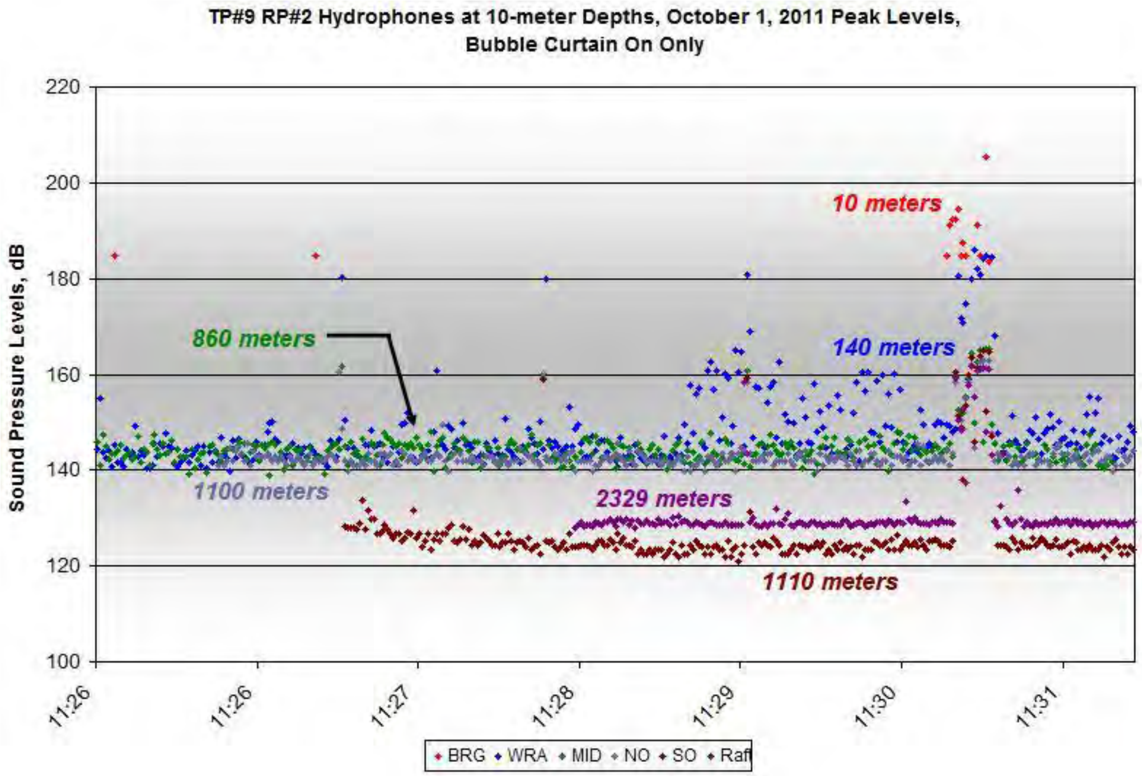

Figure B289. One-second Peak Level Data for TP#9 RP#2 during Bubble On Conditions, 11:27-11:31, at Depths of 10 meters on October 1, 2011

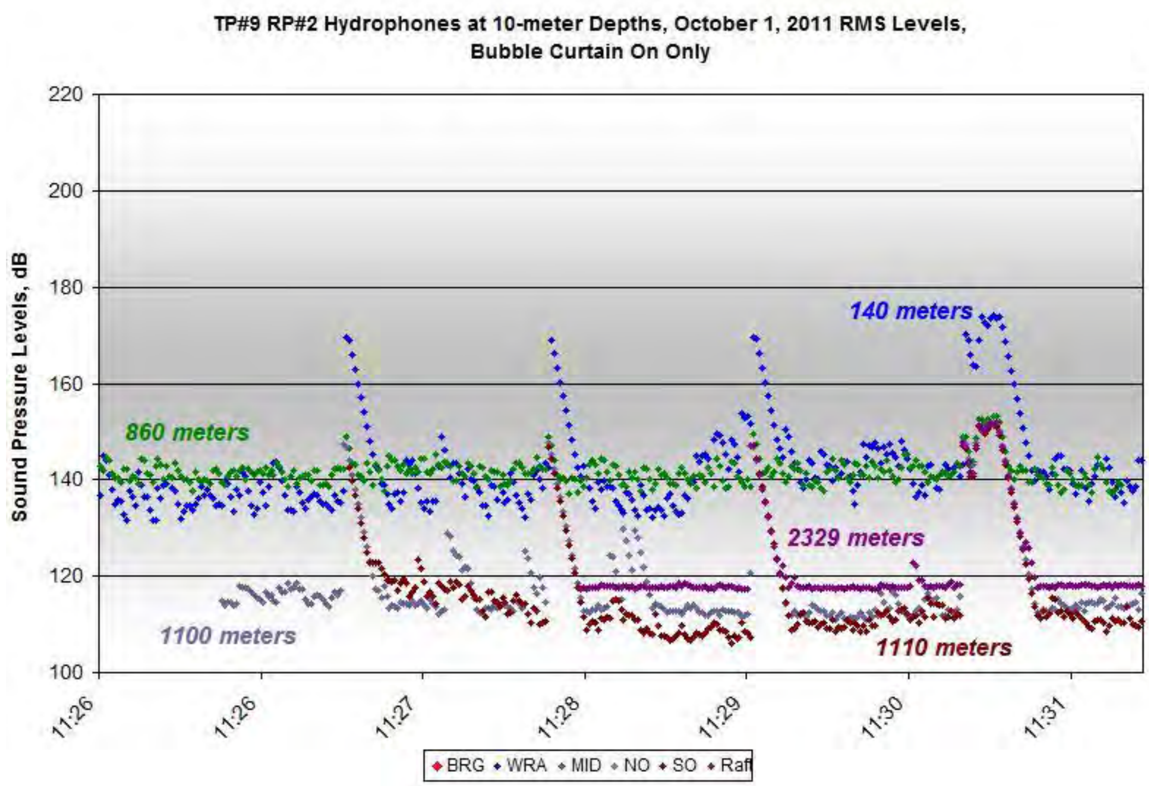

Figure B290. Impulse RMS Data for TP#9 RP#2 during Bubble On Conditions, 11:27-11:31, at Depths of 10 meters on October 1, 2011

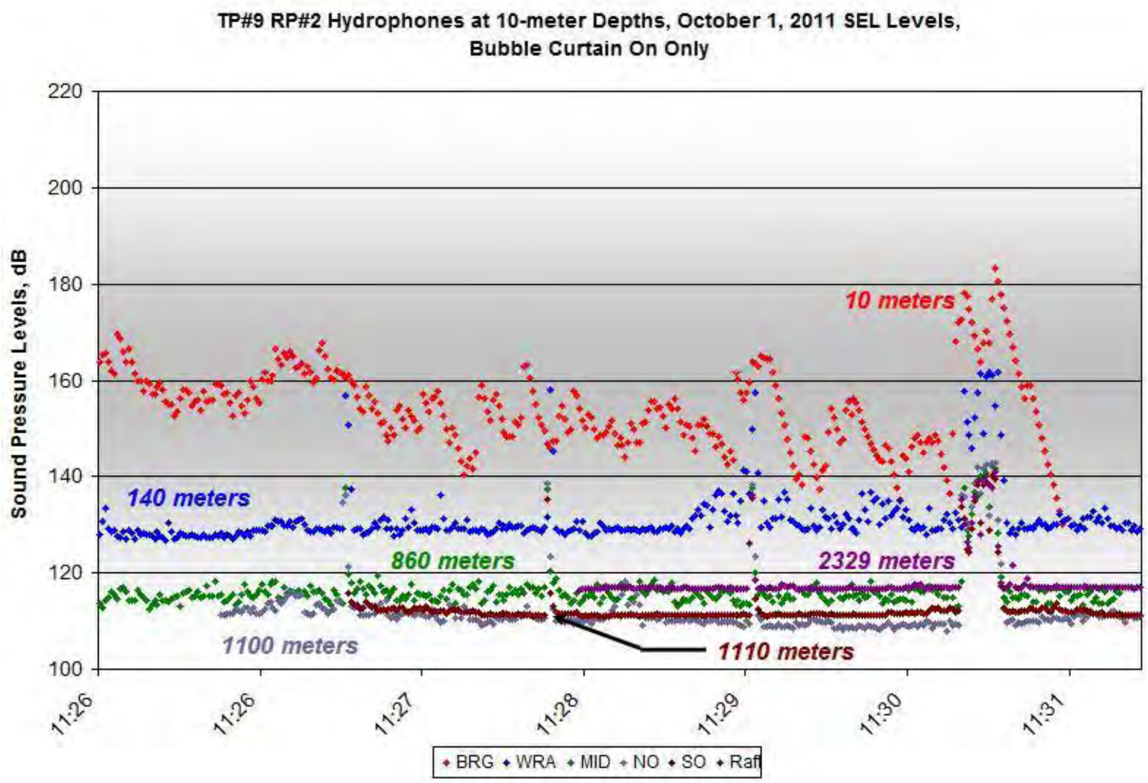

Figure B291. One-second SEL Data for TP#9 RP#2 during Bubble On Conditions, 11:27-11:31, at Depths of 10 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B292. Average One-second SEL Spectral Data Measured at the BRG Location during TP#9 RP#2, 11:27-11:31, Depths of 10 meters on October 1, 2011

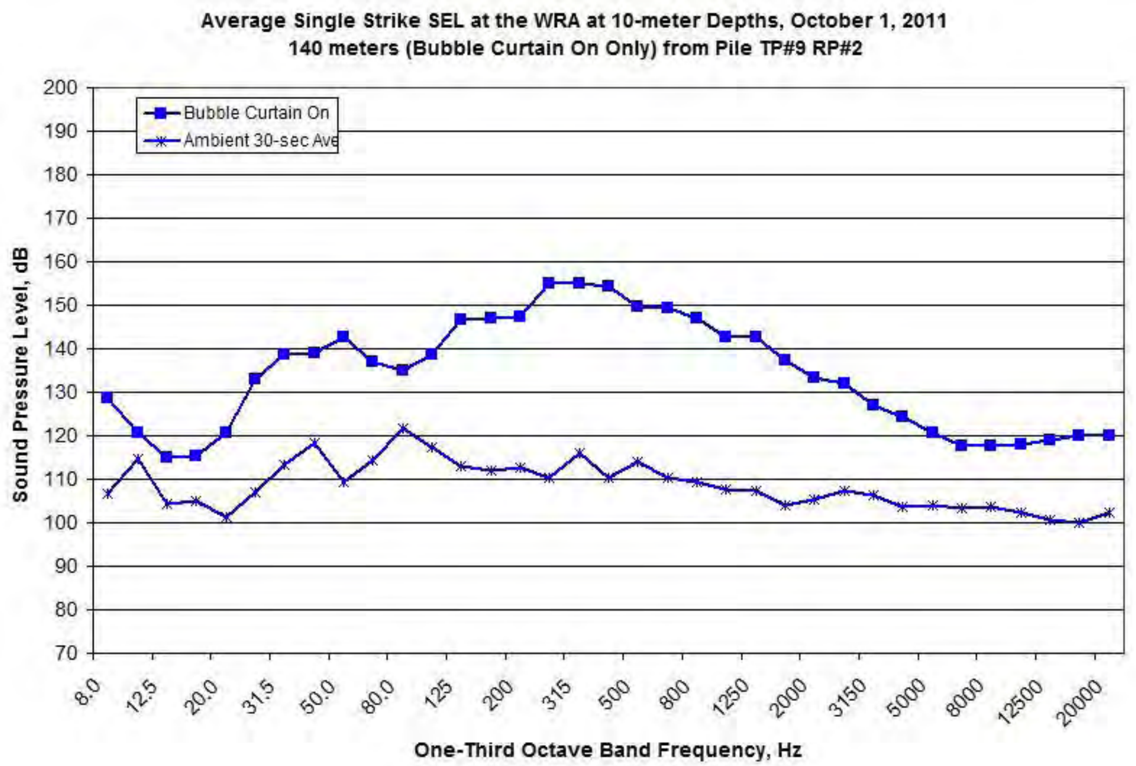

Figure B293. Average One-second SEL Spectral Data Measured at the WRA Location during TP#9 RP#2, 11:27-11:31, Depths of 10 meters on October 1, 2011

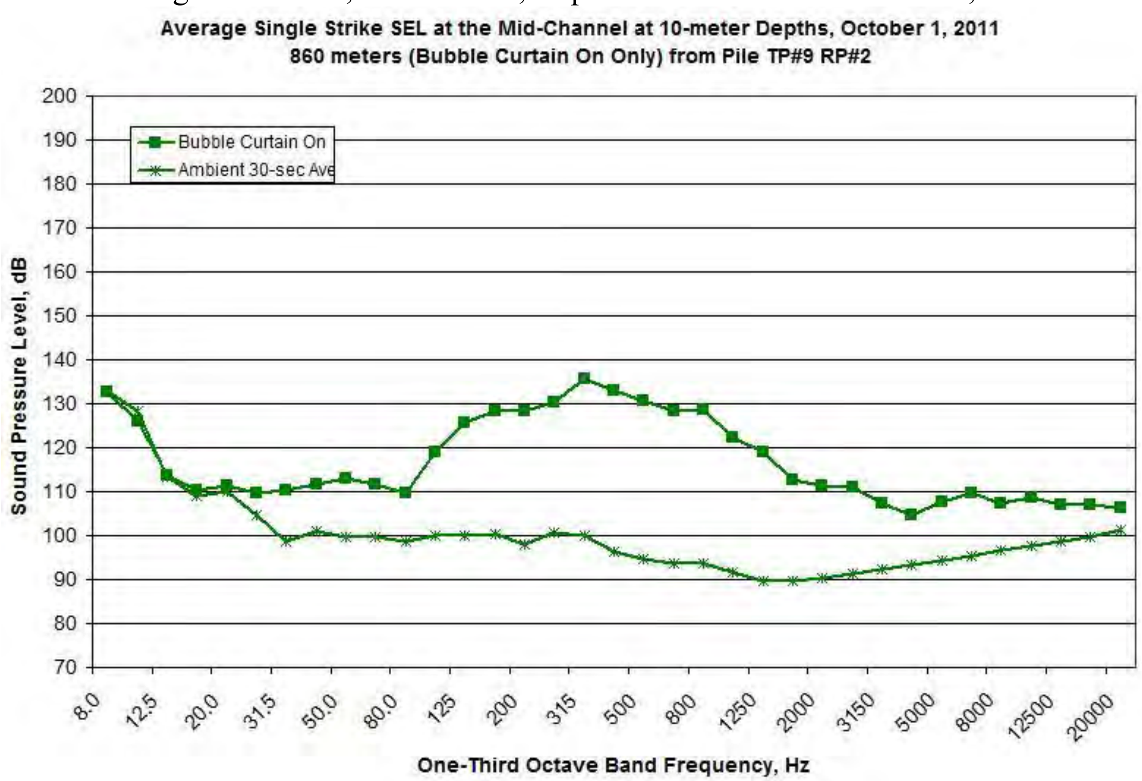

Figure B294. Average One-second SEL Spectral Data Measured at the MID Location during TP#9 RP#2, 11:27-11:31, Depths of 10 meters on October 1, 2011

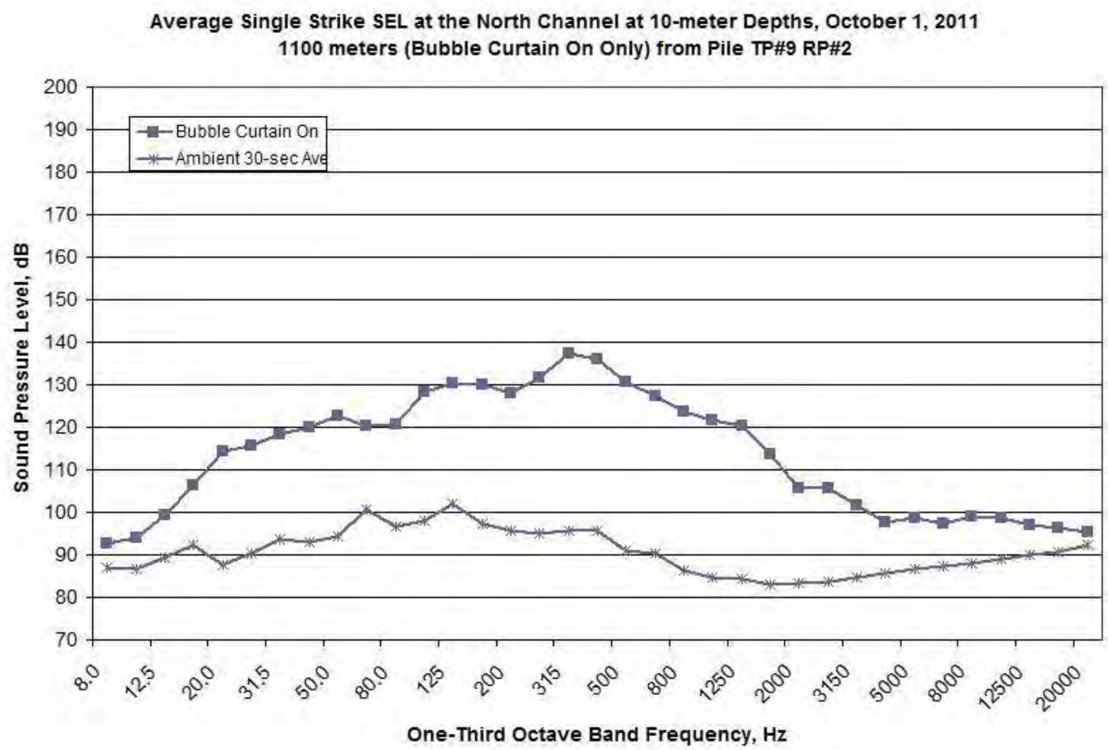

Figure B295. Average One-second SEL Spectral Data Measured at the NO Location during TP#9 RP#2, 11:27-11:31, Depths of 10 meters on October 1, 2011

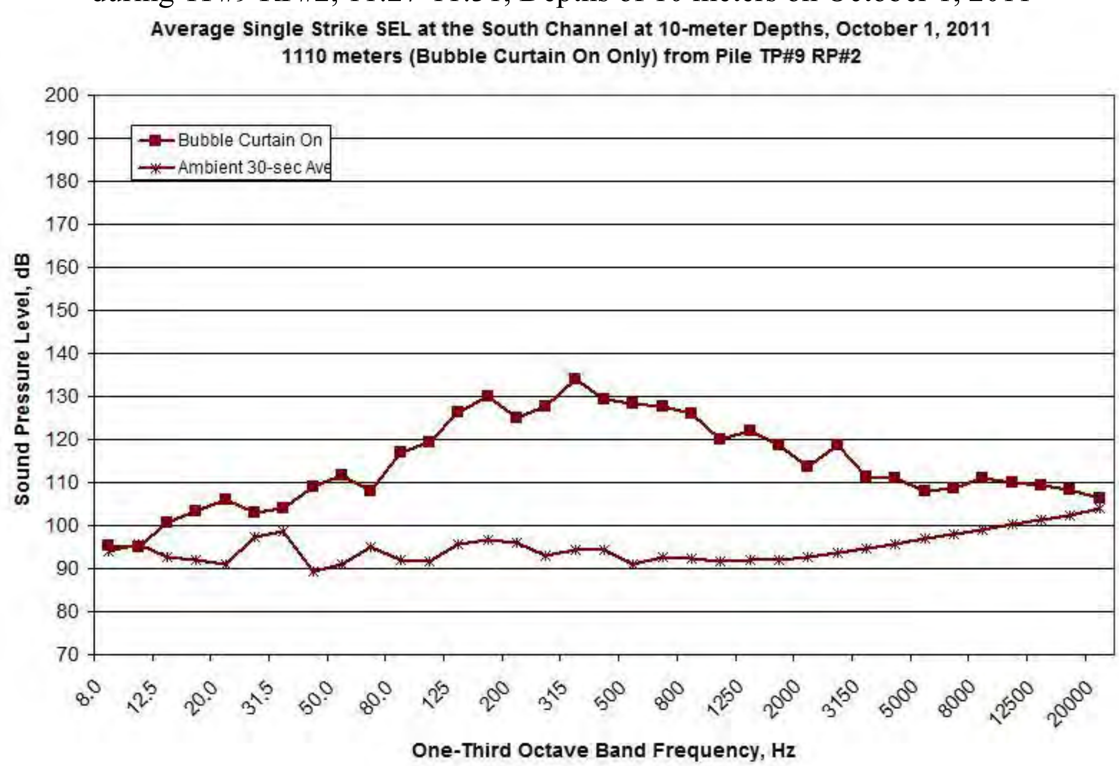

Figure B296. Average One-second SEL Spectral Data Measured at the SO Location during TP#9 RP#2, 11:27-11:31, Depths of 10 meters on October 1, 2011

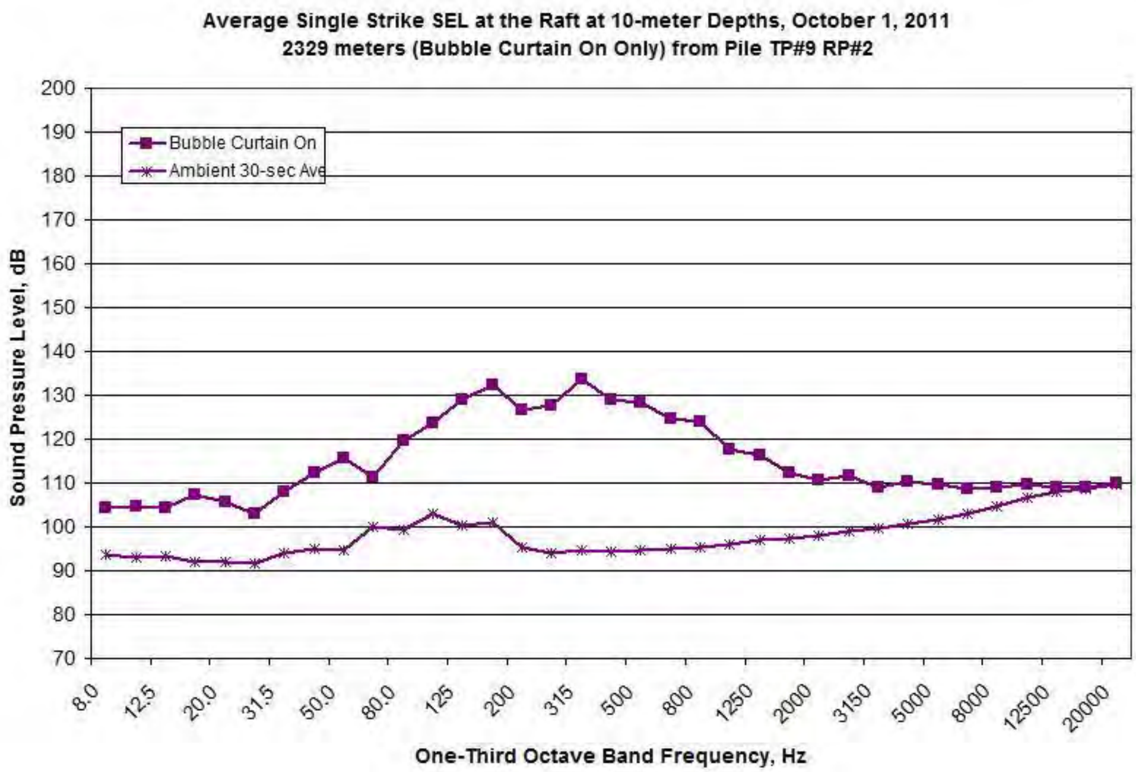

Figure B297. Average One-second SEL Spectral Data Measured at the RFT Location during TP#9 RP#2, 11:27-11:31, Depths of 10 meters on October 1, 2011

TP#9 RP#1

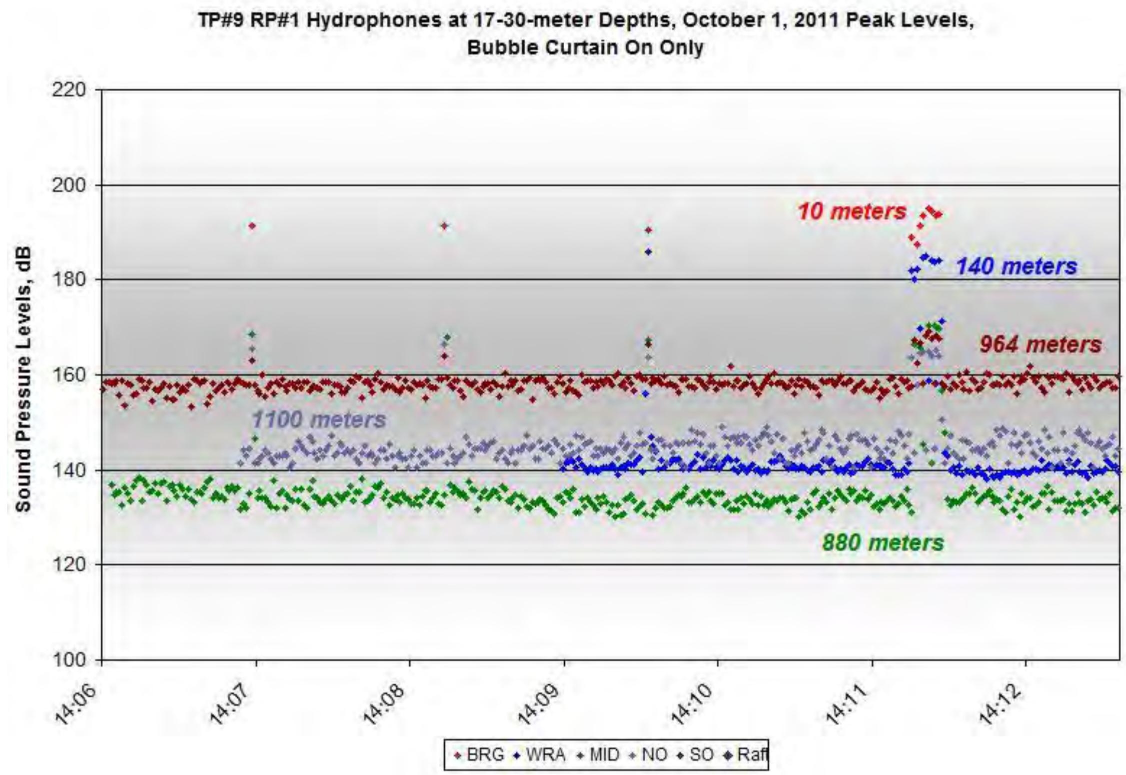

Figure B298. One-second Peak Level Data for TP#9 RP#1 during Bubble On Conditions, 14:07-14:12, at Depths of 17-30 meters on October 1, 2011

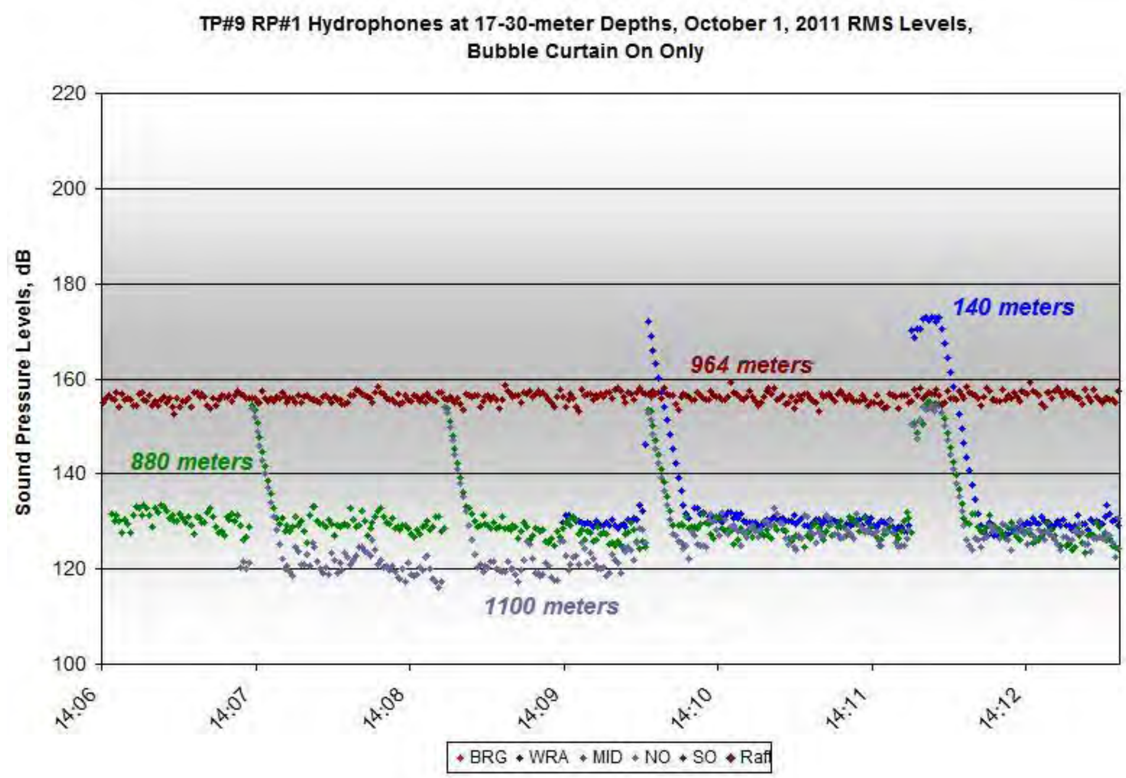

Figure B299. Impulse RMS Data for TP#9 RP#1 during Bubble On Conditions, 14:07-14:12, at Depths of 17-30 meters on October 1, 2011

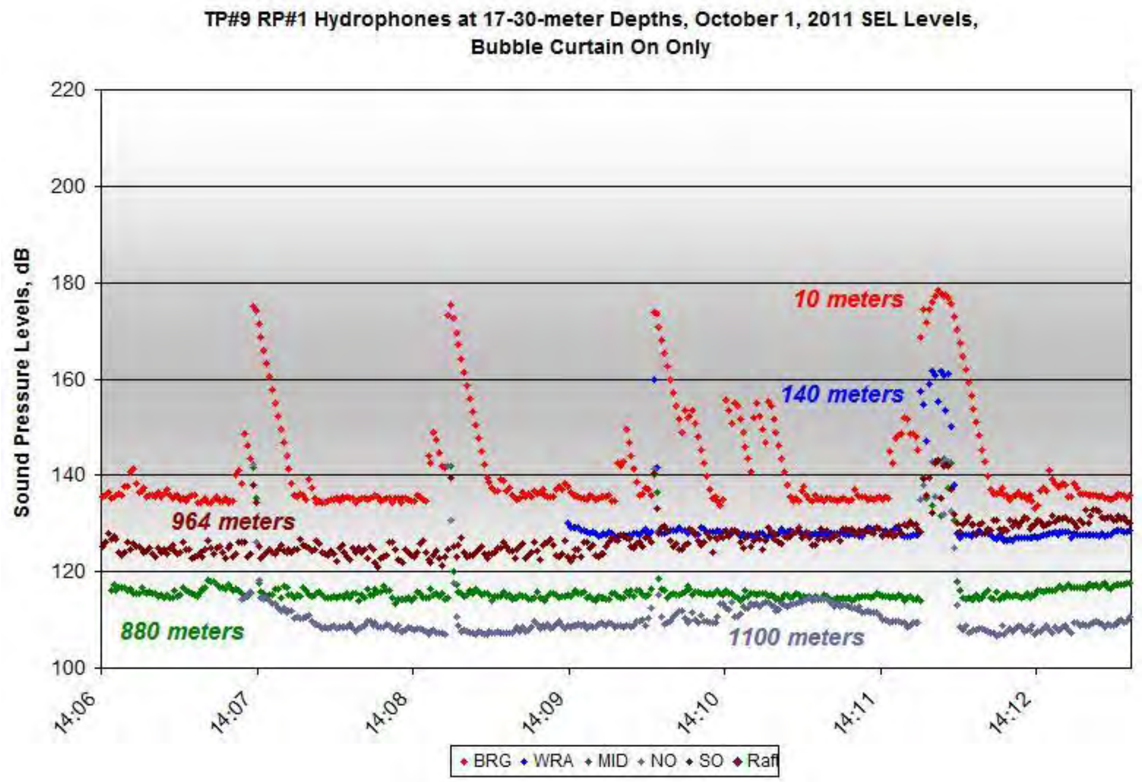

Figure B300. One-second SEL Data for TP#9 RP#1 during Bubble On Conditions, 14:07-14:12, at Depths of 17-30 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B301. Average One-second SEL Spectral Data Measured at the BRG Location during TP#9 RP#1, 14:07-14:12, Depths of 20 meters on October 1, 2011

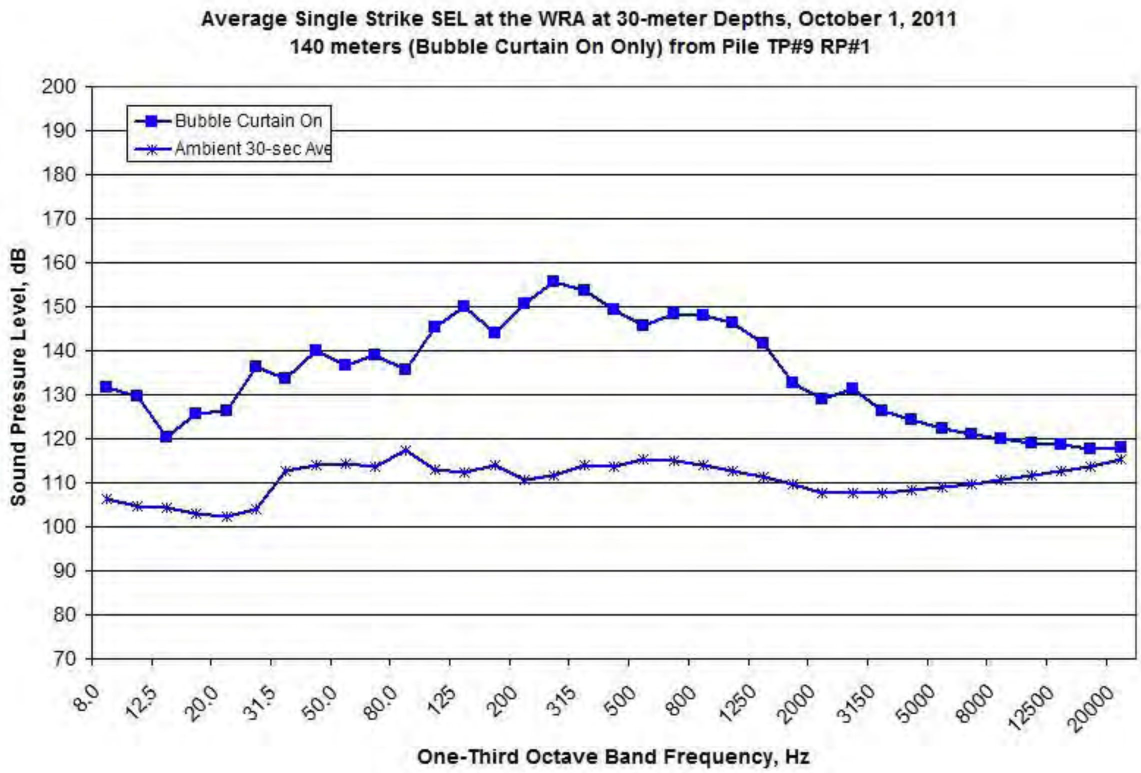

Figure B302. Average One-second SEL Spectral Data Measured at the WRA Location during TP#9 RP#1, 14:07-14:12, Depths of 30 meters on October 1, 2011

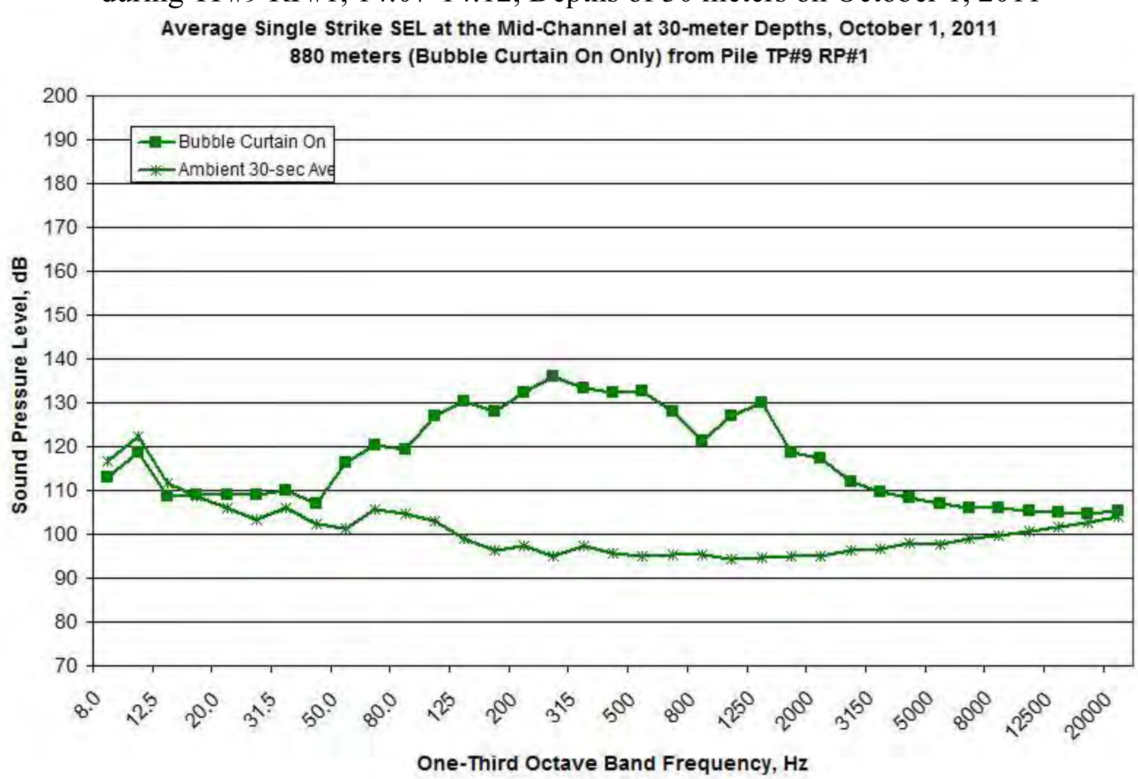

Figure B303. Average One-second SEL Spectral Data Measured at the MID Location during TP#9 RP#1, 14:07-14:12, Depths of 30 meters on October 1, 2011

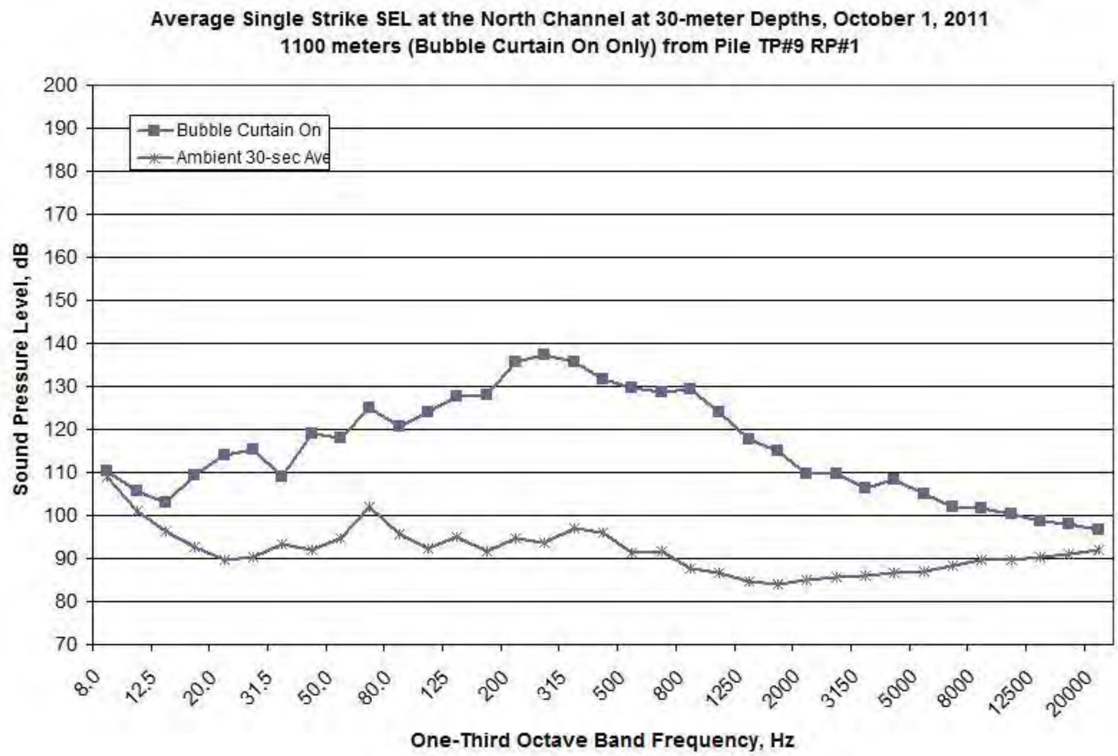

Figure B304. Average One-second SEL Spectral Data Measured at the NO Location during TP#9 RP#1, 14:07-14:12, Depths of 30 meters on October 1, 2011

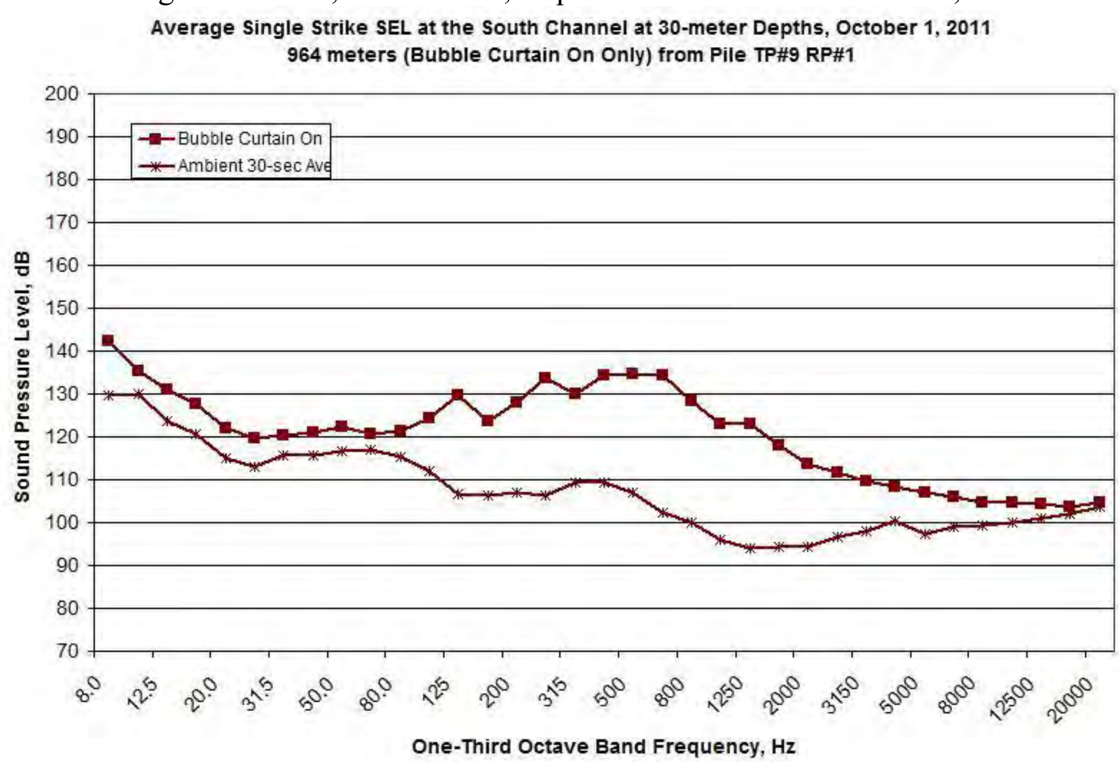

Figure B305. Average One-second SEL Spectral Data Measured at the SO Location during TP#9 RP#1, 14:07-14:12, Depths of 30 meters on October 1, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B306. Average One-second SEL Spectral Data Measured at the RFT Location during TP#9 RP#1, 14:07-14:12, Depths of 17 meters on October 1, 2011

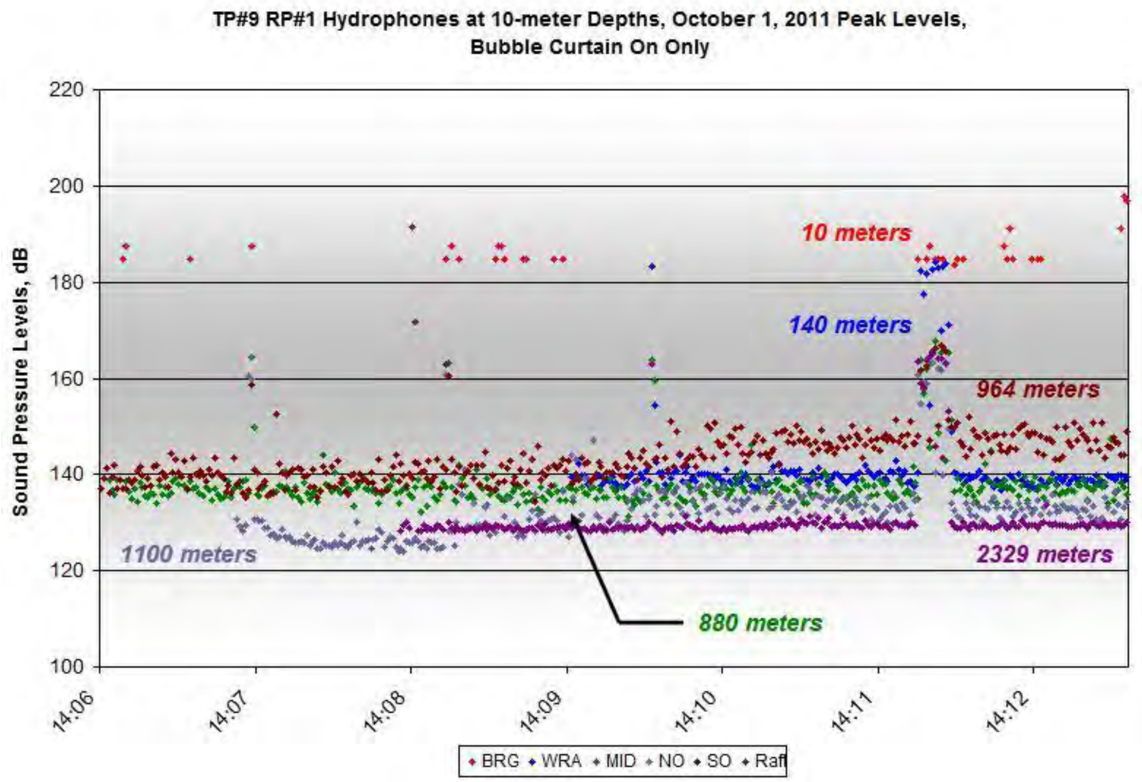

Figure B307. One-second Peak Level Data for TP#9 RP#1 during Bubble On Conditions, 14:07-14:12, at Depths of 10 meters on October 1, 2011

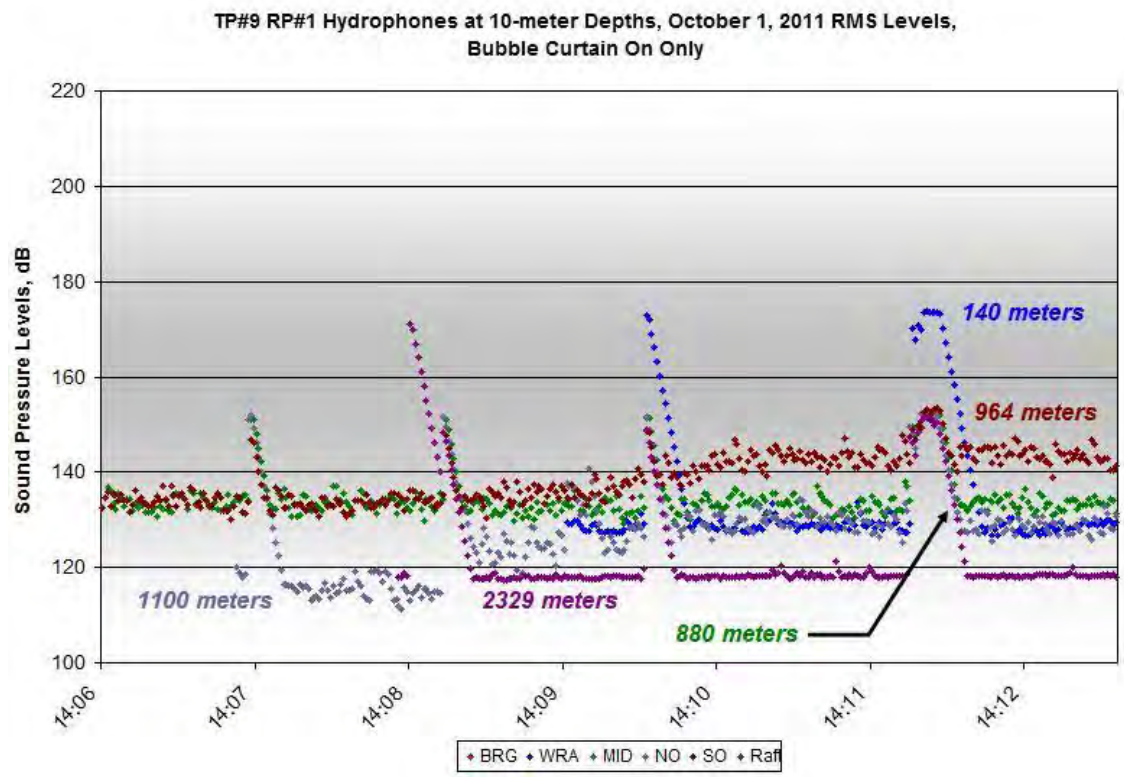

Figure B308. Impulse RMS Data for TP#9 RP#1 during Bubble On Conditions, 14:07-14:12, at Depths of 10 meters on October 1, 2011

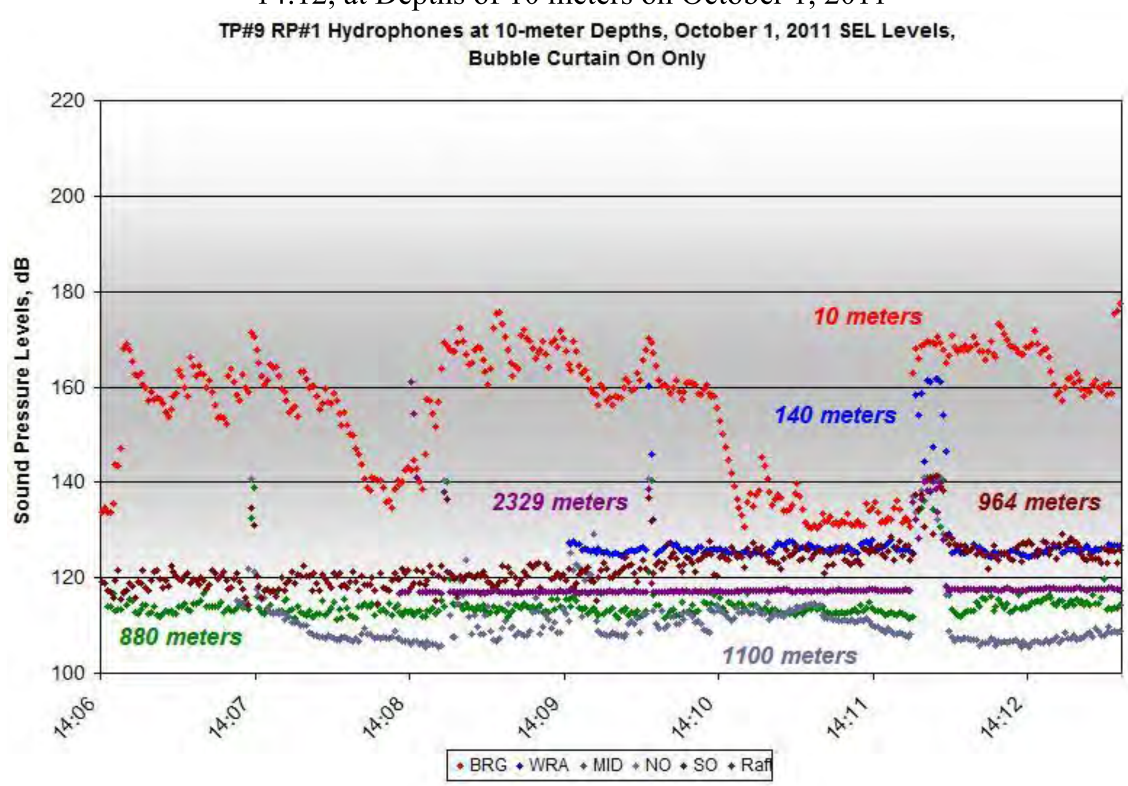

Figure B309. One-second SEL Data for TP#9 RP#1 during Bubble On Conditions, 14:07-14:12, at Depths of 10 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B310. Average One-second SEL Spectral Data Measured at the BRG Location during TP#9 RP#1, 14:07-14:12, Depths of 10 meters on October 1, 2011

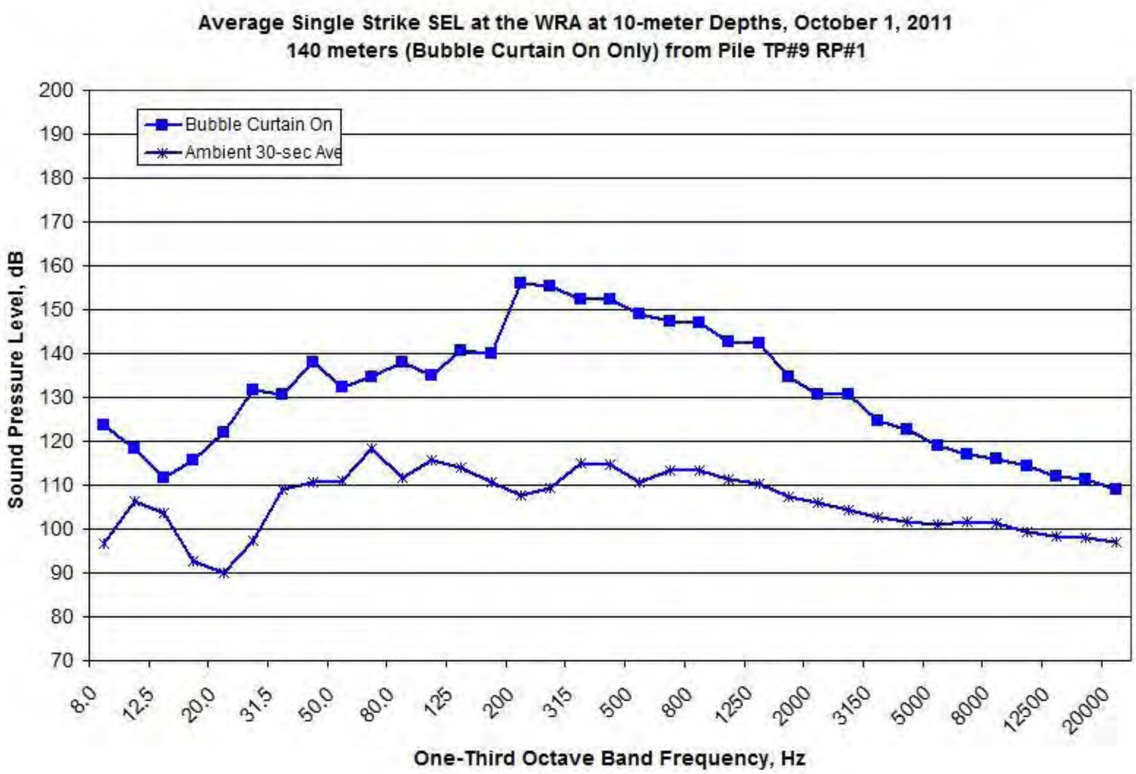

Figure B311. Average One-second SEL Spectral Data Measured at the WRA Location during TP#9 RP#1, 14:07-14:12, Depths of 10 meters on October 1, 2011

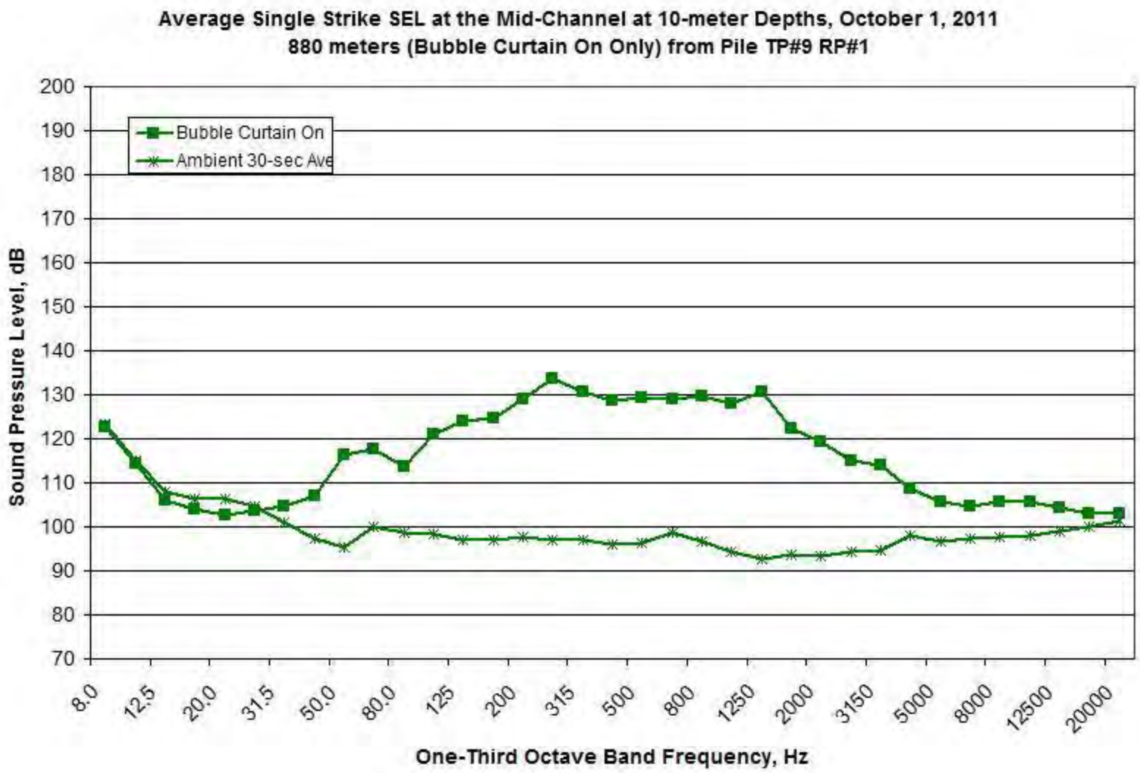

Figure B312. Average One-second SEL Spectral Data Measured at the MID Location during TP#9 RP#1, 14:07-14:12, Depths of 10 meters on October 1, 2011

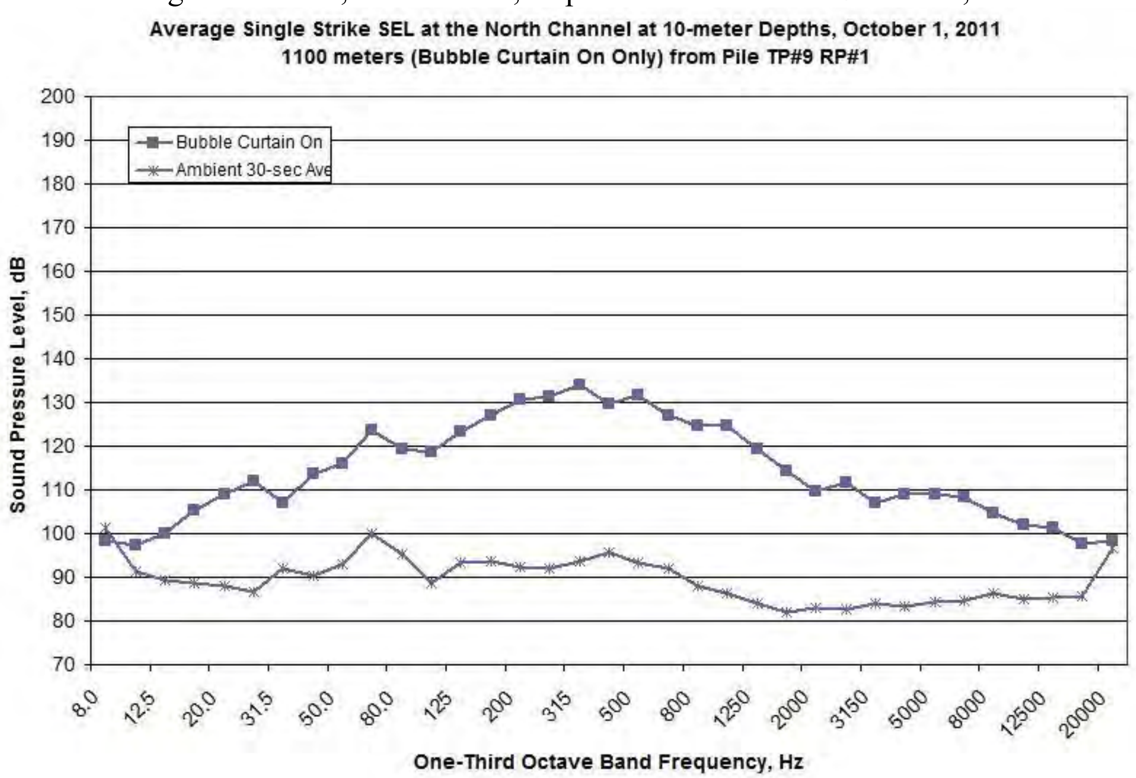

Figure B313. Average One-second SEL Spectral Data Measured at the NO Location during TP#9 RP#1, 14:07-14:12, Depths of 10 meters on October 1, 2011

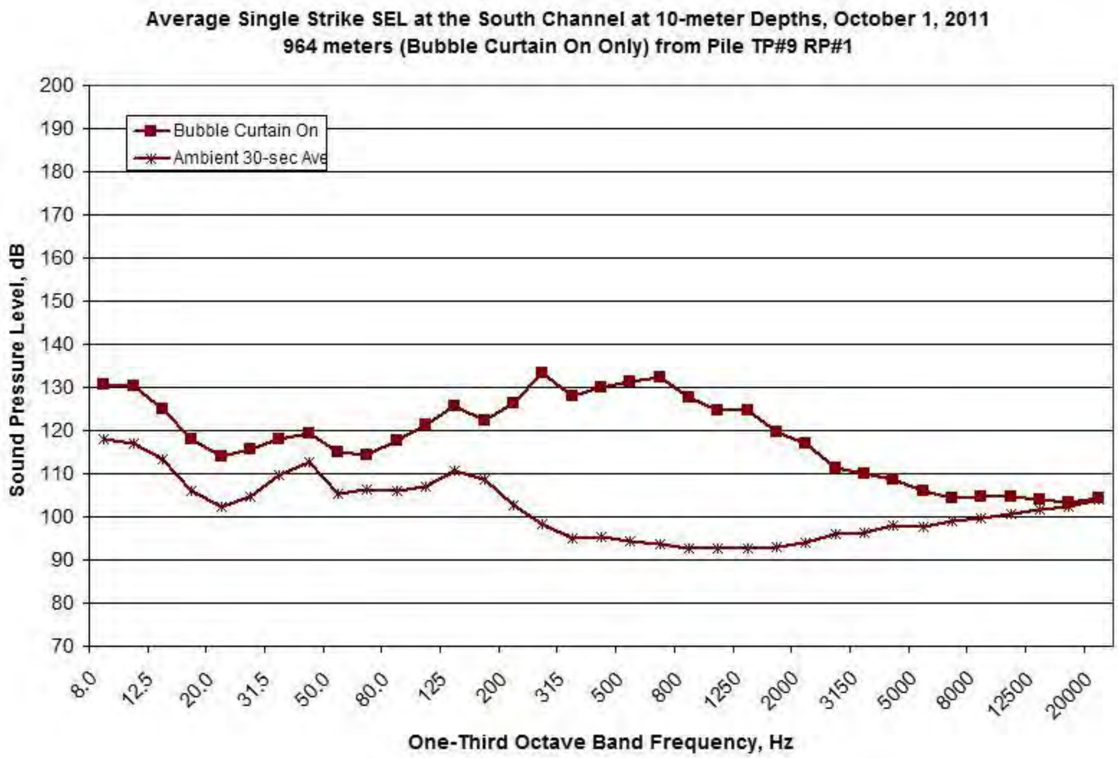

Figure B314. Average One-second SEL Spectral Data Measured at the SO Location during TP#9 RP#1, 14:07-14:12, Depths of 10 meters on October 1, 2011

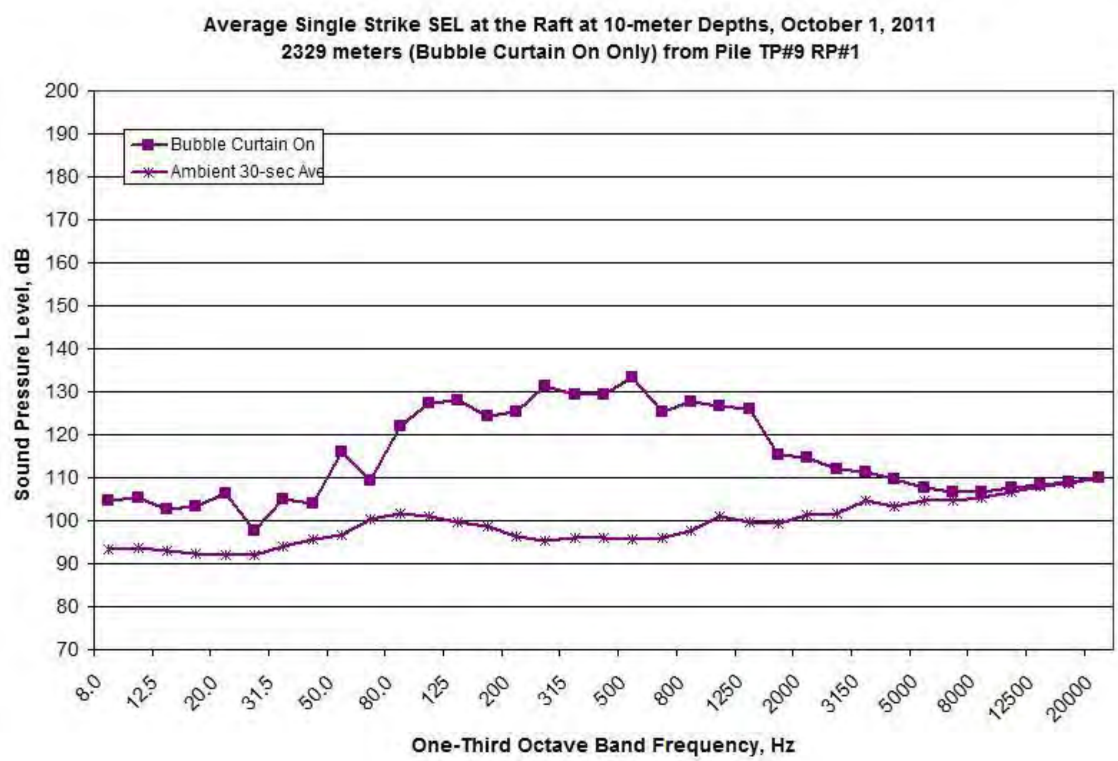

Figure B315. Average One-second SEL Spectral Data Measured at the RFT Location during TP#9 RP#1, 14:07-14:12, Depths of 10 meters on October 1, 2011

TP#9

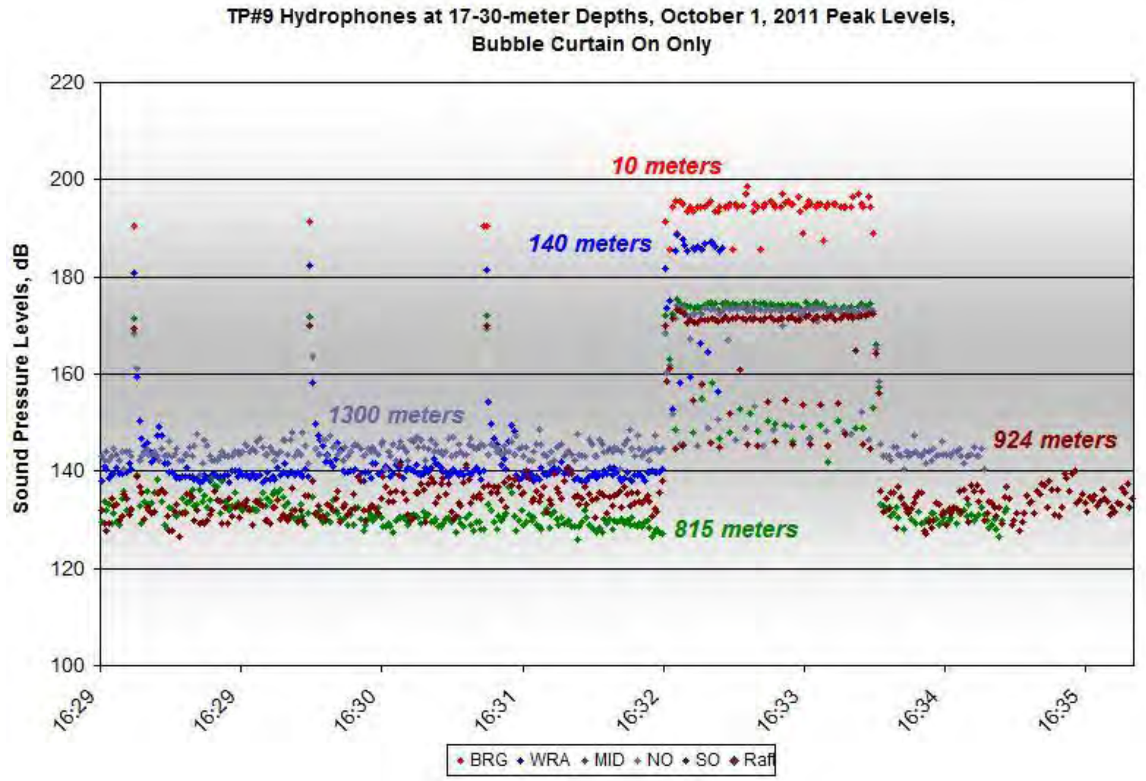

Figure B316. One-second Peak Level Data for TP#9 during Bubble On Conditions, 16:29-16:34, at Depths of 17-30 meters on October 1, 2011

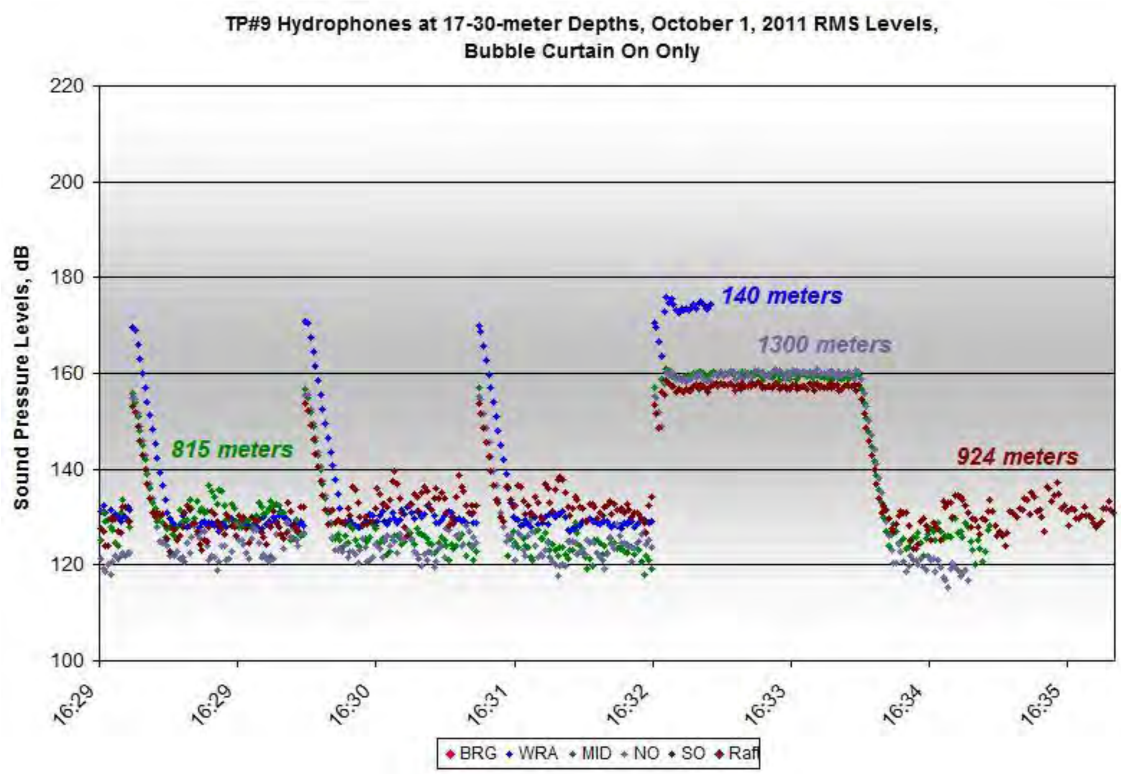

Figure B317. Impulse RMS Data for TP#9 during Bubble On Conditions, 16:29-16:34, at Depths of 17-30 meters on October 1, 2011

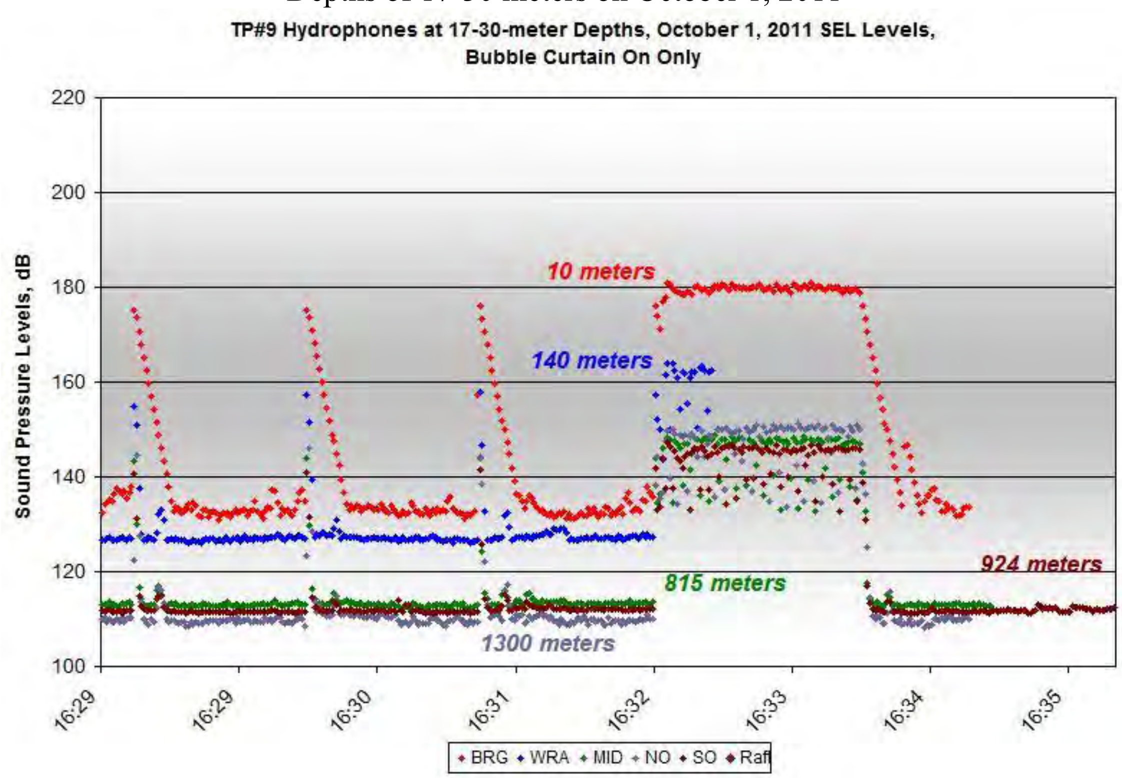

Figure B318. One-second SEL Data for TP#9 during Bubble On Conditions, 16:29-16:34, at Depths of 17-30 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B319. Average One-second SEL Spectral Data Measured at the BRG Location during TP#9, 16:29-16:34, Depths of 20 meters on October 1, 2011

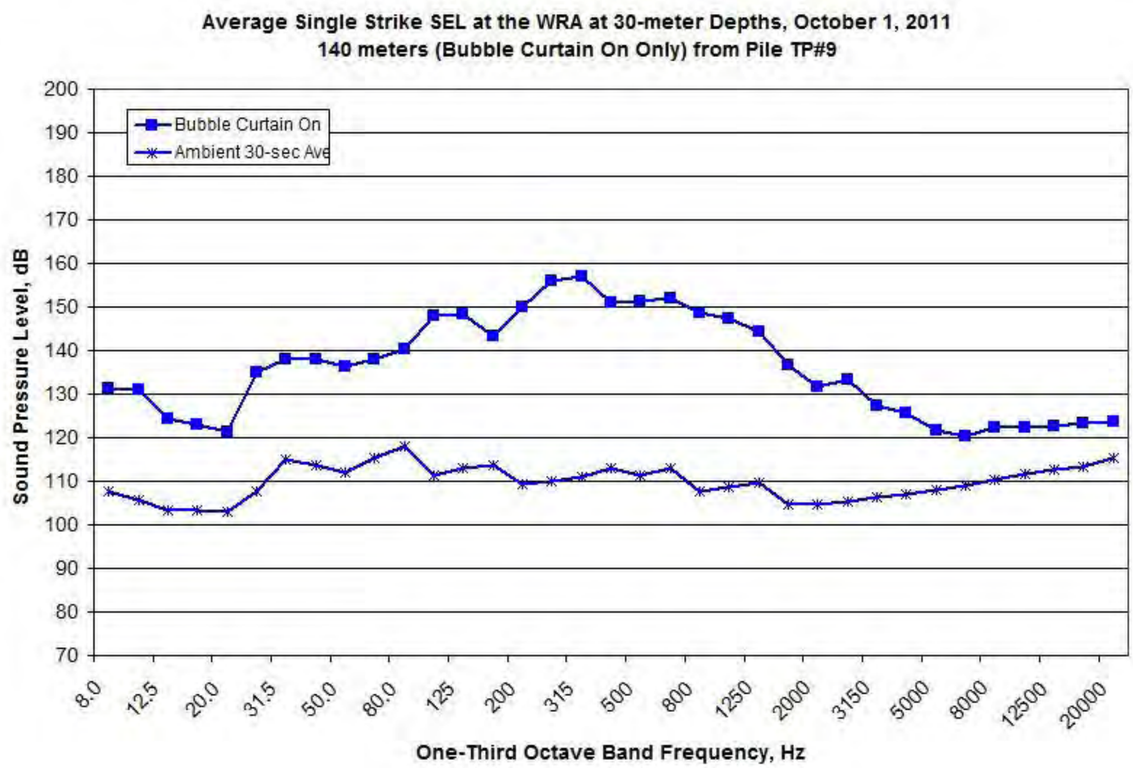

Figure B320. Average One-second SEL Spectral Data Measured at the WRA Location during TP#9, 16:29-16:34, Depths of 30 meters on October 1, 2011

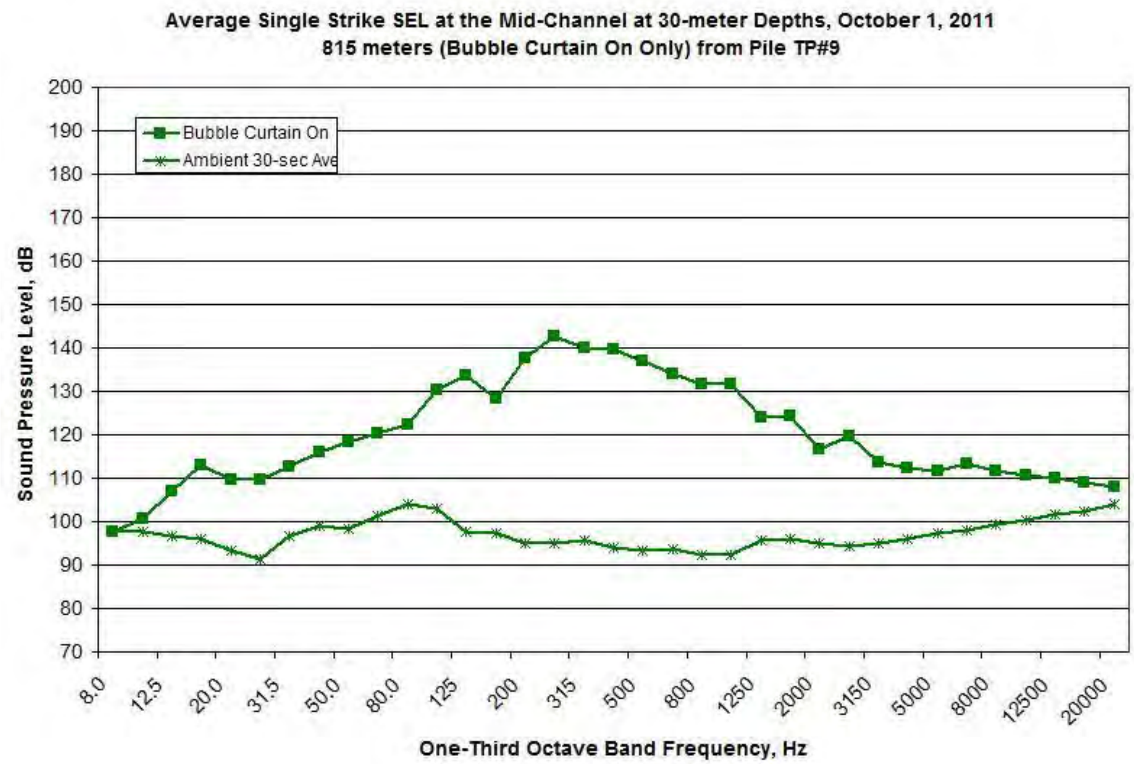

Figure B321. Average One-second SEL Spectral Data Measured at the MID Location during TP#9, 16:29-16:34, Depths of 30 meters on October 1, 2011

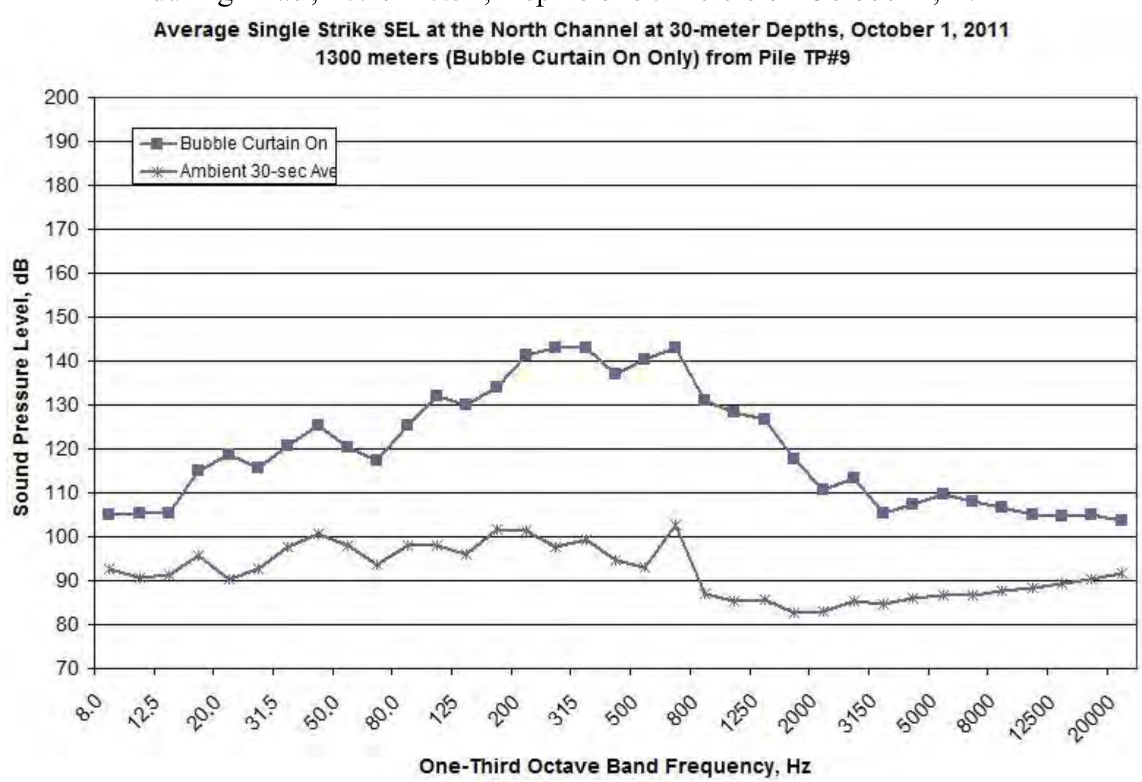

Figure B322. Average One-second SEL Spectral Data Measured at the NO Location during TP#9, 16:29-16:34, Depths of 30 meters on October 1, 2011

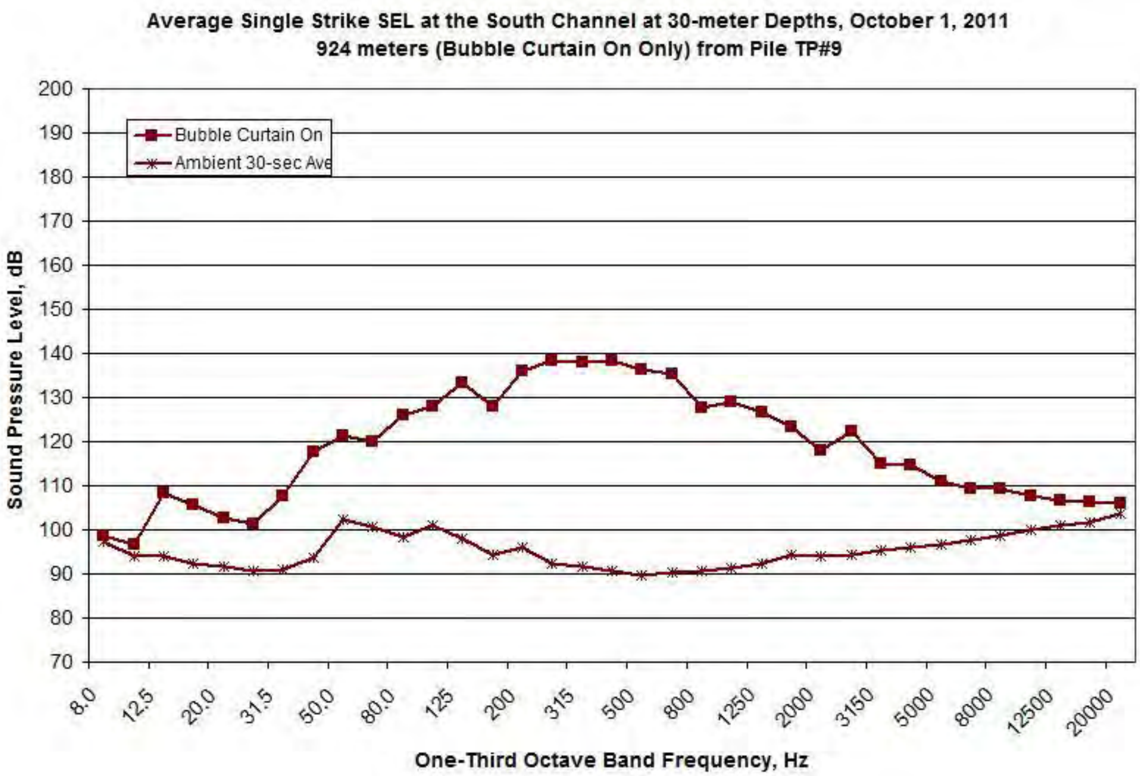

Figure B323. Average One-second SEL Spectral Data Measured at the SO Location during TP#9, 16:29-16:34, Depths of 30 meters on October 1, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B324. Average One-second SEL Spectral Data Measured at the RFT Location during TP#9, 16:29-16:34, Depths of 55 meters on October 1, 2011

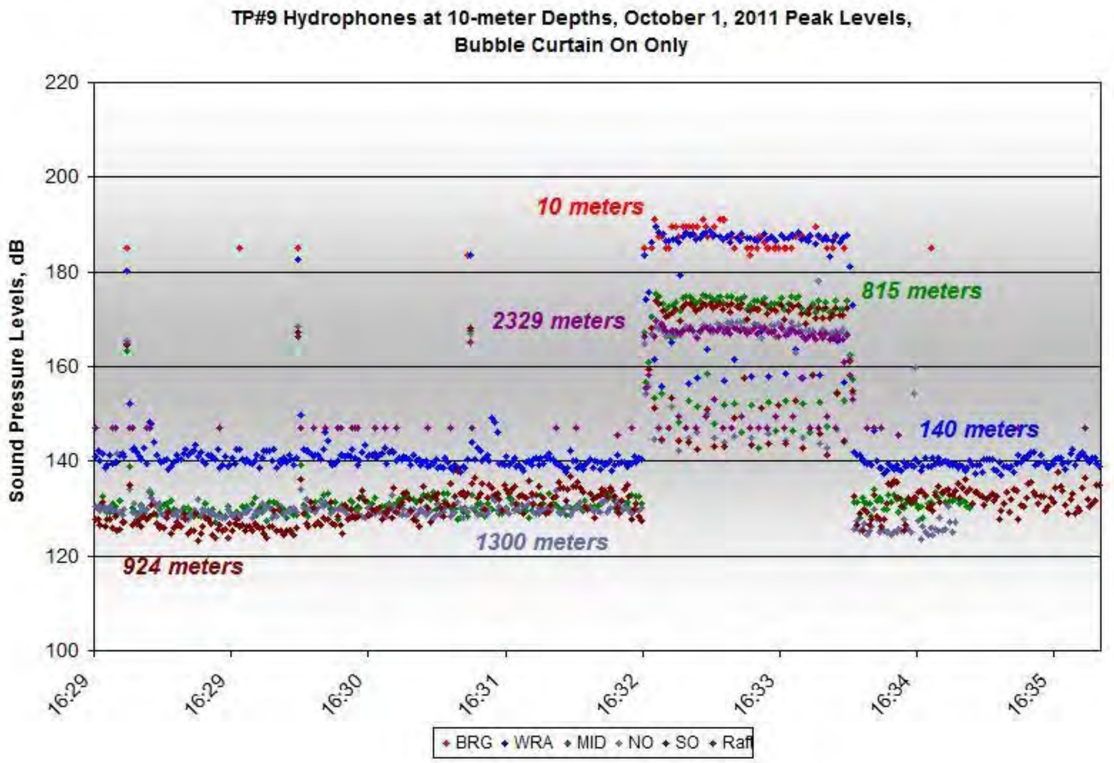

Figure B325. One-second Peak Level Data for TP#9 during Bubble On Conditions, 16:29-16:34, at Depths of 10 meters on October 1, 2011

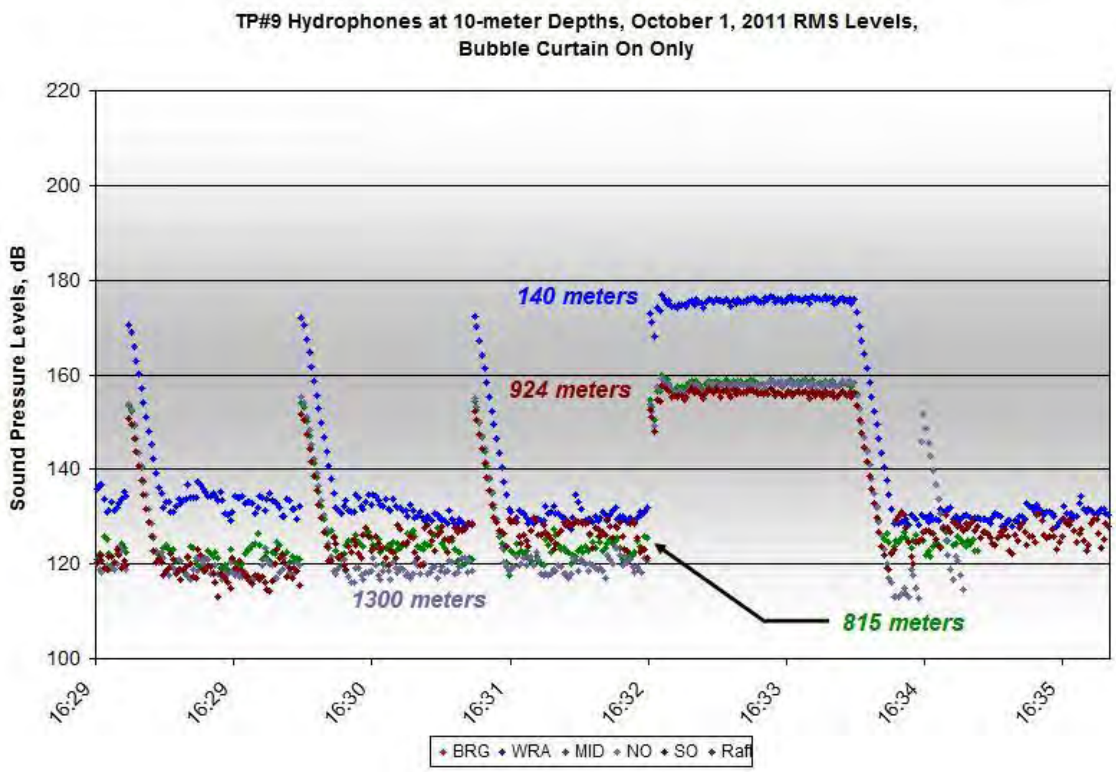

Figure B326. Impulse RMS Data for TP#9 during Bubble On Conditions, 16:29-16:34, at Depths of 10 meters on October 1, 2011

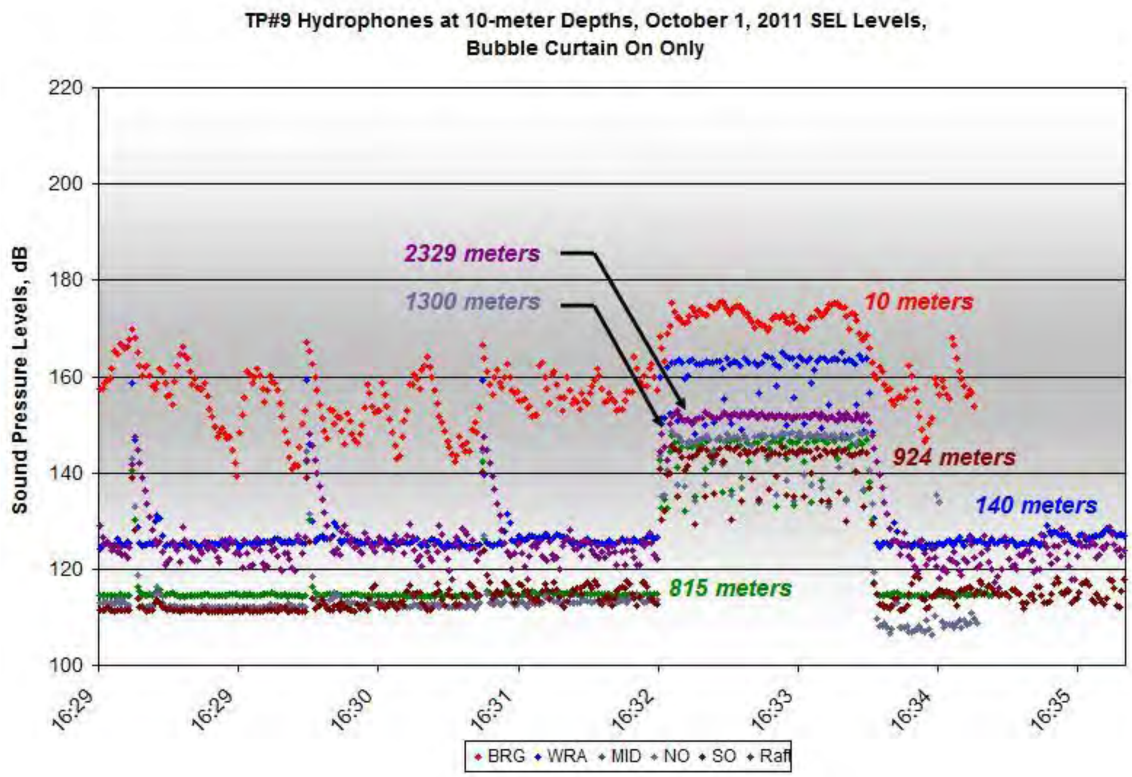

Figure B327. One-second SEL Data for TP#9 during Bubble On Conditions, 16:29-16:34, at Depths of 10 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B328. Average One-second SEL Spectral Data Measured at the BRG Location during TP#9, 16:29-16:34, Depths of 10 meters on October 1, 2011

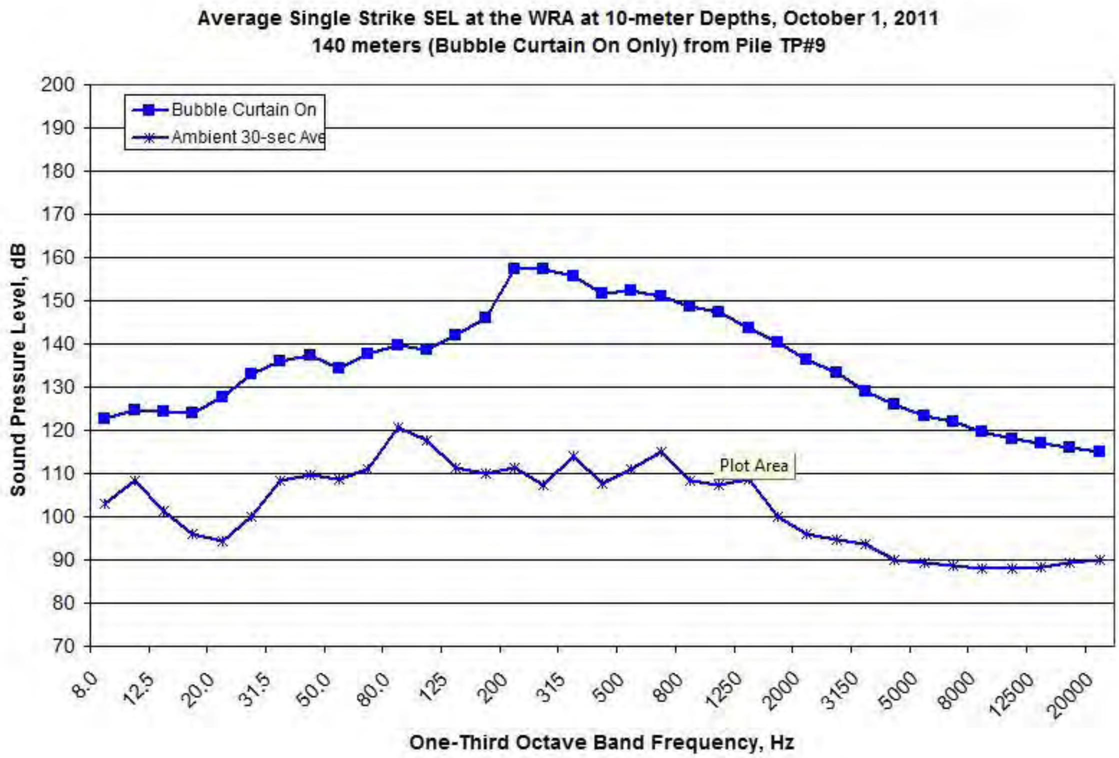

Figure B329. Average One-second SEL Spectral Data Measured at the WRA Location during TP#9, 16:29-16:34, Depths of 10 meters on October 1, 2011

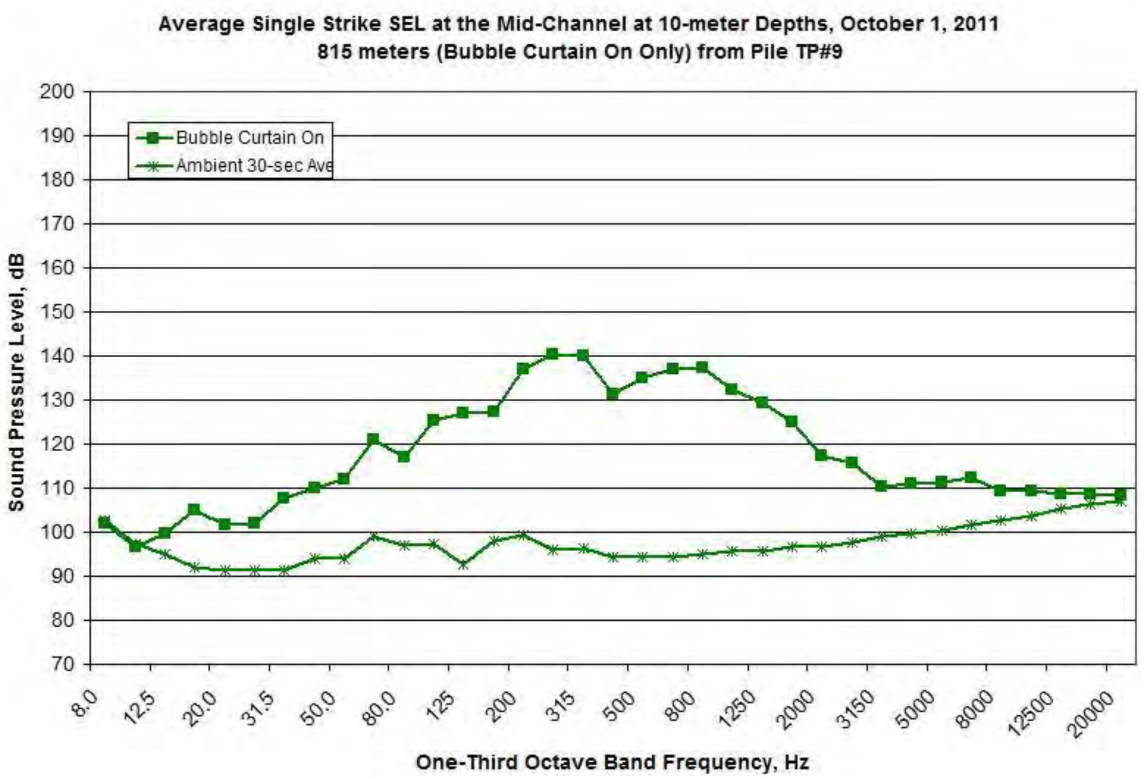

Figure B330. Average One-second SEL Spectral Data Measured at the MID Location during TP#9, 16:29-16:34, Depths of 10 meters on October 1, 2011

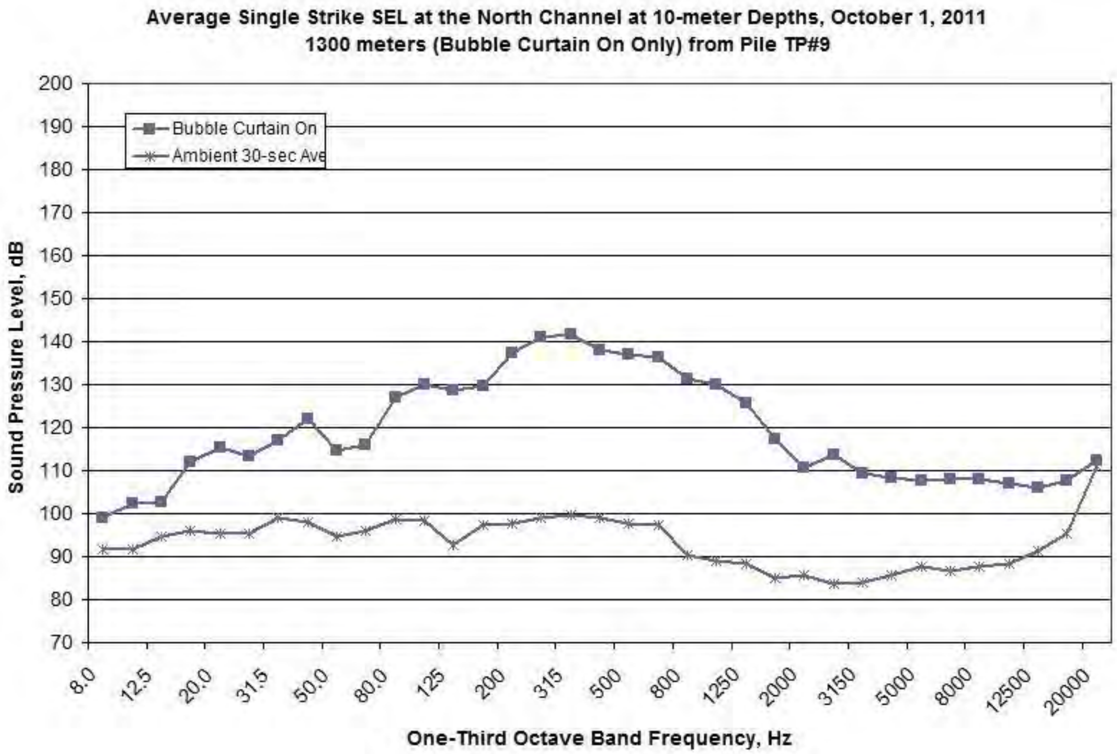

Figure B331. Average One-second SEL Spectral Data Measured at the NO Location during TP#9, 16:29-16:34, Depths of 10 meters on October 1, 2011

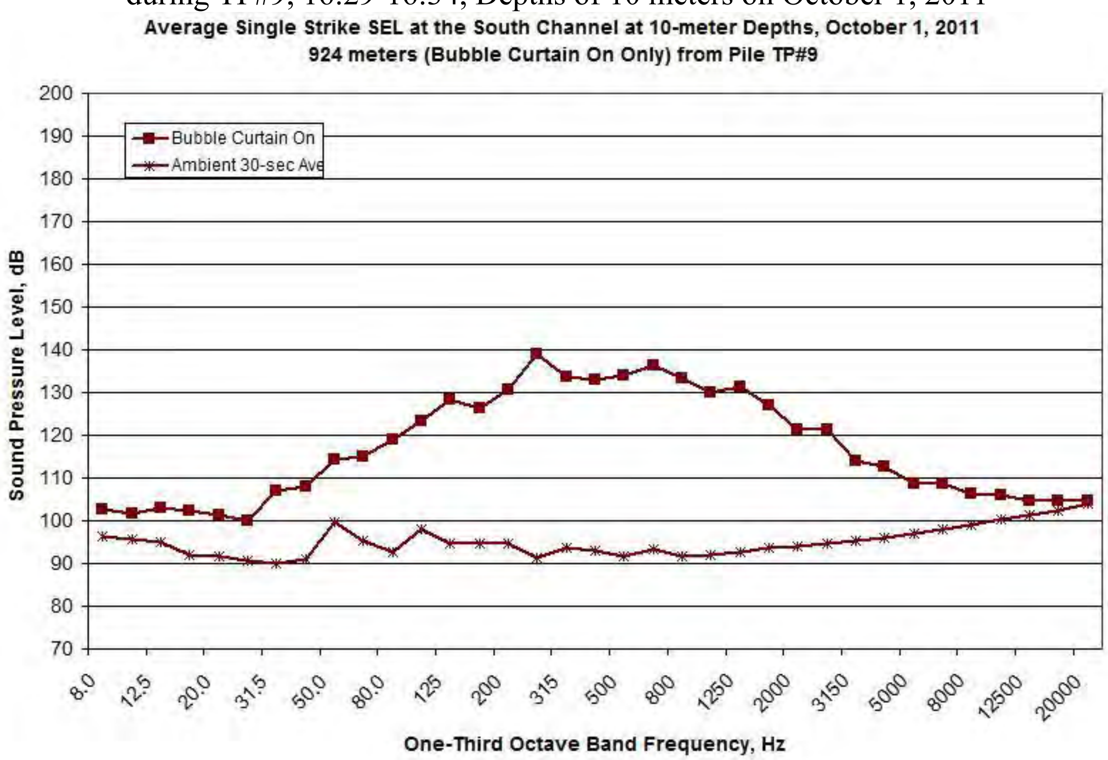

Figure B332. Average One-second SEL Spectral Data Measured at the SO Location during TP#9, 16:29-16:34, Depths of 10 meters on October 1, 2011

NO SPECTRA DATA AVAILABLE

Figure B333. Average One-second SEL Spectral Data Measured at the RFT Location during TP#9, 16:29-16:34, Depths of 10 meters on October 1, 2011

10/3/2011 – TP#6

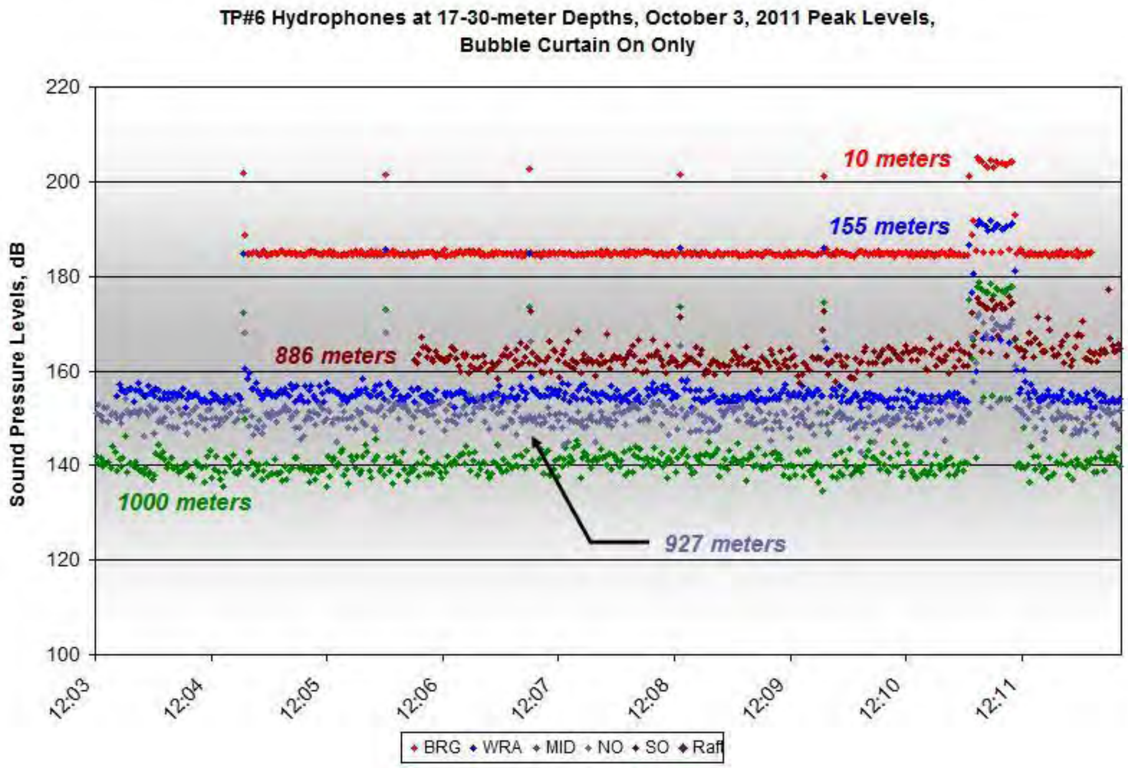

Figure B334. One-second Peak Level Data for TP#6 during Bubble On Conditions, 12:04-12:11, at Depths of 17-30 meters on October 3, 2011

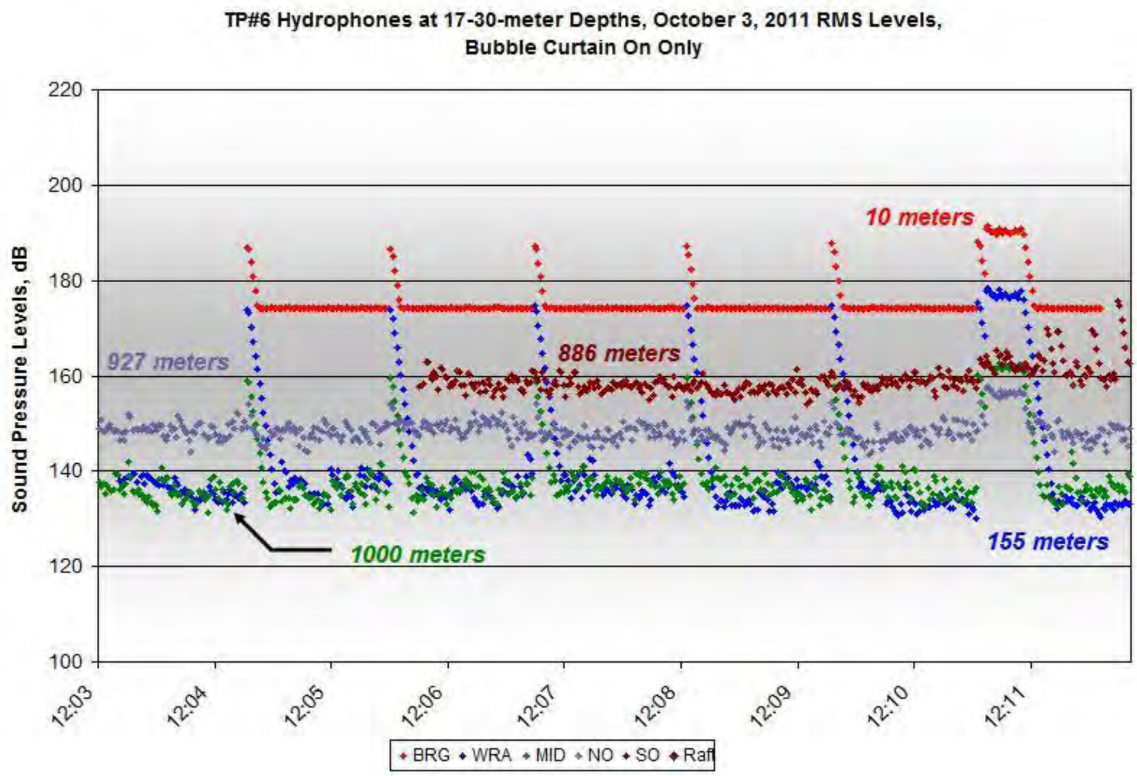

Figure B335. Impulse RMS Data for TP#6 during Bubble On Conditions, 12:04-12:11, at Depths of 17-30 meters on October 3, 2011

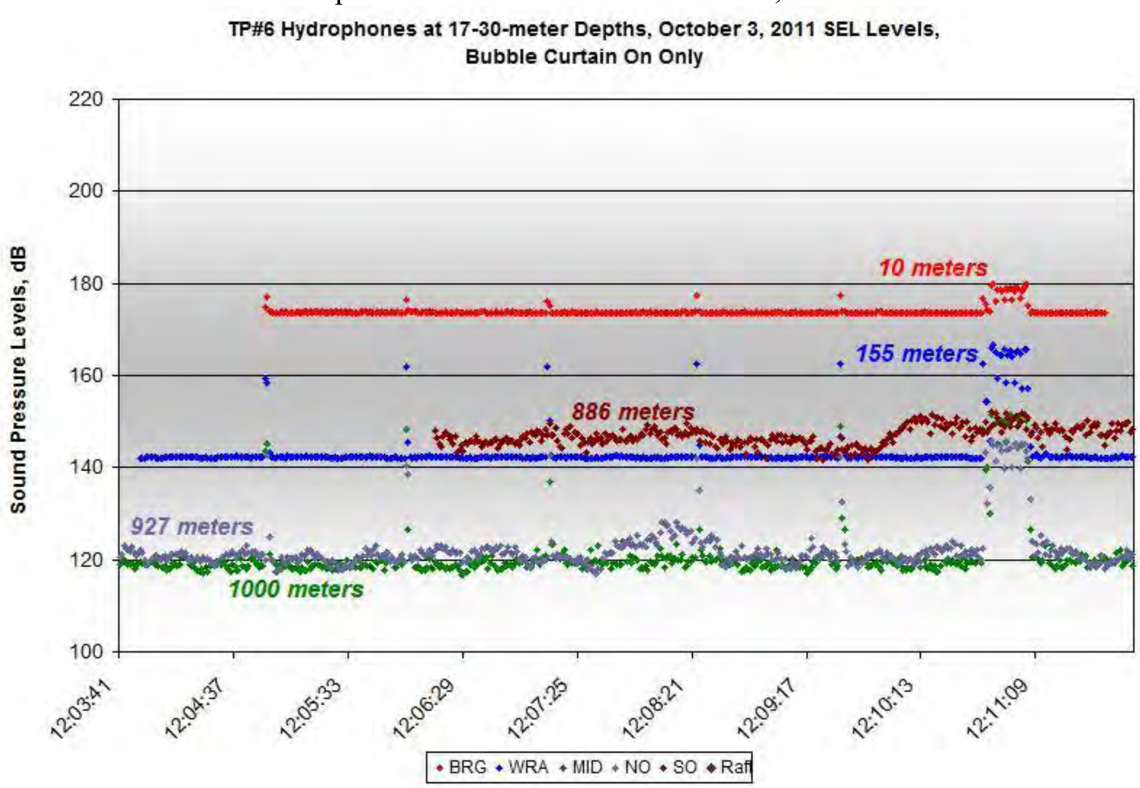

Figure B336. One-second SEL Data for TP#6 during Bubble On Conditions, 12:04-12:11, at Depths of 17-30 meters on October 3, 2011

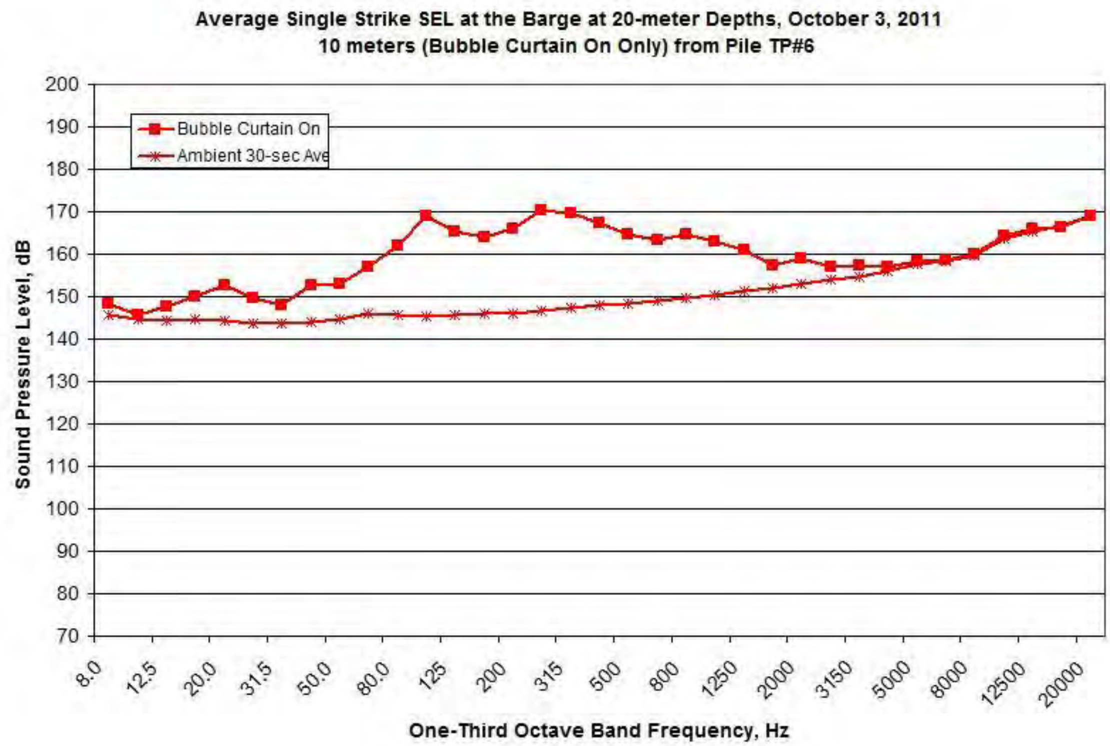

Figure B337. Average One-second SEL Spectral Data Measured at the BRG Location during TP#6, 12:04-12:11, Depths of 20 meters on October 3, 2011

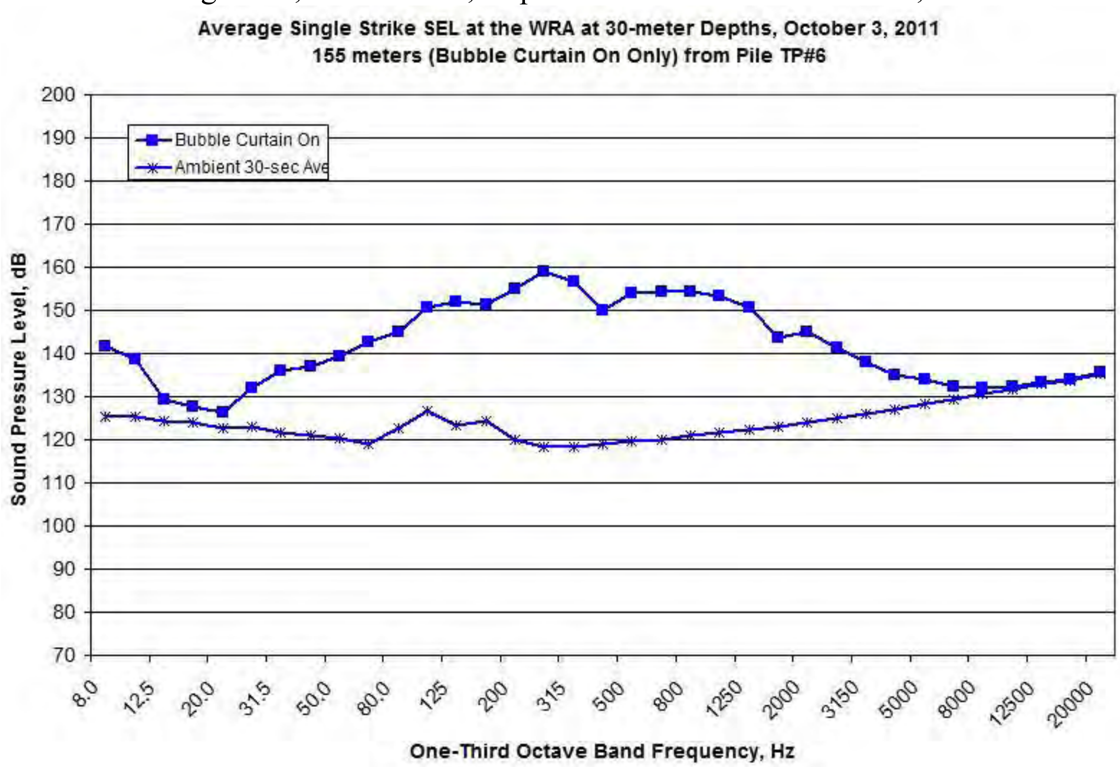

Figure B338. Average One-second SEL Spectral Data Measured at the WRA Location during TP#6, 12:04-12:11, Depths of 30 meters on October 3, 2011

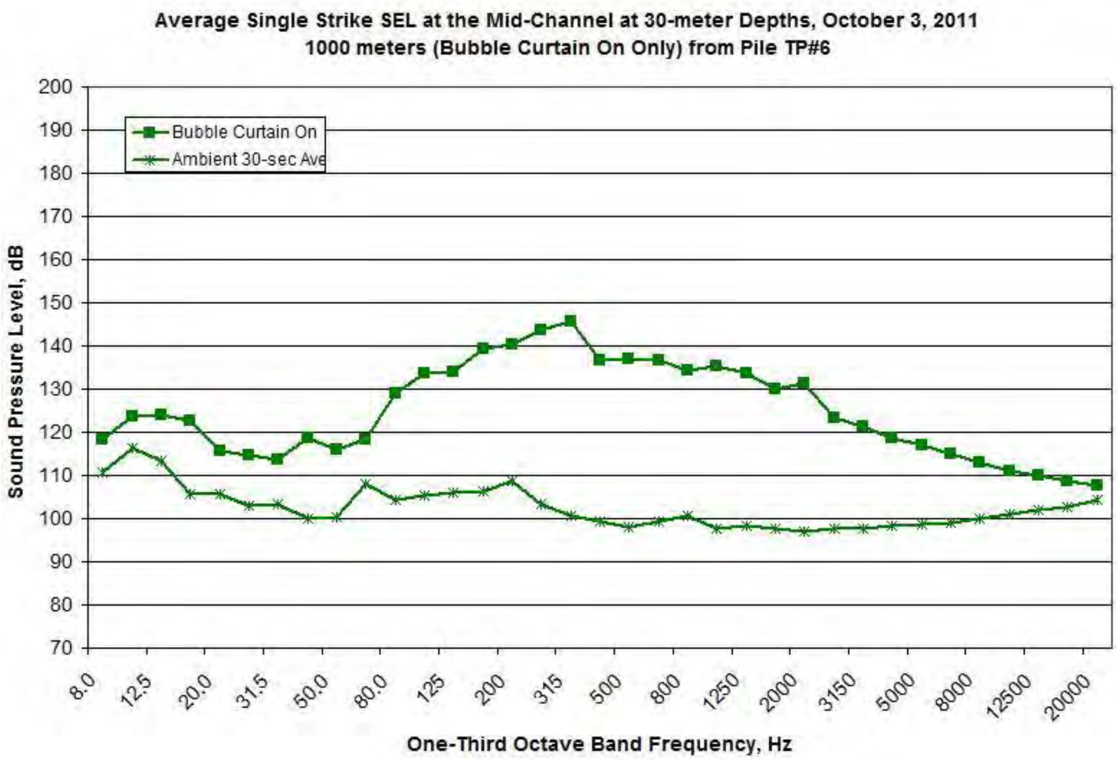

Figure B339. Average One-second SEL Spectral Data Measured at the MID Location during TP#6, 12:04-12:11, Depths of 30 meters on October 3, 2011

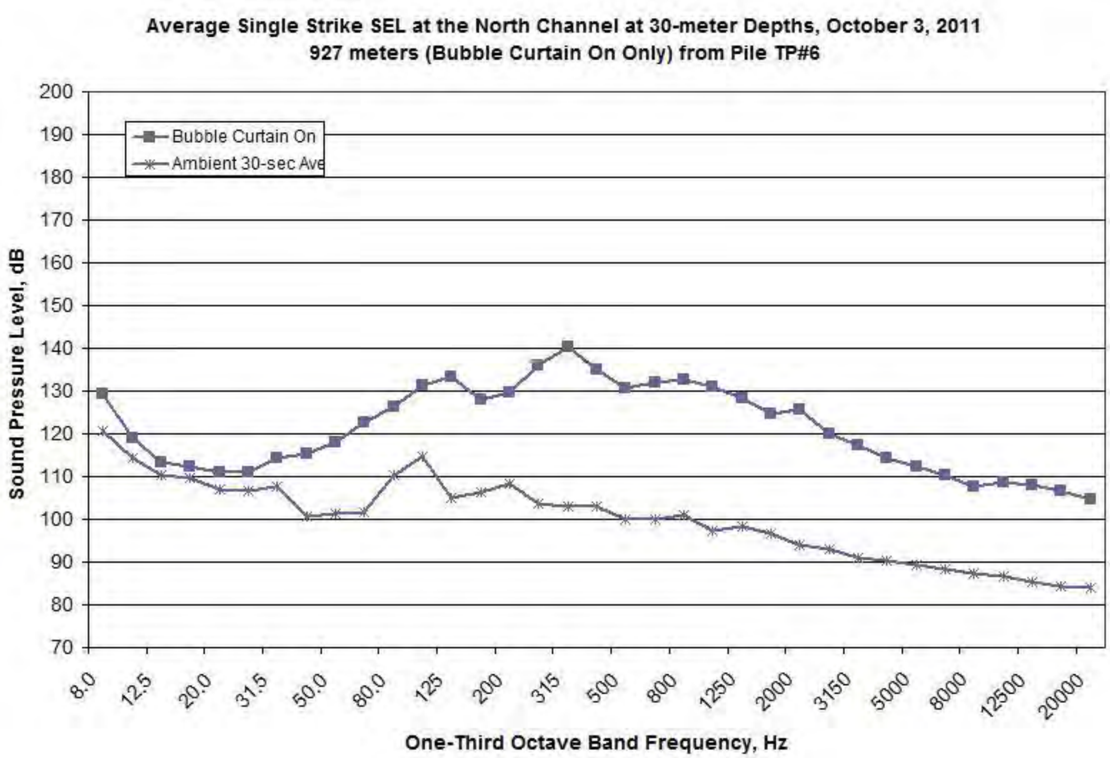

Figure B340. Average One-second SEL Spectral Data Measured at the NO Location during TP#6, 12:04-12:11, Depths of 30 meters on October 3, 2011

PILE DRIVING NO DISCERNIBLE

Figure B341. Average One-second SEL Spectral Data Measured at the SO Location during TP#6, 12:04-12:11, Depths of 30 meters on October 3, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B342. Average One-second SEL Spectral Data Measured at the RFT Location during TP#6, 12:04-12:11, Depths of 17 meters on October 3, 2011

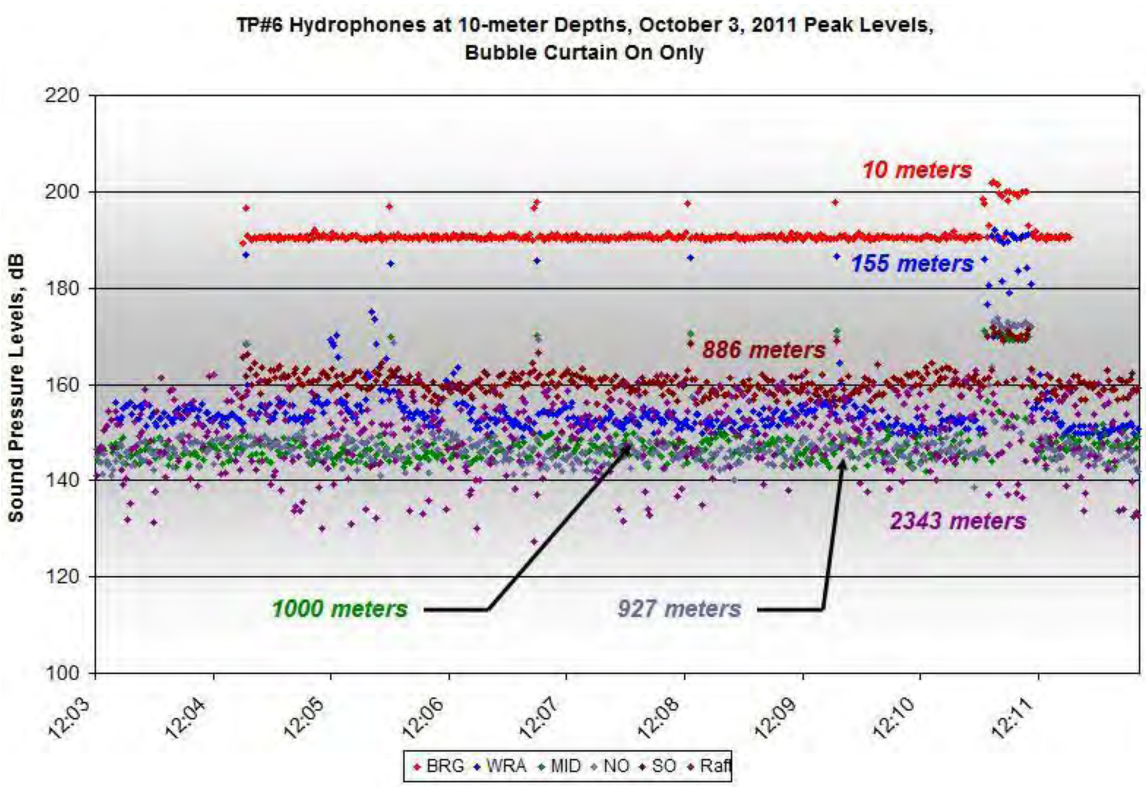

Figure B343. One-second Peak Level Data for TP#6 during Bubble On Conditions, 12:04-12:11, at Depths of 10 meters on October 3, 2011

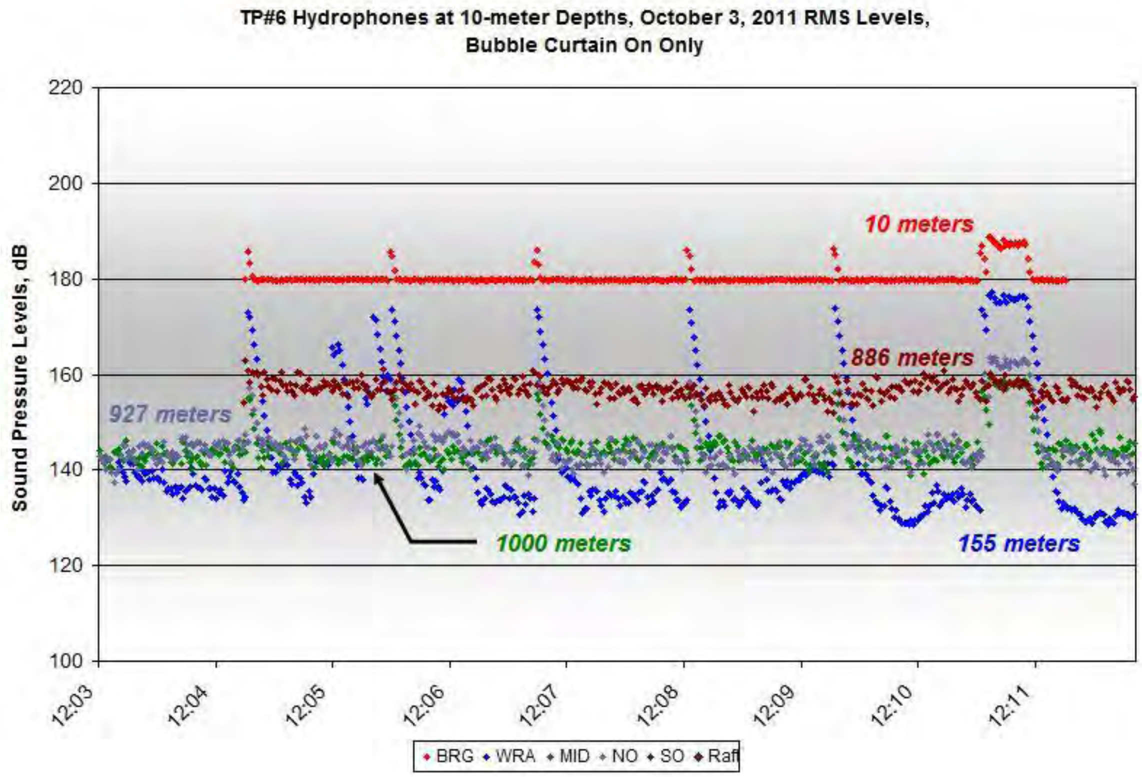

Figure B344. Impulse RMS Data for TP#6 during Bubble On Conditions, 12:04-12:11, at Depths of 10 meters on October 3, 2011

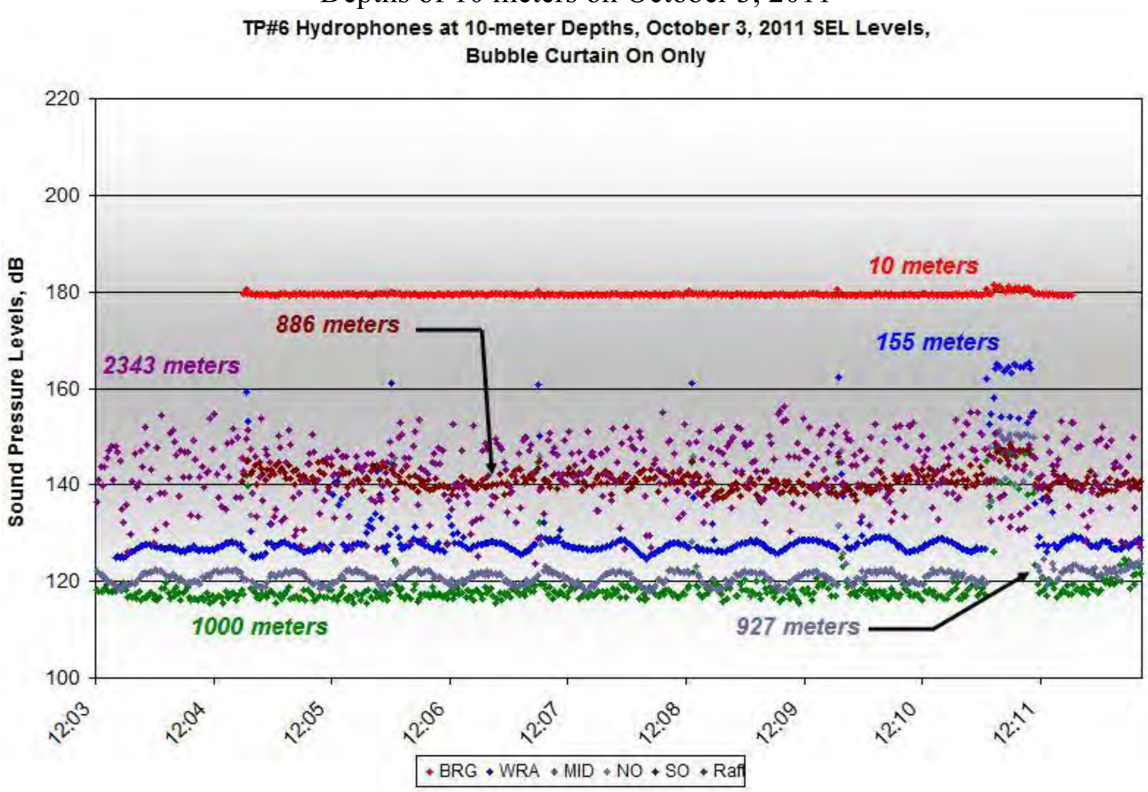

Figure B345. One-second SEL Data for TP#6 during Bubble On Conditions, 12:04-12:11, at Depths of 10 meters on October 3, 2011

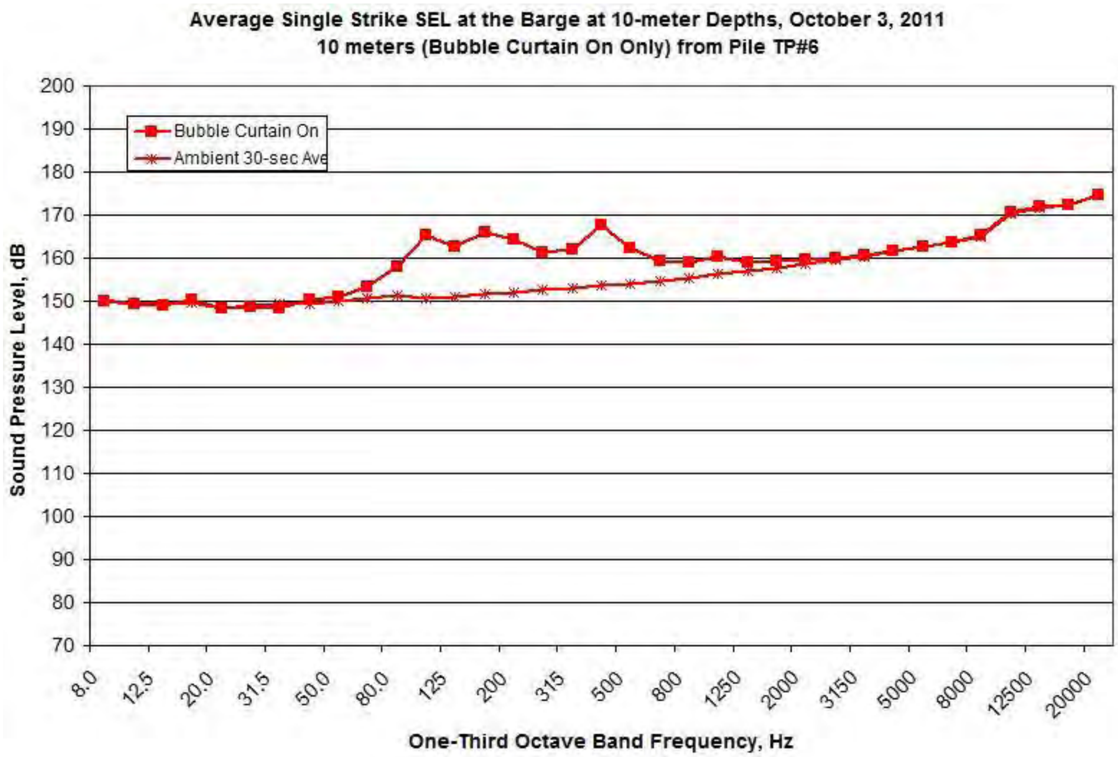

Figure B346. Average One-second SEL Spectral Data Measured at the BRG Location during TP#6, 12:04-12:11, Depths of 10 meters on October 3, 2011

Figure B347. Average One-second SEL Spectral Data Measured at the WRA Location during TP#6, 12:04-12:11, Depths of 10 meters on October 3, 2011

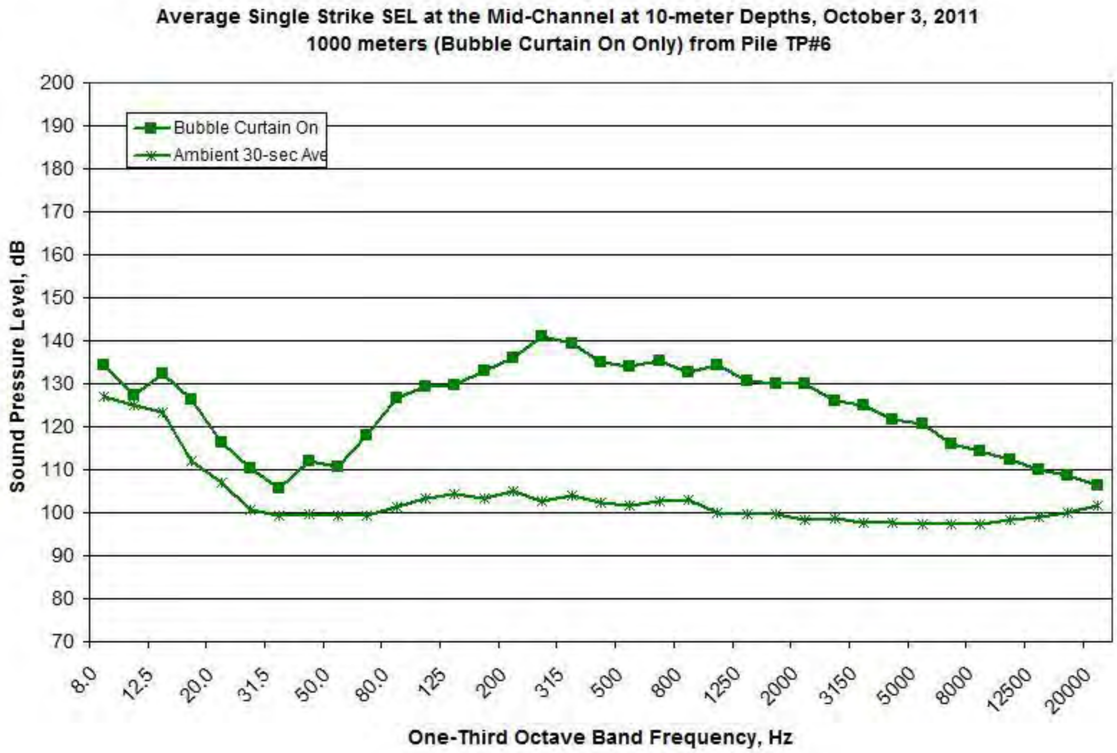

Figure B348. Average One-second SEL Spectral Data Measured at the MID Location during TP#6, 12:04-12:11, Depths of 10 meters on October 3, 2011

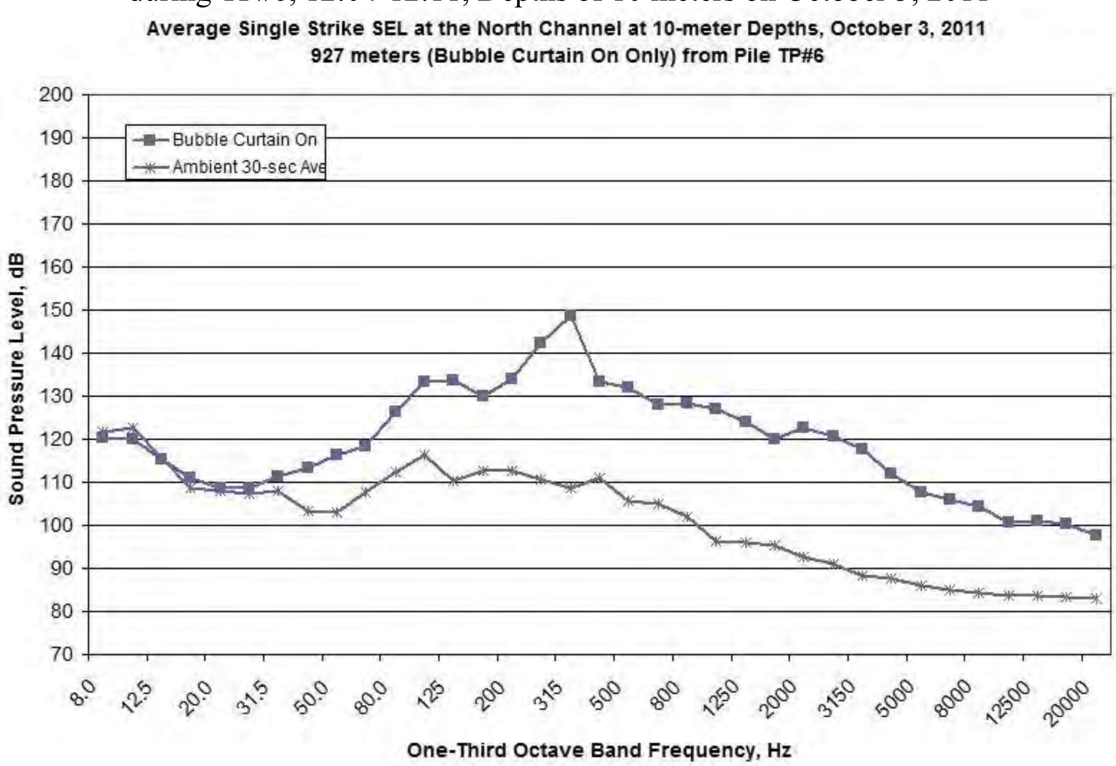

Figure B349. Average One-second SEL Spectral Data Measured at the NO Location during TP#6, 12:04-12:11, Depths of 10 meters on October 3, 2011

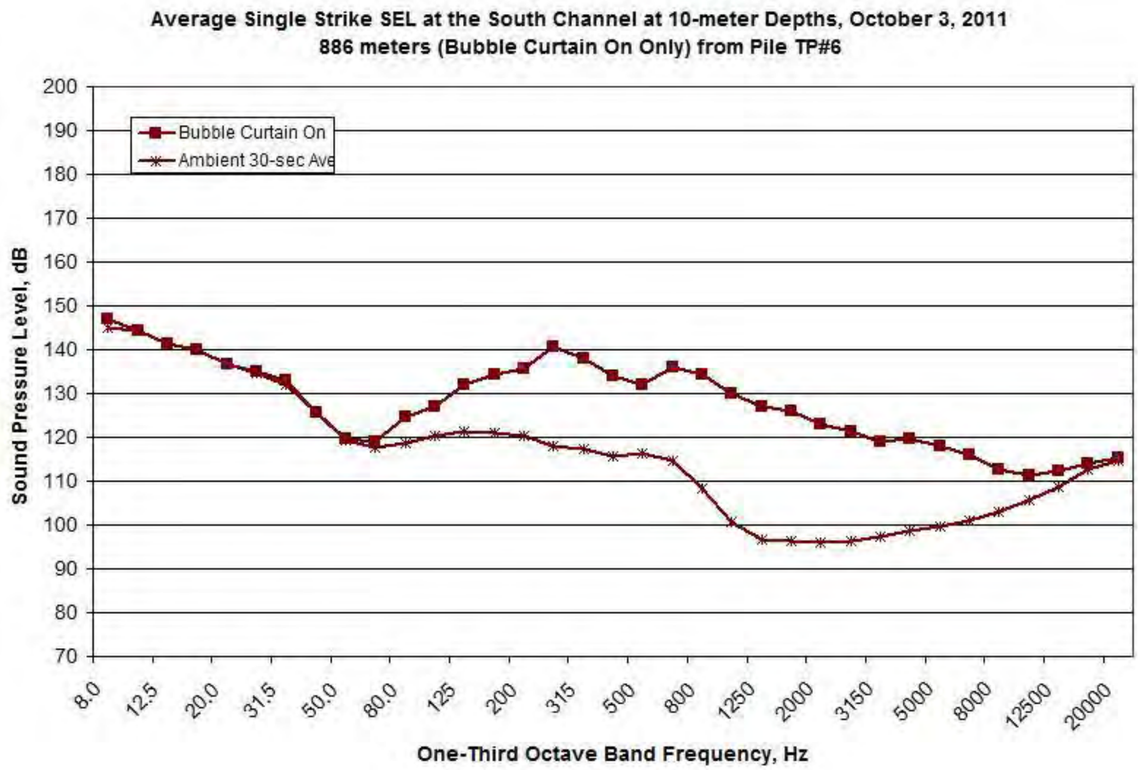

Figure B350. Average One-second SEL Spectral Data Measured at the SO Location during TP#6, 12:04-12:11, Depths of 10 meters on October 3, 2011

NO SPECTRA DATA AVAILABLE

Figure B351. Average One-second SEL Spectral Data Measured at the RFT Location during TP#6, 12:04-12:11, Depths of 10 meters on October 3, 2011

TP#4

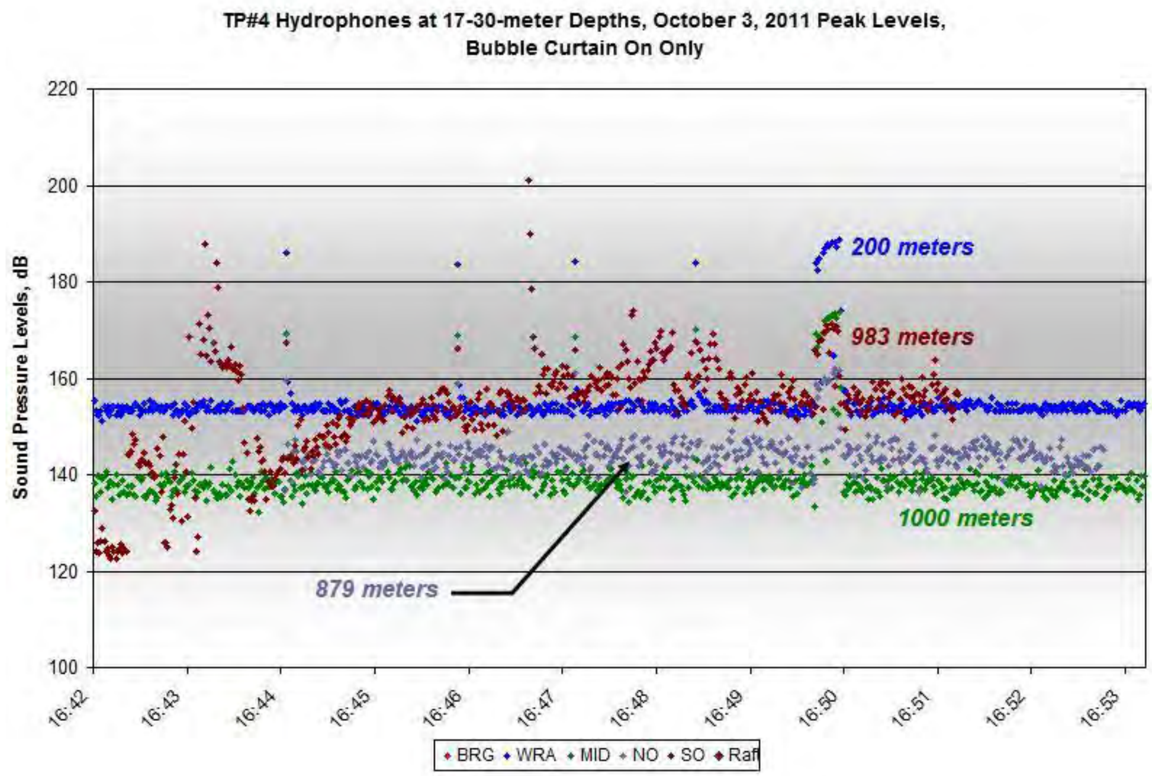

Figure B352. One-second Peak Level Data for TP#4 during Bubble On Conditions, 16:44-16:50, at Depths of 17-30 meters on October 3, 2011

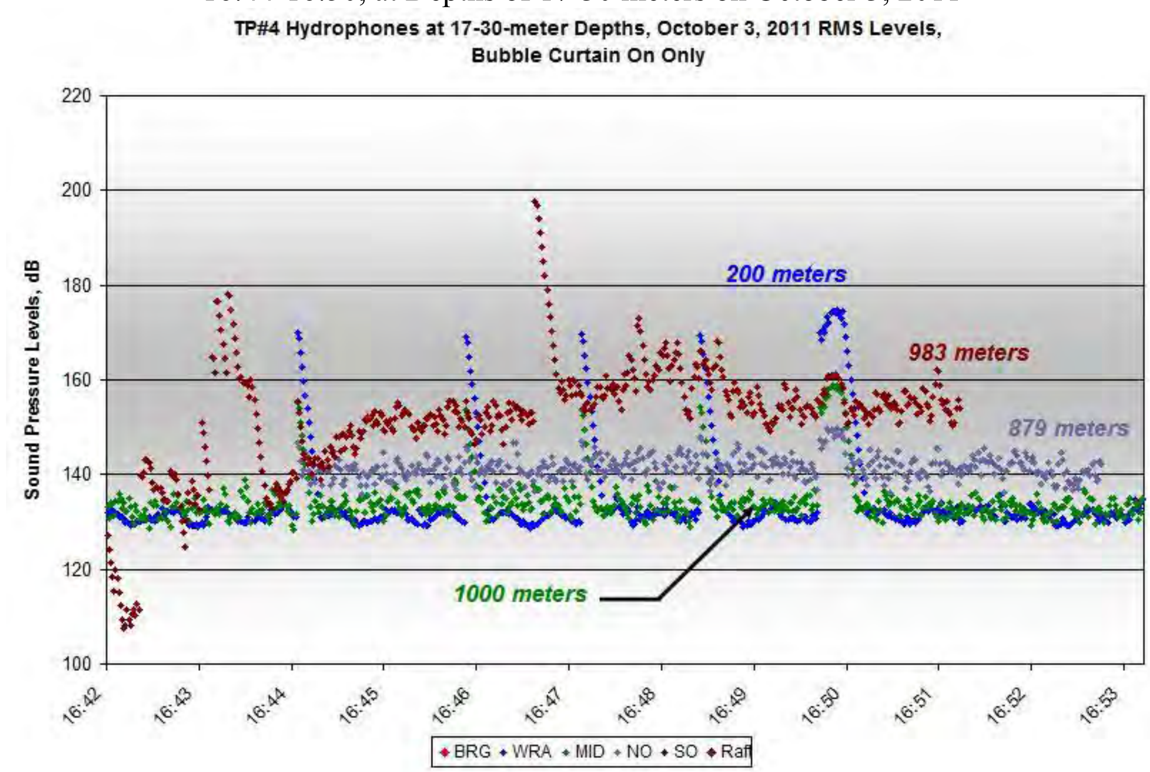

Figure B353. Impulse RMS Data for TP#4 during Bubble On Conditions, 16:44-16:50, at Depths of 17-30 meters on October 3, 2011

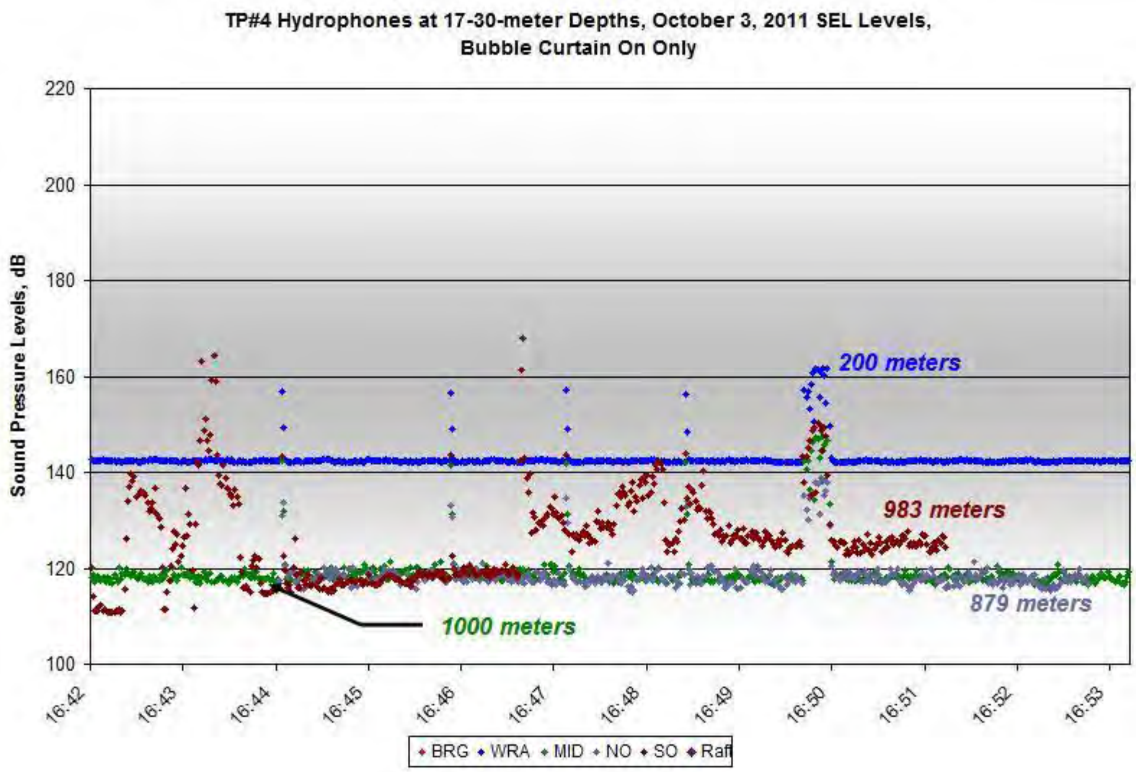

Figure B354. One-second SEL Data for TP#4 during Bubble On Conditions, 16:44-16:50, at Depths of 17-30 meters on October 3, 2011

NO SPECTRA DATA AVAILABLE

Figure B355. Average One-second SEL Spectral Data Measured at the BRG Location during TP#4, 16:44-16:50, Depths of 20 meters on October 3, 2011

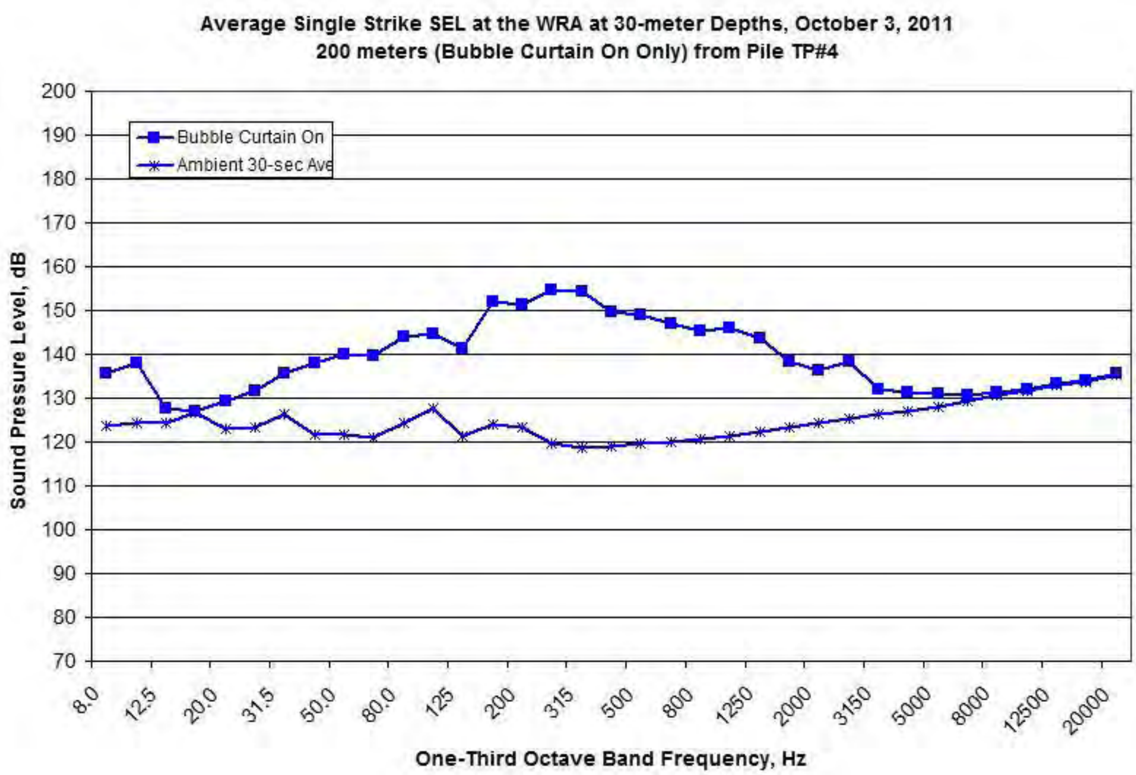

Figure B356. Average One-second SEL Spectral Data Measured at the WRA Location during TP#4, 16:44-16:50, Depths of 30 meters on October 3, 2011

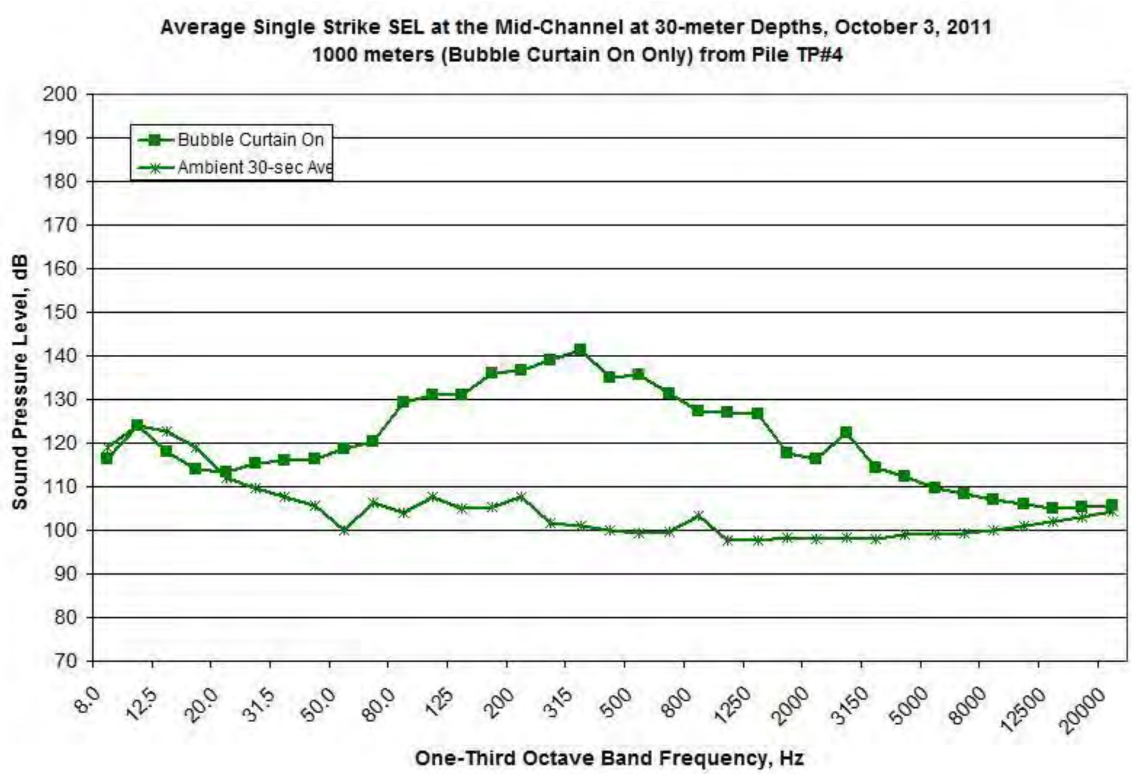

Figure B357. Average One-second SEL Spectral Data Measured at the MID Location during TP#4, 16:44-16:50, Depths of 30 meters on October 3, 2011

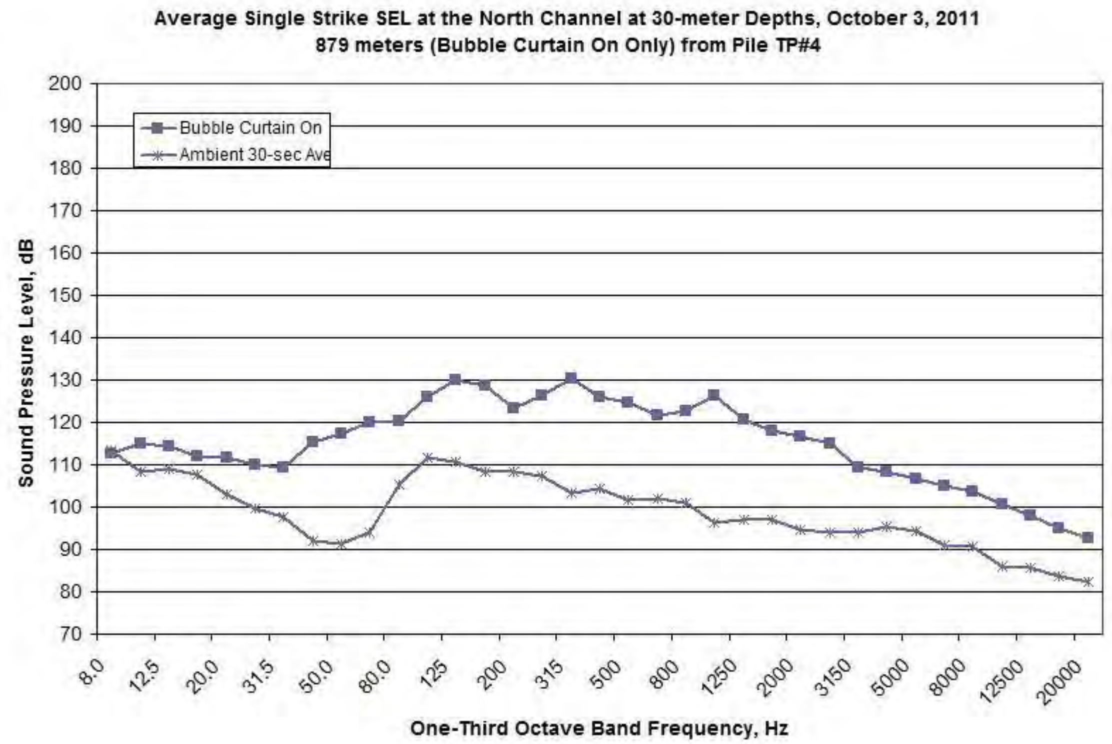

Figure B358. Average One-second SEL Spectral Data Measured at the NO Location during TP#4, 16:44-16:50, Depths of 30 meters on October 3, 2011

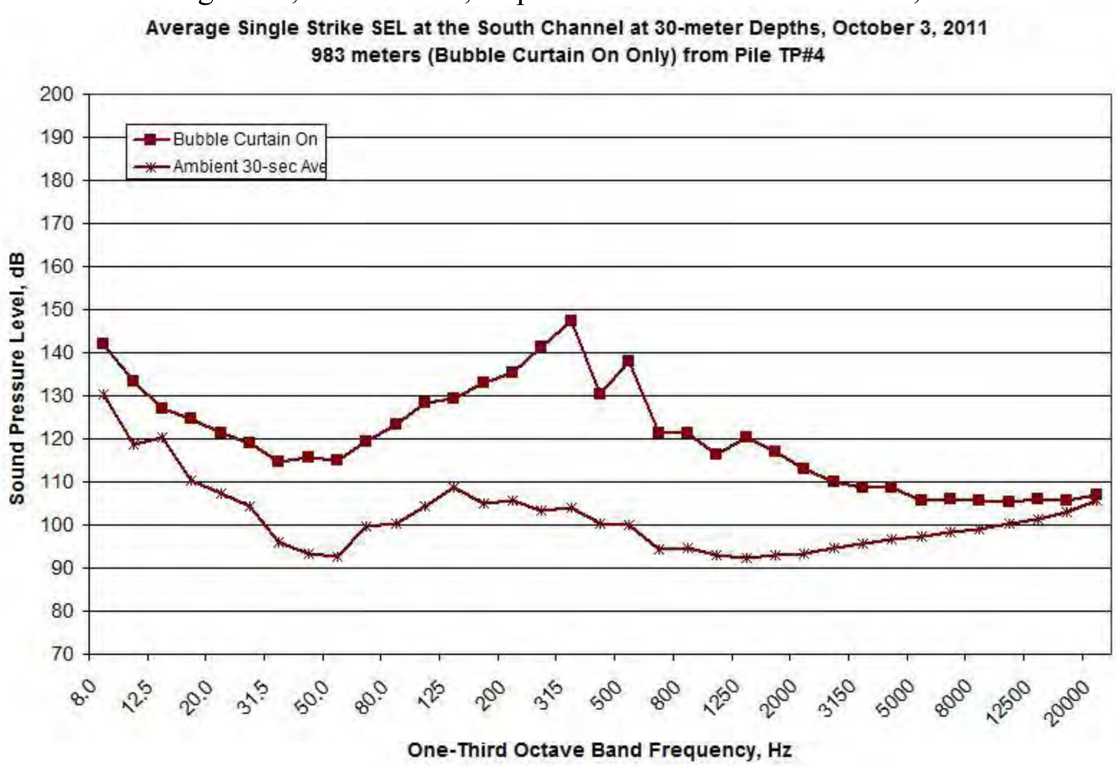

Figure B359. Average One-second SEL Spectral Data Measured at the SO Location during TP#4, 16:44-16:50, Depths of 30 meters on October 3, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B360. Average One-second SEL Spectral Data Measured at the RFT Location during TP#4, 16:44-16:50, Depths of 17 meters on October 3, 2011

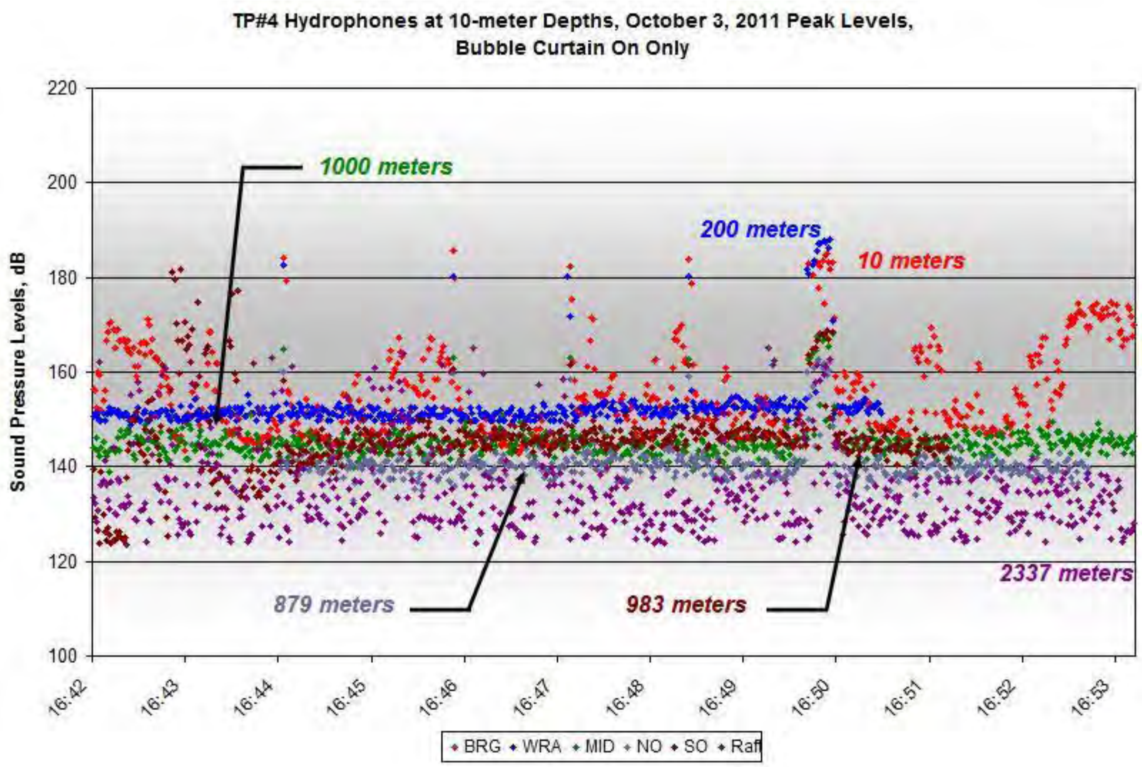

Figure B361. One-second Peak Level Data for TP#4 during Bubble On Conditions, 16:44-16:50, at Depths of 10 meters on October 3, 2011

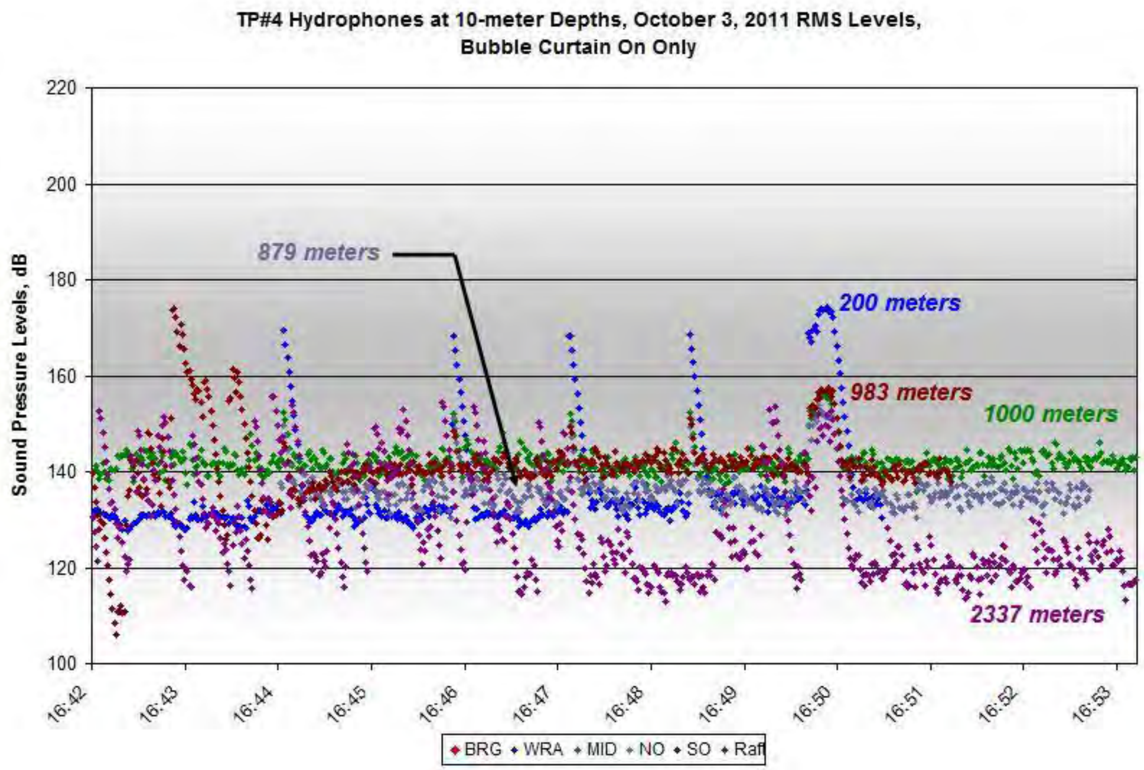

Figure B362. Impulse RMS Data for TP#4 during Bubble On Conditions, 16:44-16:50, at Depths of 10 meters on October 3, 2011

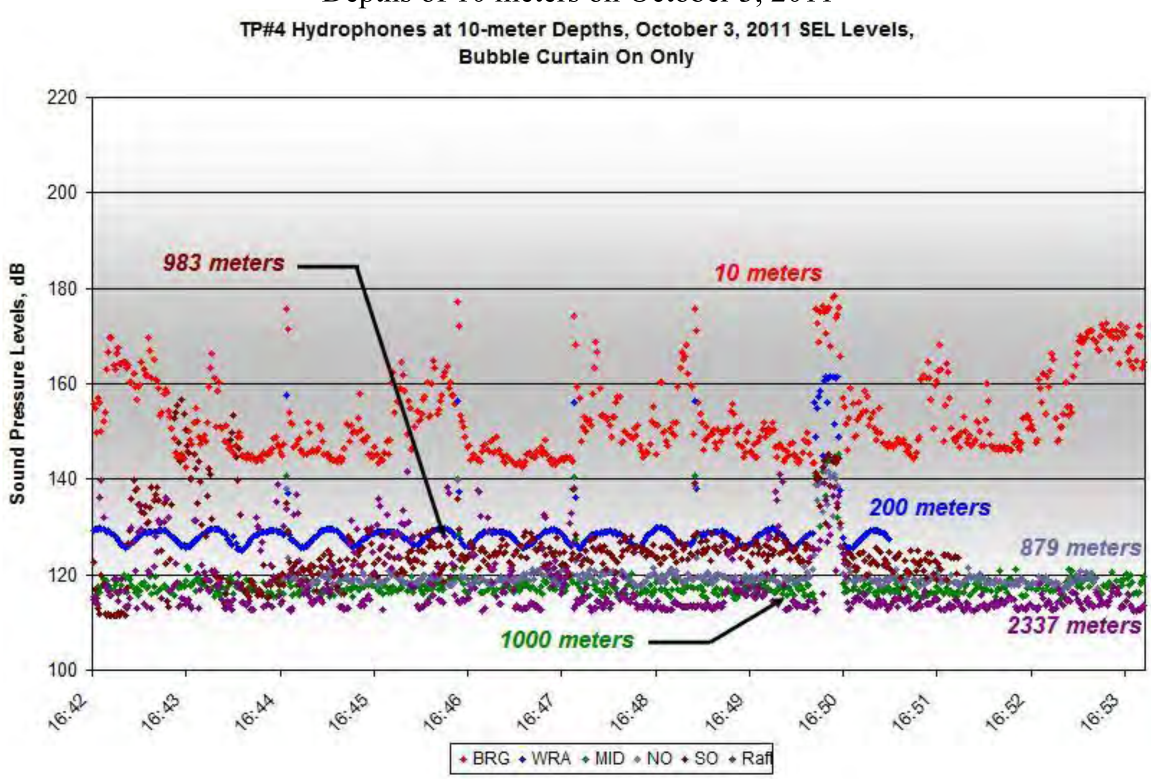

Figure B363. One-second SEL Data for TP#4 during Bubble On Conditions, 16:44-16:50, at Depths of 10 meters on October 3, 2011

NO SPECTRA DATA AVAILABLE

Figure B364. Average One-second SEL Spectral Data Measured at the BRG Location during TP#4, 16:44-16:50, Depths of 10 meters on October 3, 2011

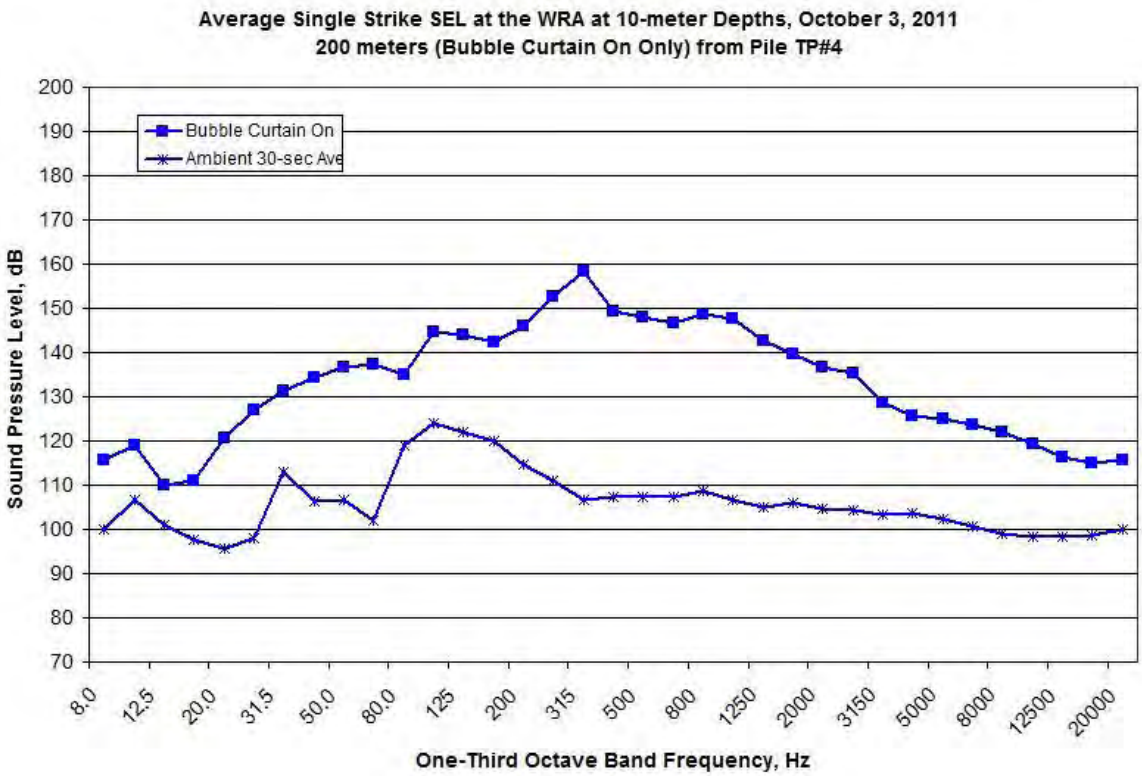

Figure B365. Average One-second SEL Spectral Data Measured at the WRA Location during TP#4, 16:44-16:50, Depths of 10 meters on October 3, 2011

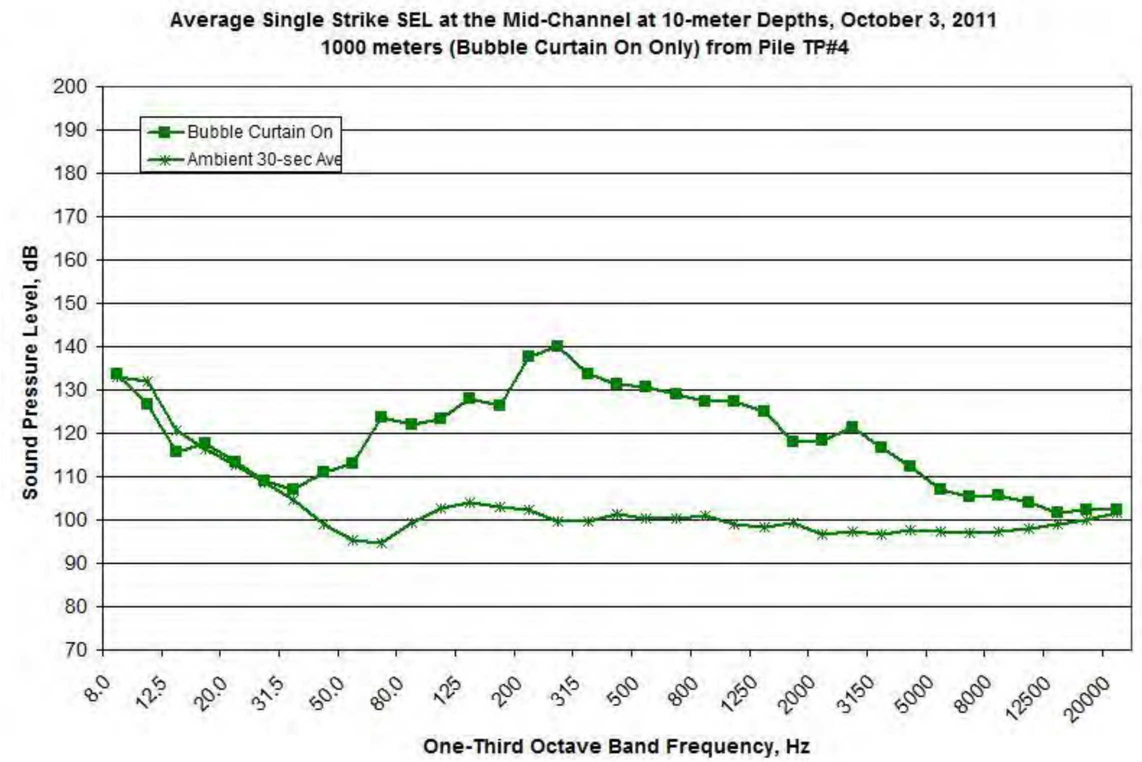

Figure B366. Average One-second SEL Spectral Data Measured at the MID Location during TP#4, 16:44-16:50, Depths of 10 meters on October 3, 2011

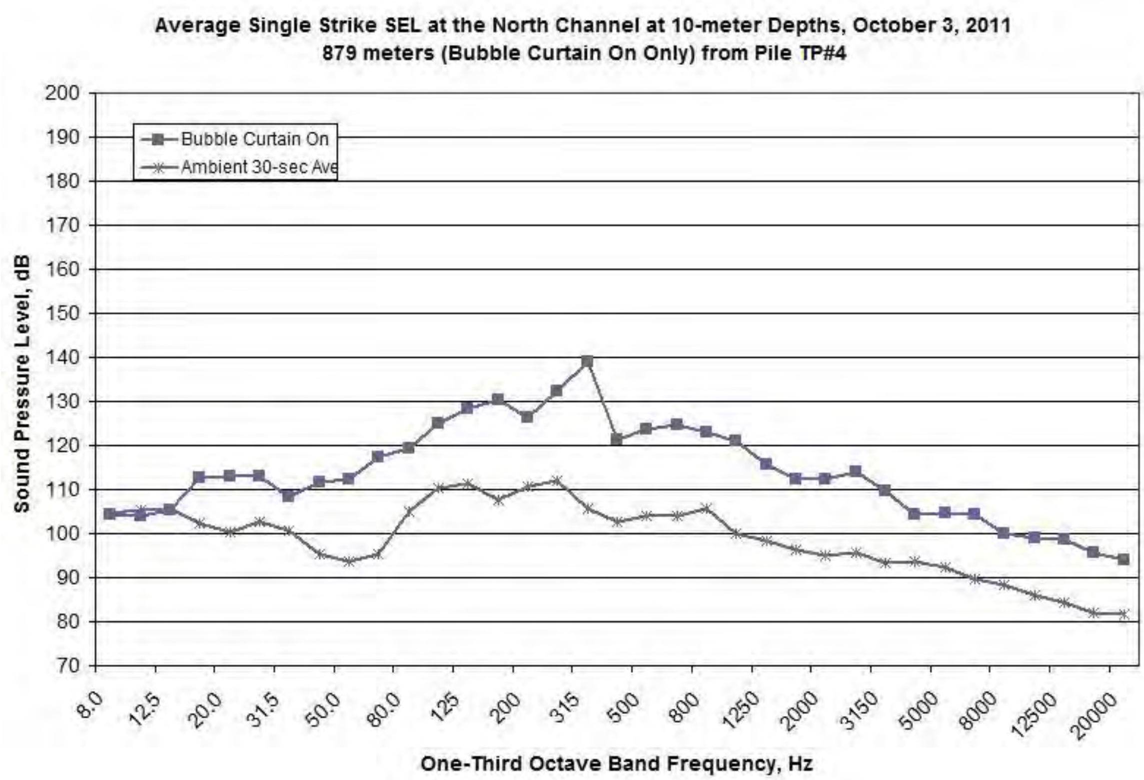

Figure B367. Average One-second SEL Spectral Data Measured at the NO Location during TP#4, 16:44-16:50, Depths of 10 meters on October 3, 2011

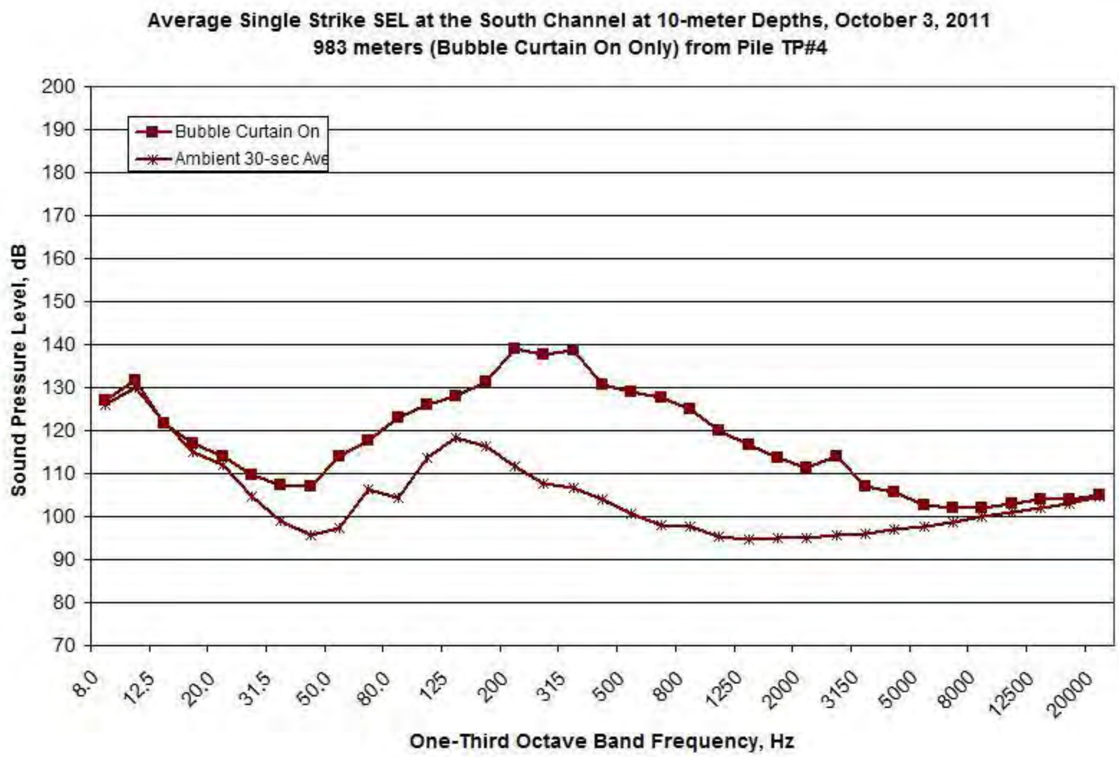

Figure B368. Average One-second SEL Spectral Data Measured at the SO Location during TP#4, 16:44-16:50, Depths of 10 meters on October 3, 2011

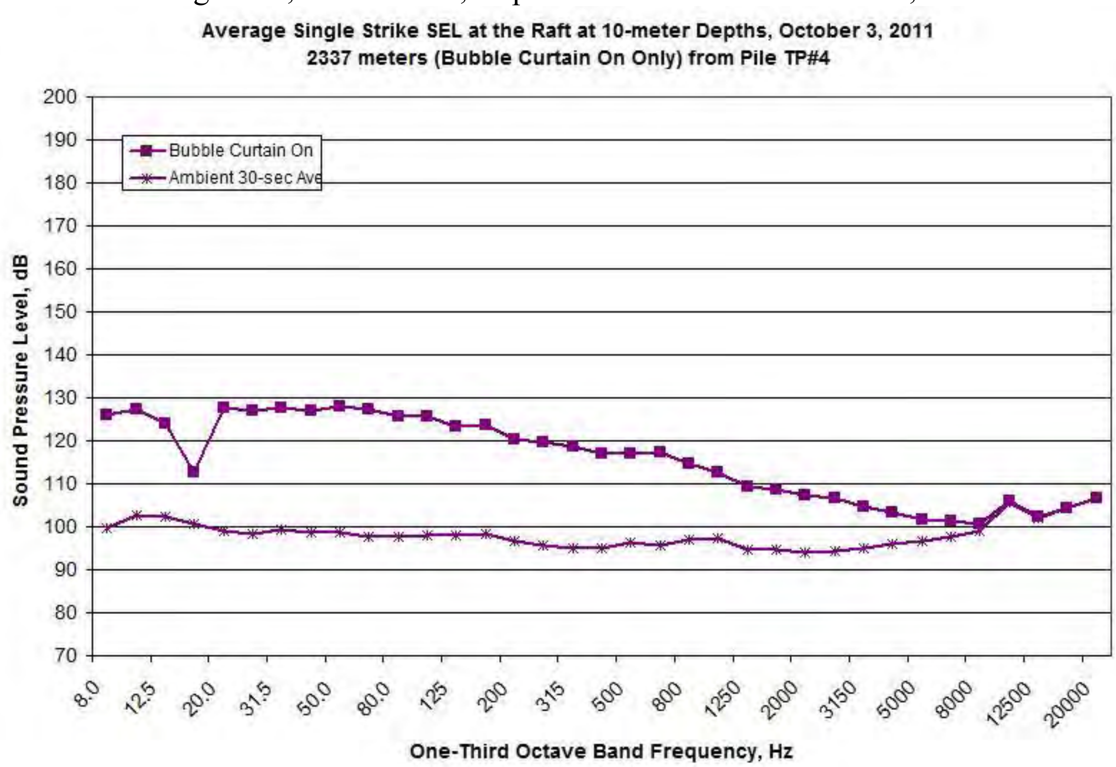

Figure B369. Average One-second SEL Spectral Data Measured at the RFT Location during TP#4, 16:44-16:50, Depths of 10 meters on October 3, 2011

10/4/2011 – TTP#4

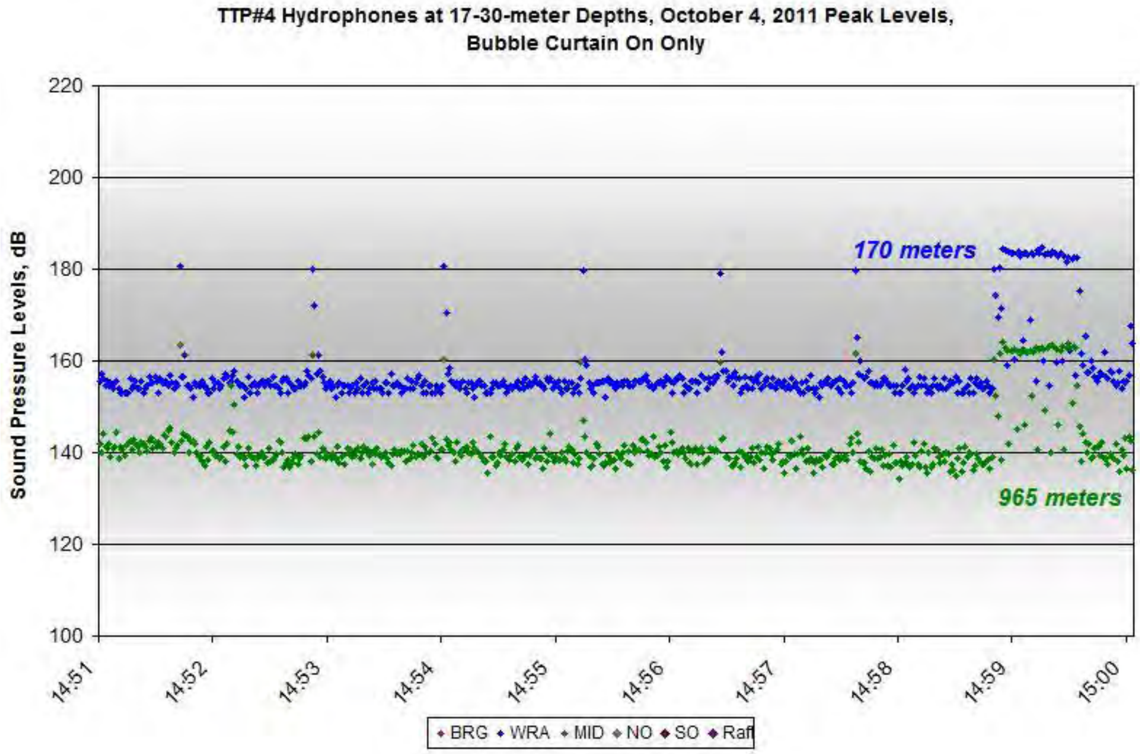

Figure B370. One-second Peak Level Data for TTP#4 during Bubble On Conditions, 14:49-14:59, at Depths of 17-30 meters on October 4, 2011

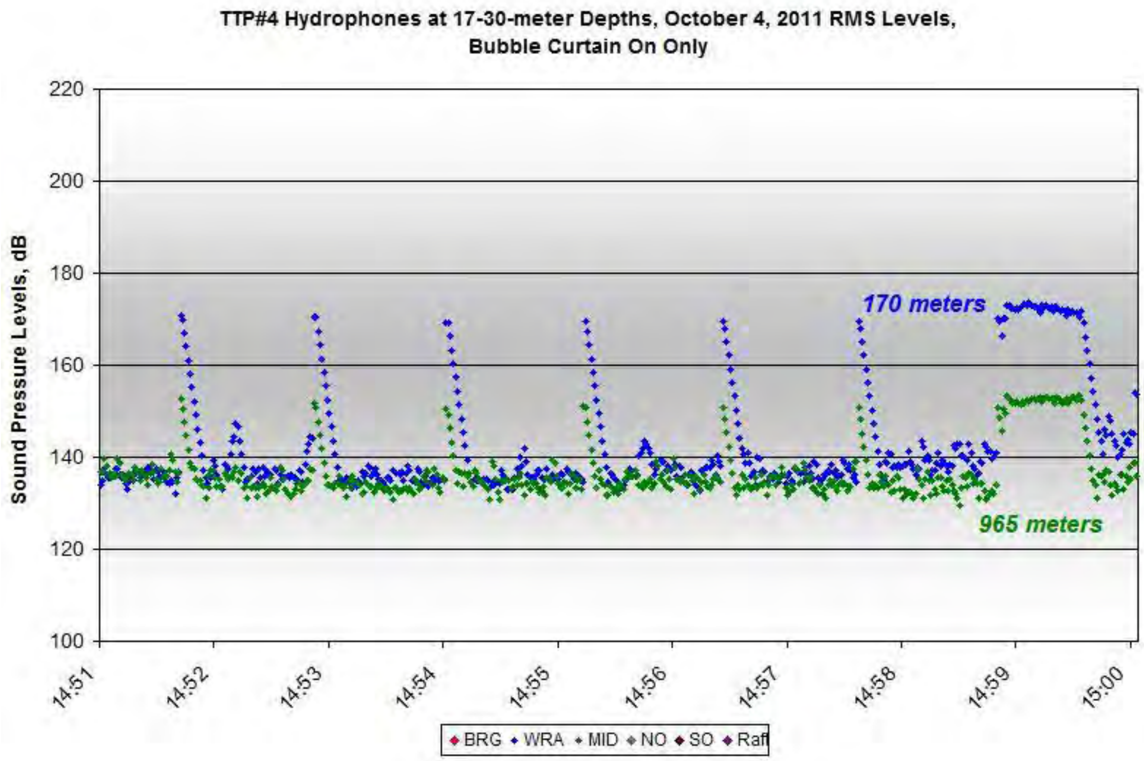

Figure B371. Impulse RMS Data for TTP#4 during Bubble On Conditions, 14:49-14:59, at Depths of 17-30 meters on October 4, 2011

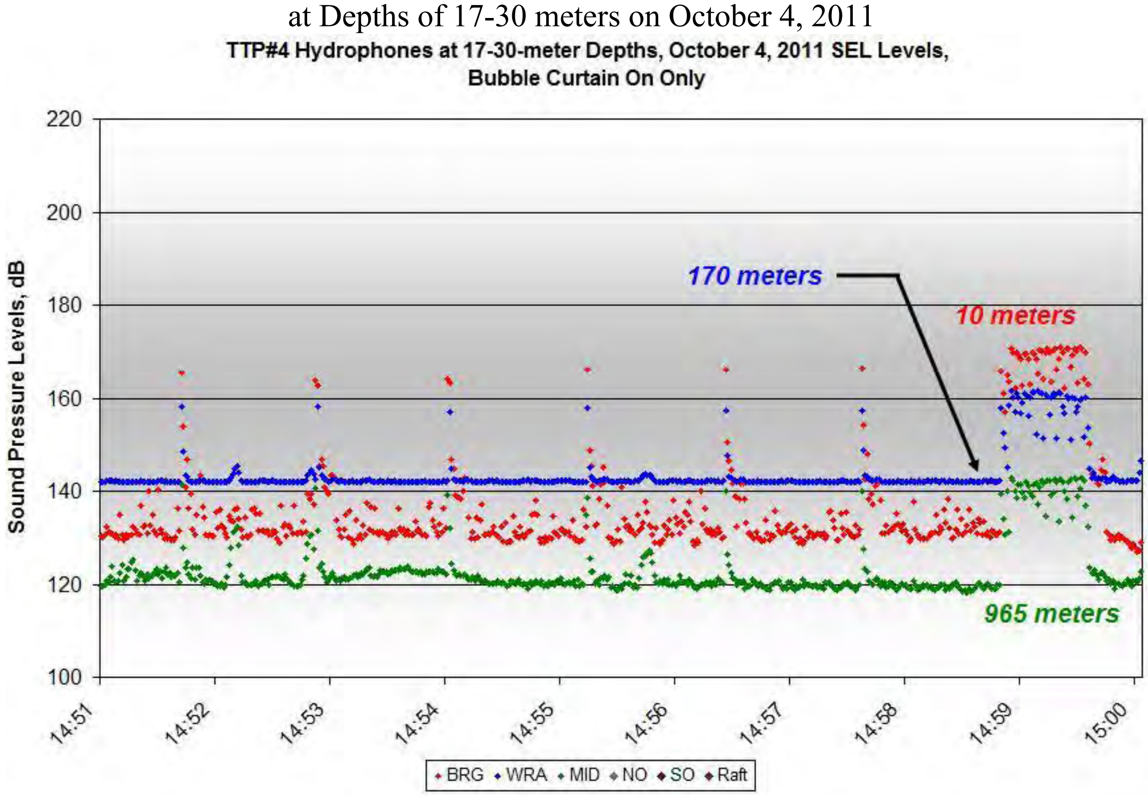

Figure B372. One-second SEL Data for TTP#4 during Bubble On Conditions, 14:49-14:59, at Depths of 17-30 meters on October 4, 2011

NO SPECTRA DATA AVAILABLE

Figure B373. Average One-second SEL Spectral Data Measured at the BRG Location during TTP#4, 14:49-14:59, Depths of 20 meters on October 4, 2011

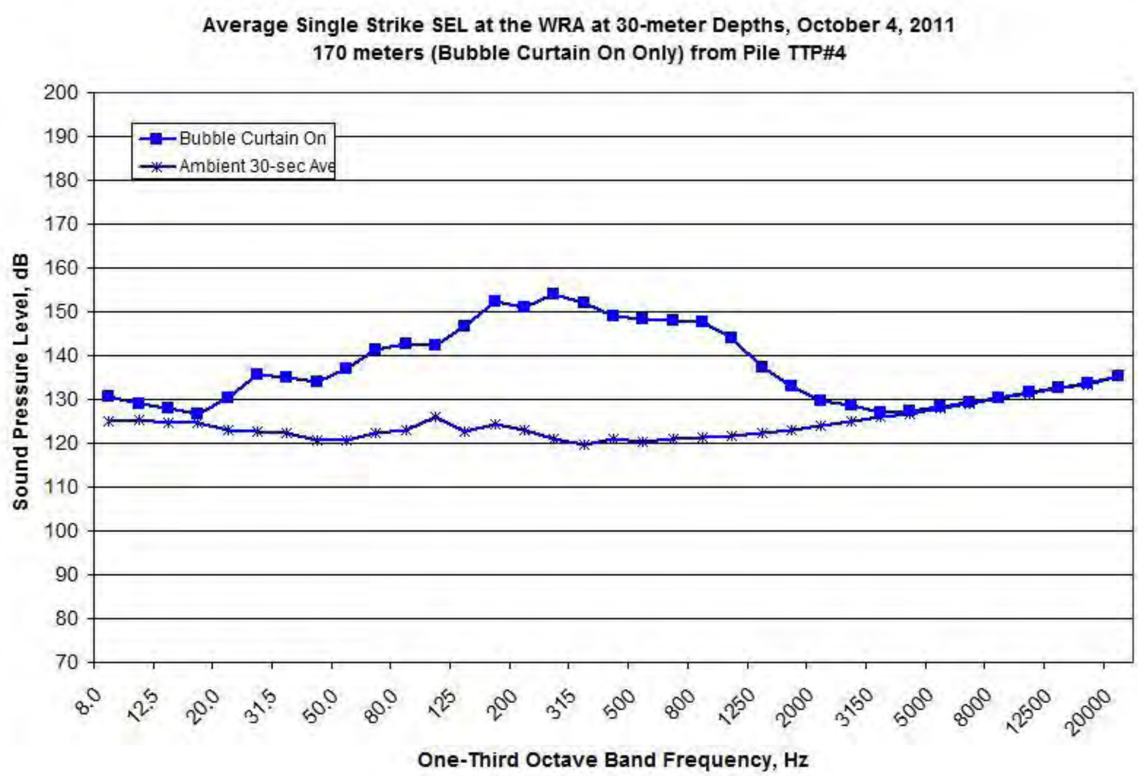

Figure B374. Average One-second SEL Spectral Data Measured at the WRA Location during TTP#4, 14:49-14:59, Depths of 30 meters on October 4, 2011

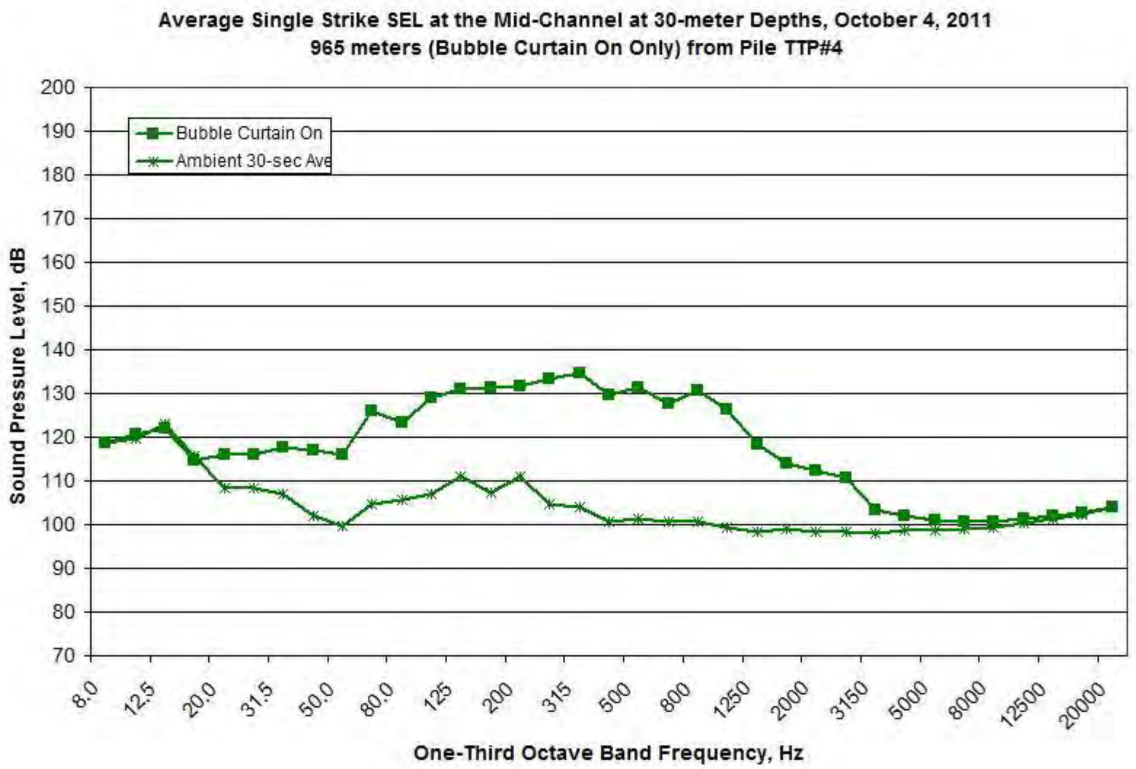

Figure B375. Average One-second SEL Spectral Data Measured at the MID Location during TTP#4, 14:49-14:59, Depths of 30 meters on October 4, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B376. Average One-second SEL Spectral Data Measured at the RFT Location during TTP#4, 14:49-14:59, Depths of 17 meters on October 4, 2011

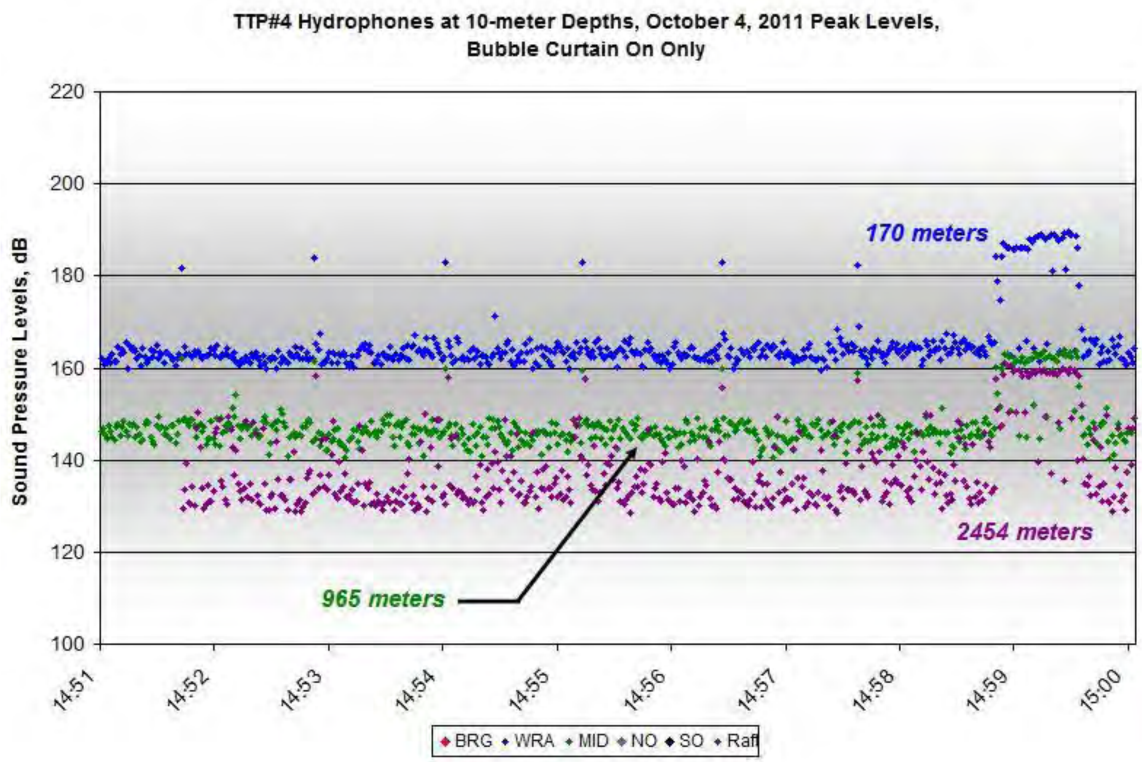

Figure B377. One-second Peak Level Data for TTP#4 during Bubble On Conditions, 14:49-14:59, at Depths of 10 meters on October 4, 2011

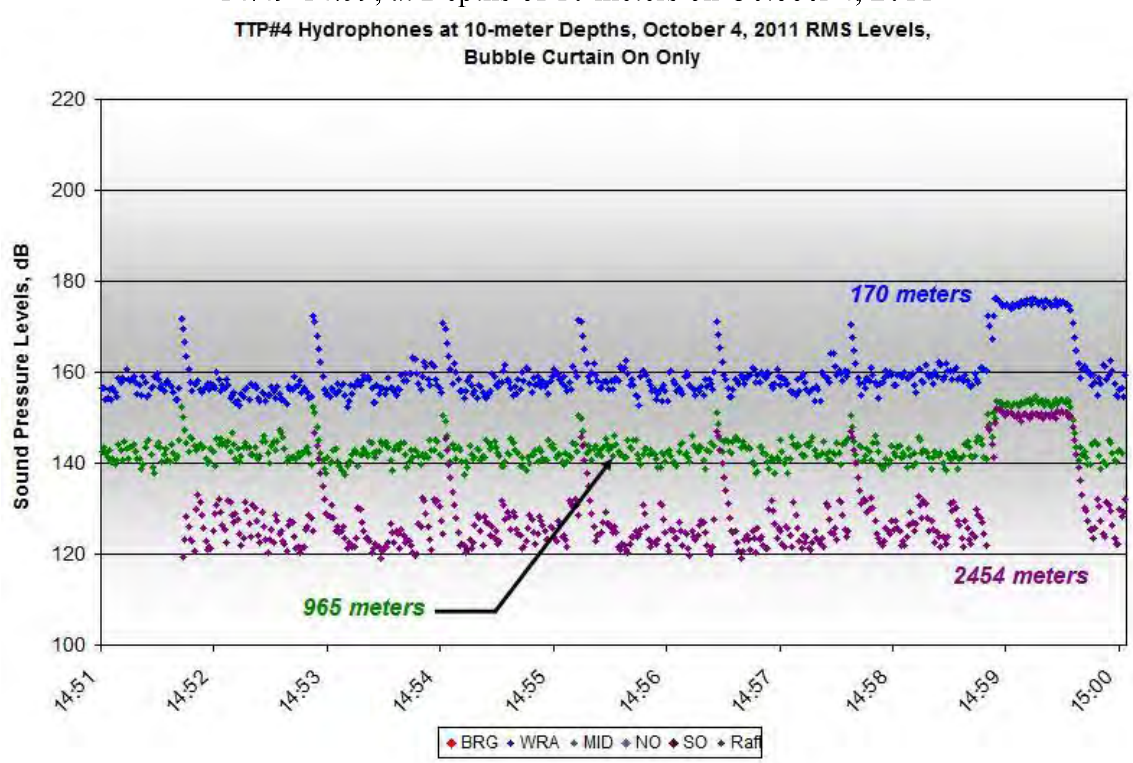

Figure B378. Impulse RMS Data for TTP#4 during Bubble On Conditions, 14:49-14:59, at Depths of 10 meters on October 4, 2011

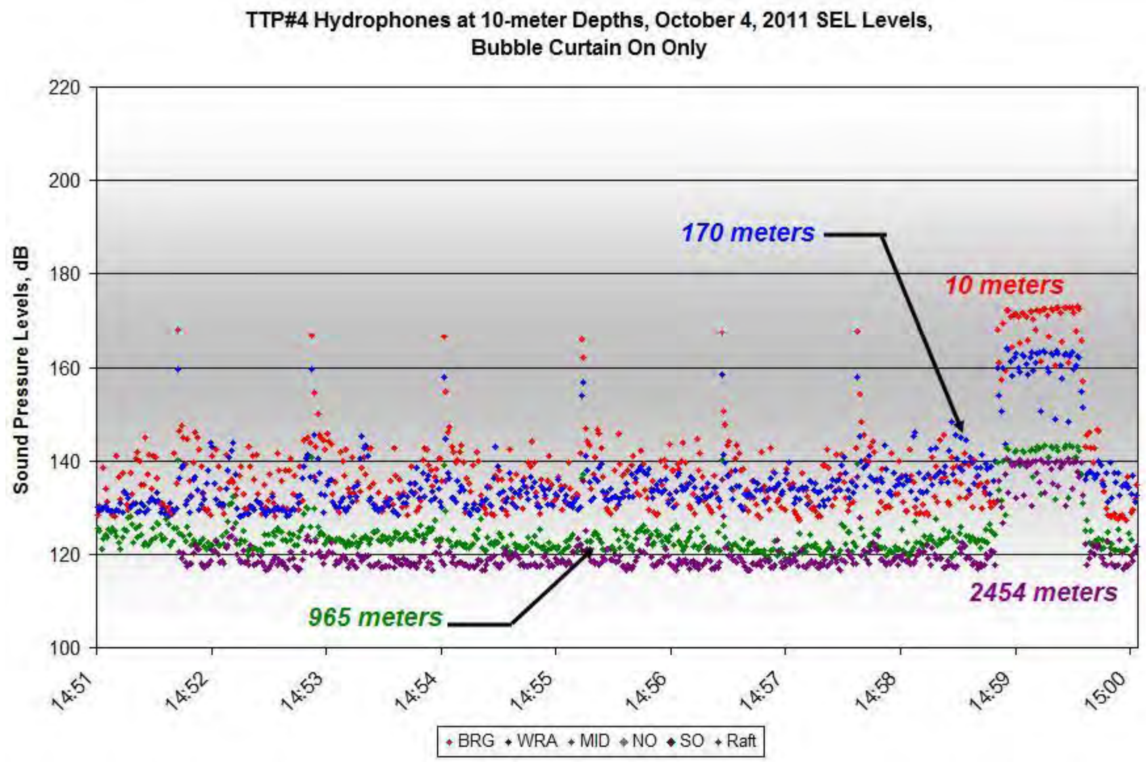

Figure B379. One-second SEL Data for TTP#4 during Bubble On Conditions, 14:49-14:59, at Depths of 10 meters on October 4, 2011

NO SPECTRA DATA AVAILABLE

Figure B380. Average One-second SEL Spectral Data Measured at the BRG Location during TTP#4, 14:49-14:59, Depths of 10 meters on October 4, 2011

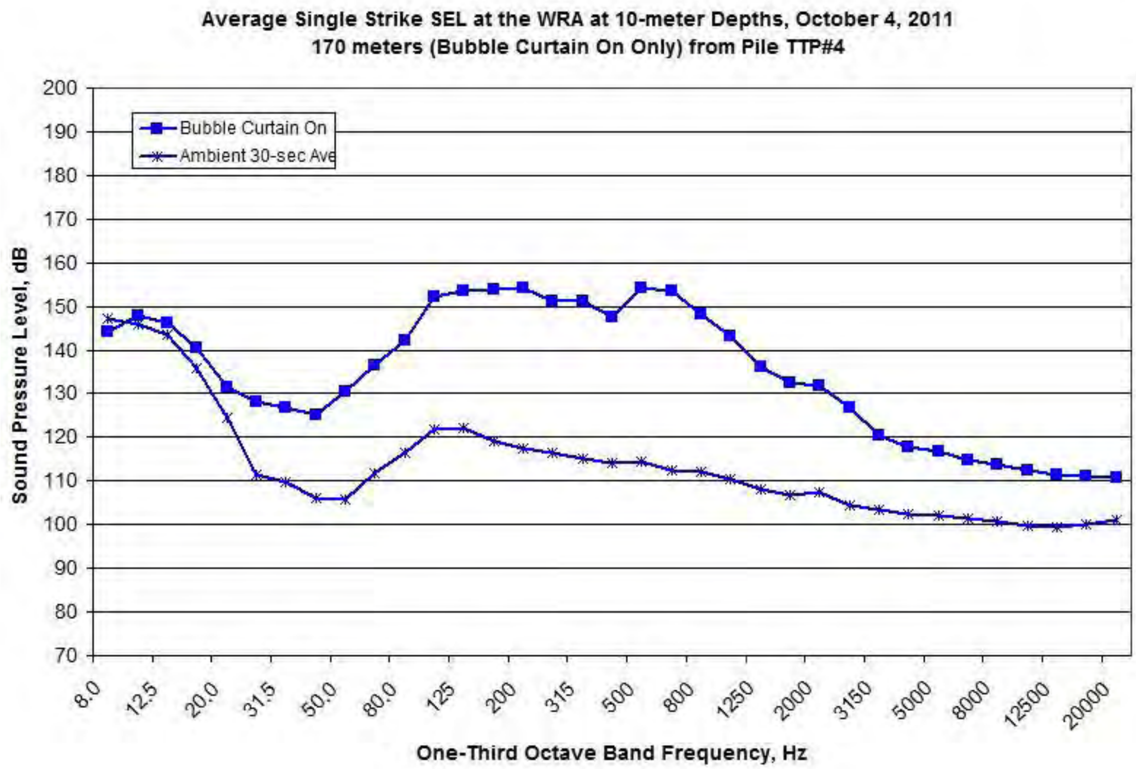

Figure B381. Average One-second SEL Spectral Data Measured at the WRA Location during TTP#4, 14:49-14:59, Depths of 10 meters on October 4, 2011

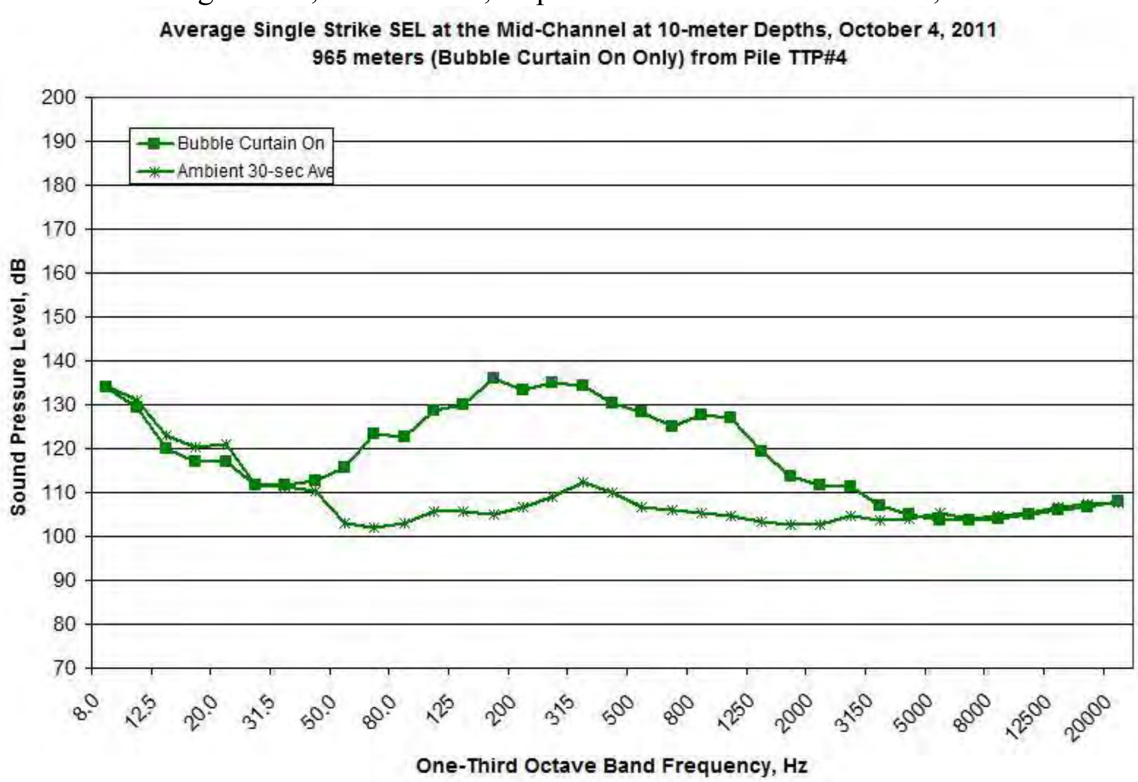

Figure B382. Average One-second SEL Spectral Data Measured at the MID Location during TTP#4, 14:49-14:59, Depths of 10 meters on October 4, 2011

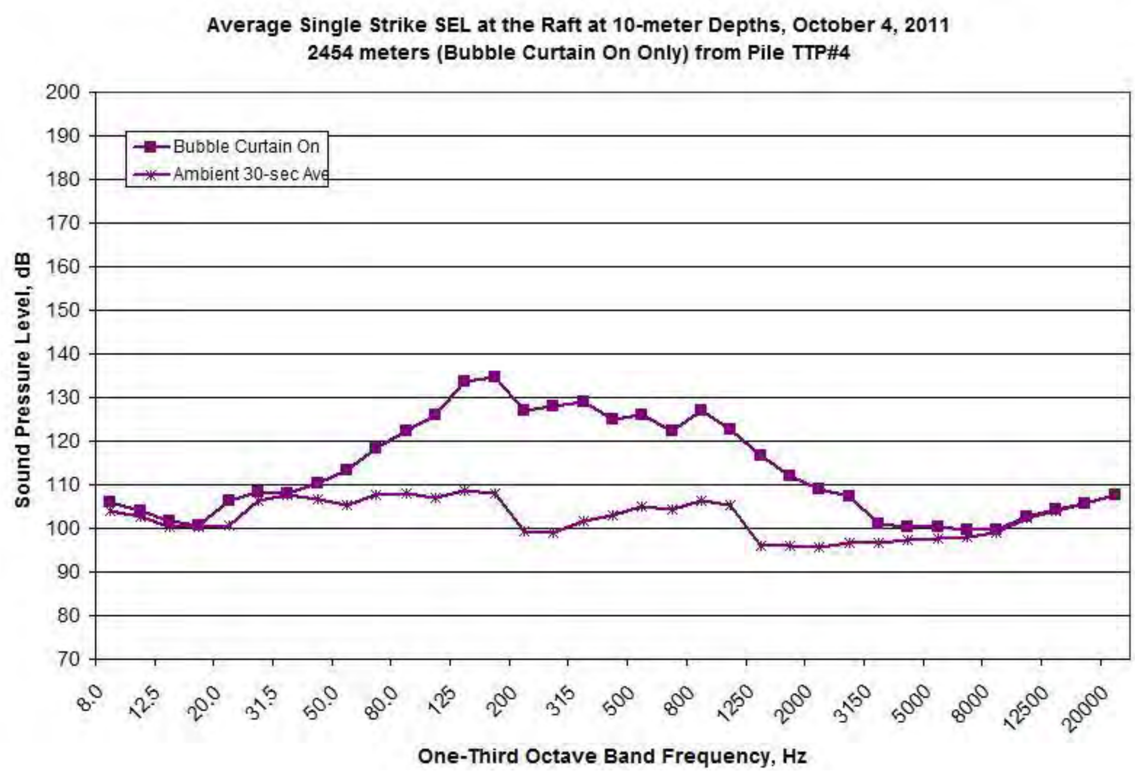

Figure B383. Average One-second SEL Spectral Data Measured at the RFT Location during TTP#4, 14:49-14:59, Depths of 10 meters on October 4, 2011

10/8/2011 – TP#1

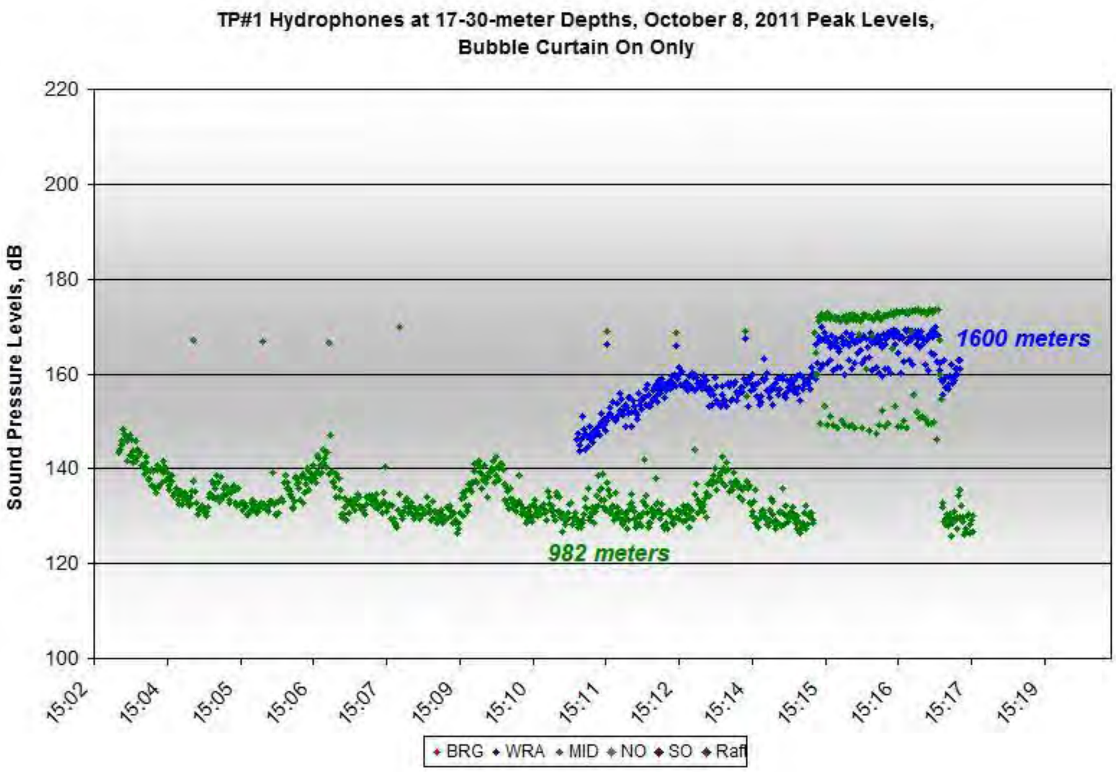

Figure B384. One-second Peak Level Data for TP#1 during Bubble On Conditions, 15:04-15:17, at Depths of 17-30 meters on October 8, 2011

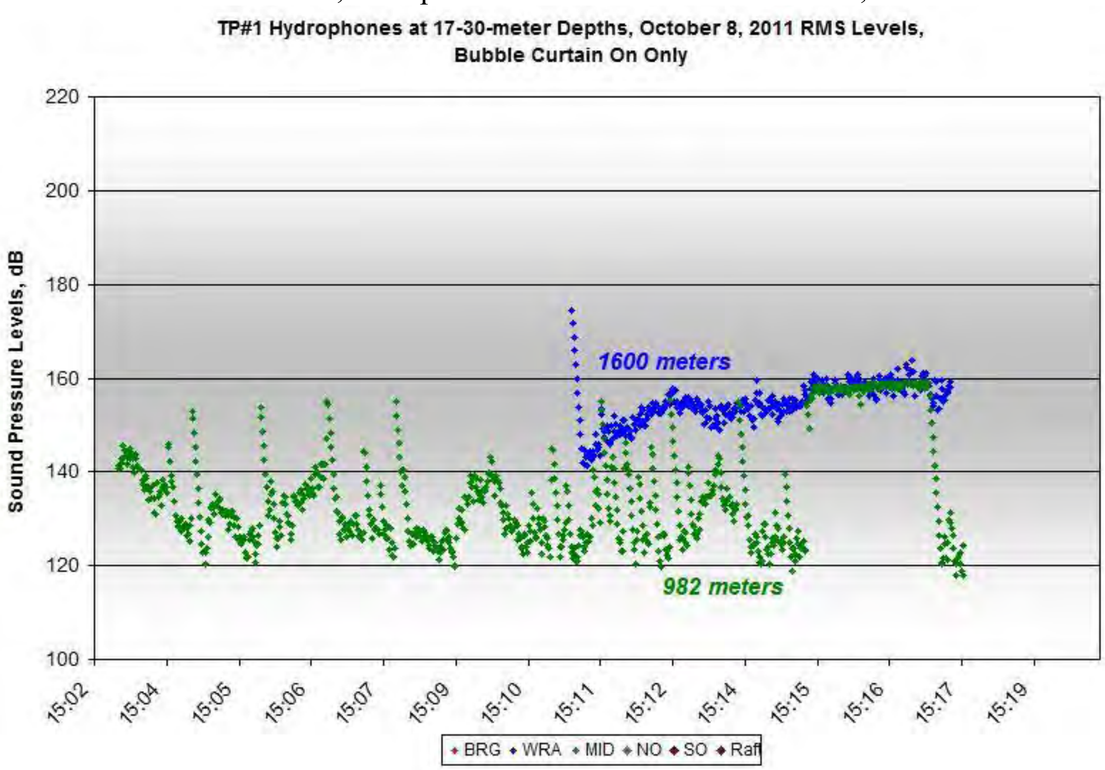

Figure B385. Impulse RMS Data for TP#1 during Bubble On Conditions, 15:04-15:17, at Depths of 17-30 meters on October 8, 2011

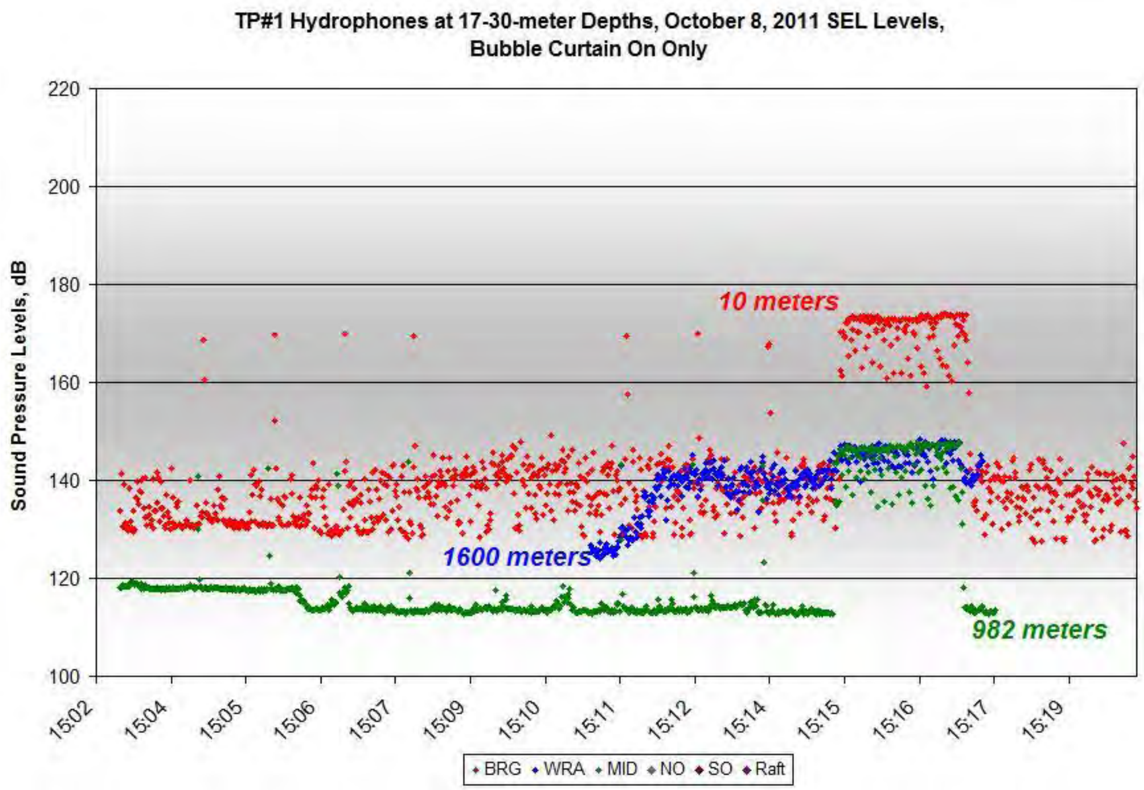

Figure B386. One-second SEL Data for TP#1 during Bubble On Conditions, 15:04-15:17, at Depths of 17-30 meters on October 8, 2011

NO SPECTRA DATA AVAILABLE

Figure B387. Average One-second SEL Spectral Data Measured at the BRG Location during TP#1, 15:04-15:17, Depths of 20 meters on October 8, 2011

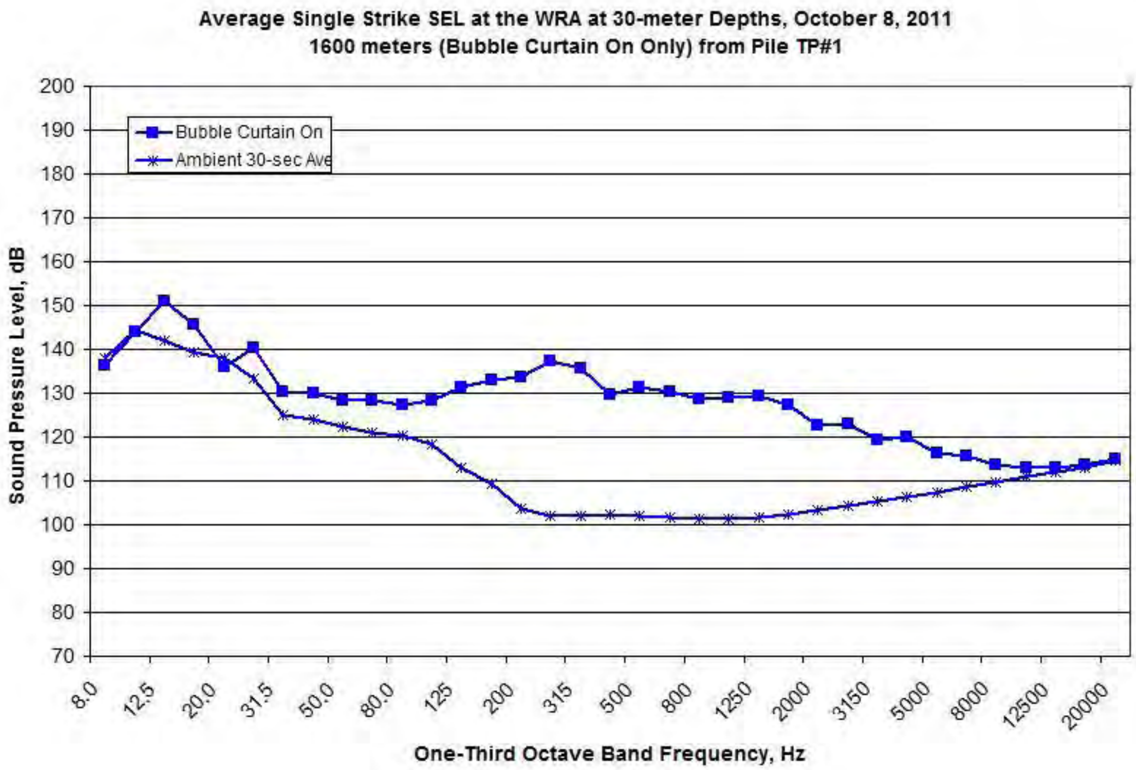

Figure B388. Average One-second SEL Spectral Data Measured at the WRA Location during TP#1, 15:04-15:17, Depths of 30 meters on October 8, 2011

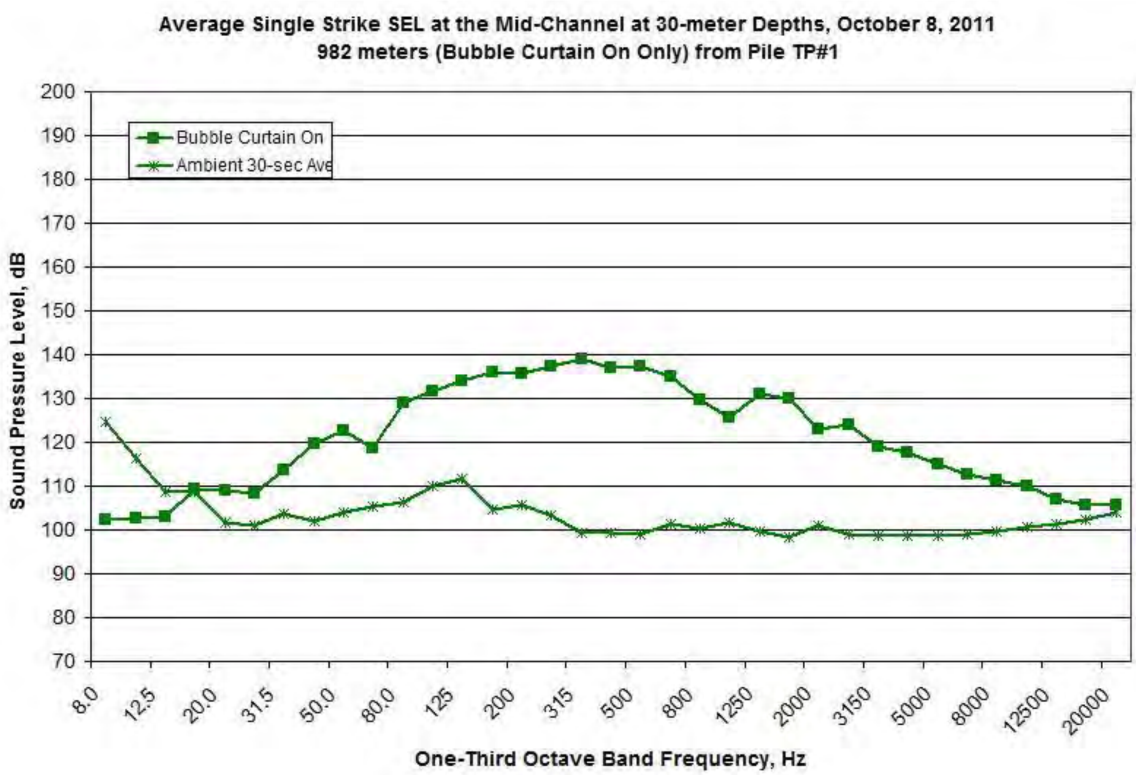

Figure B389. Average One-second SEL Spectral Data Measured at the MID Location during TP#1, 15:04-15:17, Depths of 30 meters on October 8, 2011

NO DATA AVAILABLE – EQUIPMENT MALFUNCTION

Figure B390. Average One-second SEL Spectral Data Measured at the RFT Location during TP#1, 15:04-15:17, Depths of 17 meters on October 8, 2011

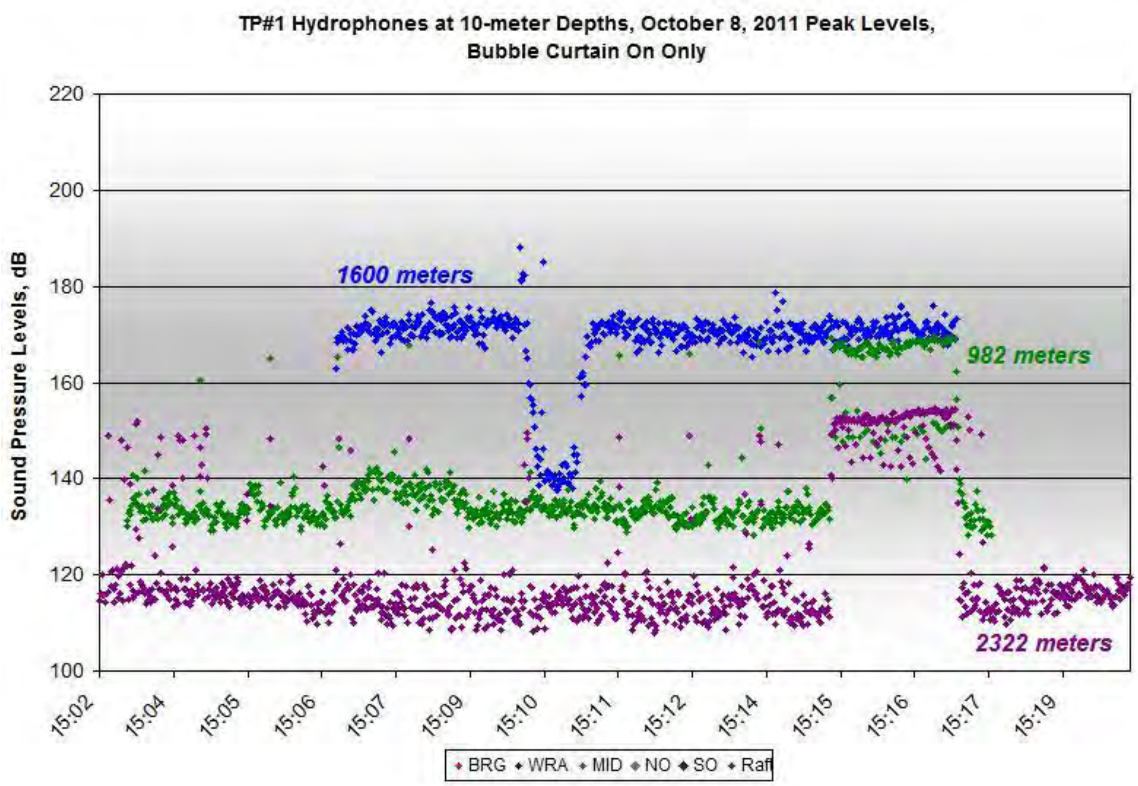

Figure B391. One-second Peak Level Data for TP#1 during Bubble On Conditions, 15:04-15:17, at Depths of 10 meters on October 8, 2011

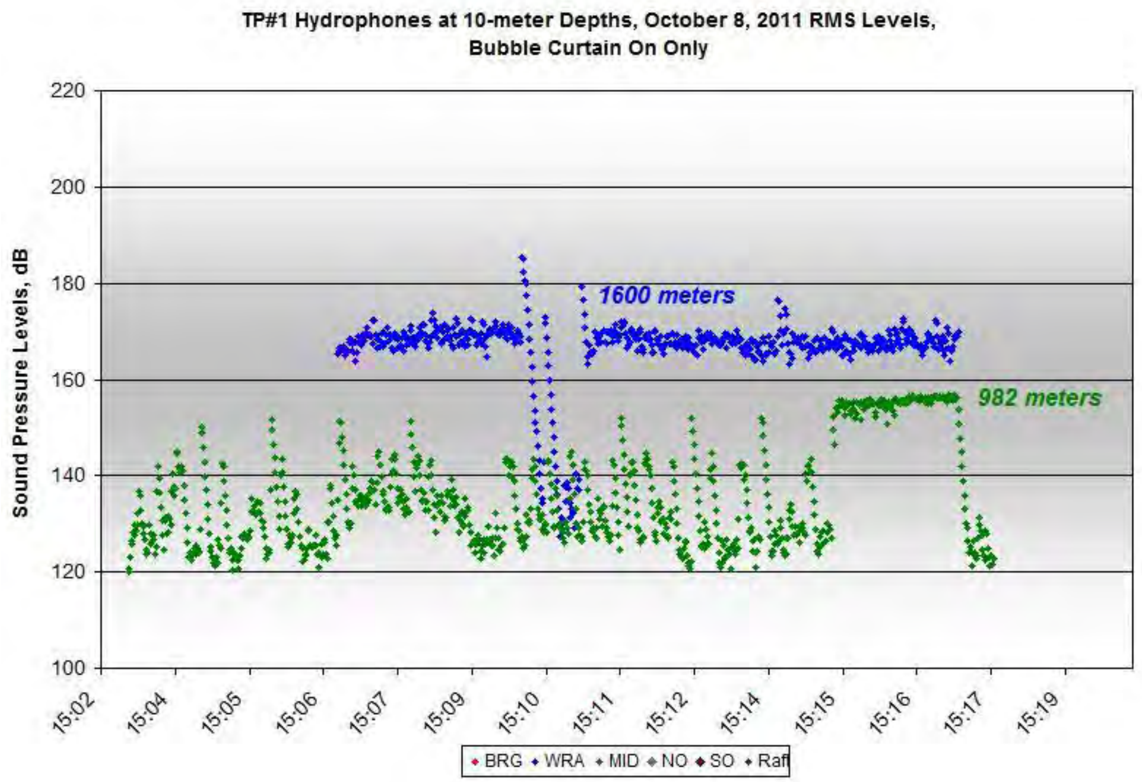

Figure B392. Impulse RMS Data for TP#1 during Bubble On Conditions, 15:04-15:17, at Depths of 10 meters on October 8, 2011

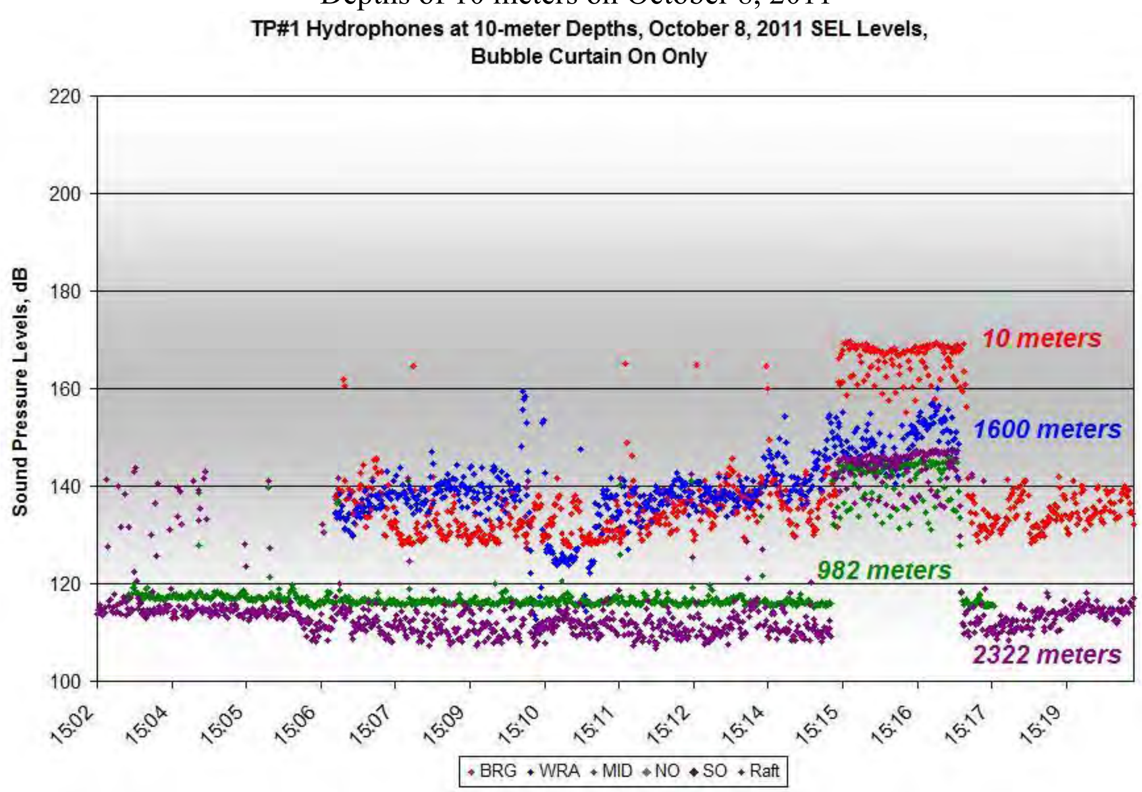

Figure B393. One-second SEL Data for TP#1 during Bubble On Conditions, 15:04-15:17, at Depths of 10 meters on October 8, 2011

NO SPECTRA DATA AVAILABLE

Figure B394. Average One-second SEL Spectral Data Measured at the BRG Location during TP#1, 15:04-15:17, Depths of 10 meters on October 8, 2011

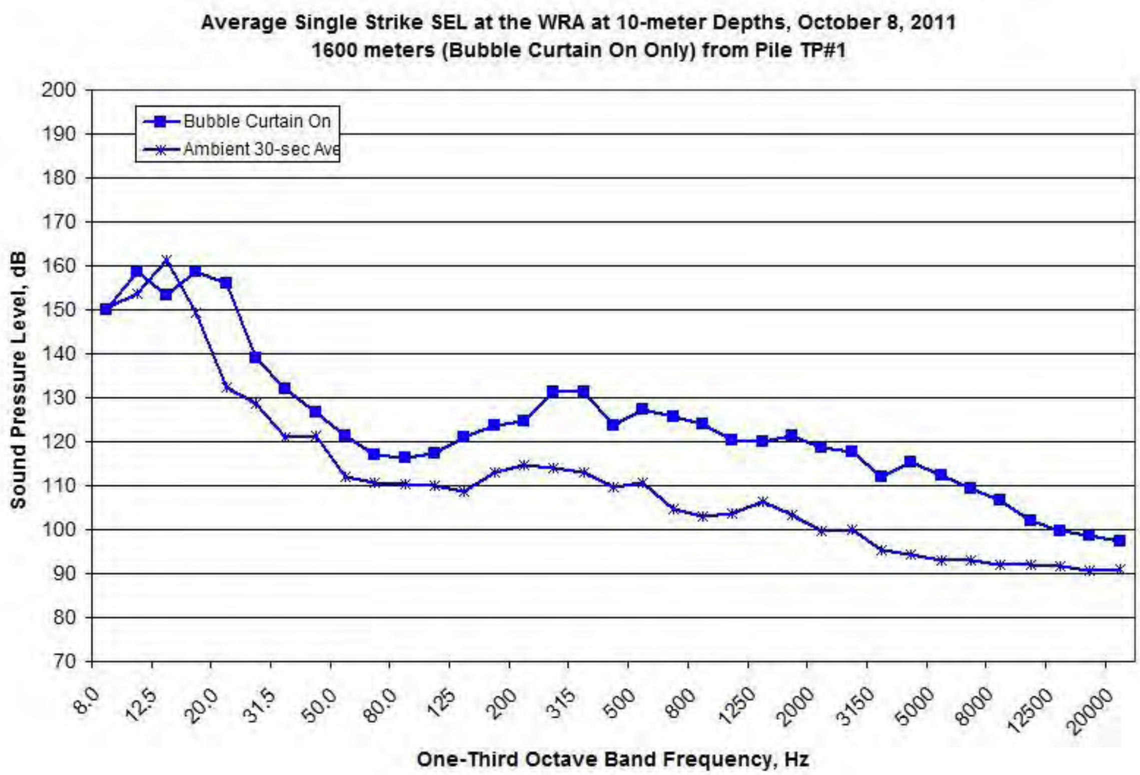

Figure B395. Average One-second SEL Spectral Data Measured at the WRA Location during TP#1, 15:04-15:17, Depths of 10 meters on October 8, 2011

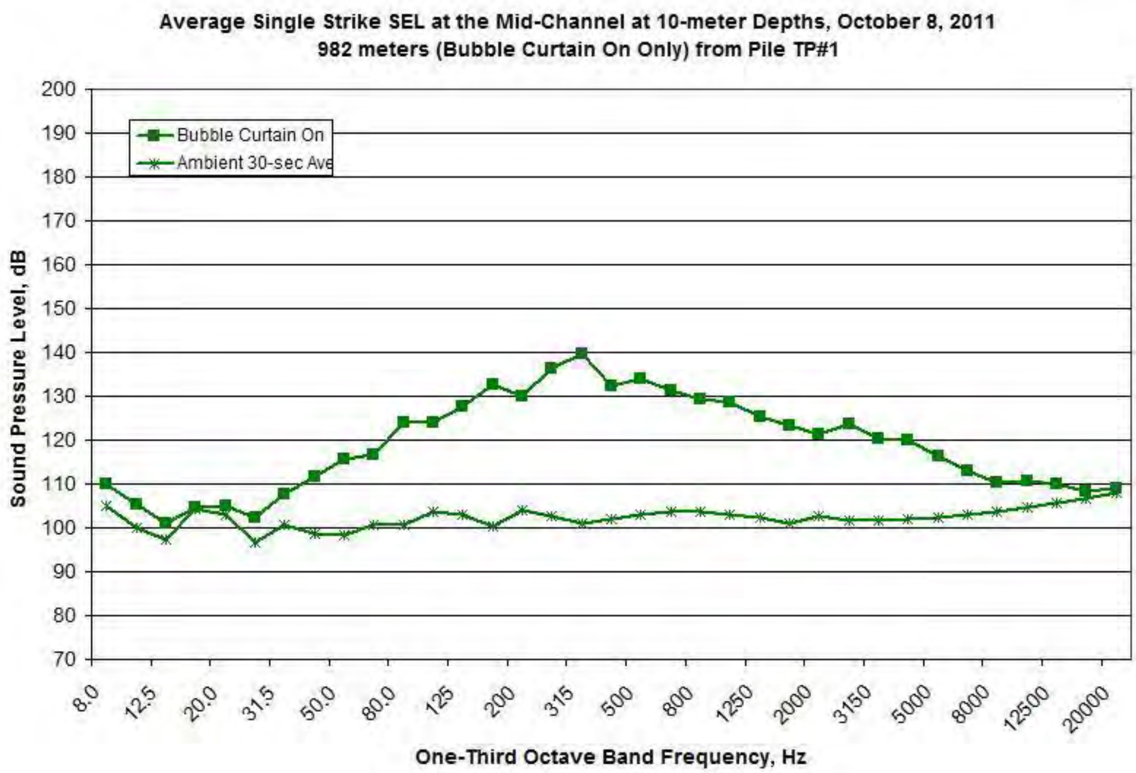

Figure B396. Average One-second SEL Spectral Data Measured at the MID Location during TP#1, 15:04-15:17, Depths of 10 meters on October 8, 2011

NO SPECTRA DATA AVAILABLE

Figure B397. Average One-second SEL Spectral Data Measured at the RFT Location during TP#1, 15:04-15:17, Depths of 10 meters on October 8, 2011

APPENDIX C

AIRBORNE RESULTS

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APPENDIX C – AIRBORNE MICROPHONE RESULTS

C.1. AIRBORNE RESULTS DURING VIBRATORY PILE DRIVING

8/29/2011 – TTP#1

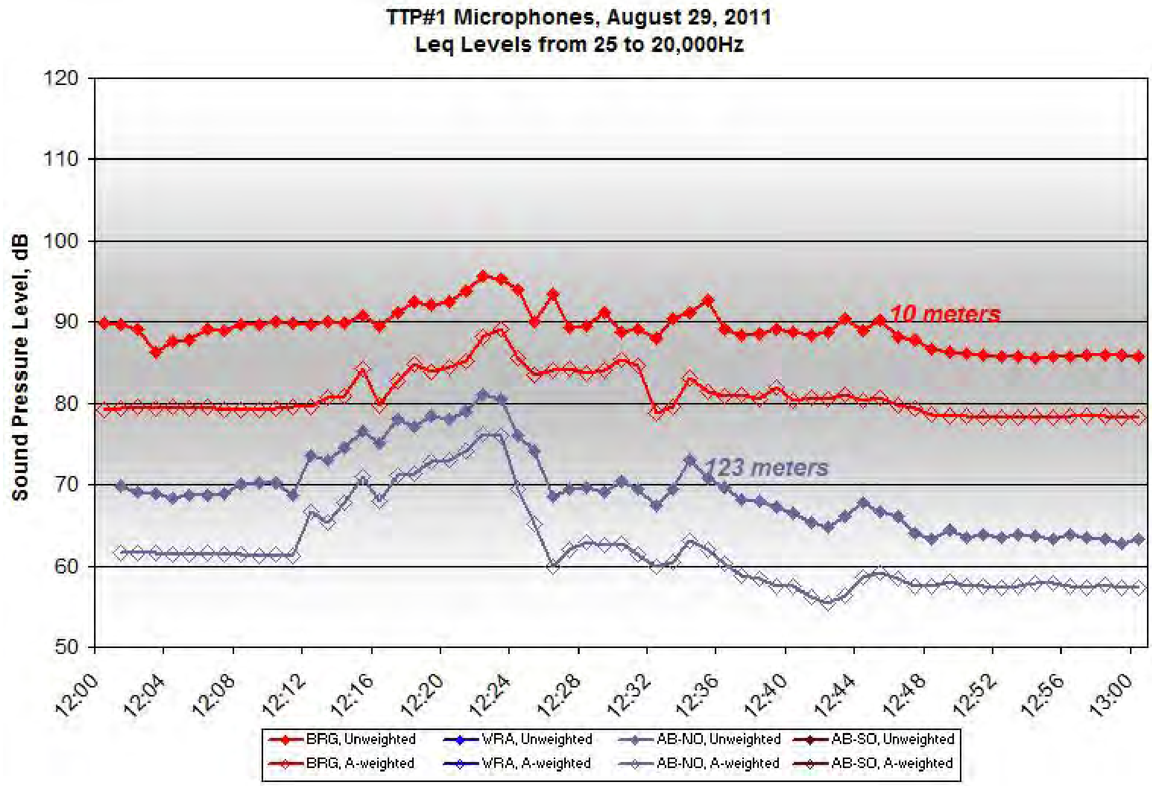

Figure C1. One-minute Unweighted and A-weighted Leq Level Data at TTP#1, 12:13-12:22, on August 29, 2011

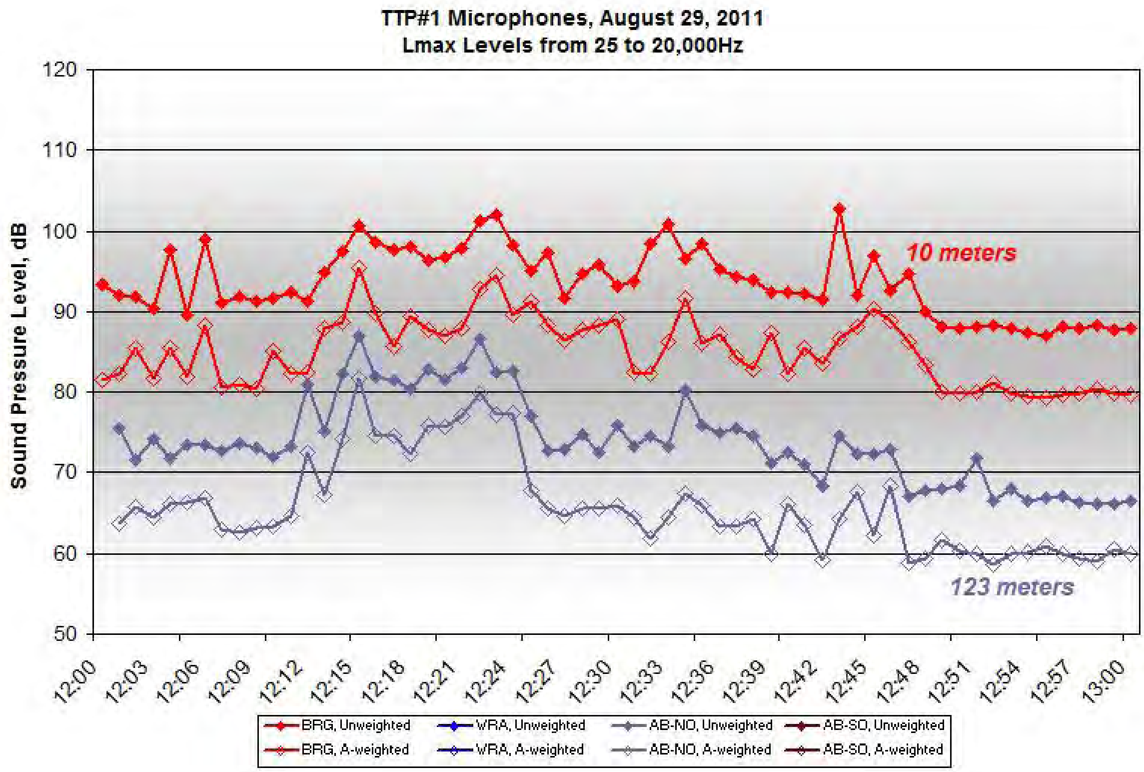

Figure C2. One-minute Unweighted and A-weighted Lmax Level Data at TTP#1, 12:13-12:22, on August 29, 2011

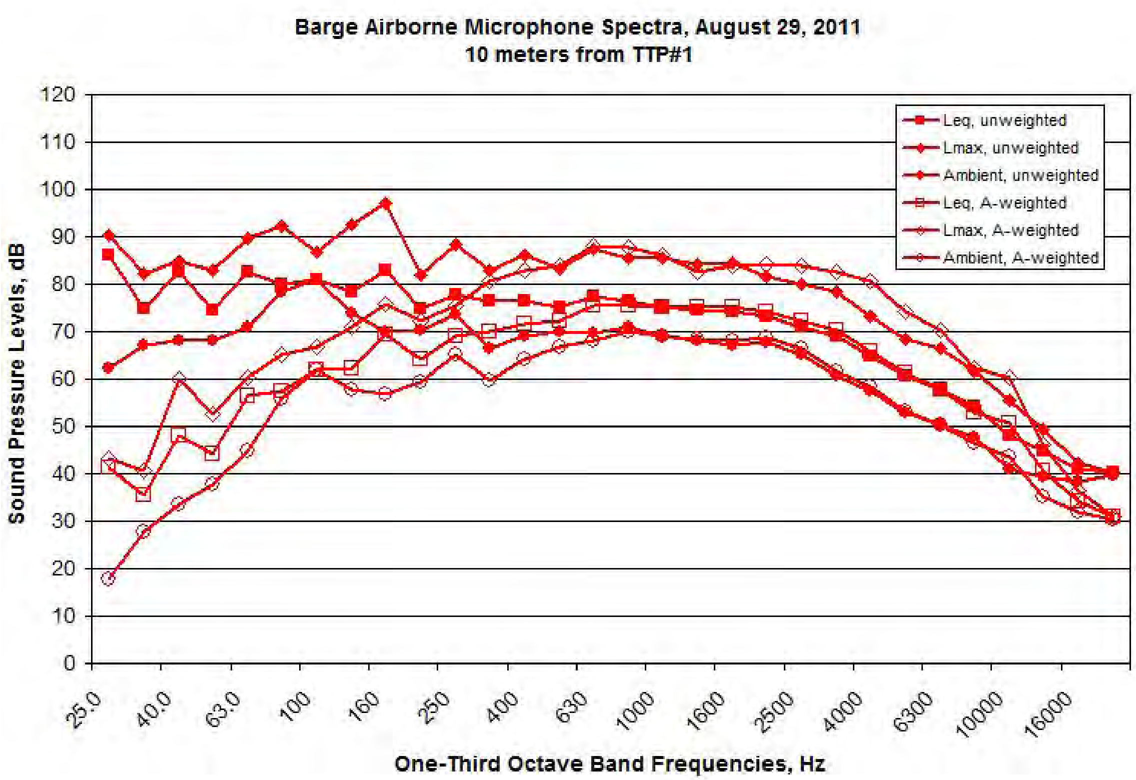

Figure C3. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#1, 12:13-12:22, on August 29, 2011

NO DATA AVAILABLE

Figure C4. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#1, 12:13-12:22, on August 29, 2011

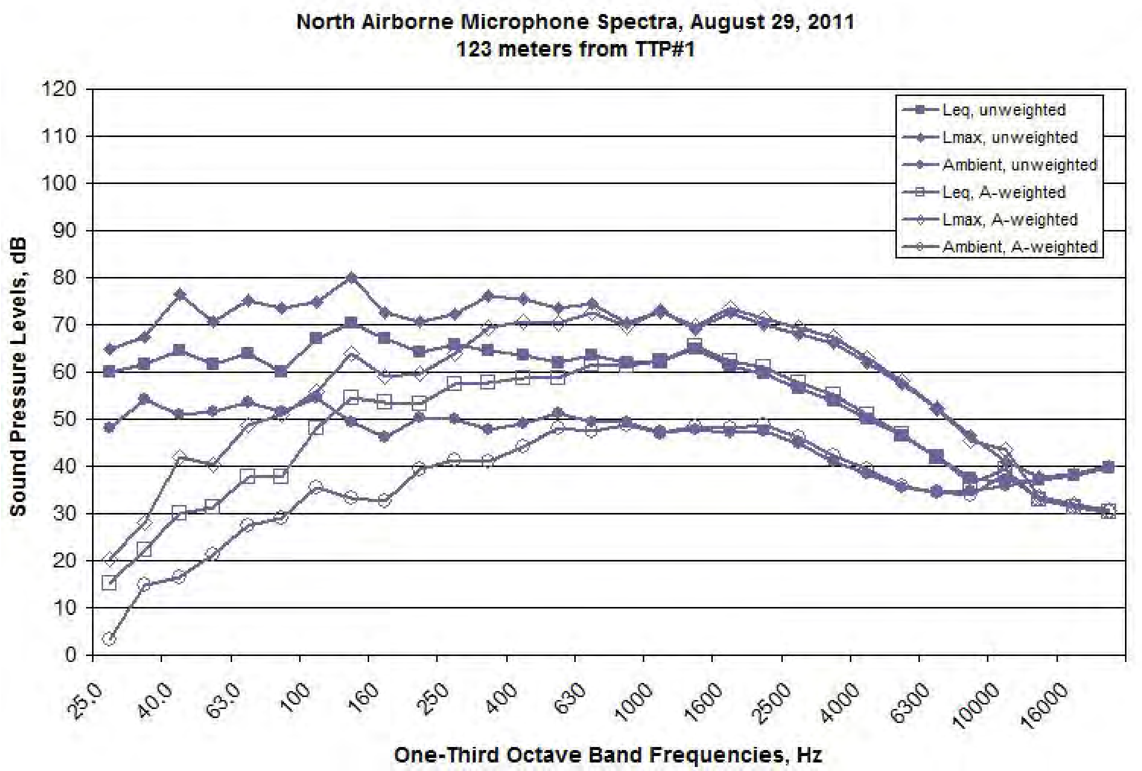

Figure C5. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#1, 12:13-12:22, on August 29, 2011

NO DATA AVAILABLE

Figure C6. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#1, 12:13-12:22, on August 29, 2011

TTP#2

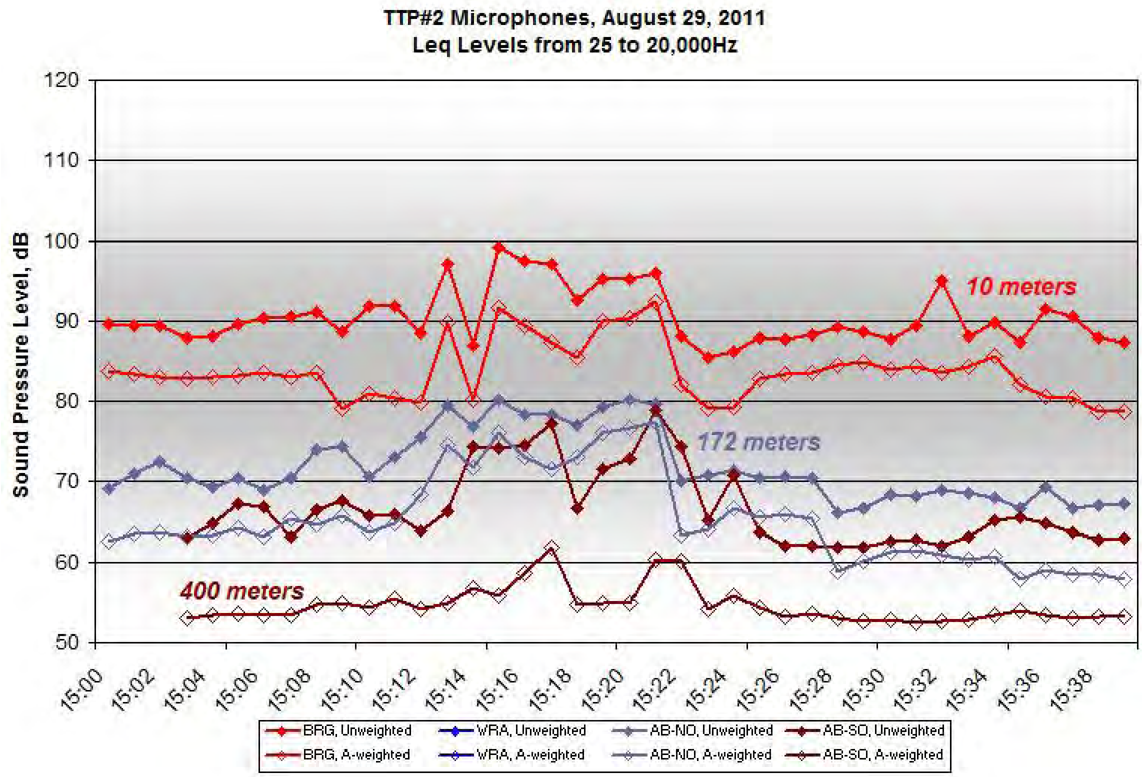

Figure C7. One-minute Unweighted and A-weighted Leq Level Data at TTP#2, 15:11-15:20, on August 29, 2011

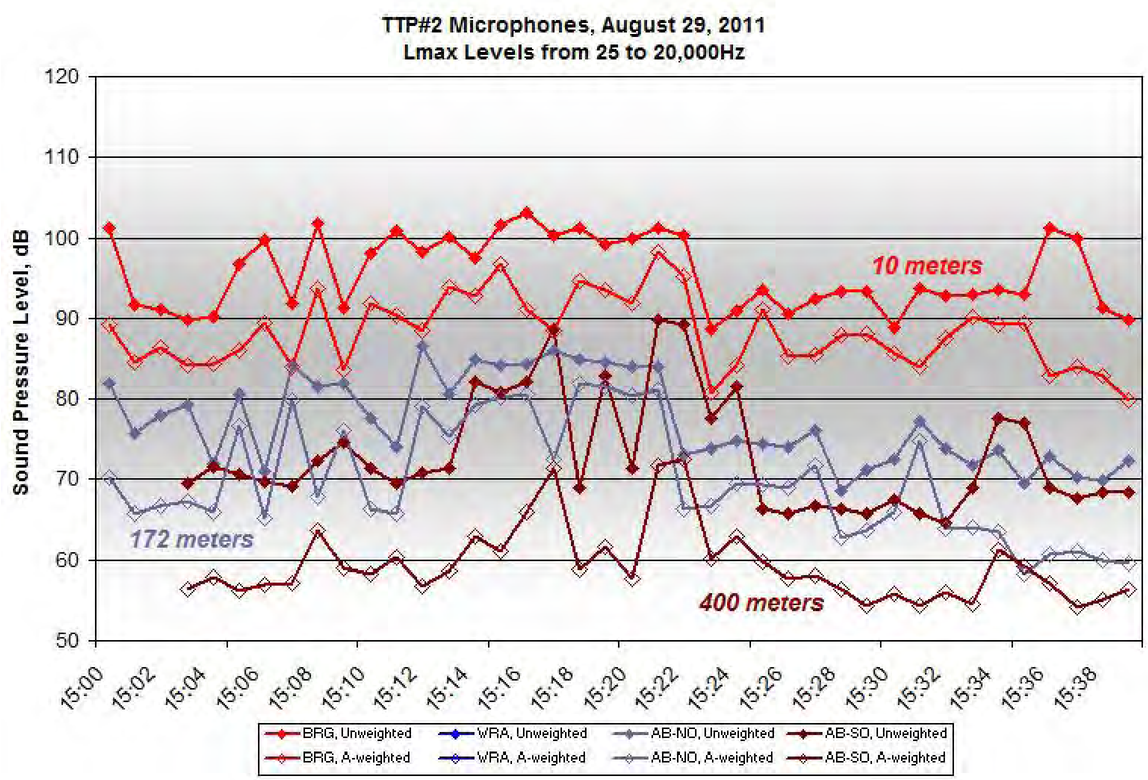

Figure C8. One-minute Unweighted and A-weighted Lmax Level Data at TTP#2, 15:11-15:20, on August 29, 2011

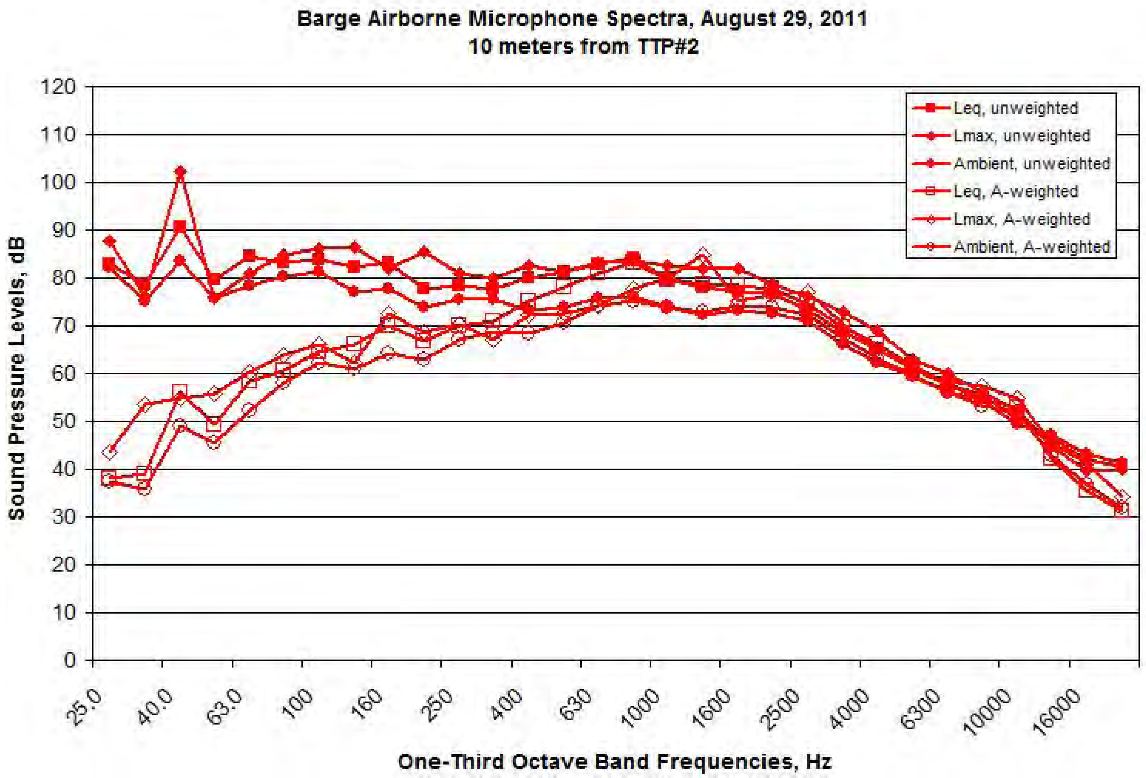

Figure C9. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#2, 15:11-15:20, on August 29, 2011

NO DATA AVAILABLE

Figure C10. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#2, 15:11-15:20, on August 29, 2011

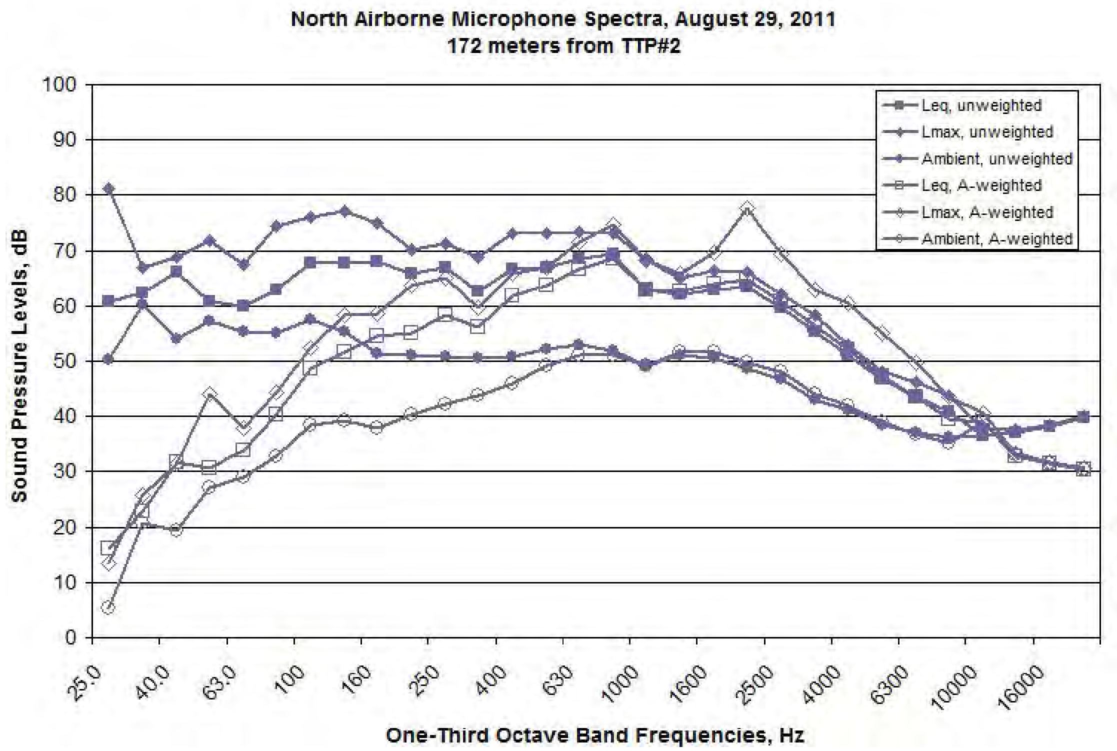

Figure C11. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#2, 15:11-15:20, on August 29, 2011

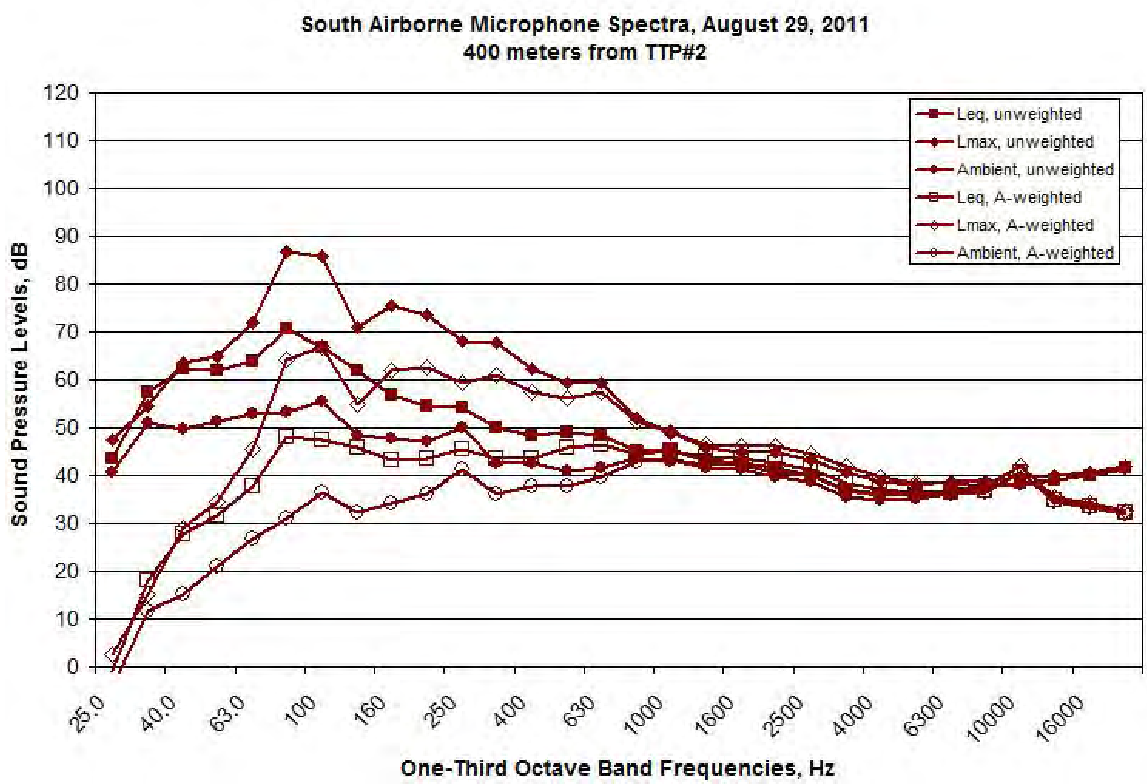

Figure C12. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#2, 15:11-15:20, on August 29, 2011

8/30/2011 – TTP#3, 9:57-10:14

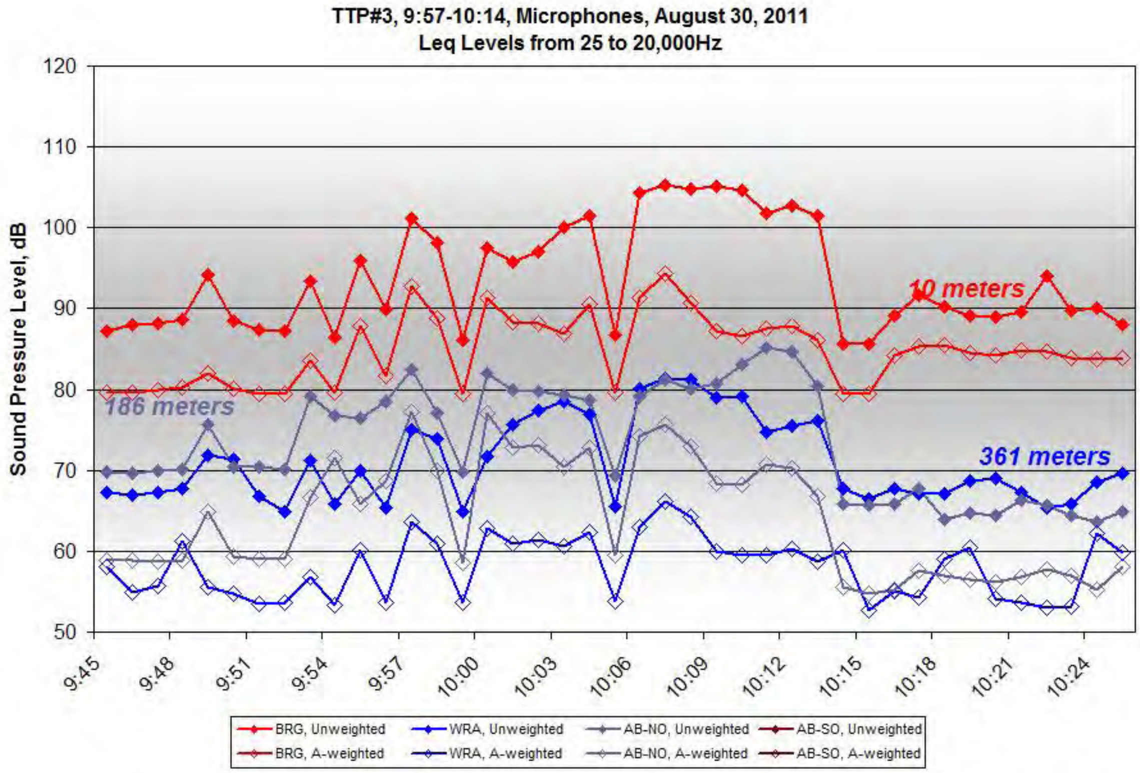

Figure C13. One-minute Unweighted and A-weighted Leq Level Data at TTP#3, 9:57-10:14, on August 30, 2011

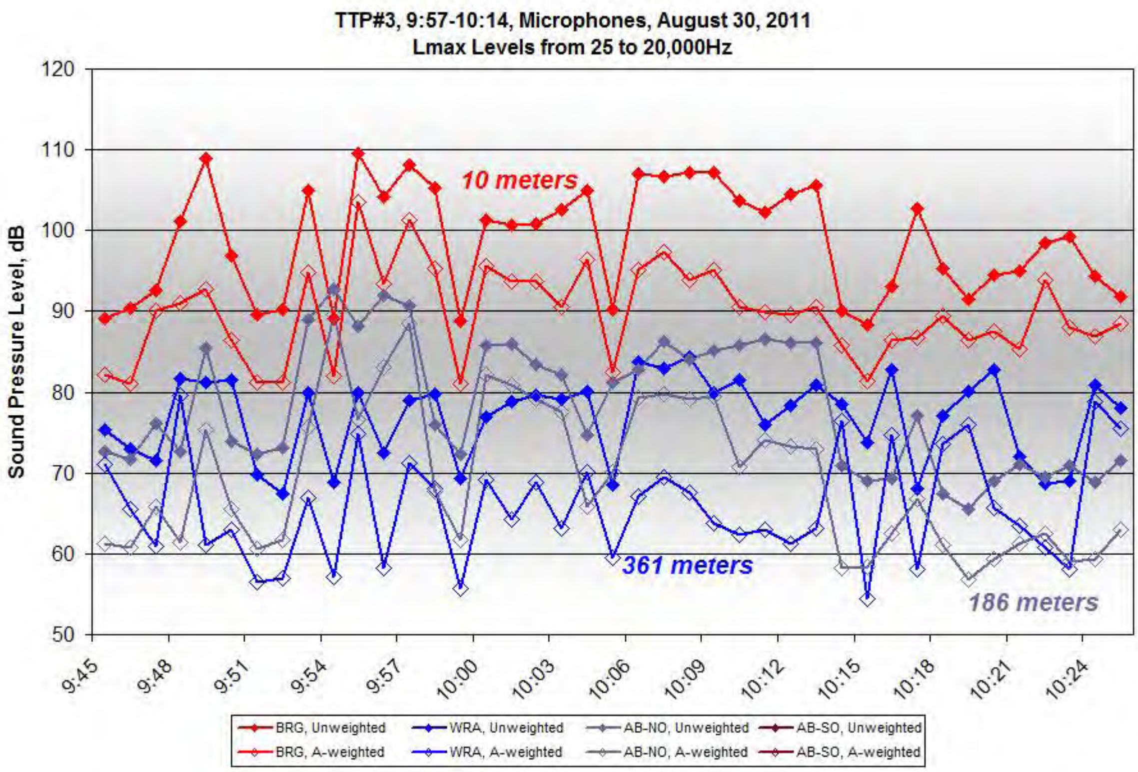

Figure C14. One-minute Unweighted and A-weighted Lmax Level during at TTP#3, 9:57-10:14, on August 30, 2011

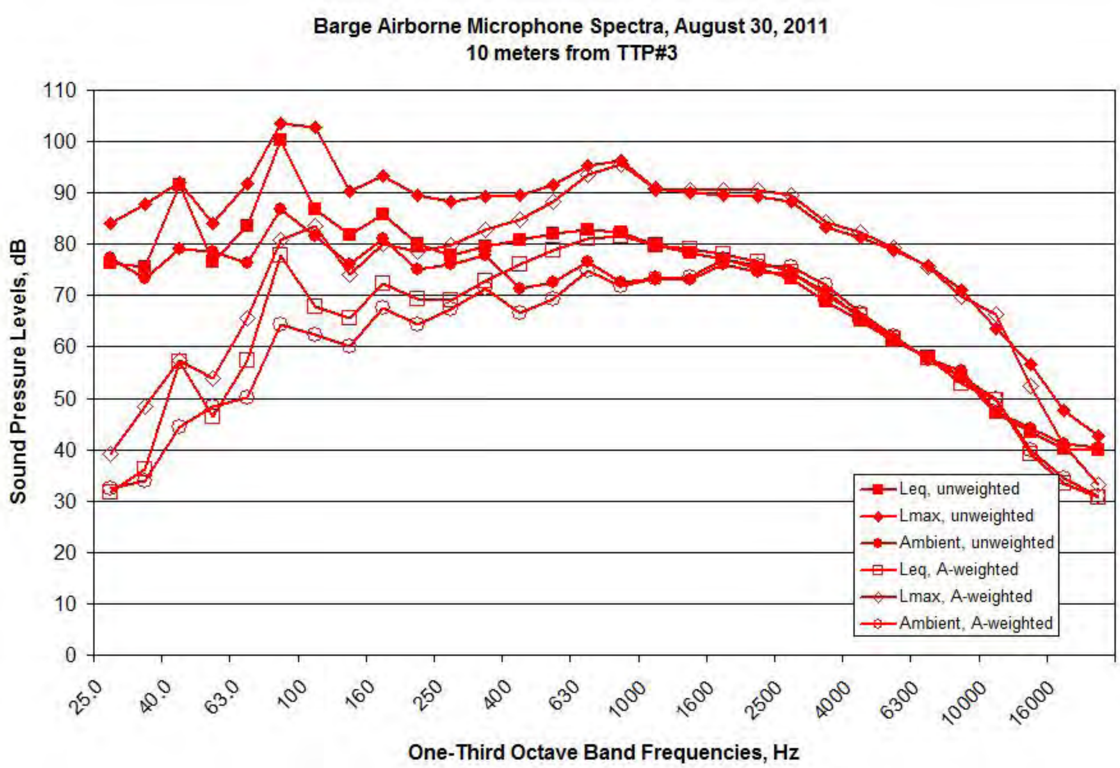

Figure C15. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#3, 9:57-10:14, on August 30, 2011

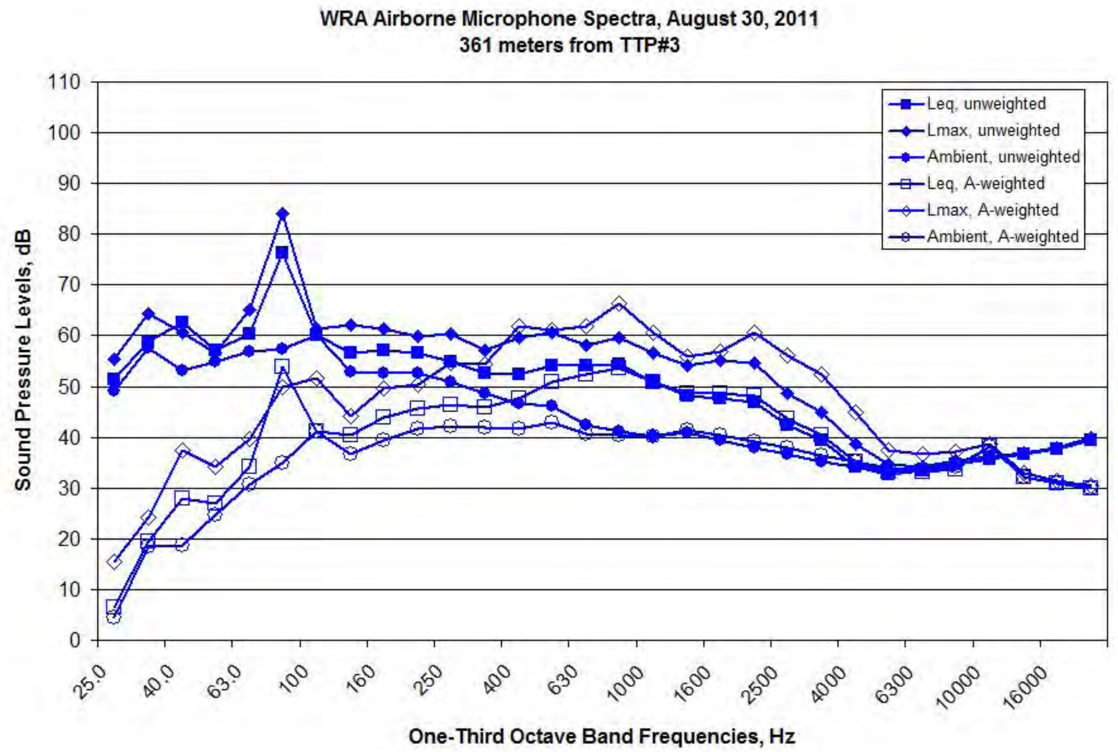

Figure C16. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#3, 9:57-10:14, on August 30, 2011

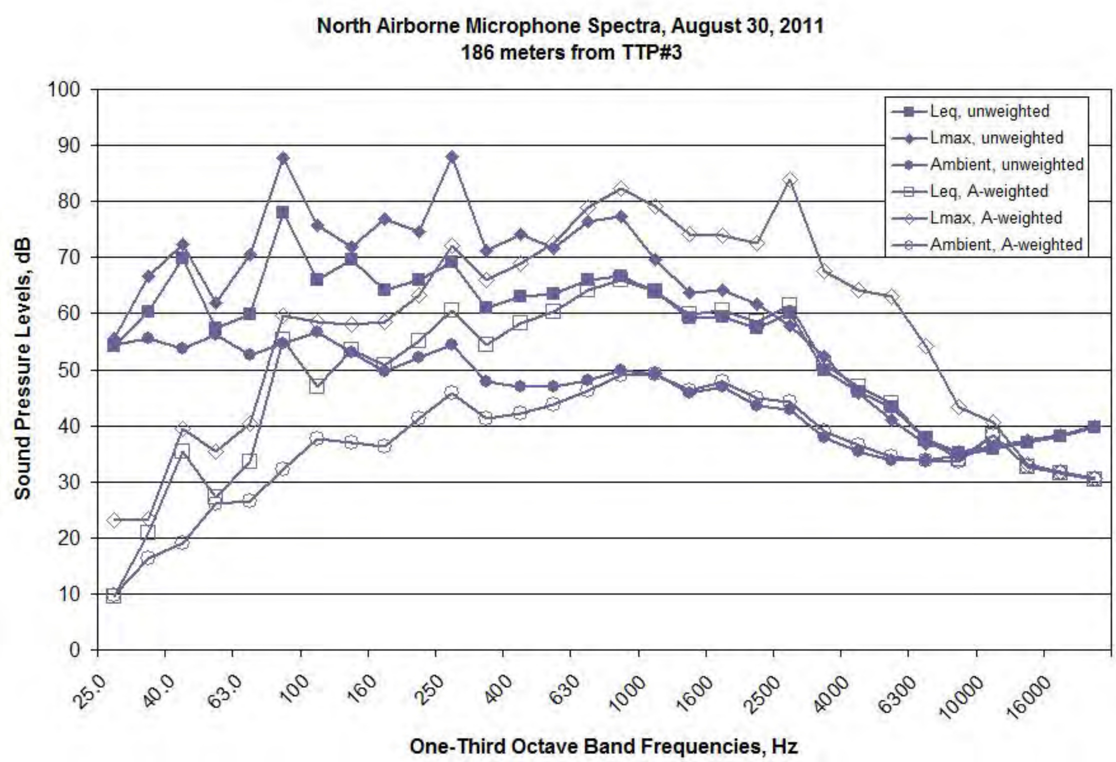

Figure C17. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#3, 9:57-10:14, on August 30, 2011

NO DATA AVAILABLE

Figure C18. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#3, 9:57-10:14, on August 30, 2011

TTP#3, 10:43-10:48

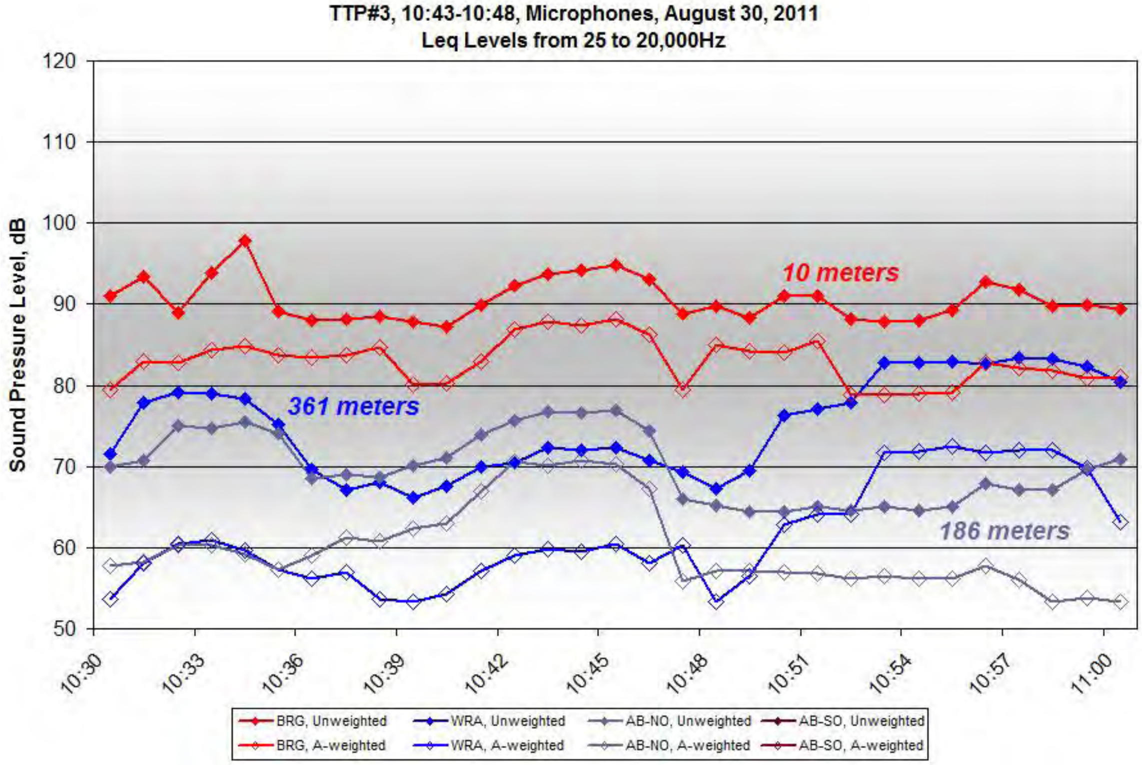

Figure C19. One-minute Unweighted and A-weighted Leq Level at TTP#3, 10:43-10:48, on August 30, 2011

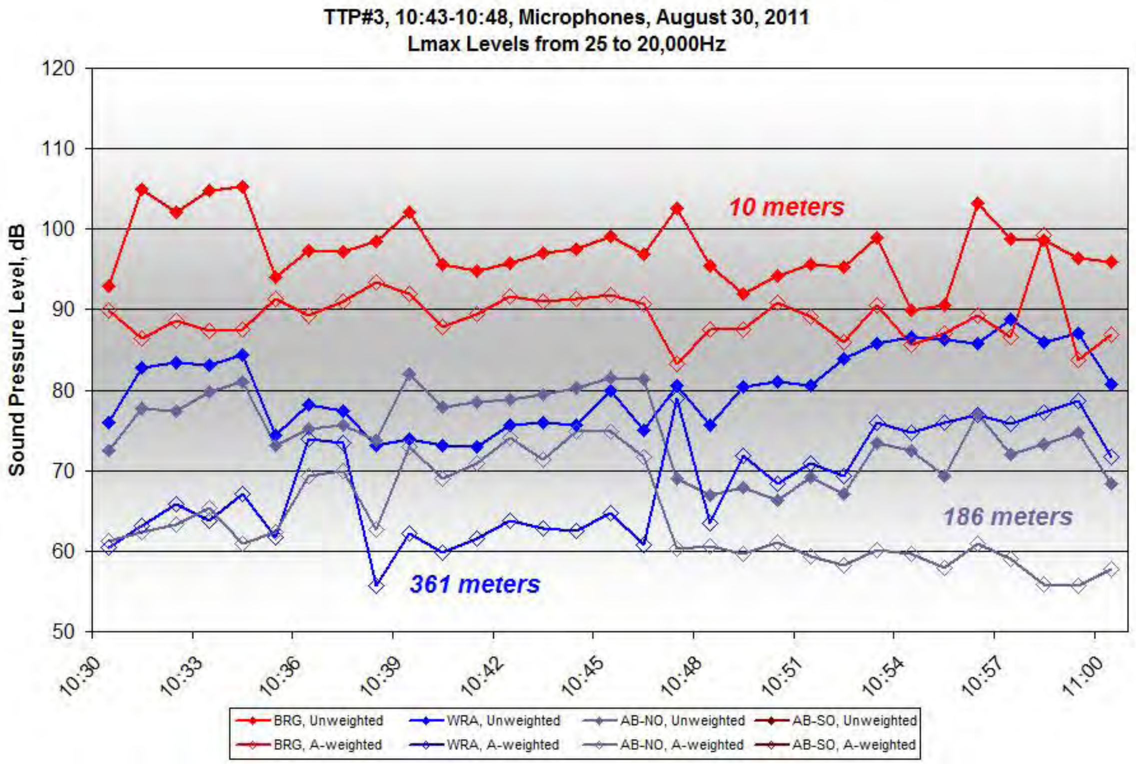

Figure C20. One-minute Unweighted and A-weighted Lmax Level Data at TTP#3, 10:43-10:48, on August 30, 2011

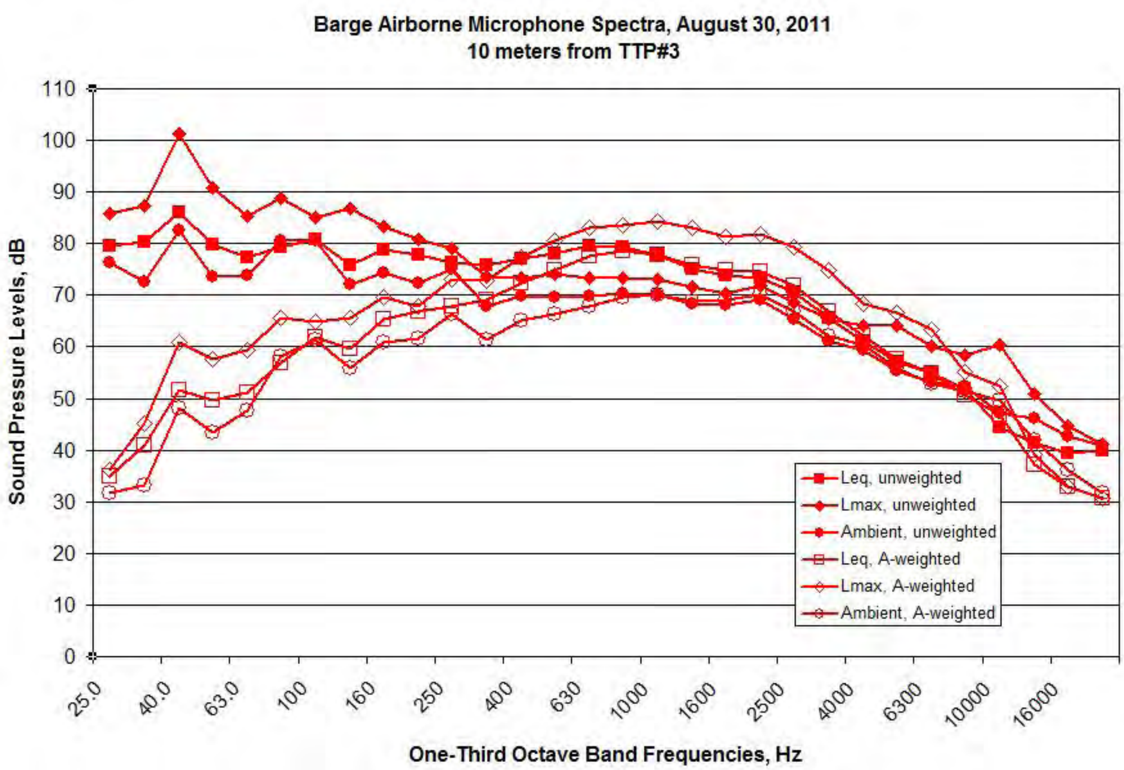

Figure C21. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#3, 10:43-10:48, on August 30, 2011

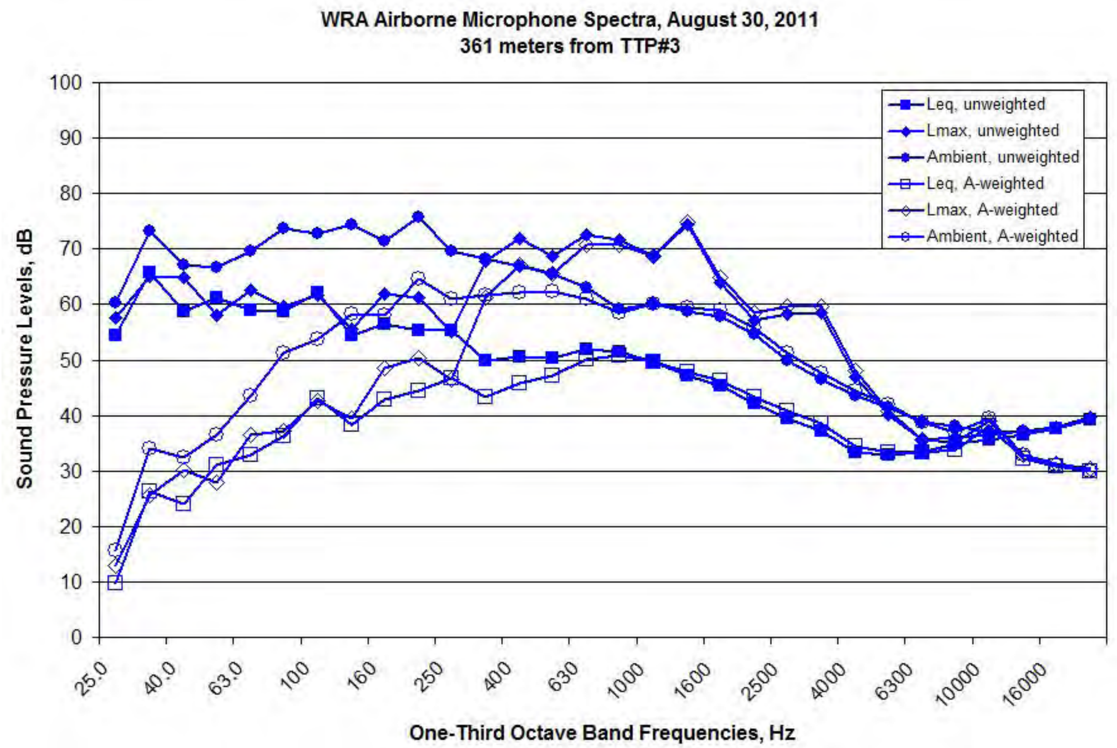

Figure C22. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#3, 10:43-10:48, on August 30, 2011

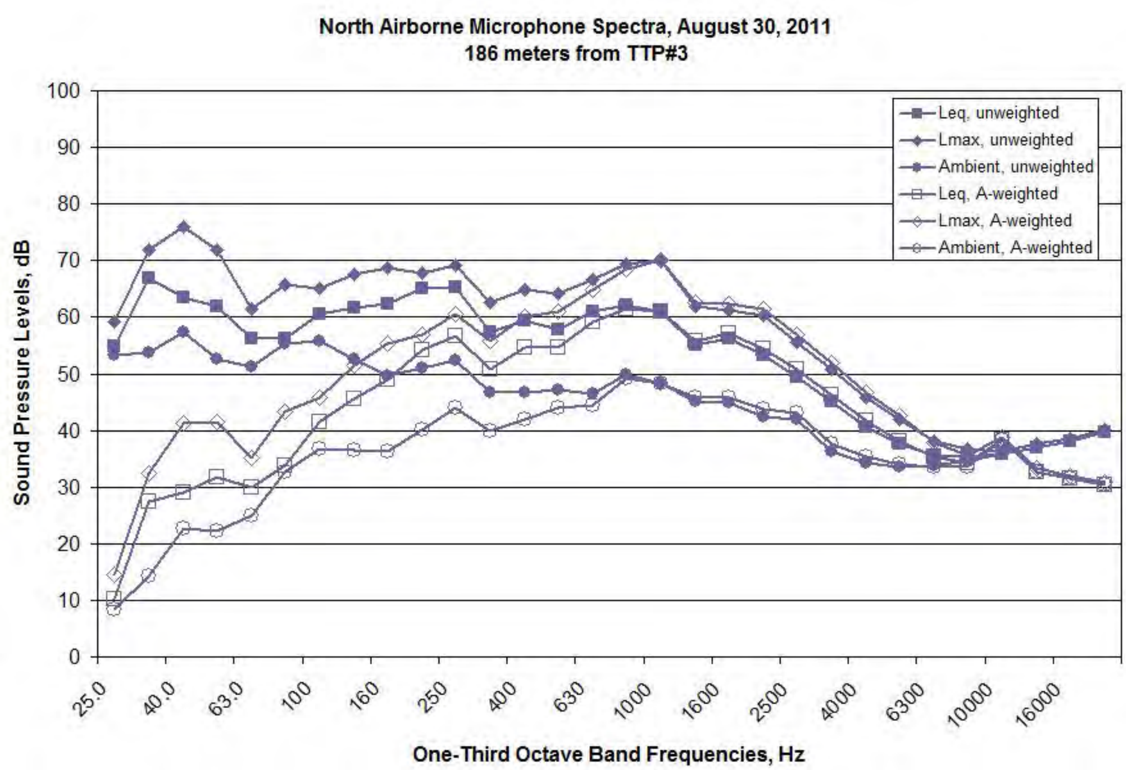

Figure C23. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#3, 10:43-10:48, on August 30, 2011

NO DATA AVAILABLE

Figure C24. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#3, 10:43-10:48, on August 30, 2011

TP#3

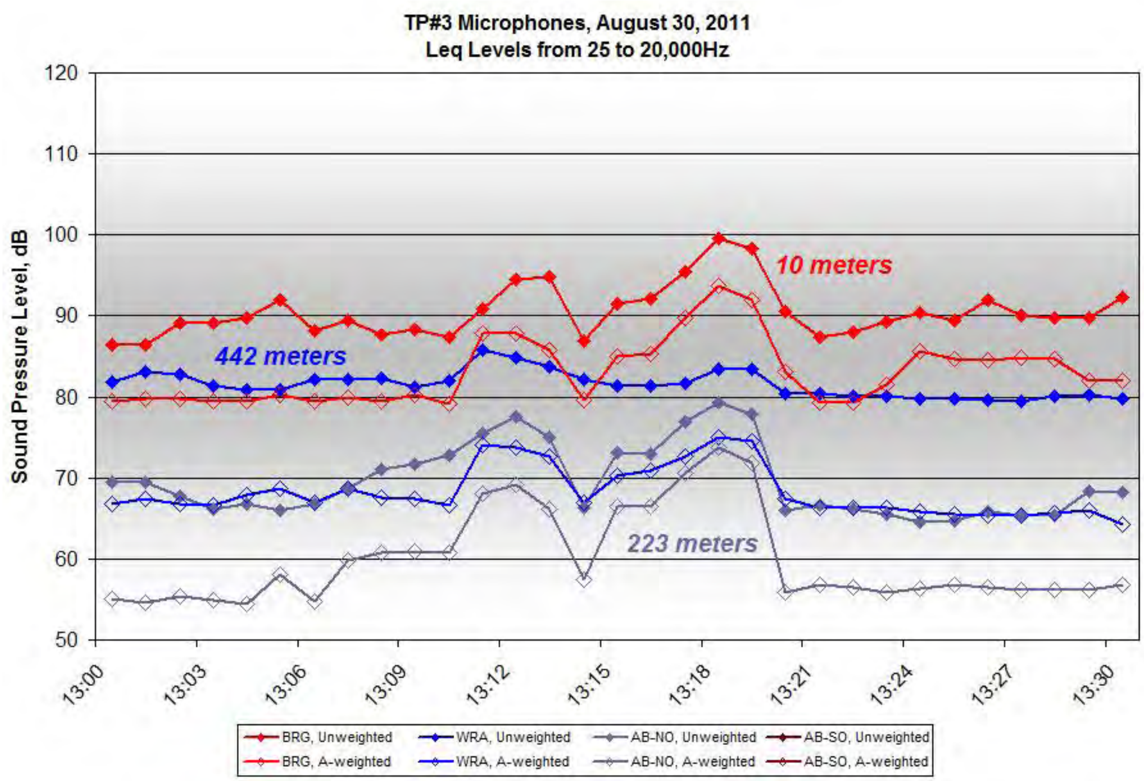

Figure C25. One-minute Unweighted and A-weighted Leq Level Data at TP#3, 13:13-13:20, on August 30, 2011

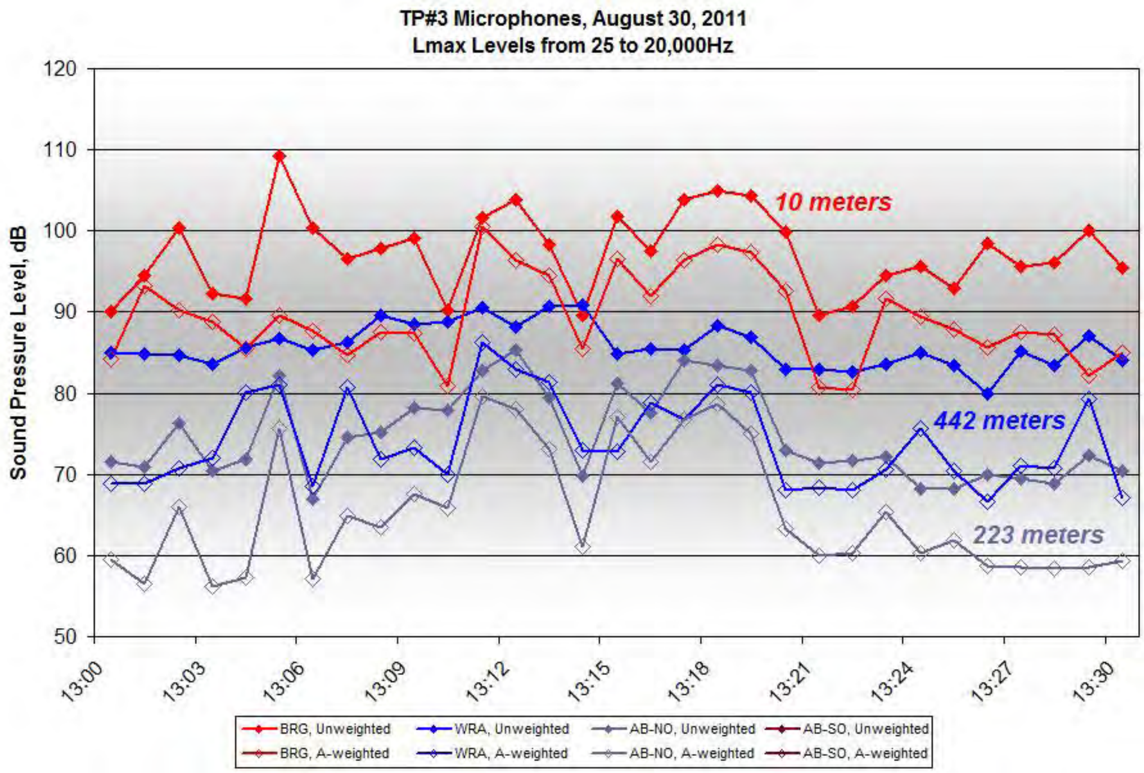

Figure C26. One-minute Unweighted and A-weighted Lmax Level at TP#3, 13:13-13:20, on August 30, 2011

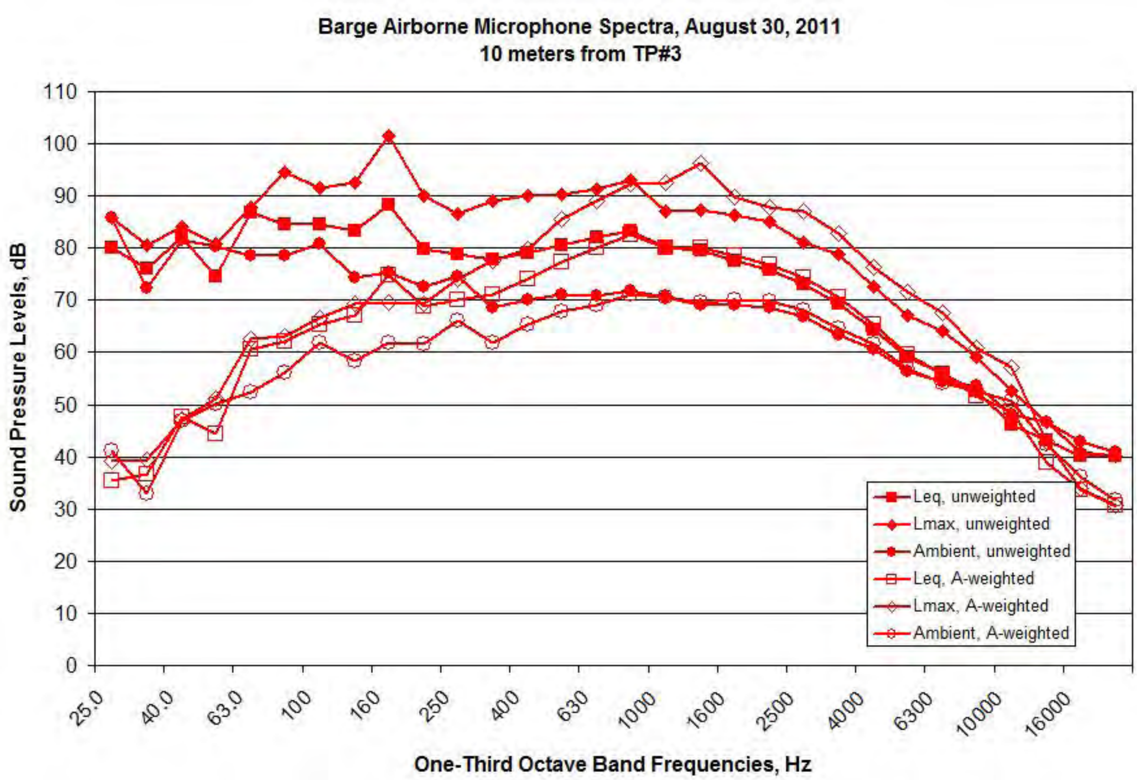

Figure C27. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3, 13:13-13:20, on August 30, 2011

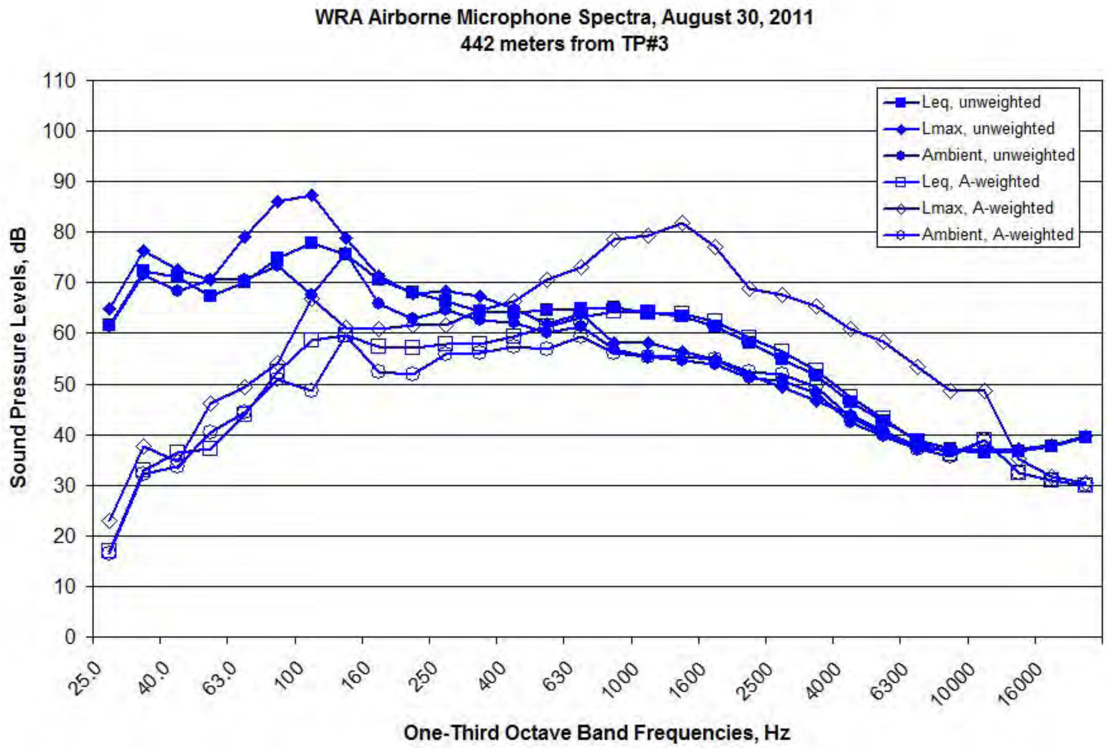

Figure C28. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3, 13:13-13:20, on August 30, 2011

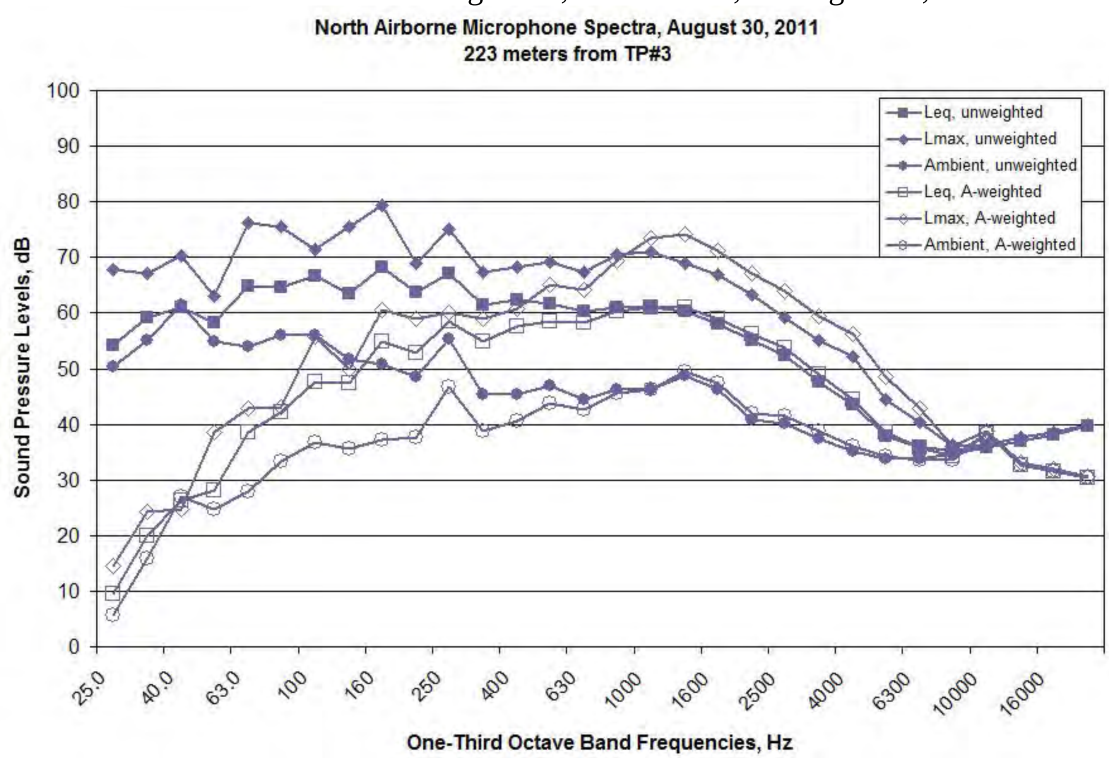

Figure C29. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3, 13:13-13:20, on August 30, 2011

NO DATA AVAILABLE

Figure C30. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3, 13:13-13:20, on August 30, 2011

TP#7

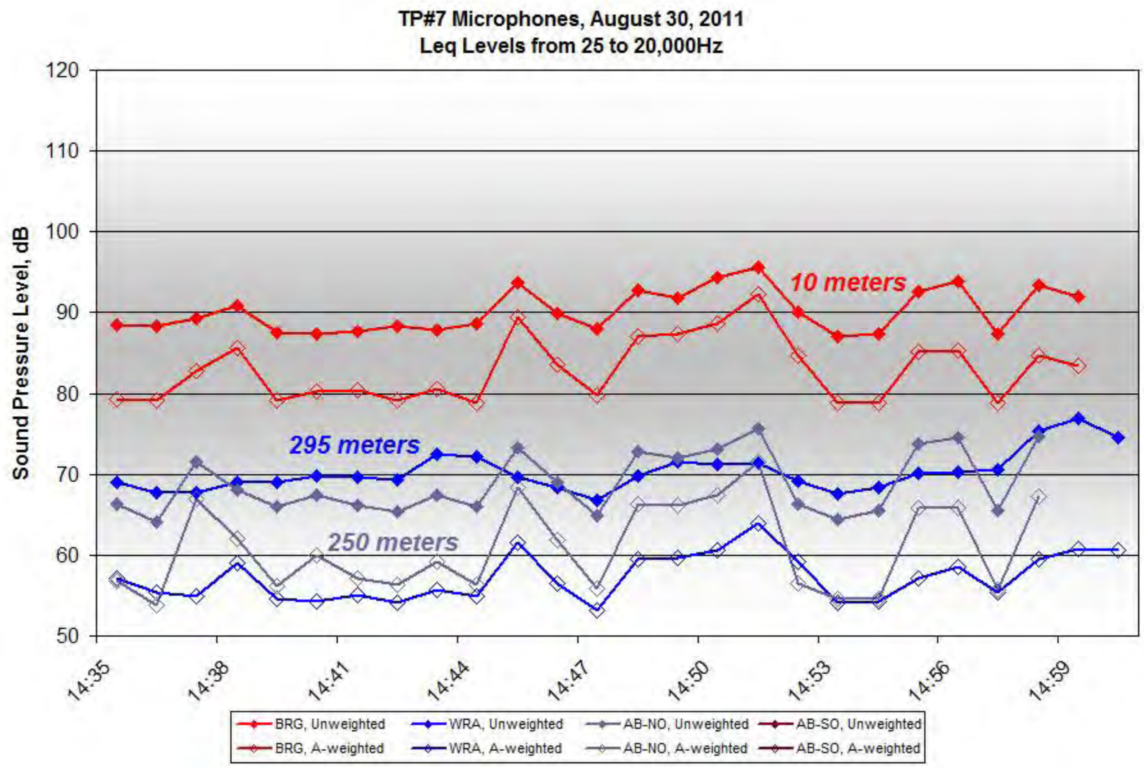

Figure C31. One-minute Unweighted and A-weighted Leq Level Data at TP#7, 14:45-14:52, on August 30, 2011

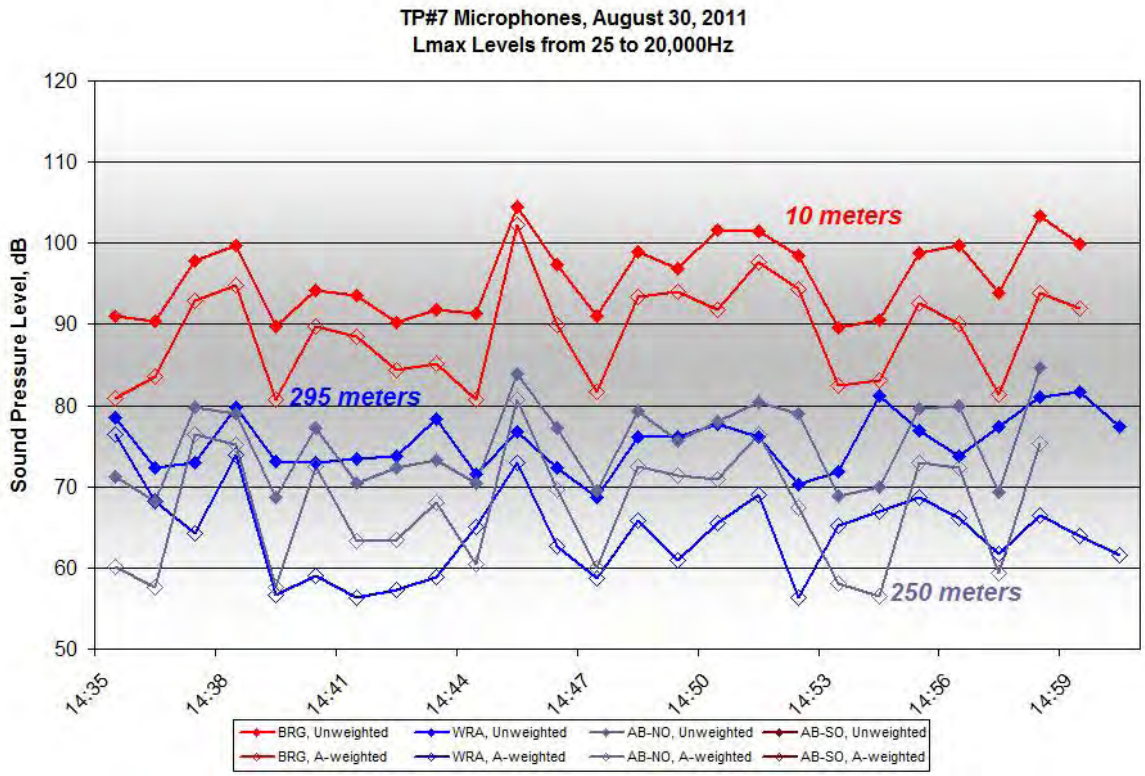

Figure C32. One-minute Unweighted and A-weighted Lmax Level Data at TP#7, 14:45-14:52, on August 30, 2011

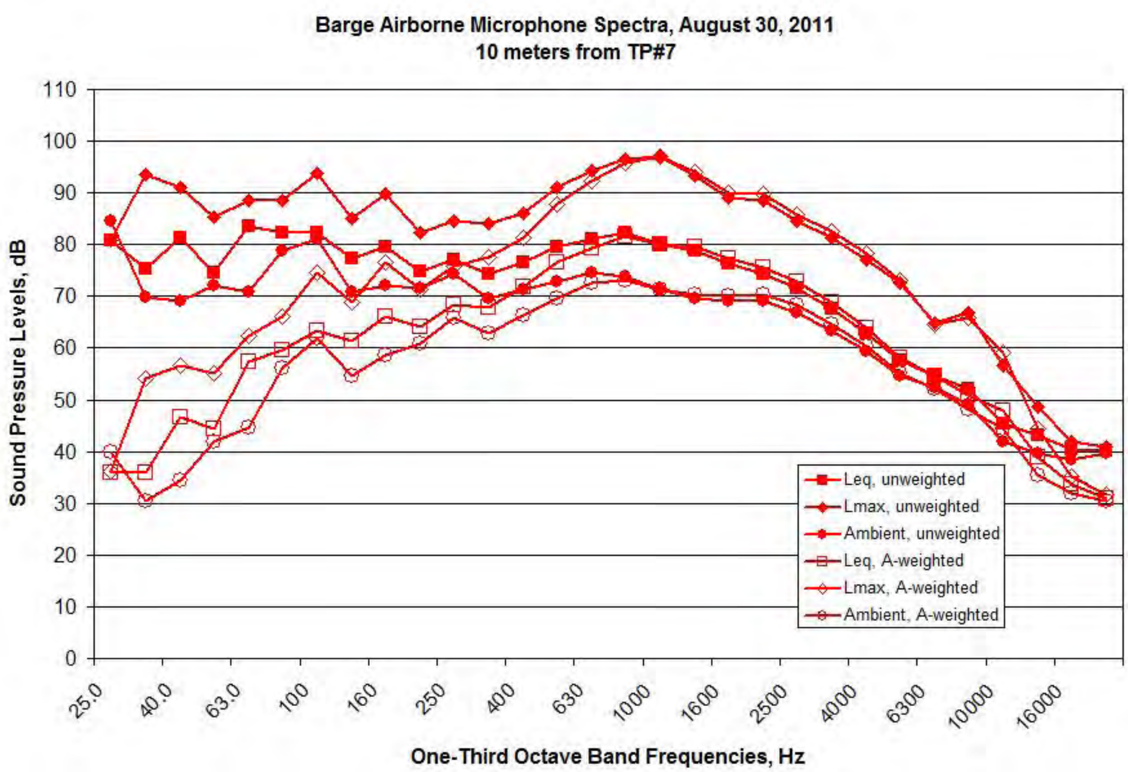

Figure C33. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#7, 14:45-14:52, on August 30, 2011

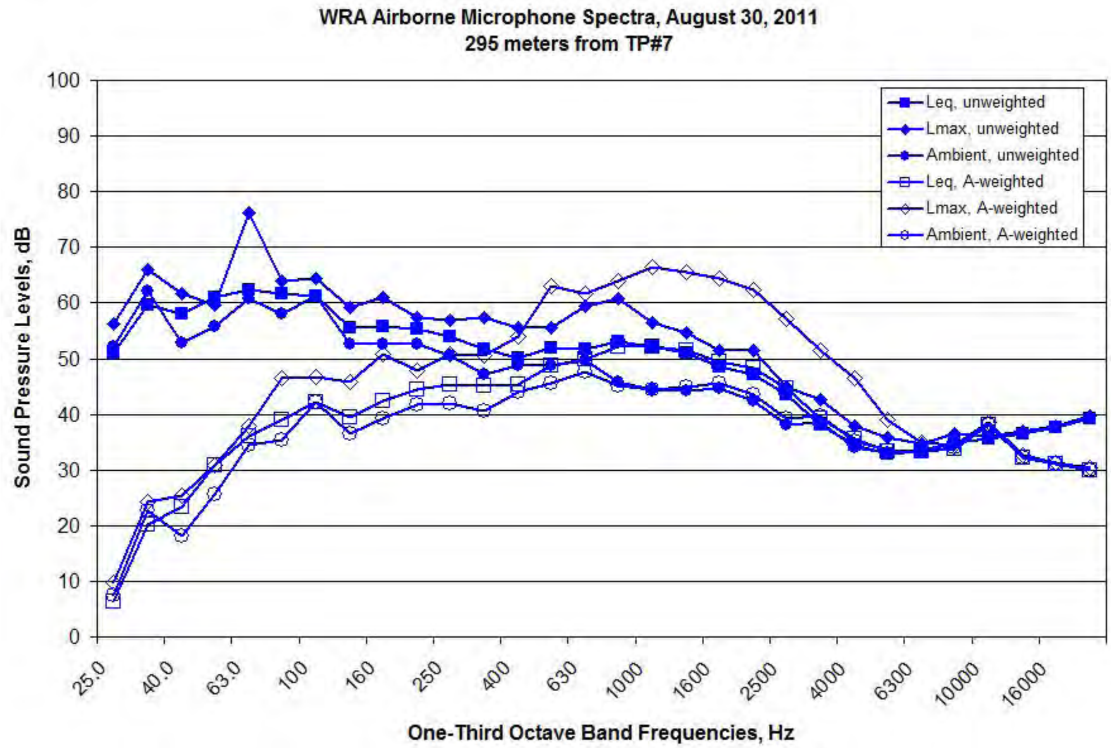

Figure C35. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#7, 14:45-14:52, on August 30, 2011

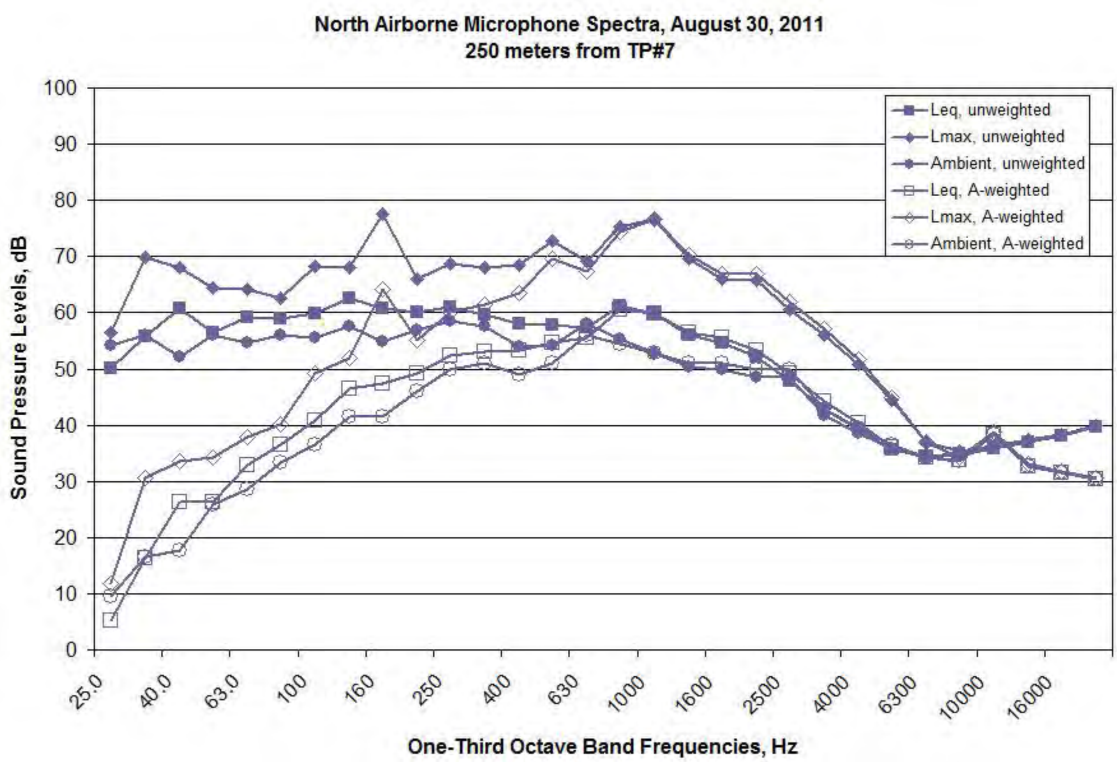

Figure C36. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#7, 14:45-14:52, on August 30, 2011

NO DATA AVAILABLE

Figure C37. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#7, 14:45-14:52, on August 30, 2011

8/31/2011 – TTP#4, 9:22-9:26

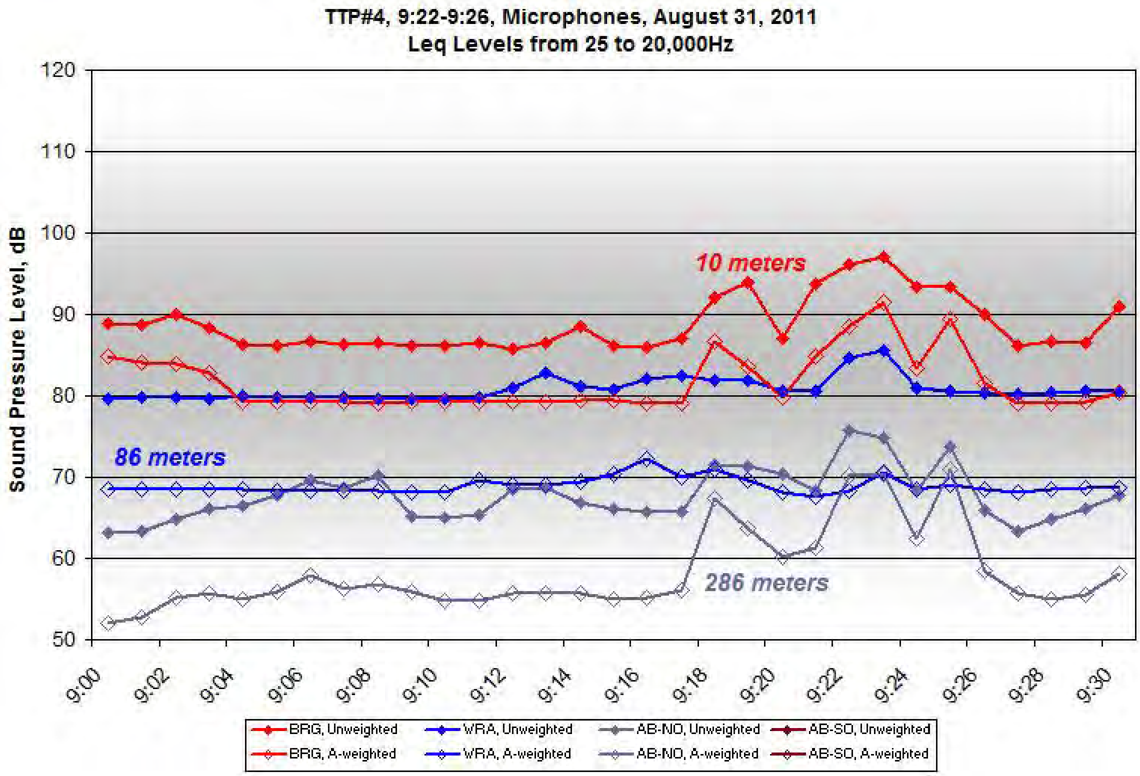

Figure C38. One-minute Unweighted and A-weighted Leq Level Data at TTP#4, 9:57-10:14, on August 31, 2011

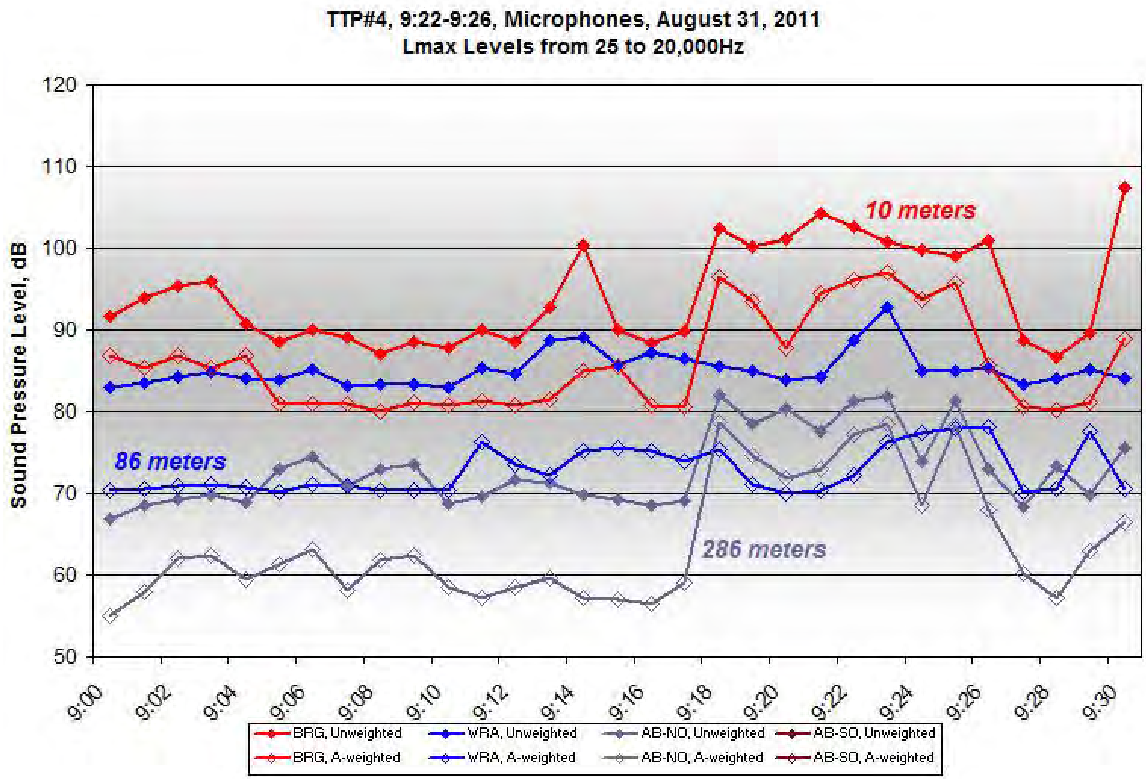

Figure C39. One-minute Unweighted and A-weighted Lmax Level at TTP#4, 9:22-9:26, on August 31, 2011

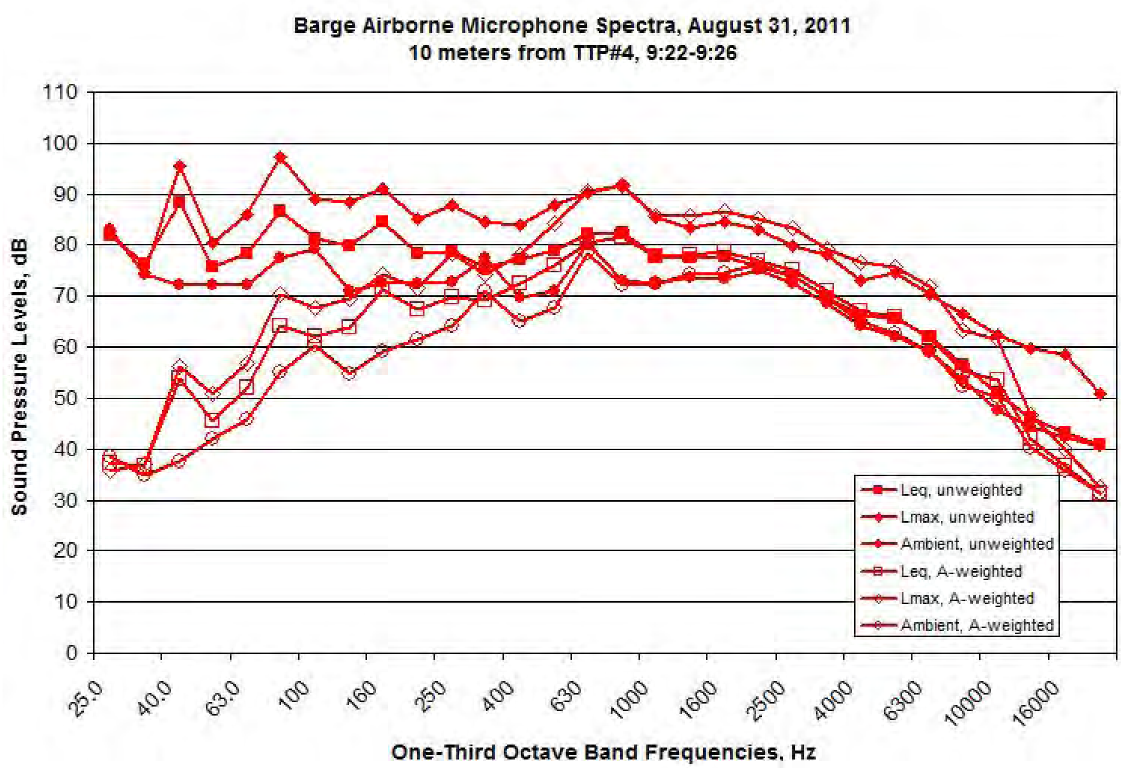

Figure C40. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#4, 9:22-9:26, on August 31, 2011

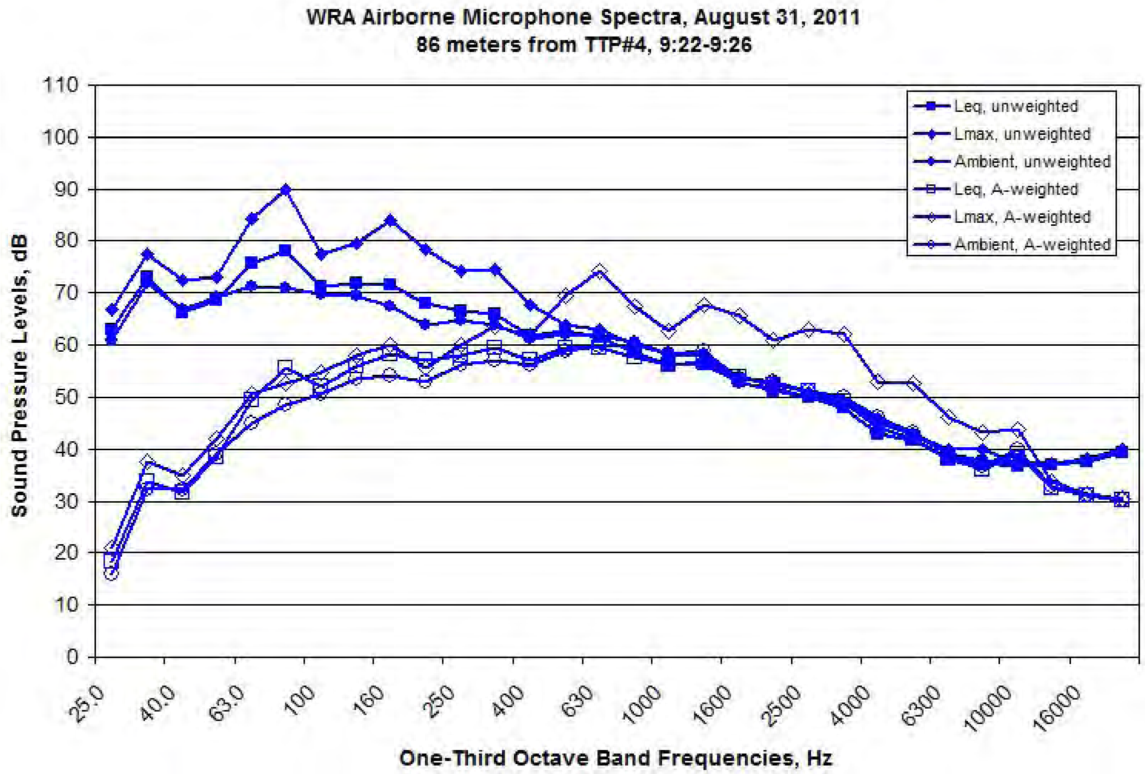

Figure C41. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#4, 9:22-9:26, on August 31, 2011

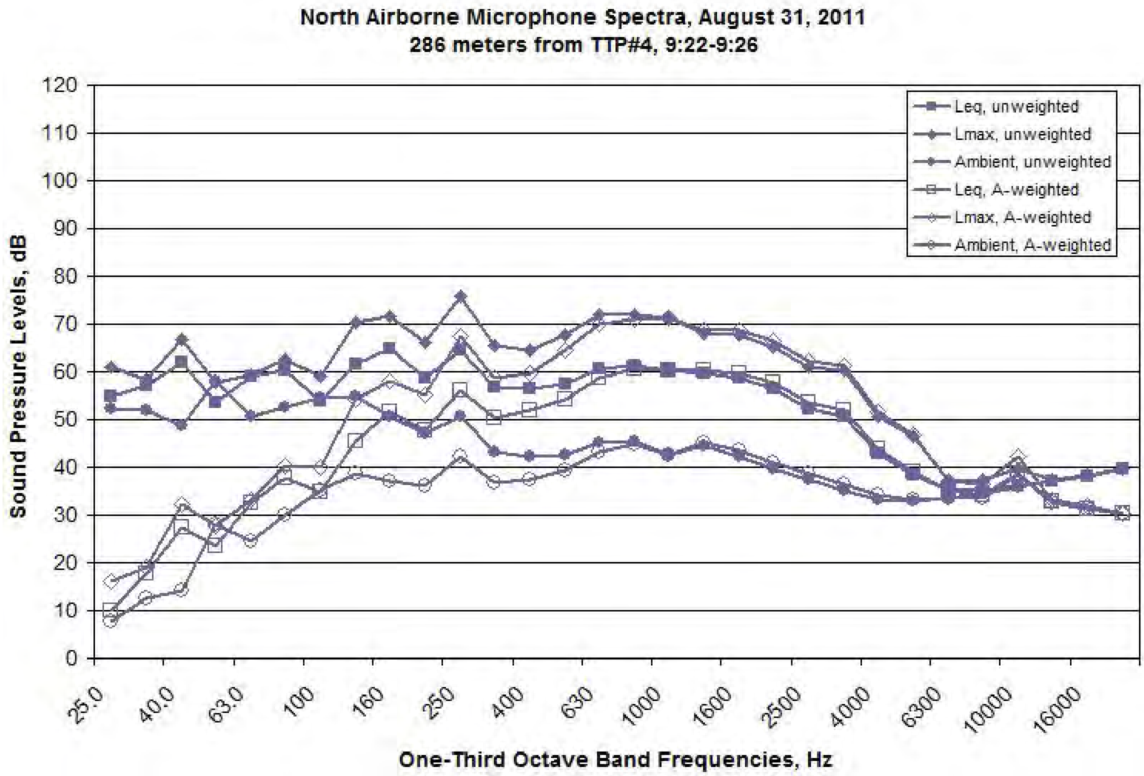

Figure C42. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#4, 9:22-9:26, on August 31, 2011

NO PILE DRIVING WAS PICKED UP AT THIS LOCATION

Figure C43. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#4, 9:22-9:26, on August 31, 2011

TTP#4, 9:44-9:57

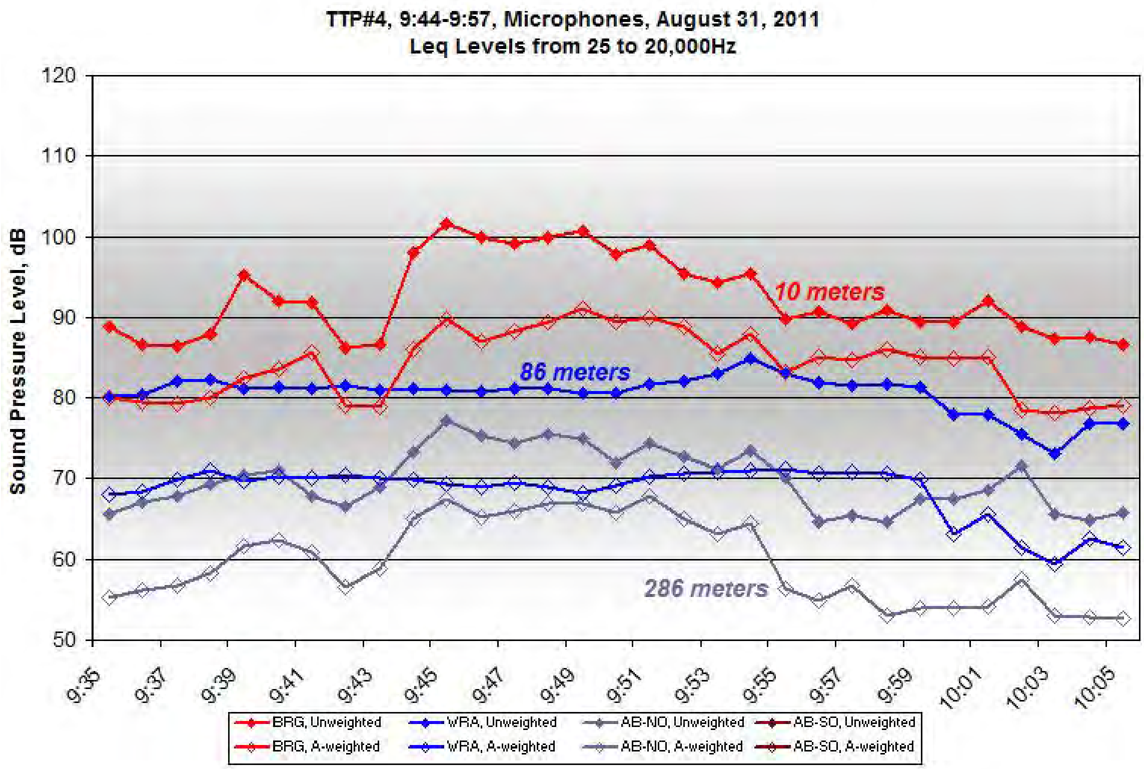

Figure C44. One-minute Unweighted and A-weighted Leq Level Data at TTP#4, 9:44-9:57, on August 31, 2011

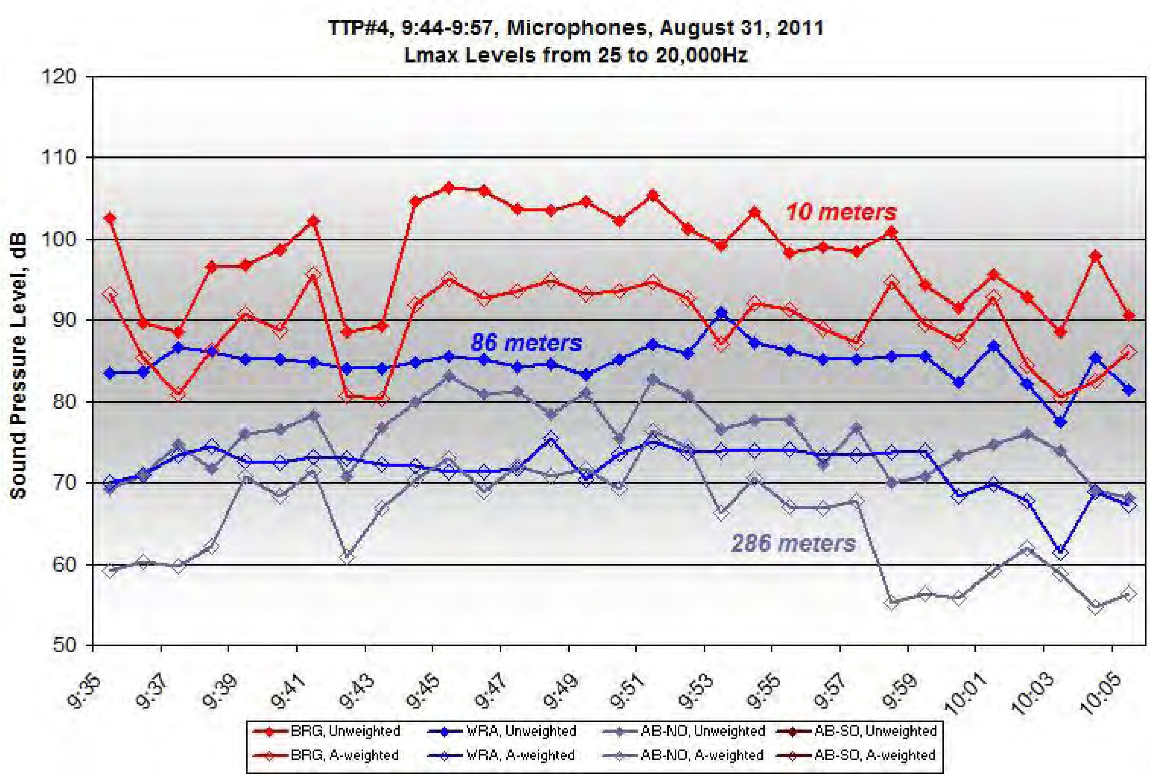

Figure C45. One-minute Unweighted and A-weighted Lmax Level Data at TTP#4, 9:44-9:57, on August 31, 2011

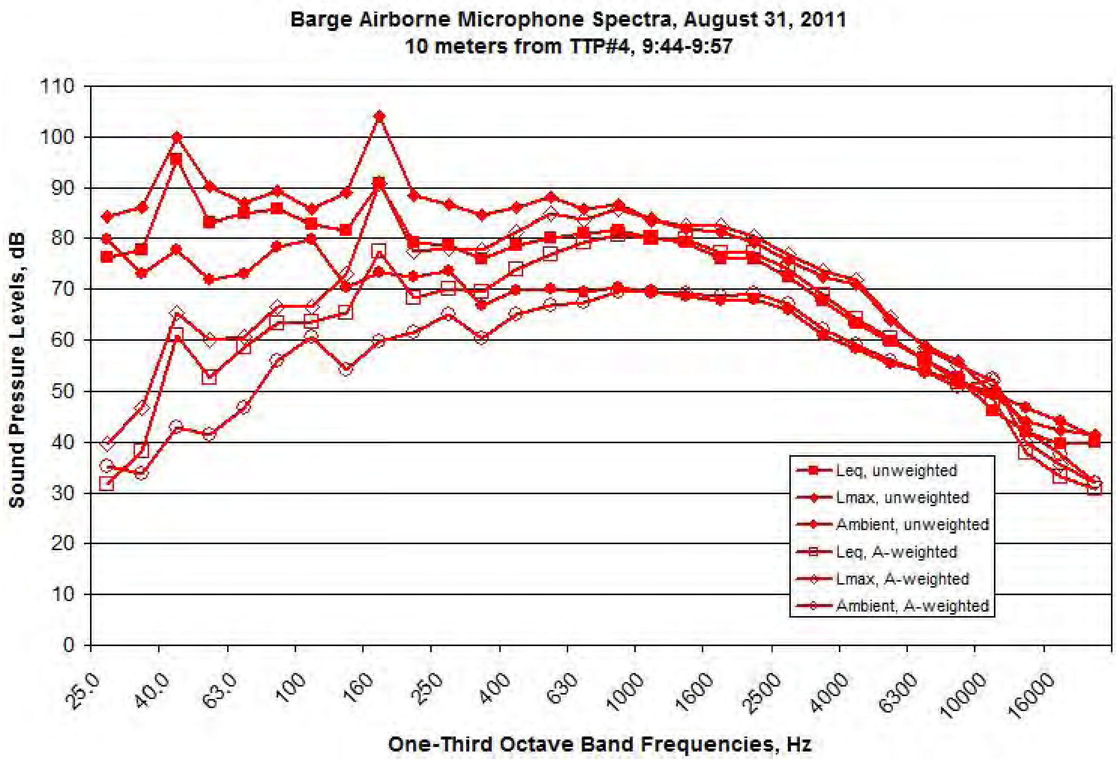

Figure C46. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#4, 9:44-9:57, on August 31, 2011

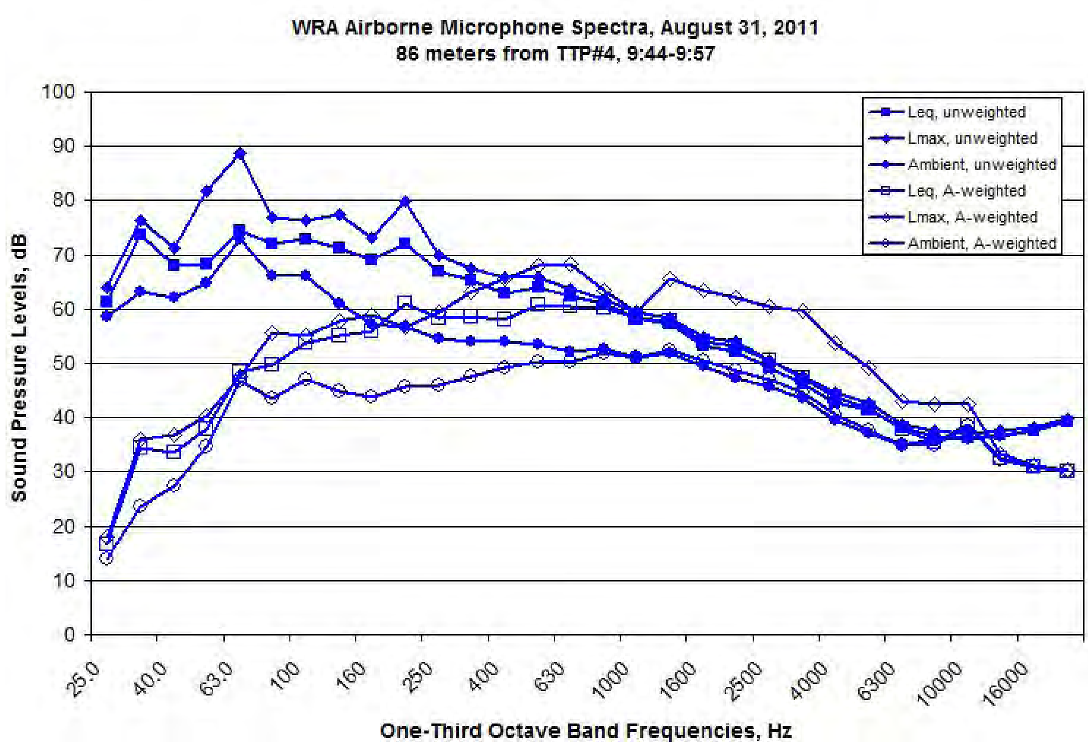

Figure C47. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#4, 9:44-9:57, on August 31, 2011

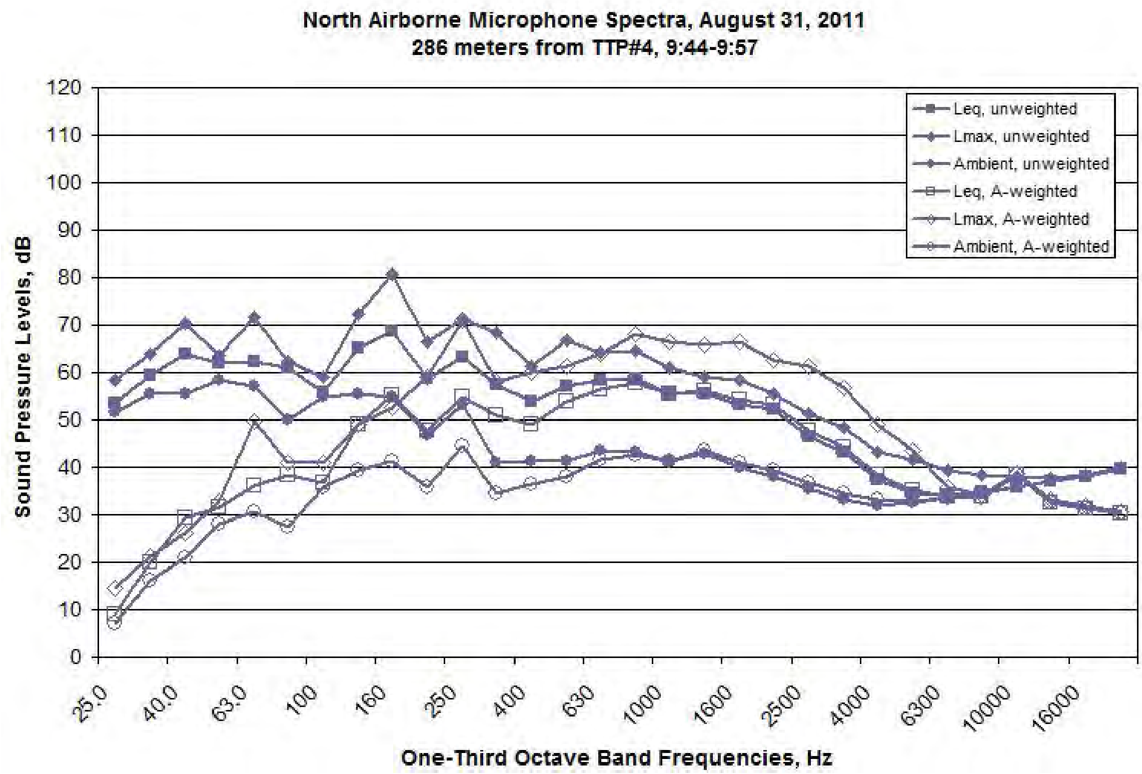

Figure C48. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#4, 9:44-9:57, on August 31, 2011

NO PILE DRIVING WAS PICKED UP AT THIS LOCATION

Figure C49. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#4, 9:44-9:57, on August 31, 2011

TP#13

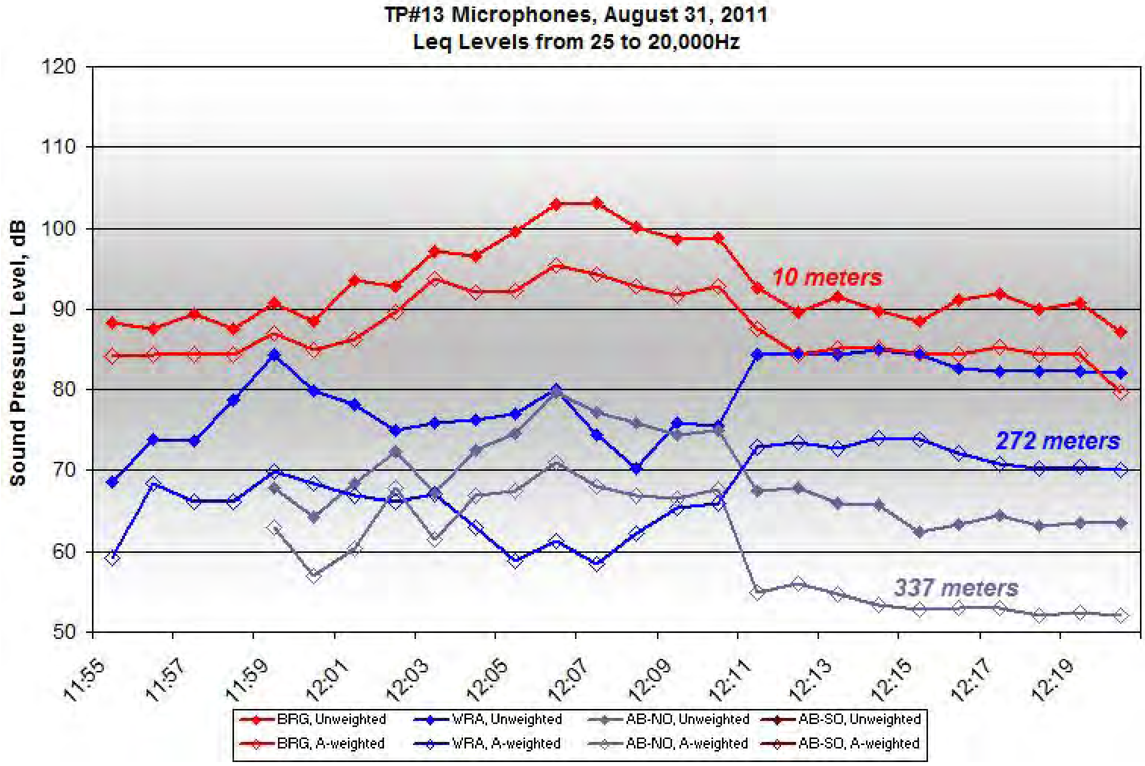

Figure C50. One-minute Unweighted and A-weighted Leq Level Data at TP#13, 12:04-12:11, on August 31, 2011

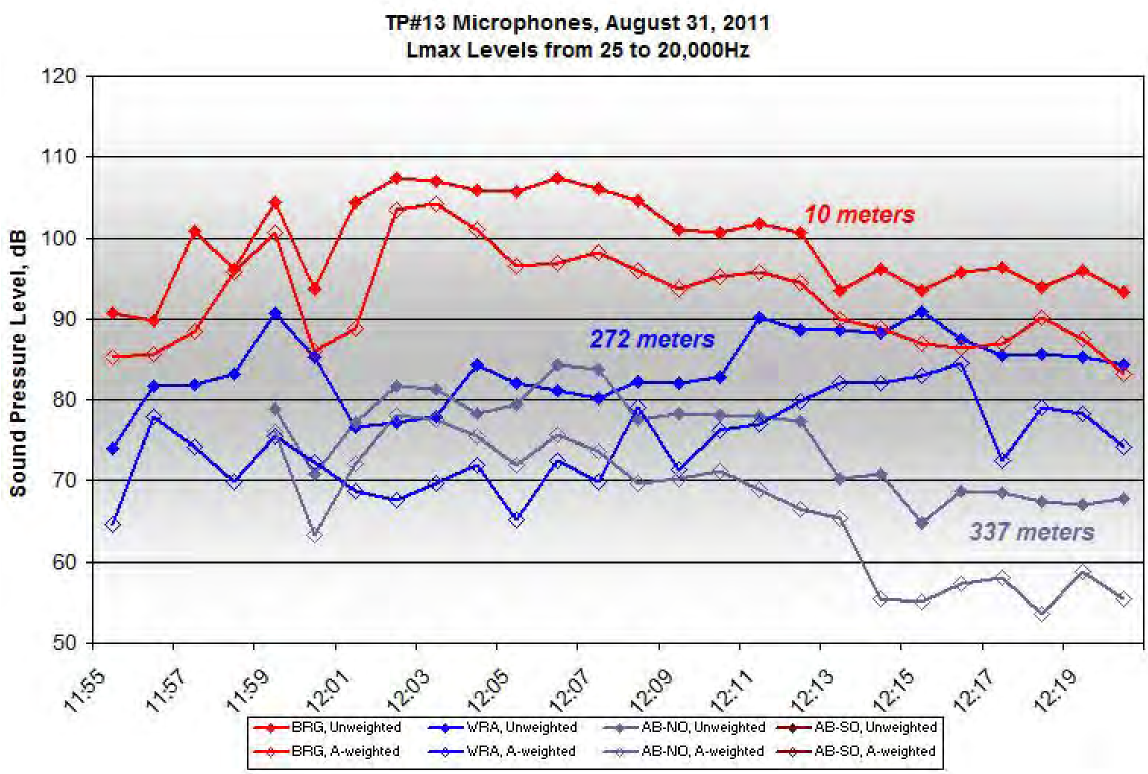

Figure C51. One-minute Unweighted and A-weighted Lmax Level at TP#13, 12:04-12:11, on August 31, 2011

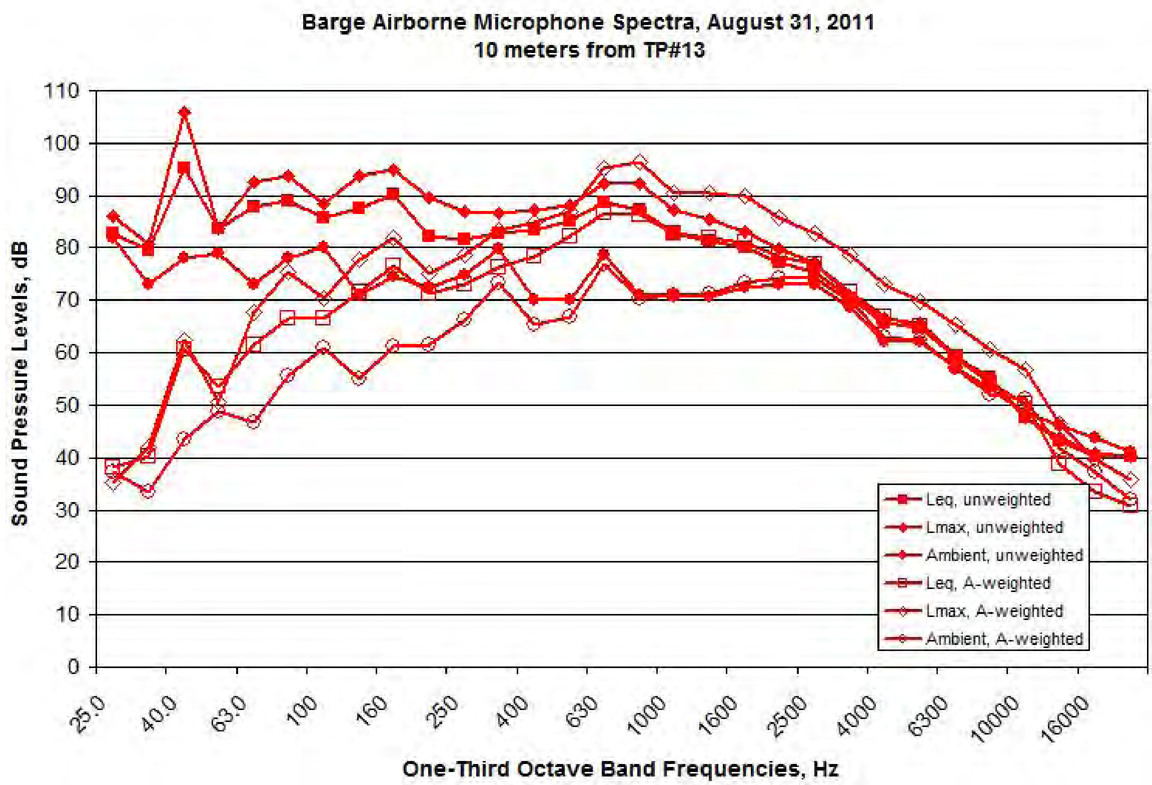

Figure C52. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#13, 12:04-12:11, on August 31, 2011

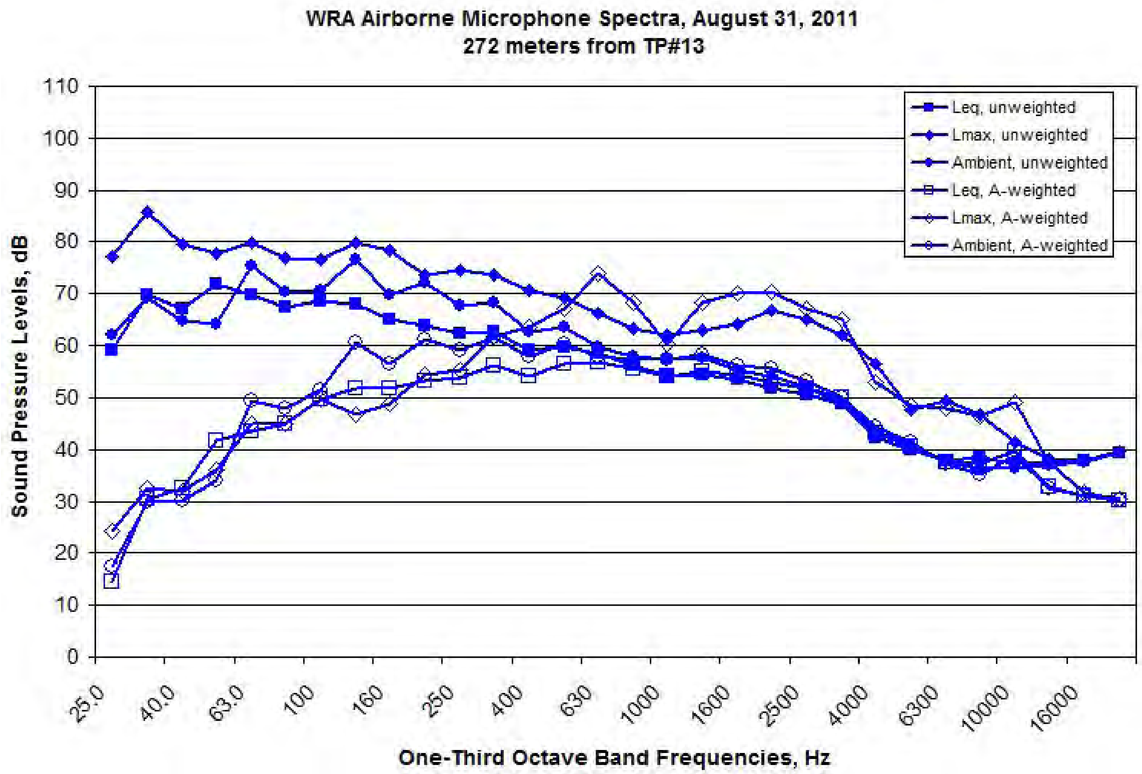

Figure C53. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#13, 12:04-12:11, on August 31, 2011

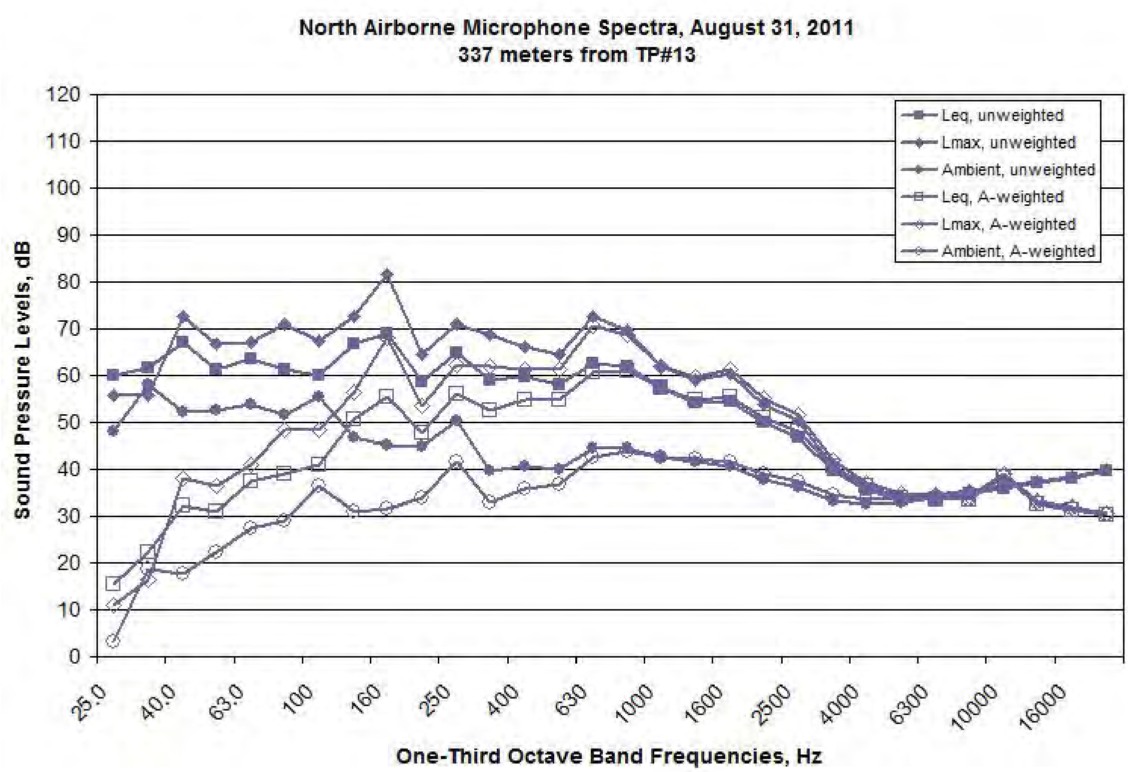

Figure C54. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#13, 12:04-12:11, on August 31, 2011

NO PILE DRIVING WAS PICKED UP AT THIS LOCATION

Figure C55. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#13, 12:04-12:11, on August 31, 2011

TP#12

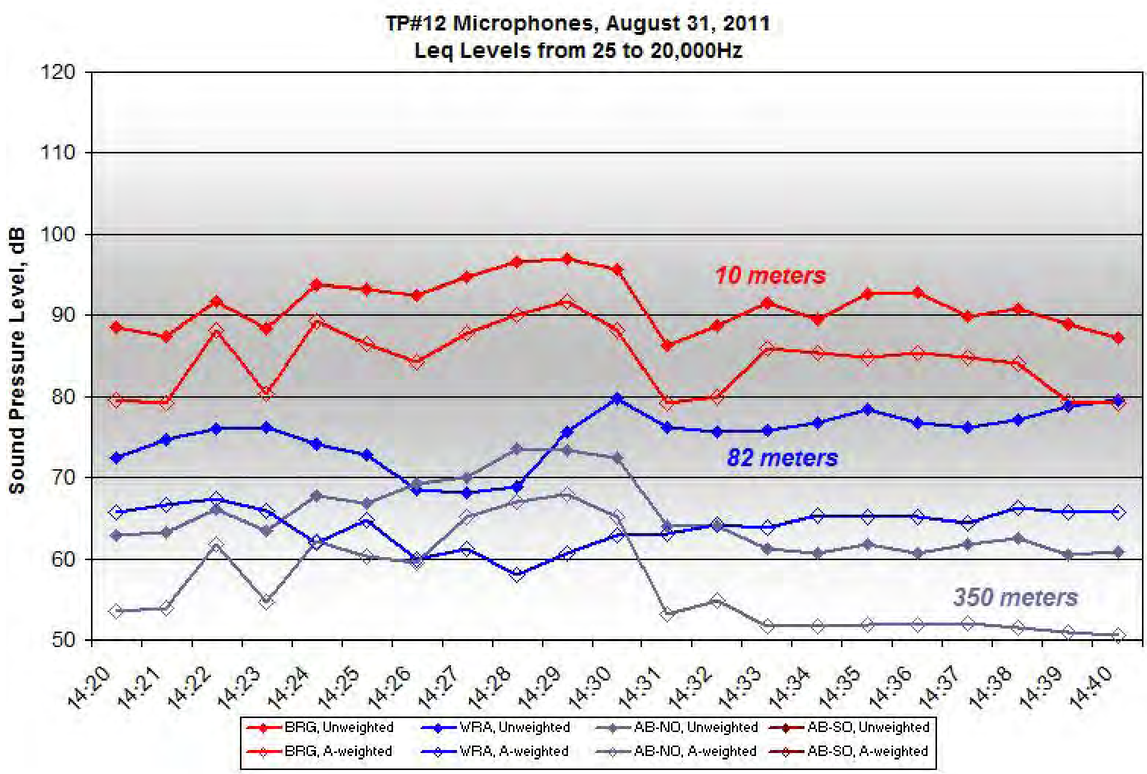

Figure C56. One-minute Unweighted and A-weighted Leq Level Data at TP#12, 14:27-14:31, on August 30, 2011

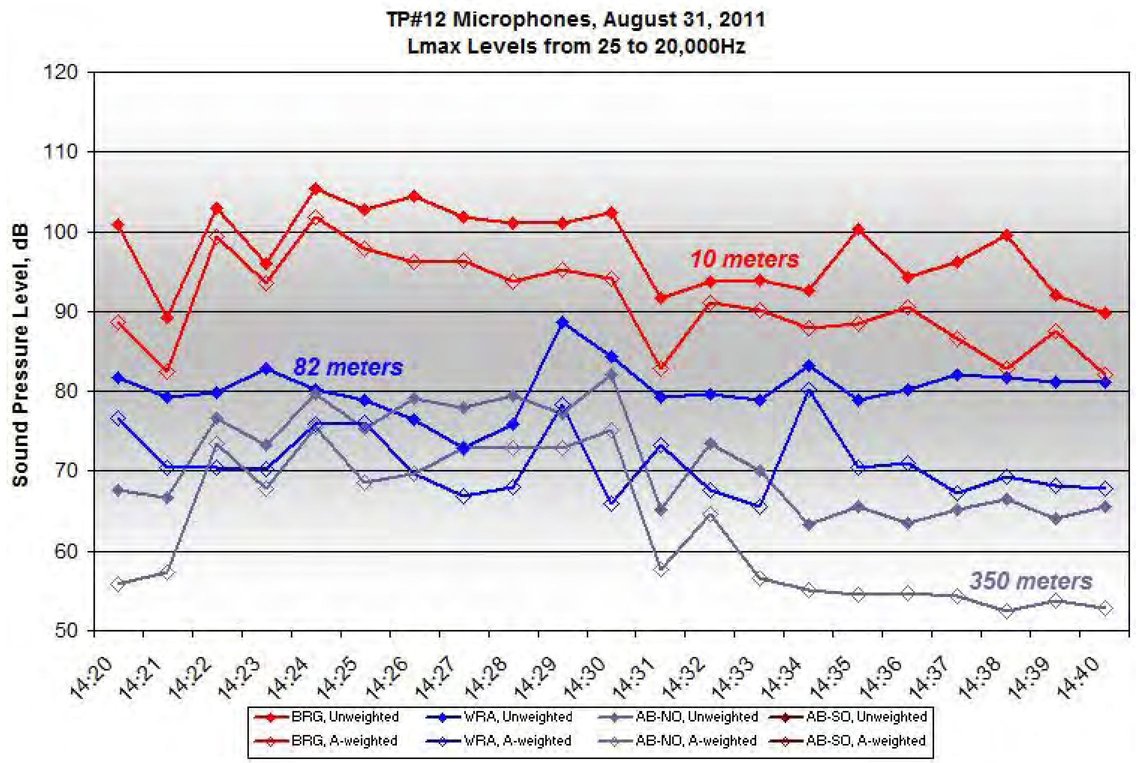

Figure C57. One-minute Unweighted and A-weighted Lmax Level Data at TP#12, 14:27-14:31, on August 30, 2011

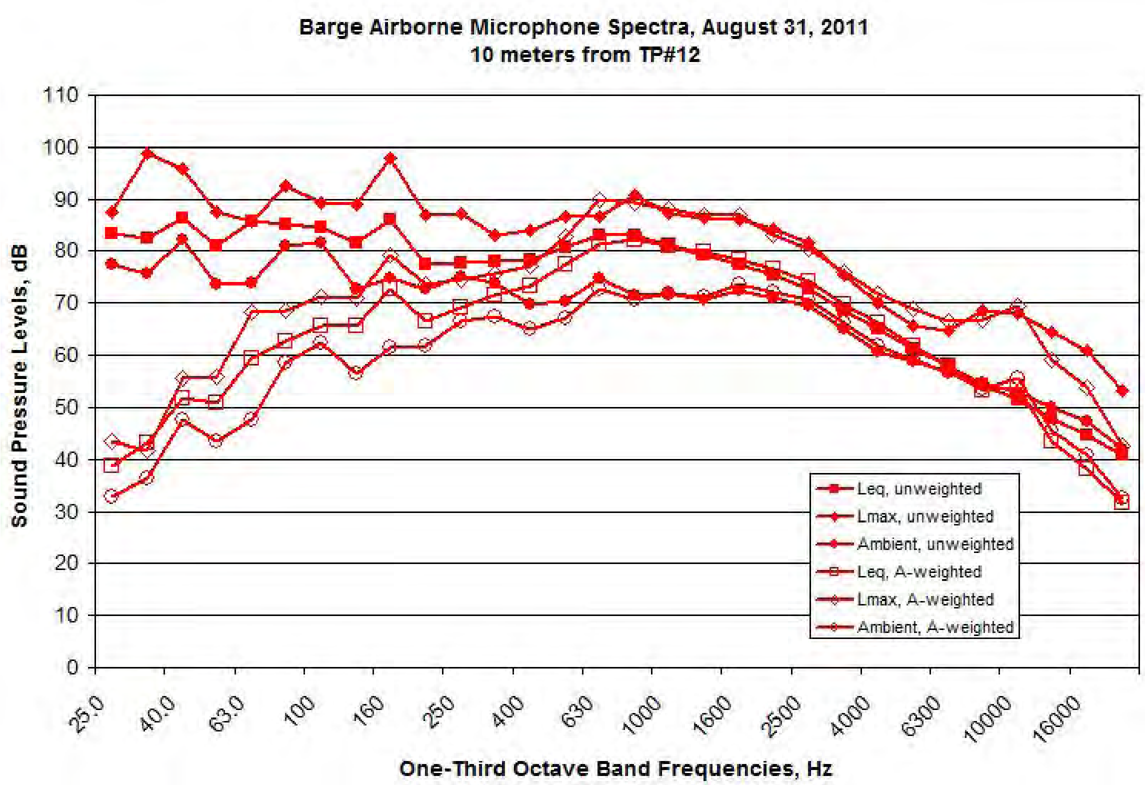

Figure C58. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#12, 14:27-14:31, on August 30, 2011

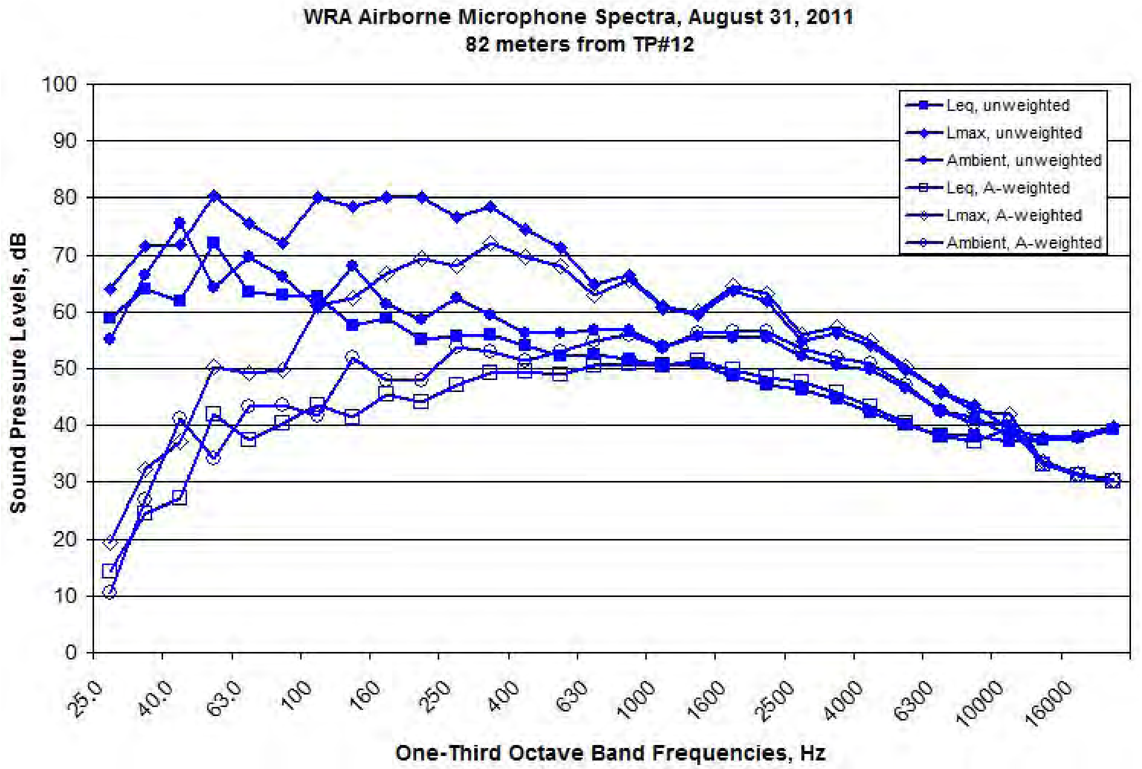

Figure C59. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#12, 14:27-14:31, on August 30, 2011

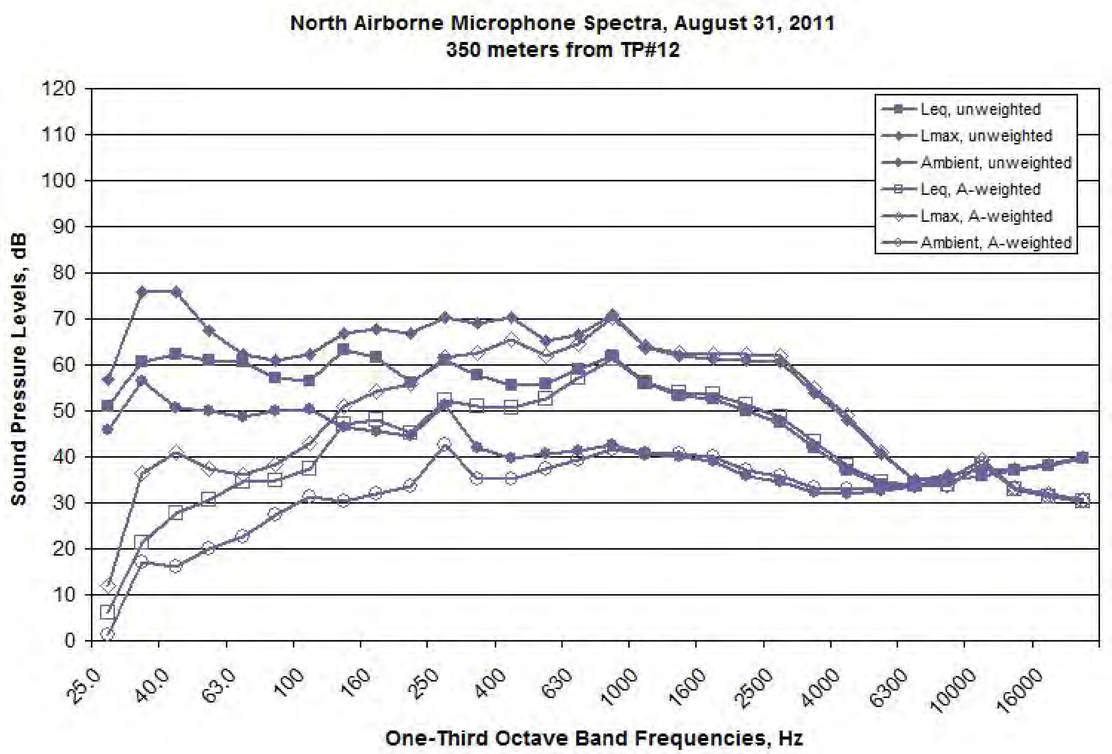

Figure C60. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#12, 14:27-14:31, on August 30, 2011

NO PILE DRIVING WAS PICKED UP AT THIS LOCATION

Figure C61. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#12, 14:27-14:31, on August 30, 2011

9/8/2011 – TP#3 RP#3

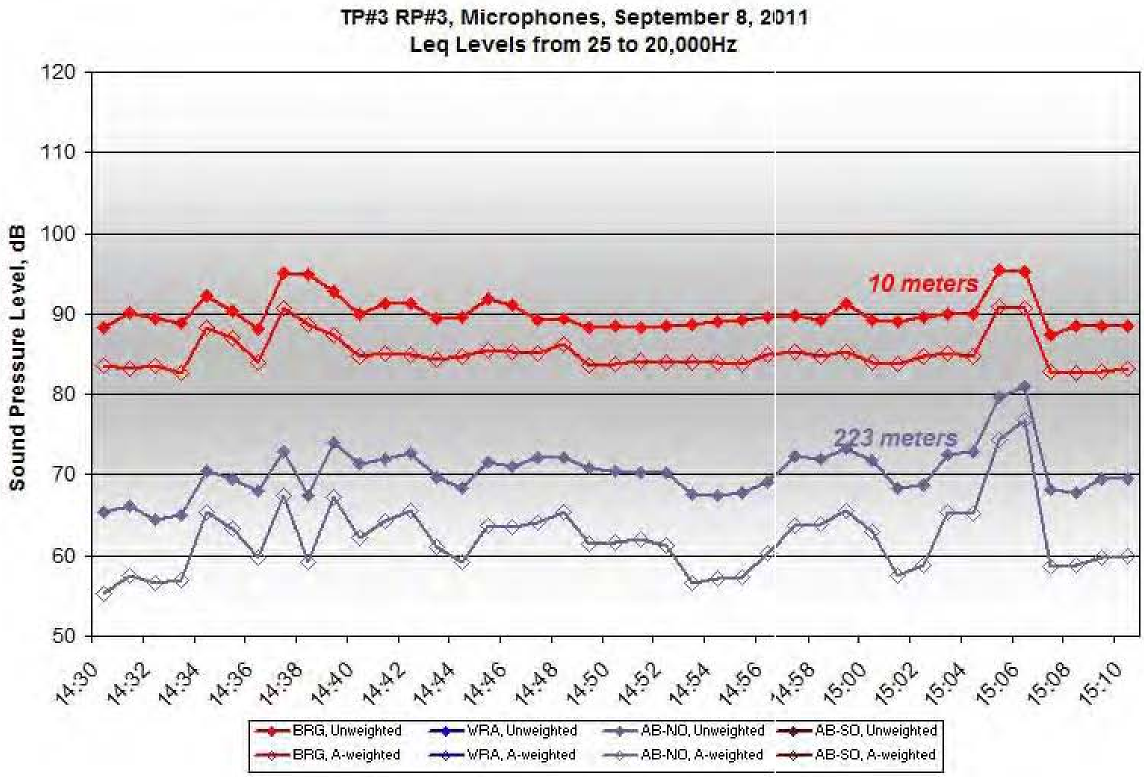

Figure C62. One-minute Unweighted and A-weighted Leq Level Data at TP#3 RP#3, 14:38-15:06, on September 8, 2011

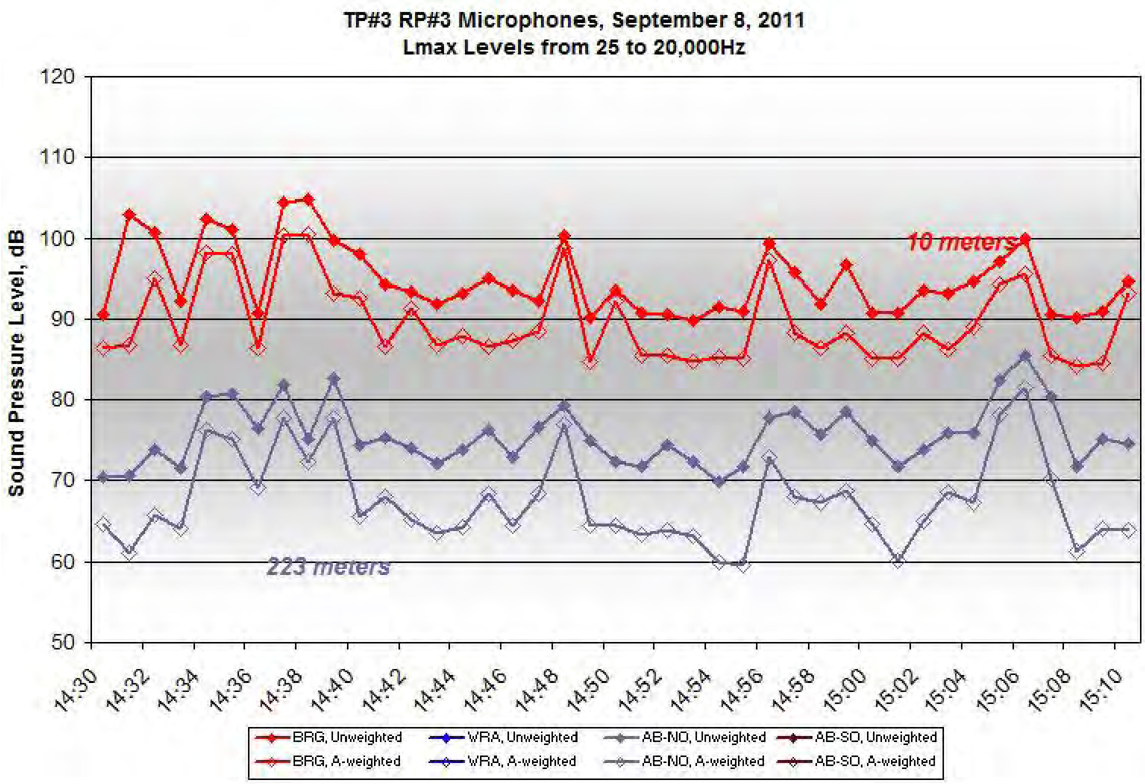

Figure C63. One-minute Unweighted and A-weighted Lmax Level Data at TP#3 RP#3, 14:38-15:06, on September 8, 2011

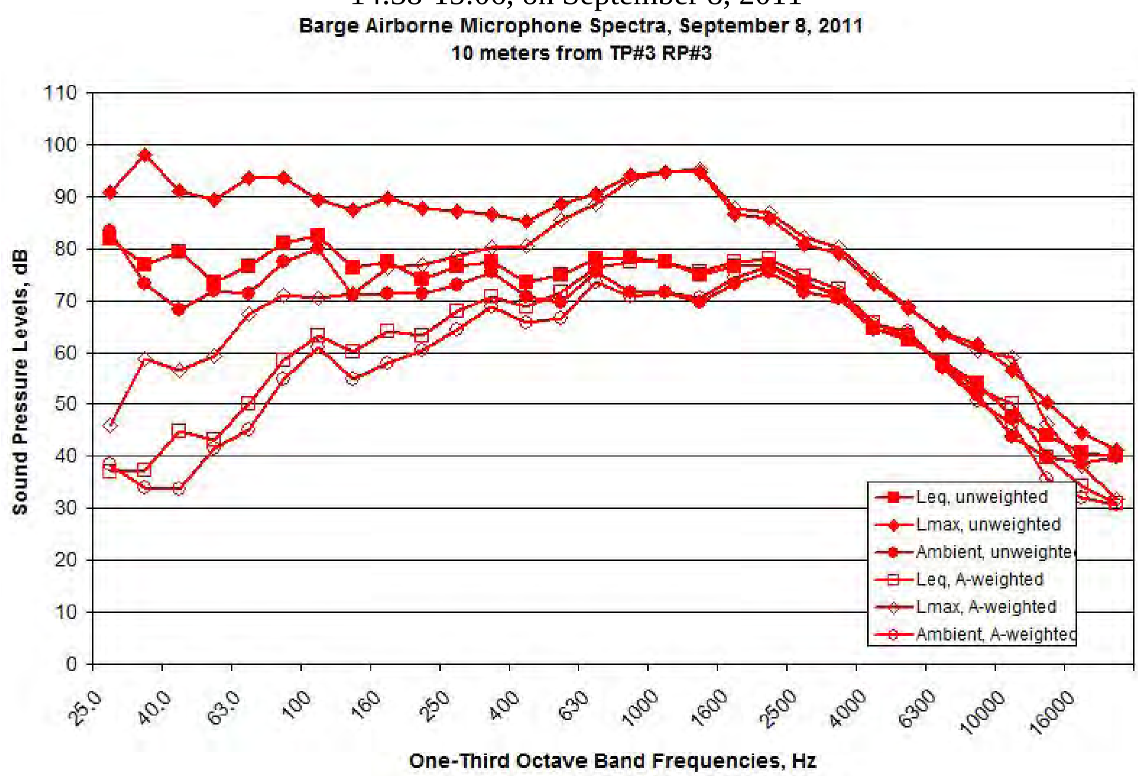

Figure C64. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#3, 14:38-15:06, on September 8, 2011

NO DATA AVAILABLE

Figure C65. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#3, 14:38-15:06, on September 8, 2011

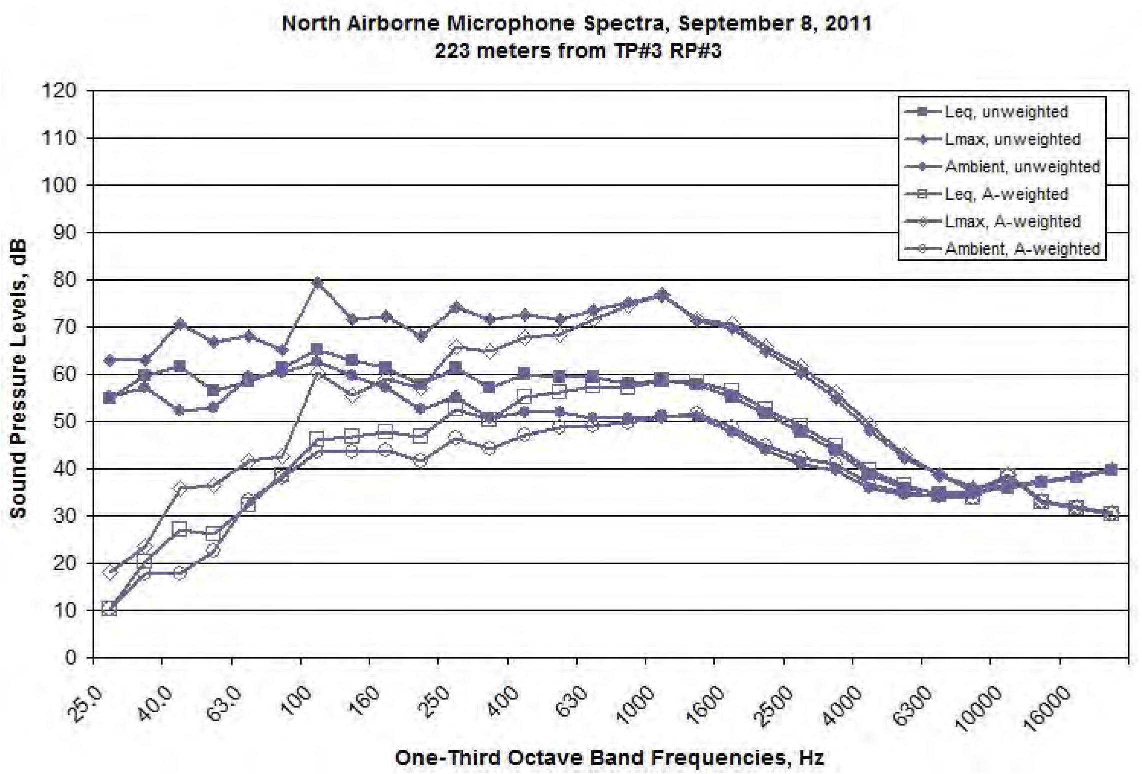

Figure C66. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#3, 14:38-15:06, on September 8, 2011

NO DATA AVAILABLE

Figure C67. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#3, 14:38-15:06, on September 8, 2011

TP#3 RP#2, 16:21-16:32

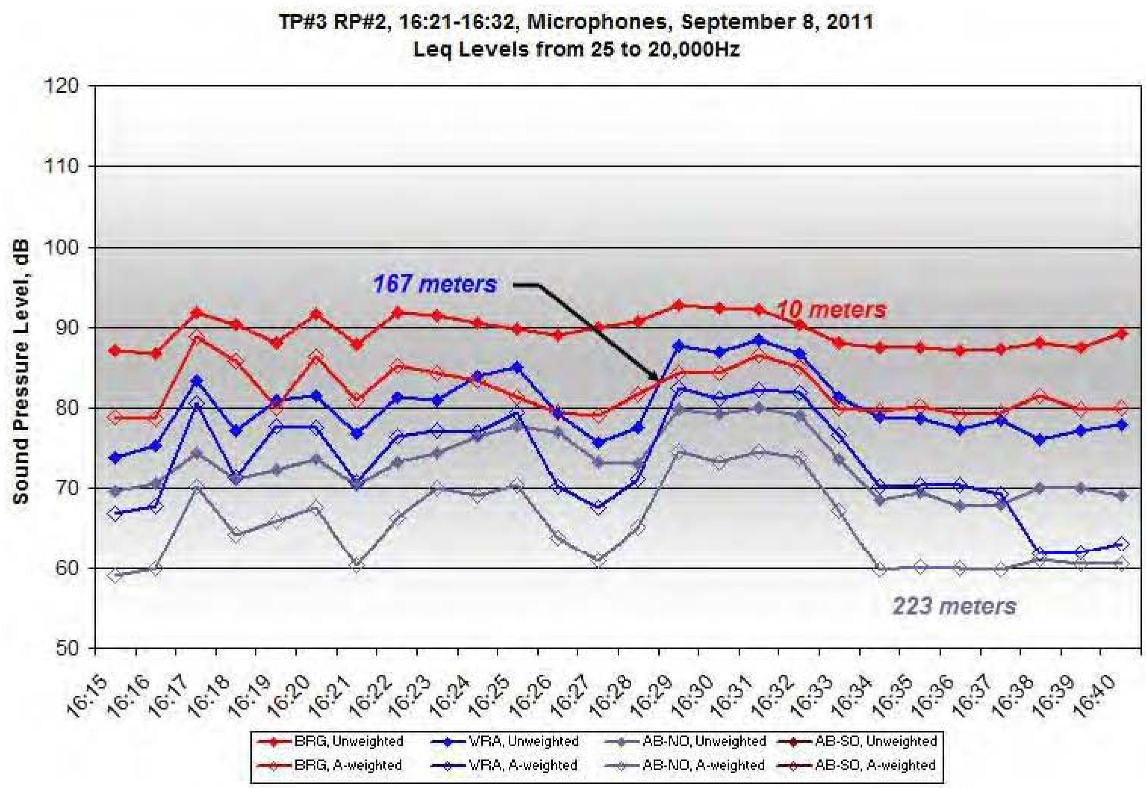

Figure C68. One-minute Unweighted and A-weighted Leq Level Data at TP#3 RP#2, 16:21-16:32, on September 8, 2011

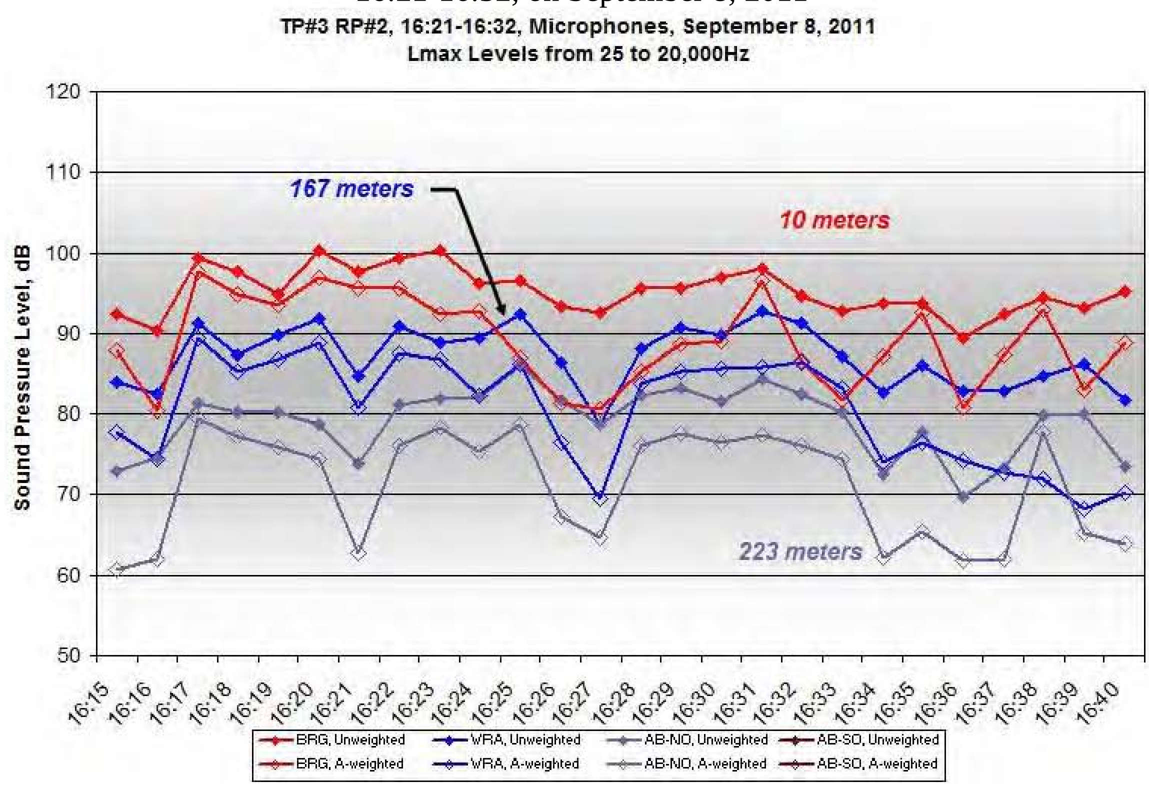

Figure C69. One-minute Unweighted and A-weighted Lmax Level at TP#3 RP#2, 16:21-16:32, on September 8, 2011

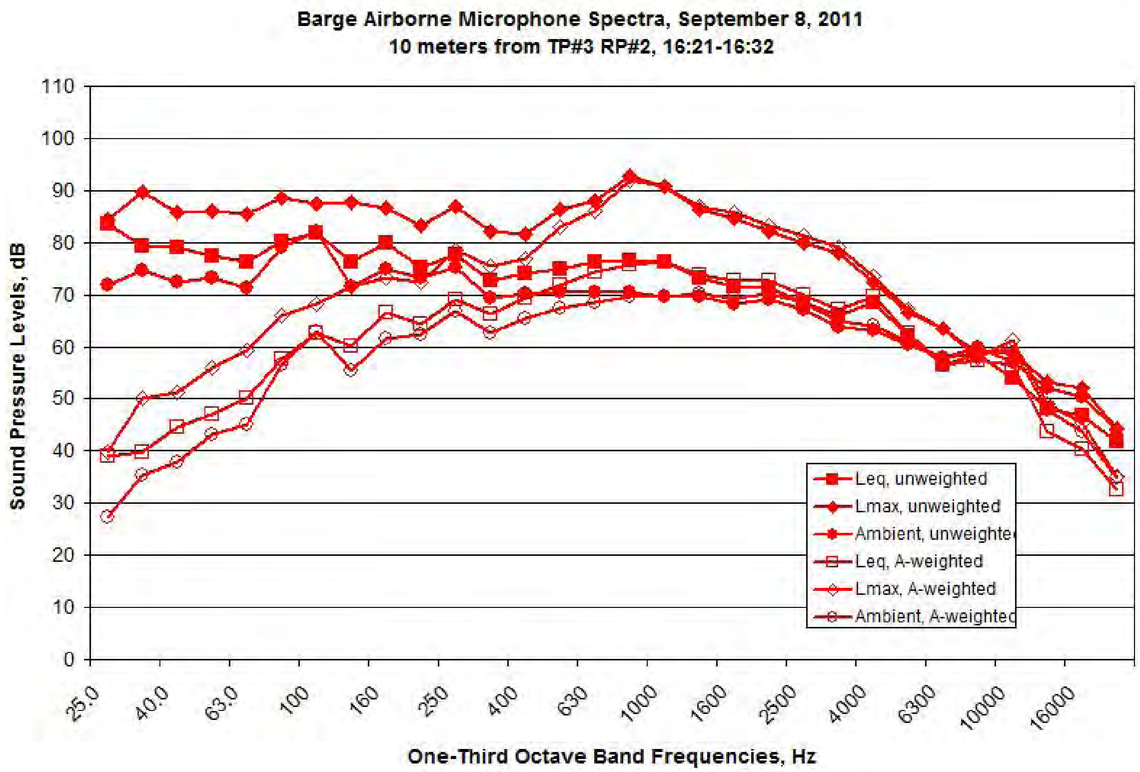

Figure C70. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#2, 16:21-16:32, on September 8, 2011

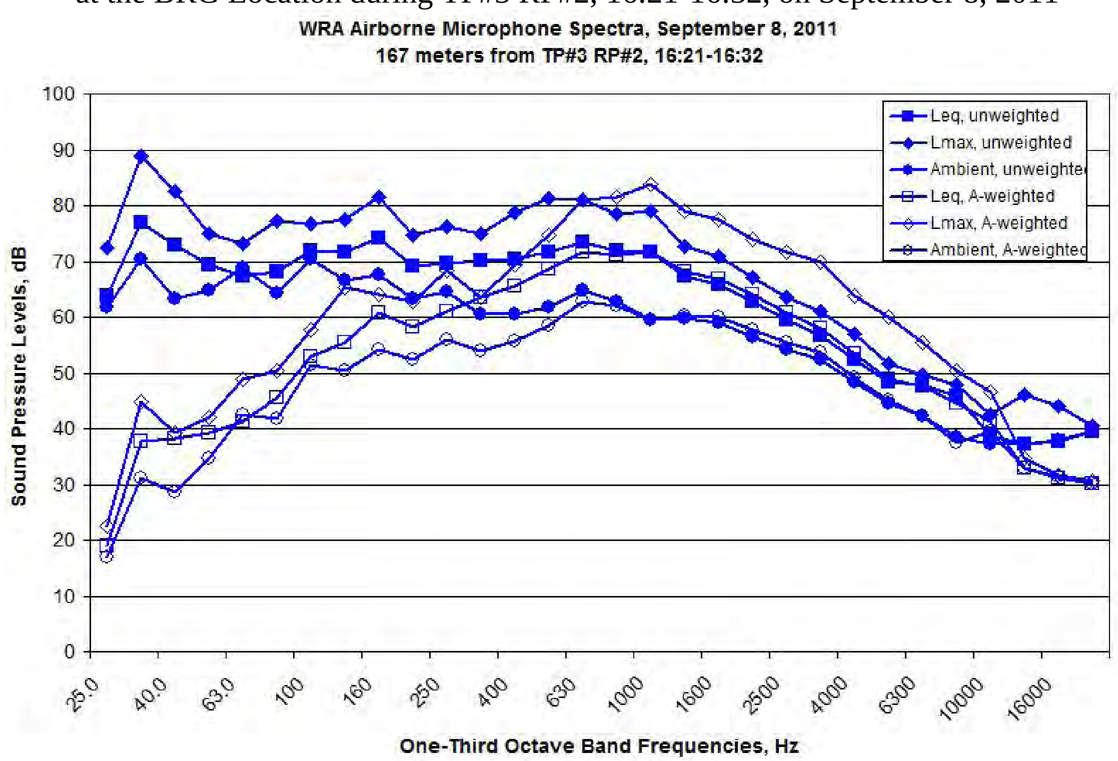

Figure C71. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#2, 16:21-16:32, on September 8, 2011

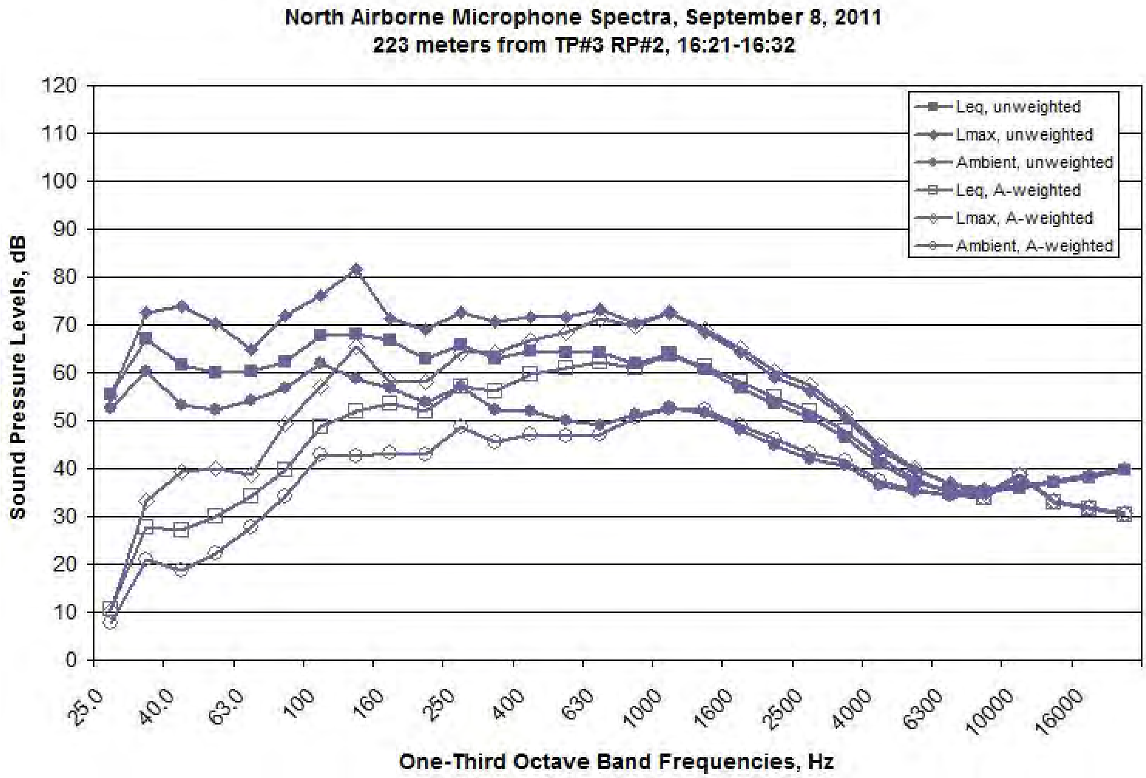

Figure C72. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#2, 16:21-16:32, on September 8, 2011

NO DATA AVAILABLE

Figure C73. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#2, 16:21-16:32, on September 8, 2011

TP#3 RP#2, 16:45-16:57

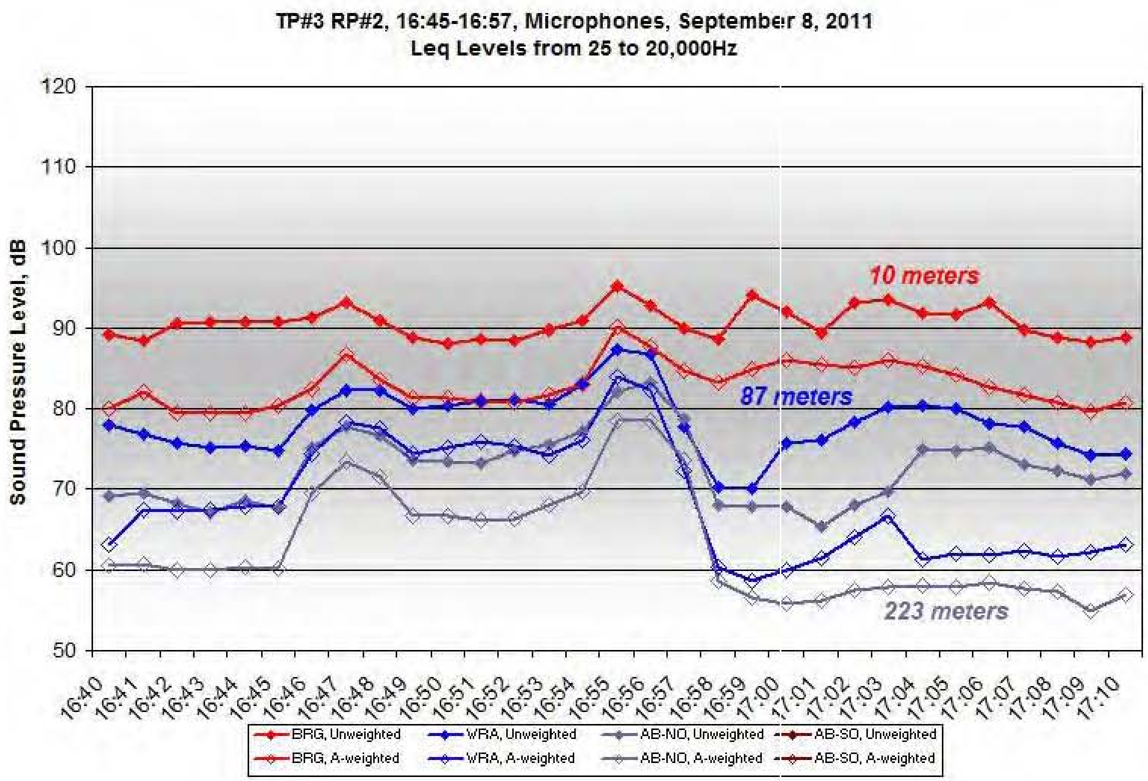

Figure C74. One-minute Unweighted and A-weighted Leq Level Data at TP#3 RP#2, 16:45-16:57, on September 8, 2011

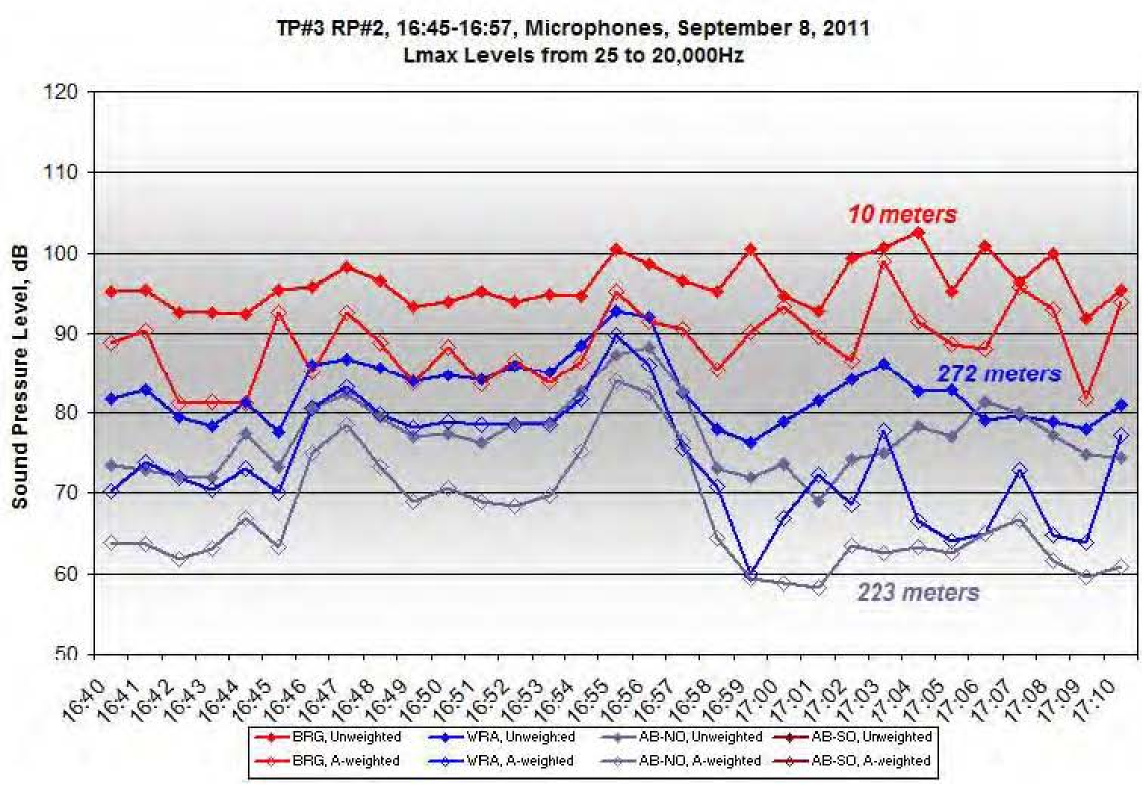

Figure C75. One-minute Unweighted and A-weighted Lmax Level Data at TP#3 RP#2, 16:45-16:57, on September 8, 2011

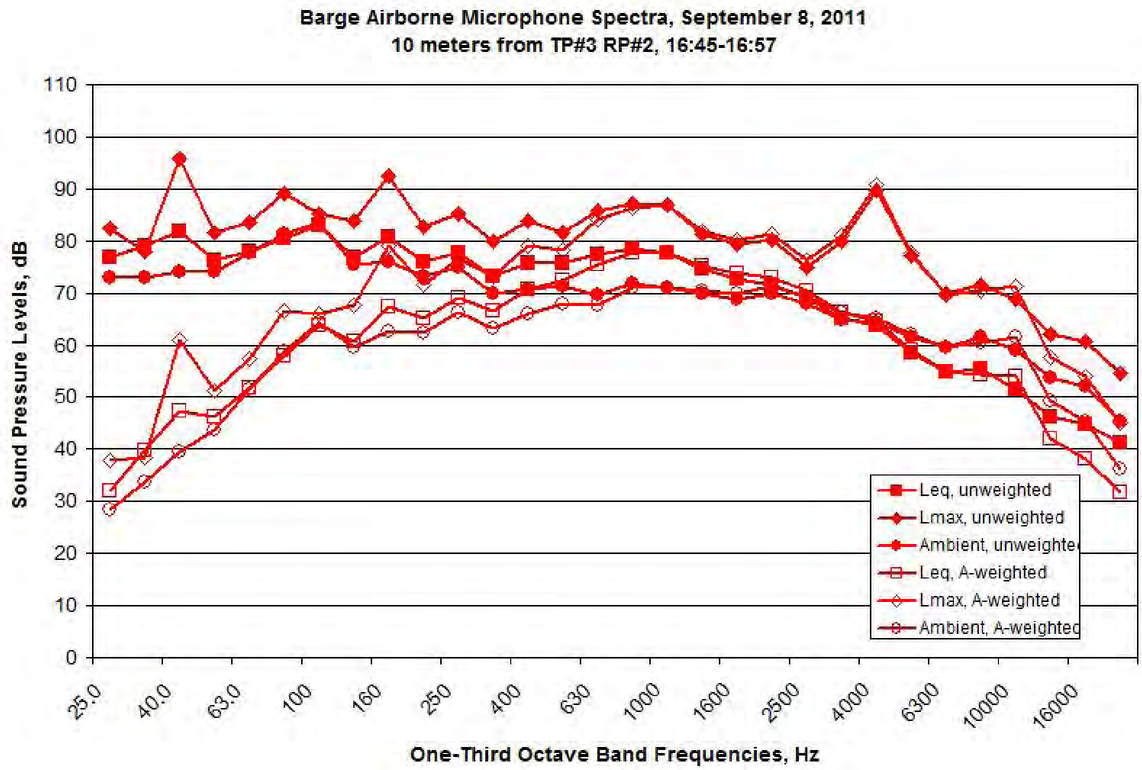

Figure C76. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#2, 16:45-16:57, on September 8, 2011

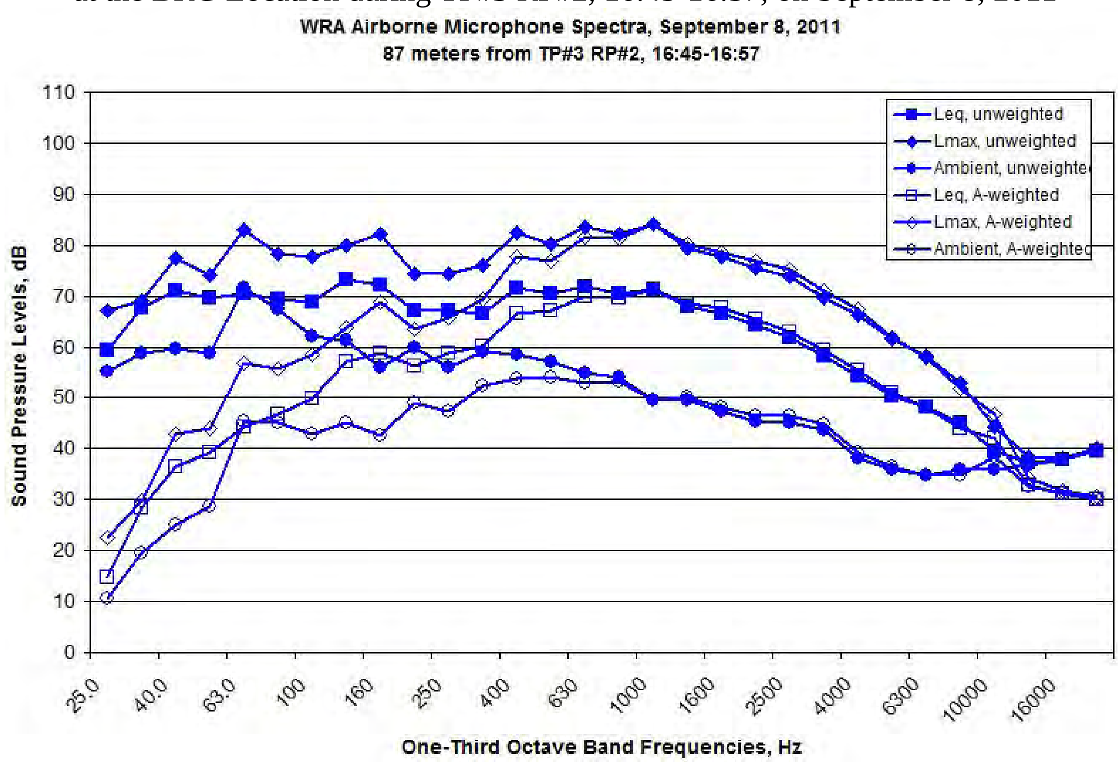

Figure C77. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#2, 16:45-16:57, on September 8, 2011

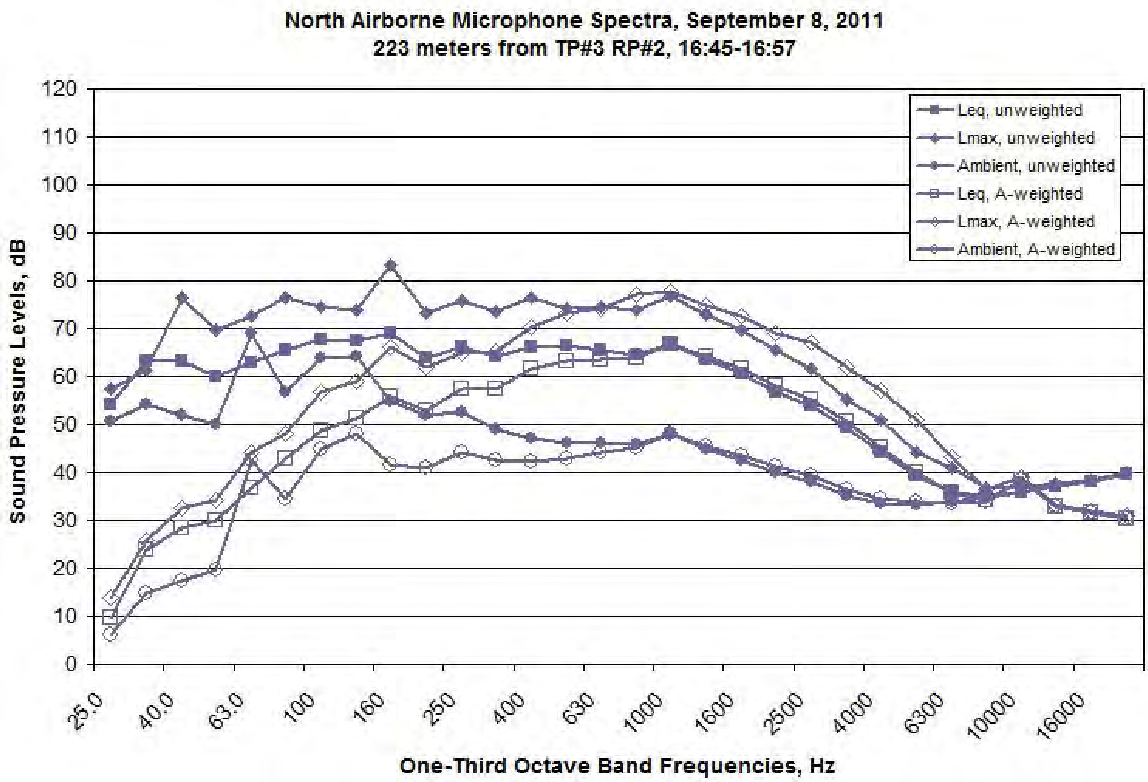

Figure C78. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#2, 16:45-16:57, on September 8, 2011

NO DATA AVAILABLE

Figure C79. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#2, 16:45-16:57, on September 8, 2011

9/10/2011 – TP#3 RP#1

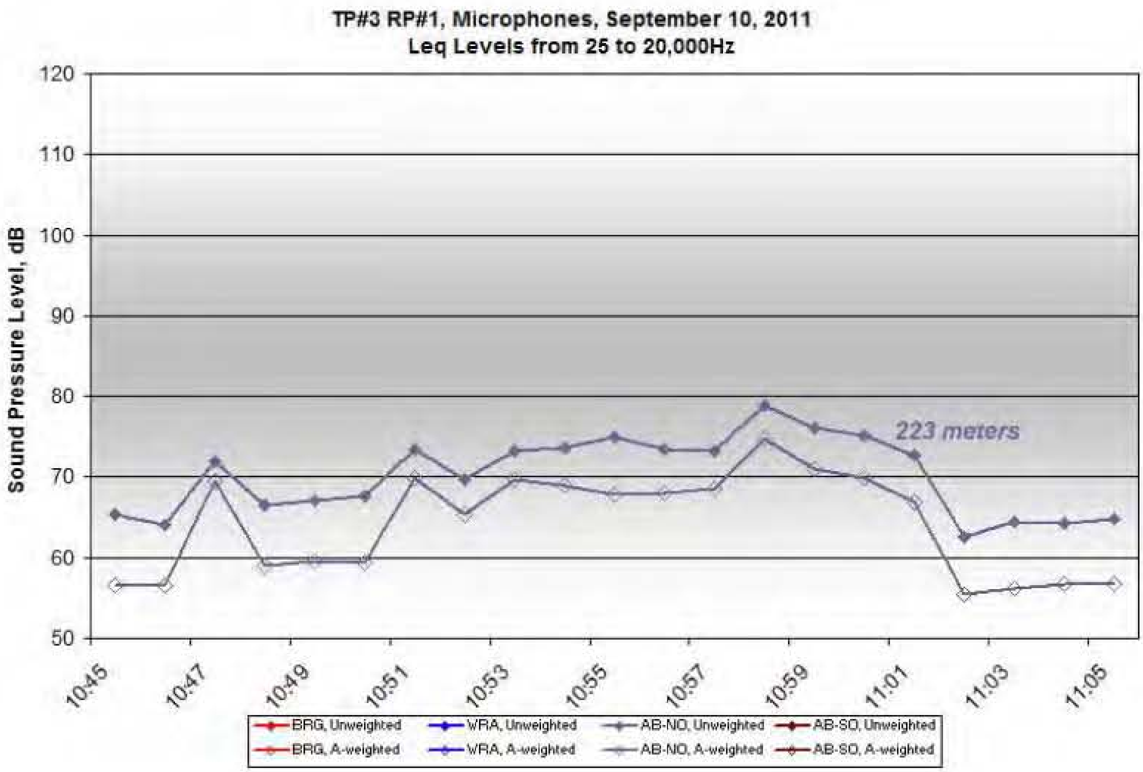

Figure C80. One-minute Unweighted and A-weighted Leq Level Data at TP#3 RP#1, 10:53-10:59, on September 10, 2011

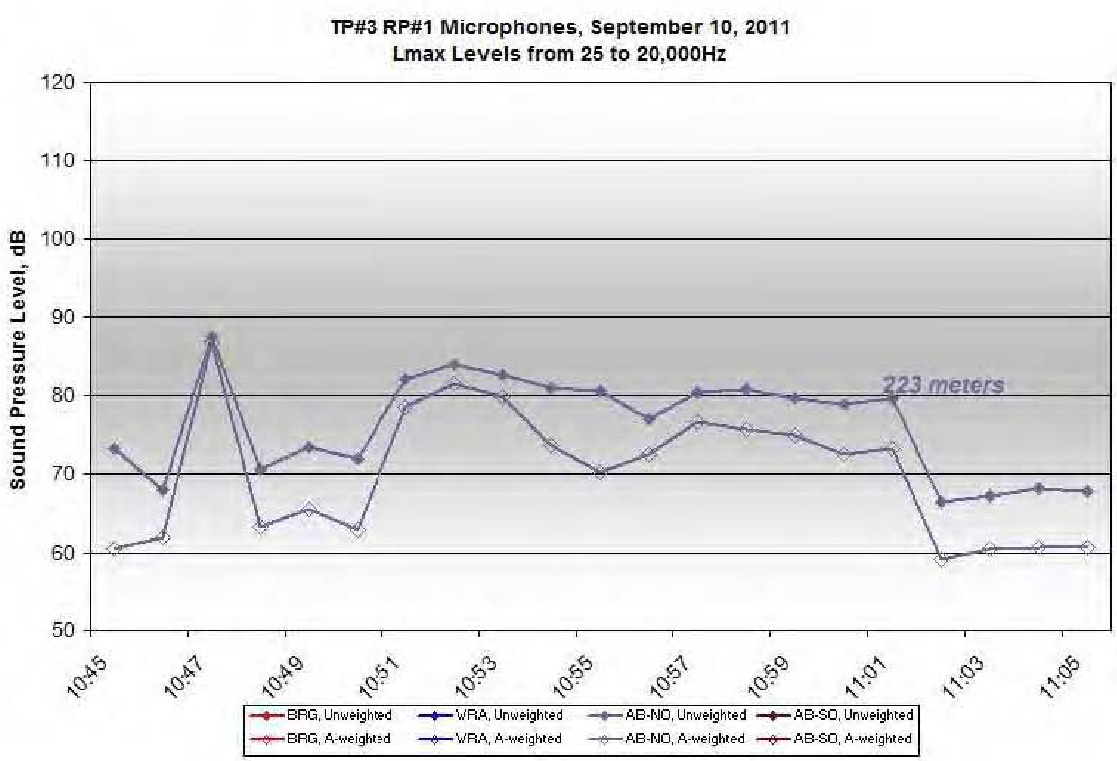

Figure C81. One-minute Unweighted and A-weighted Lmax Level Data at TP#3 RP#1, 10:53-10:59, on September 10, 2011

NO DATA AVAILABLE

Figure C82. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#1, 10:53-10:59, on September 10, 2011

NO DATA AVAILABLE

Figure C83. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#1, 10:53-10:59, on September 10, 2011

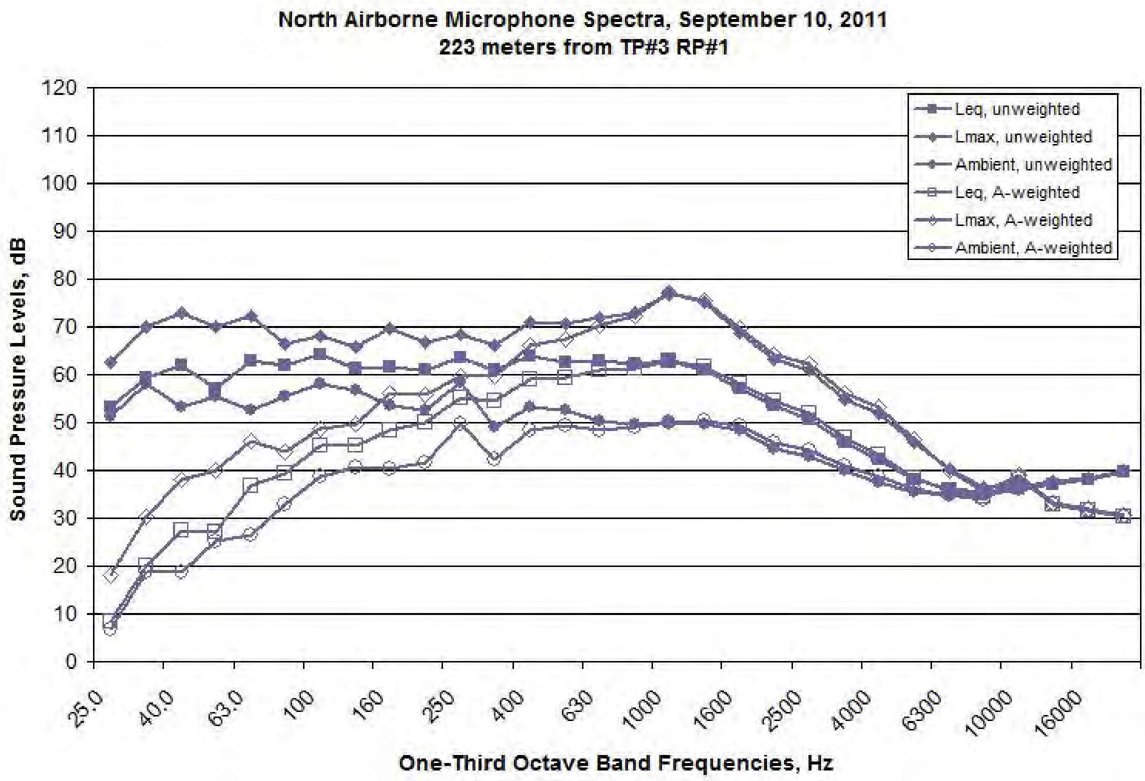

Figure C84. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#1, 10:53-10:59, on September 10, 2011

NO DATA AVAILABLE

Figure C85. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#1, 10:53-10:59, on September 10, 2011

TP#2

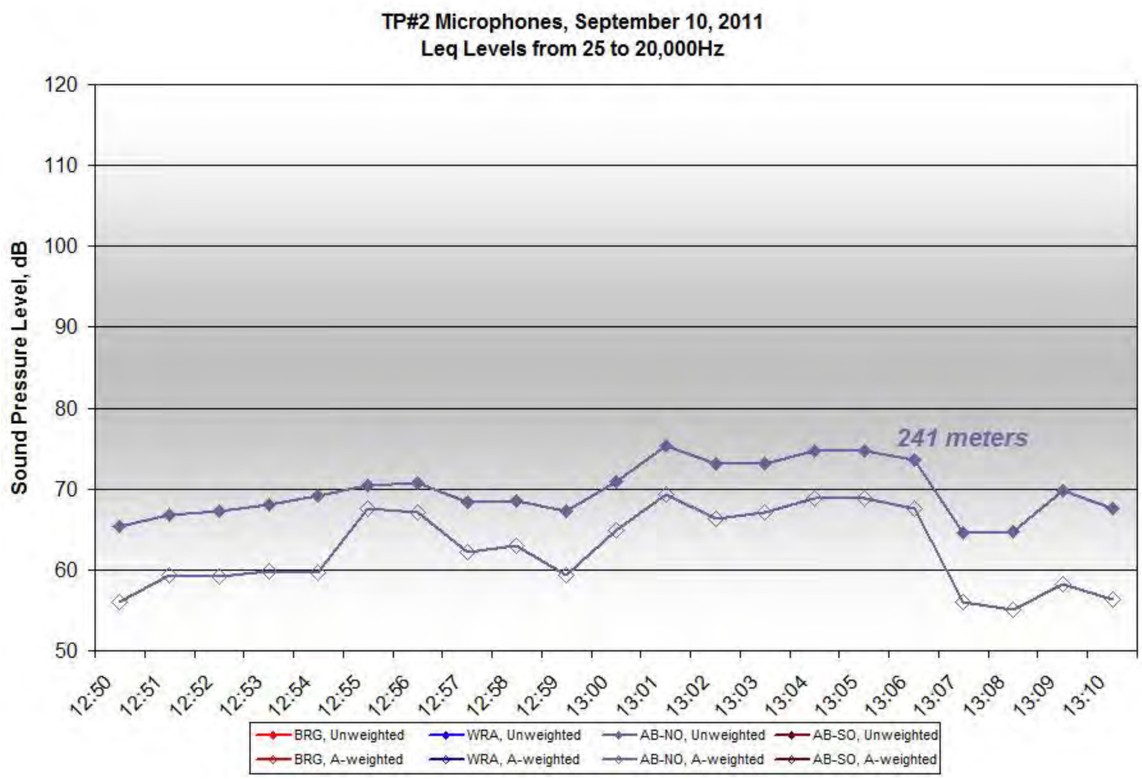

Figure C86. One-minute Unweighted and A-weighted Leq Level Data at TP#2, 12:58-13:05, on September 10, 2011

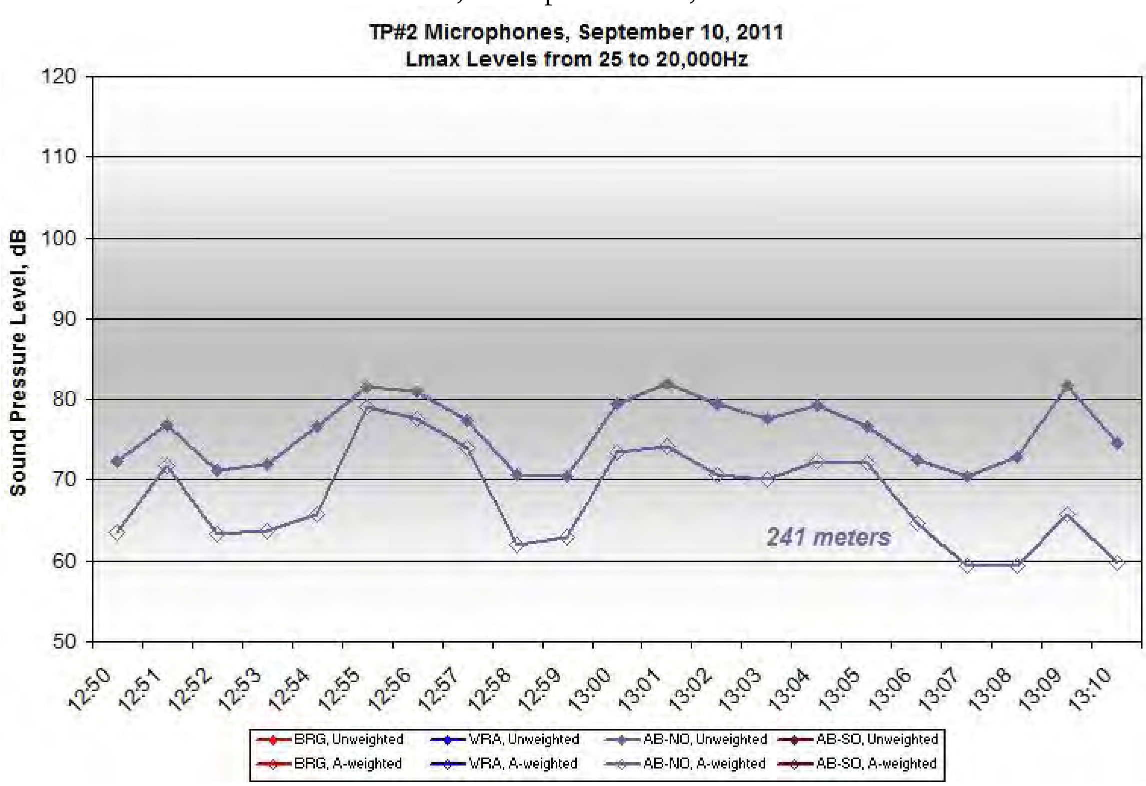

Figure C87. One-minute Unweighted and A-weighted Lmax Level at TP#2, 12:58-13:05, on September 10, 2011

NO DATA AVAILABLE

Figure C88. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#2, 12:58-13:05, on September 10, 2011

NO DATA AVAILABLE

Figure C89. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#2, 12:58-13:05, on September 10, 2011

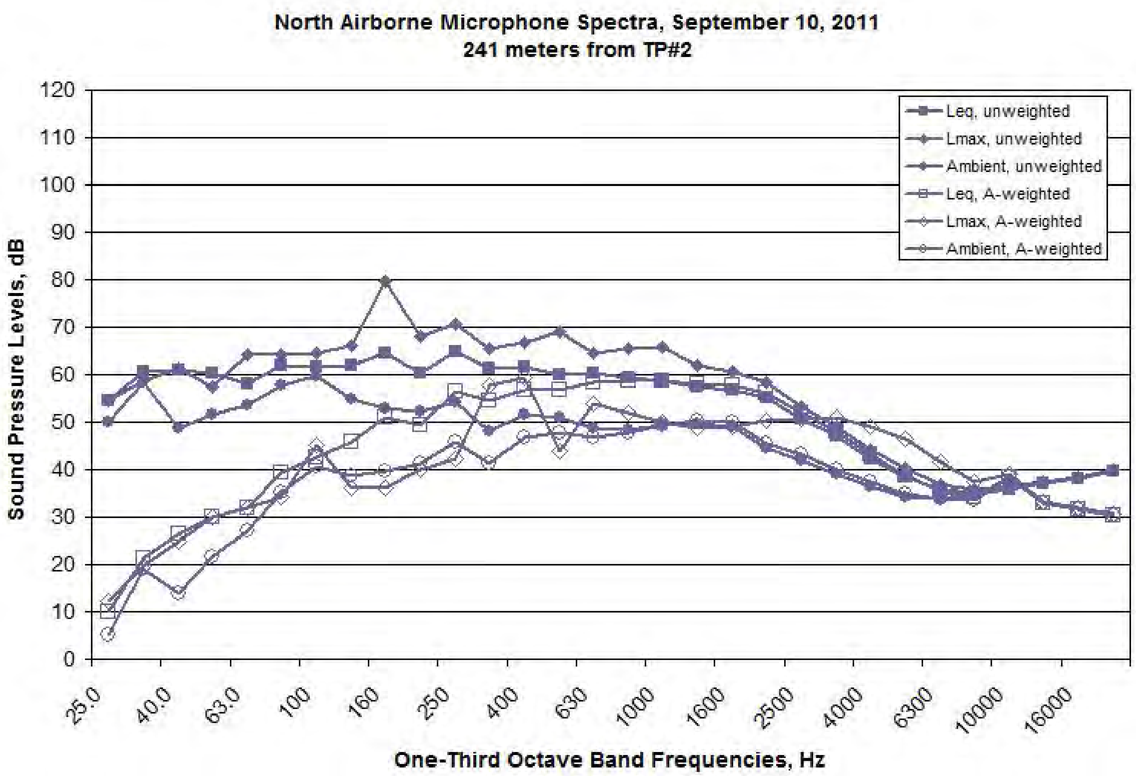

Figure C90. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#2, 12:58-13:05, on September 10, 2011

NO DATA AVAILABLE

Figure C91. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#2, 12:58-13:05, on September 10, 2011

9/17/2011 – TP#2

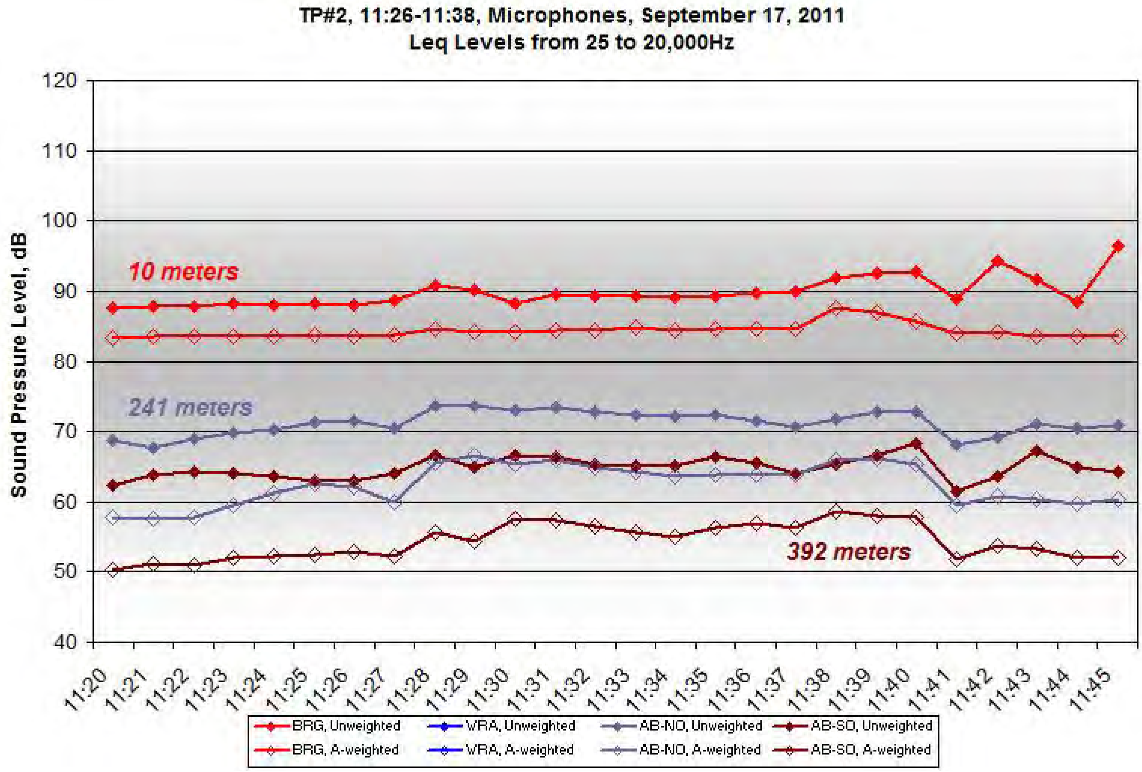

Figure C92. One-minute Unweighted and A-weighted Leq Level at TP#2, 11:26-11:38, on September 17, 2011

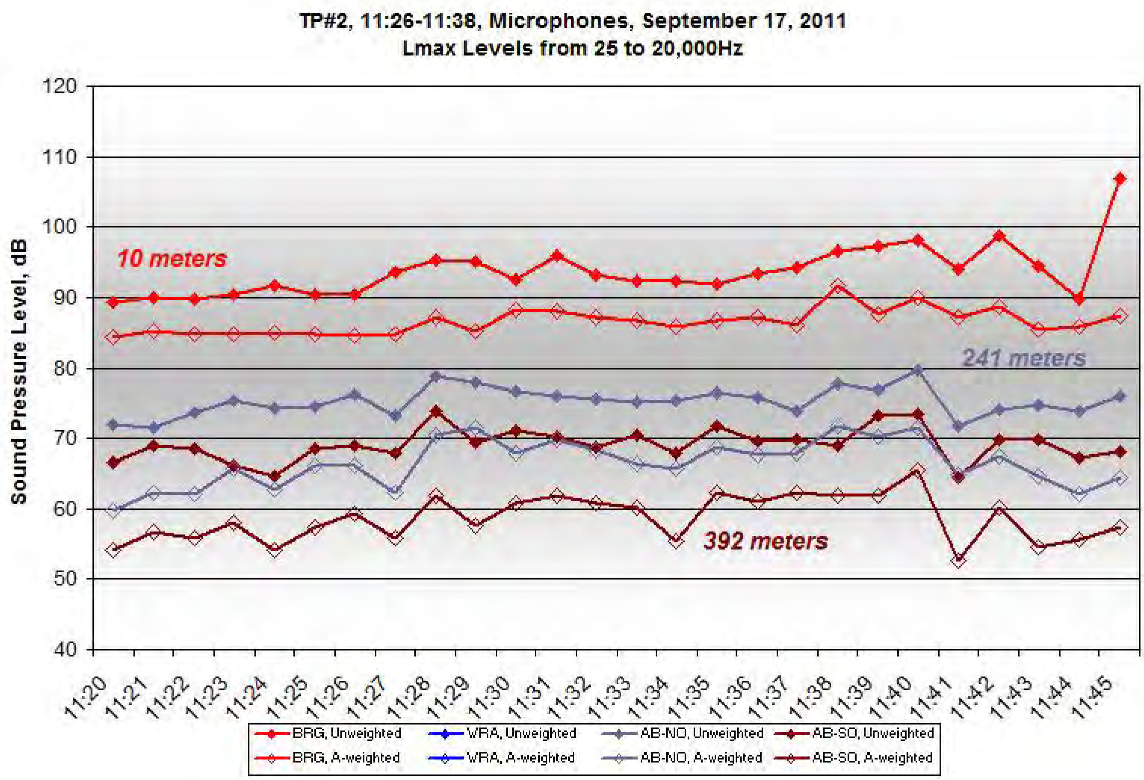

Figure C93. One-minute Unweighted and A-weighted Lmax Level at TP#2, 11:26-11:38, on September 17, 2011

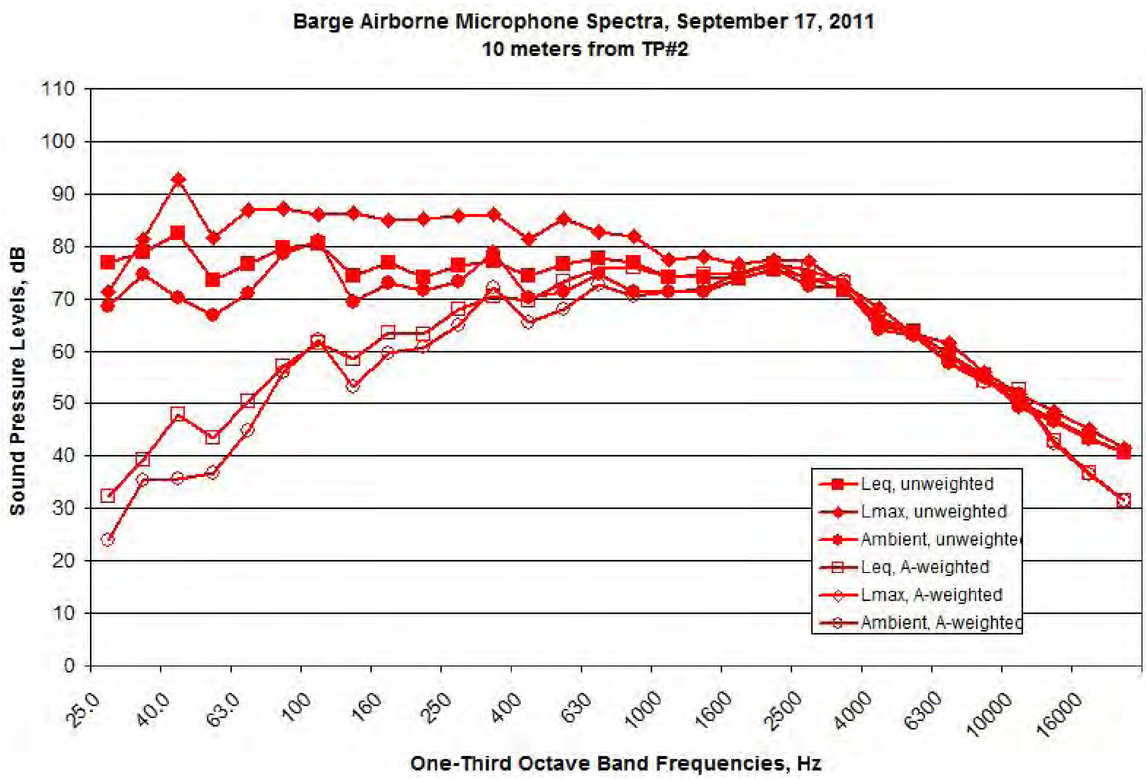

Figure C94. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#2, 11:26-11:38, on September 17, 2011

NO DATA AVAILABLE

Figure C95. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#2, 11:26-11:38, on September 17, 2011

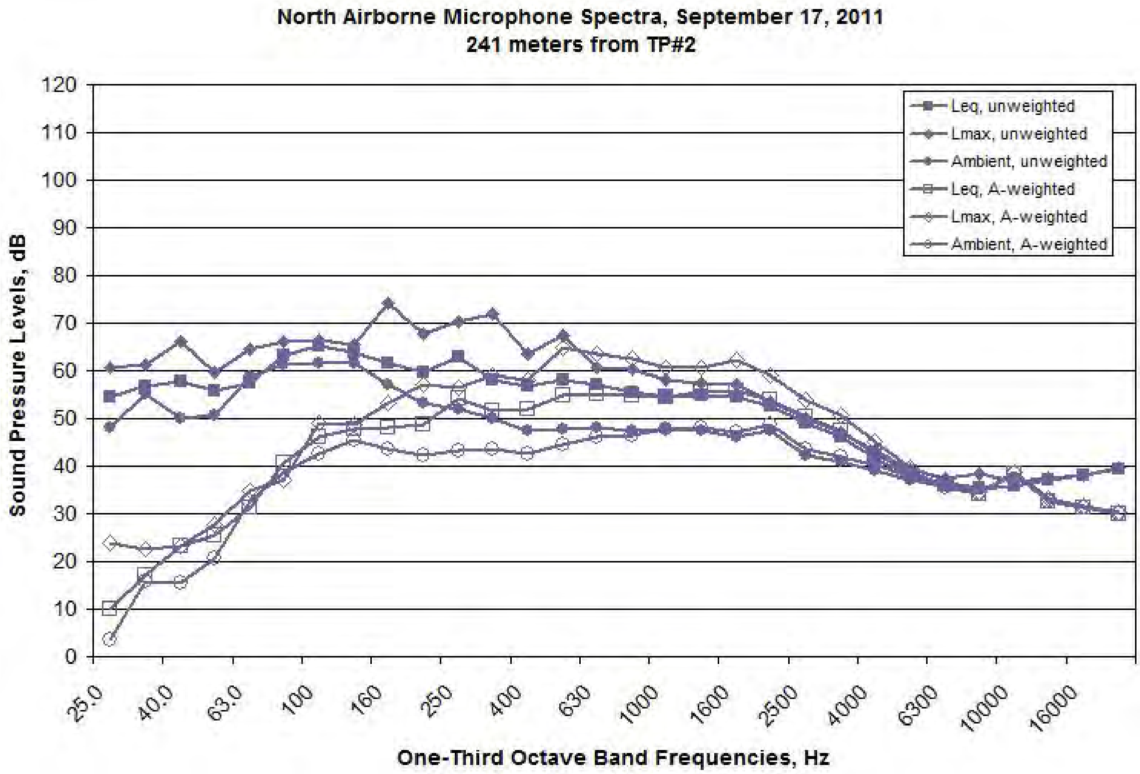

Figure C96. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#2, 11:26-11:38, on September 17, 2011

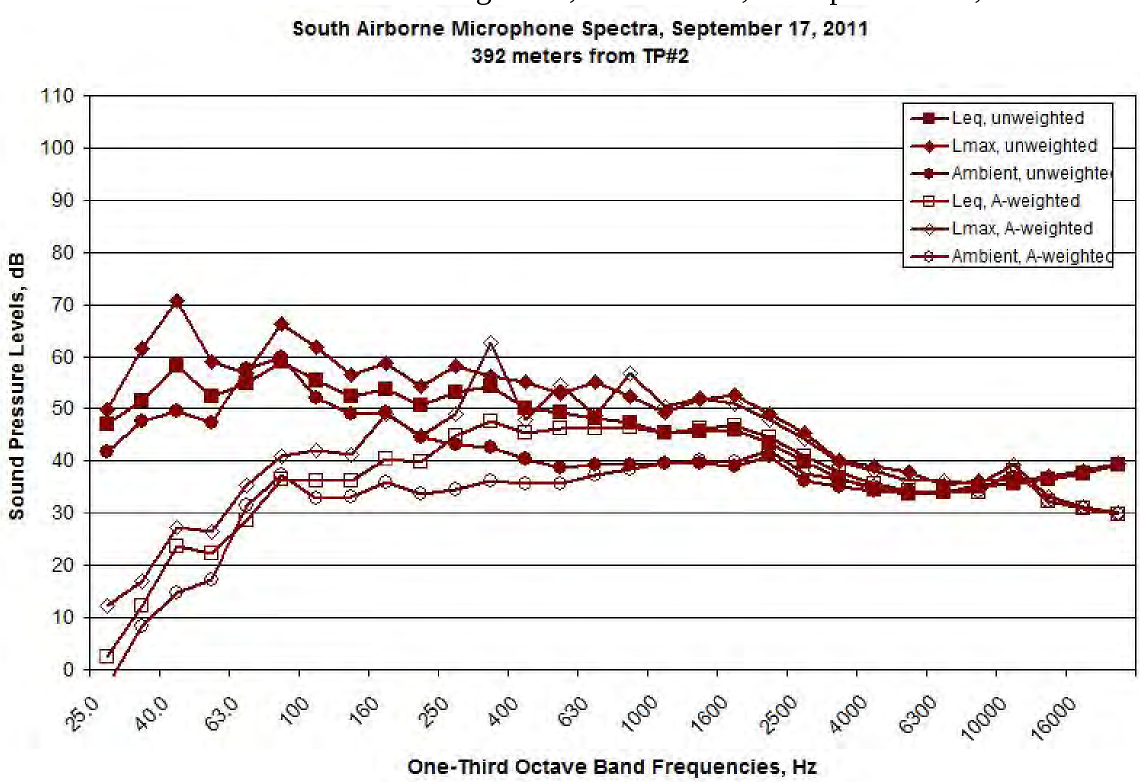

Figure C97. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#2, 11:26-11:38, on September 17, 2011

TP#3 MP#1 (Vibratory Pile Driving Event)

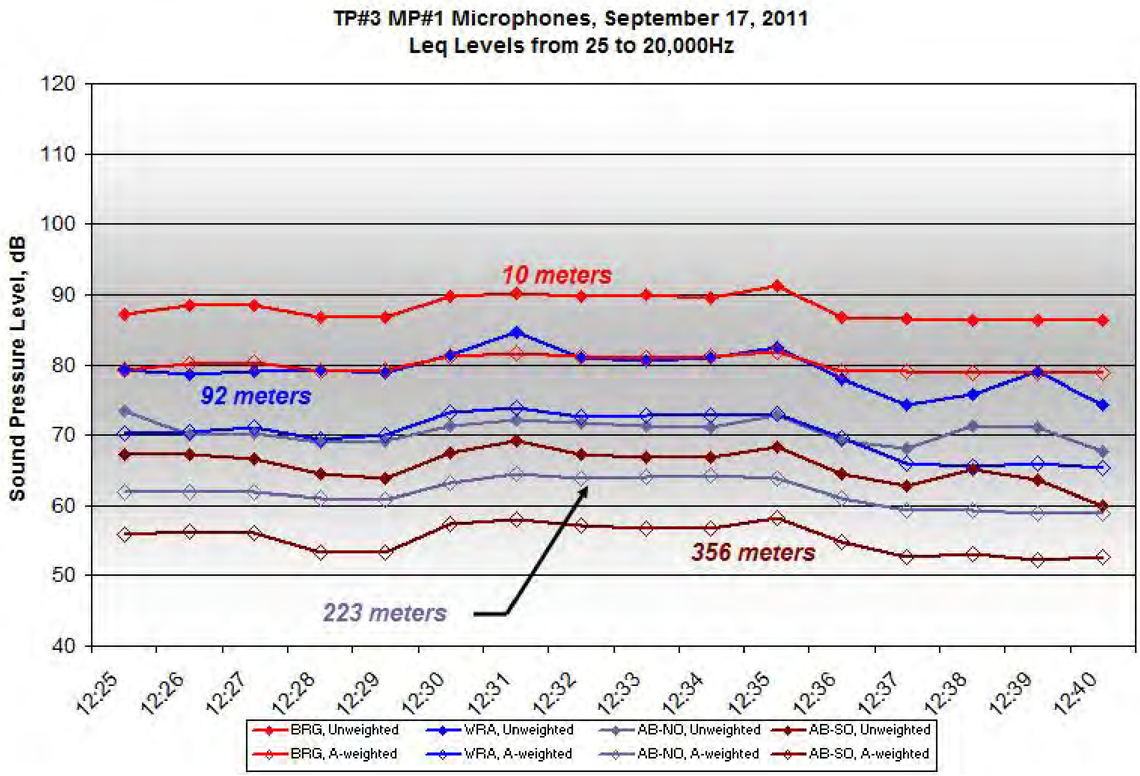

Figure C98. One-minute Unweighted and A-weighted Leq Level at TP#3 MP#1, 12:30-12:36, on September 17, 2011

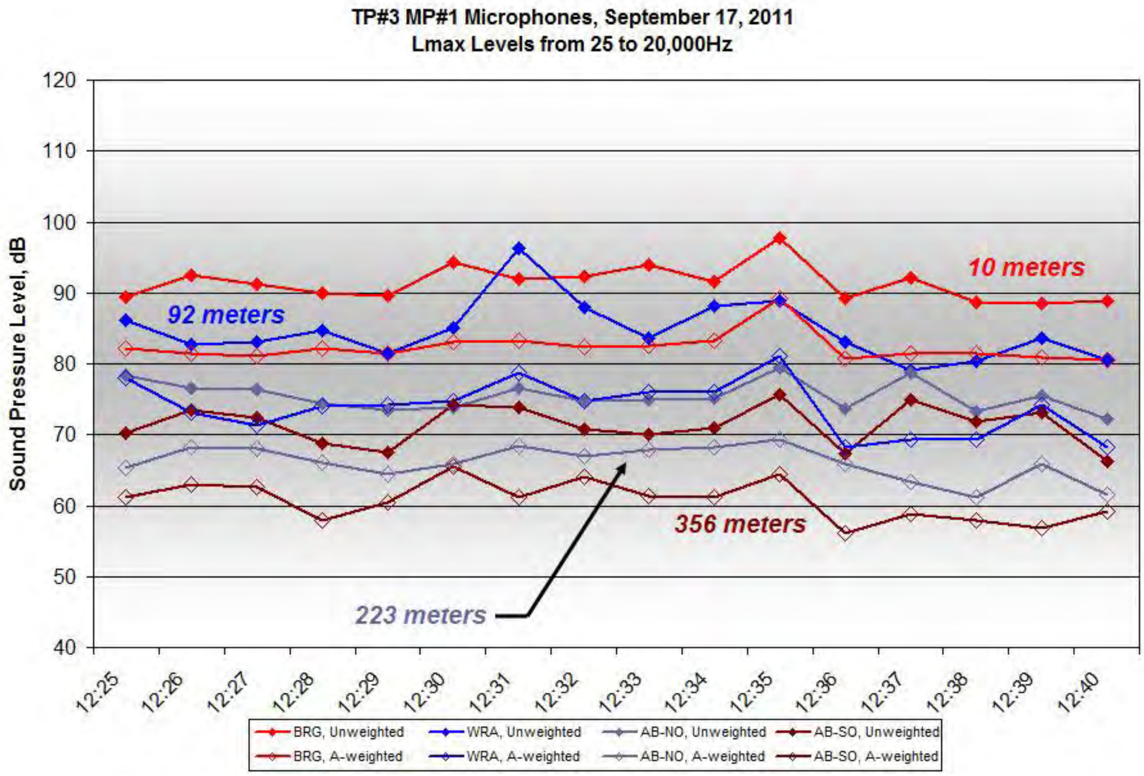

Figure C99. One-minute Unweighted and A-weighted Lmax Level at TP#3 MP#1, 12:30-12:36, on September 17, 2011

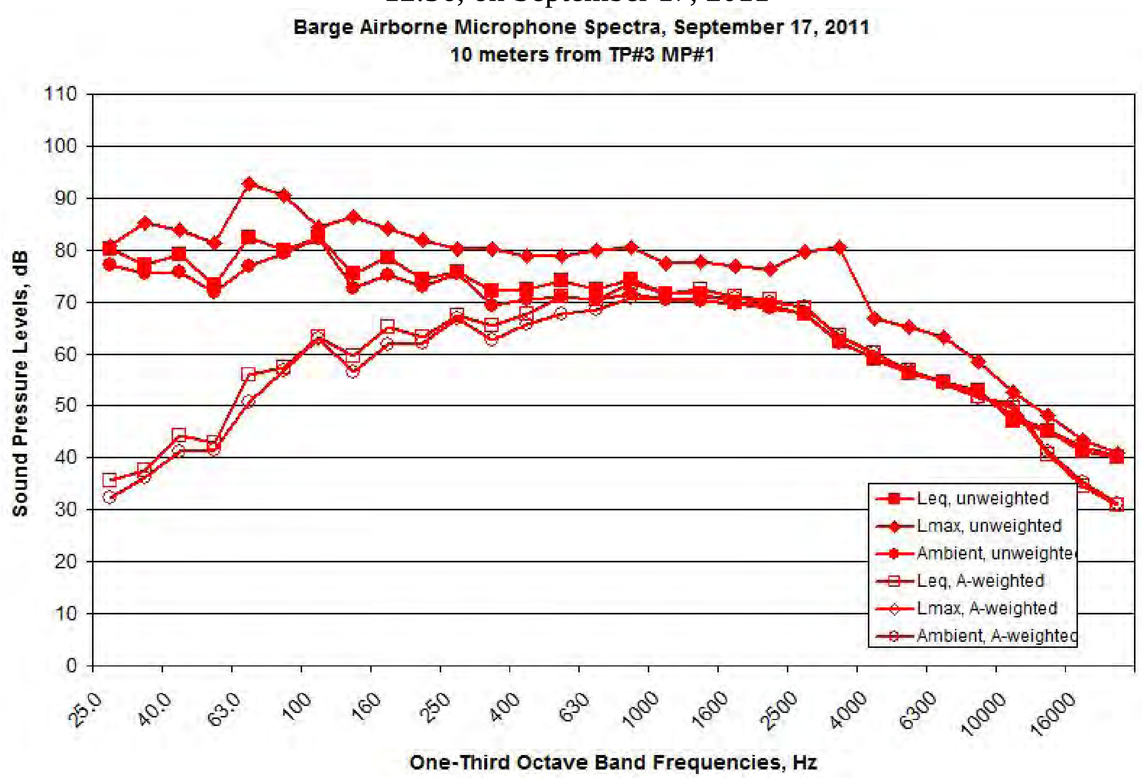

Figure C100. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 MP#1, 12:30-12:36, on September 17, 2011

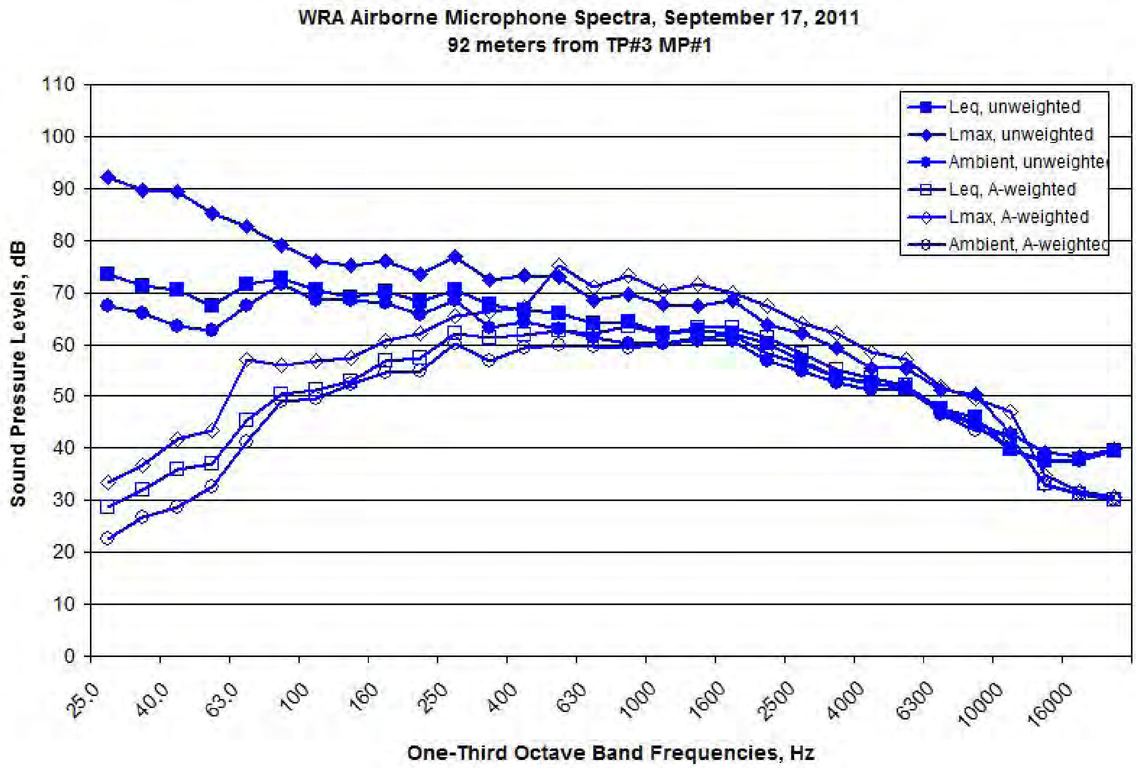

Figure C101. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 MP#1, 12:30-12:36, on September 17, 2011

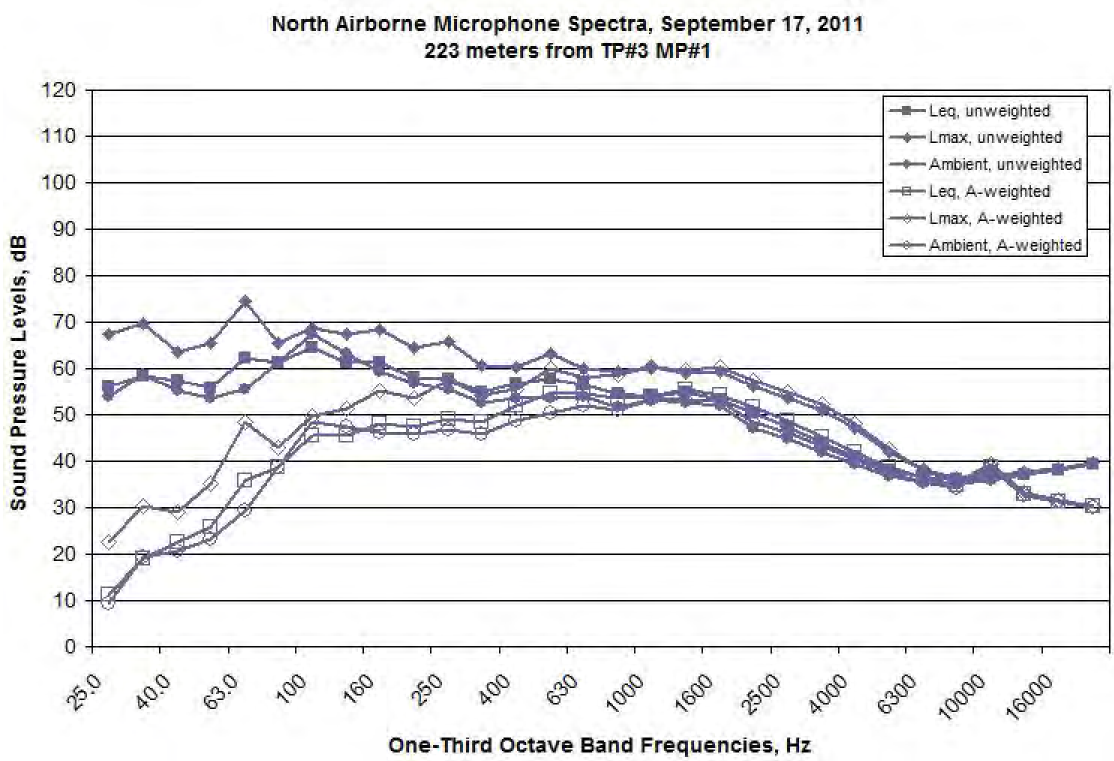

Figure C102. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 MP#1, 12:30-12:36, on September 17, 2011

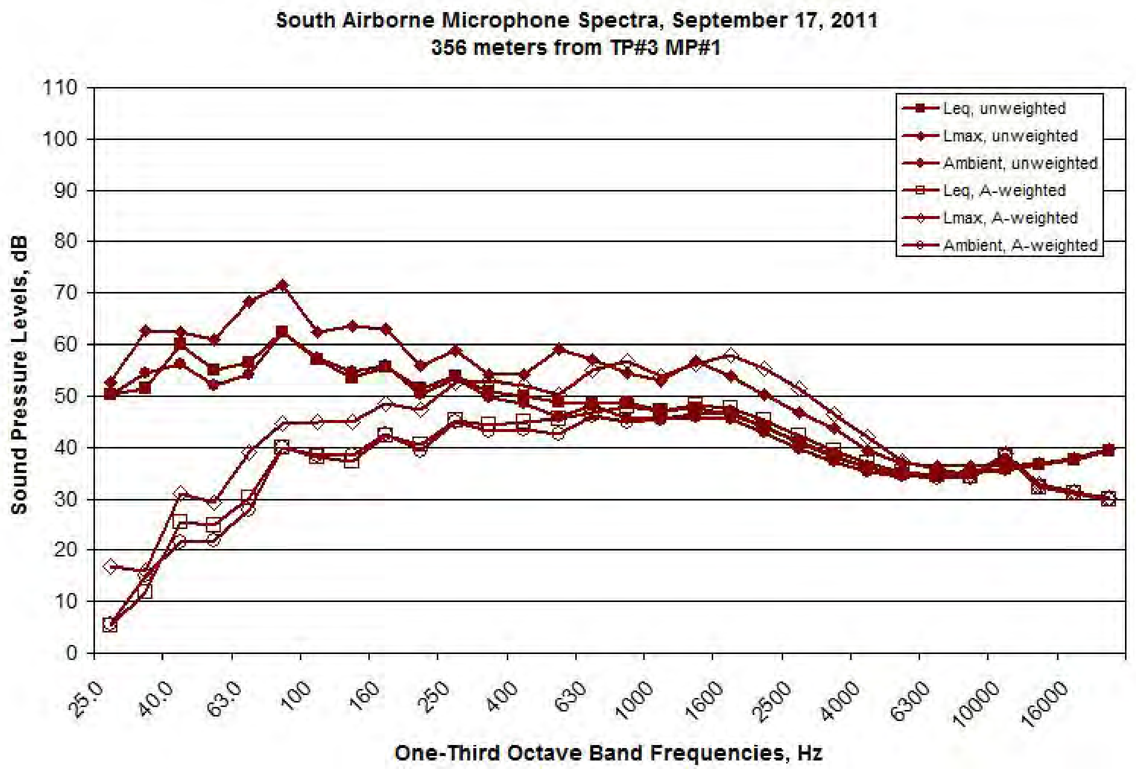

Figure C103. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 MP#1, 12:30-12:36, on September 17, 2011

TTP#2

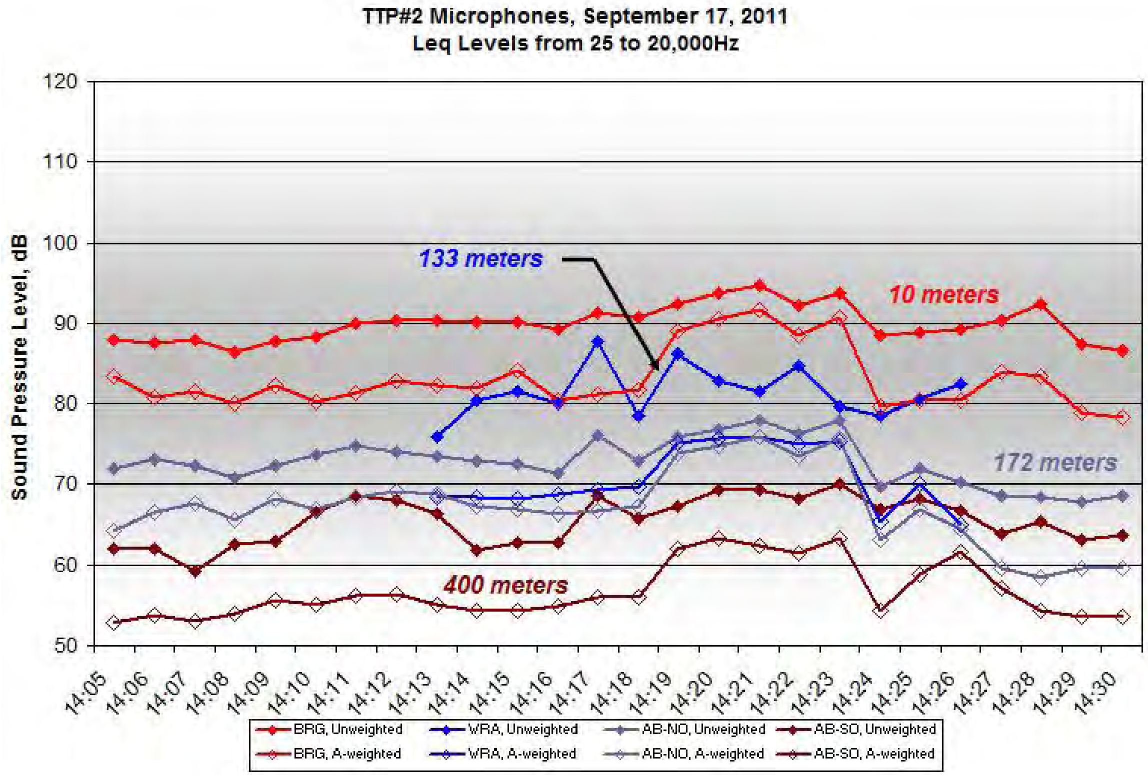

Figure C104. One-minute Unweighted and A-weighted Leq Level at TTP#2, 14:09-14:24, on September 17, 2011

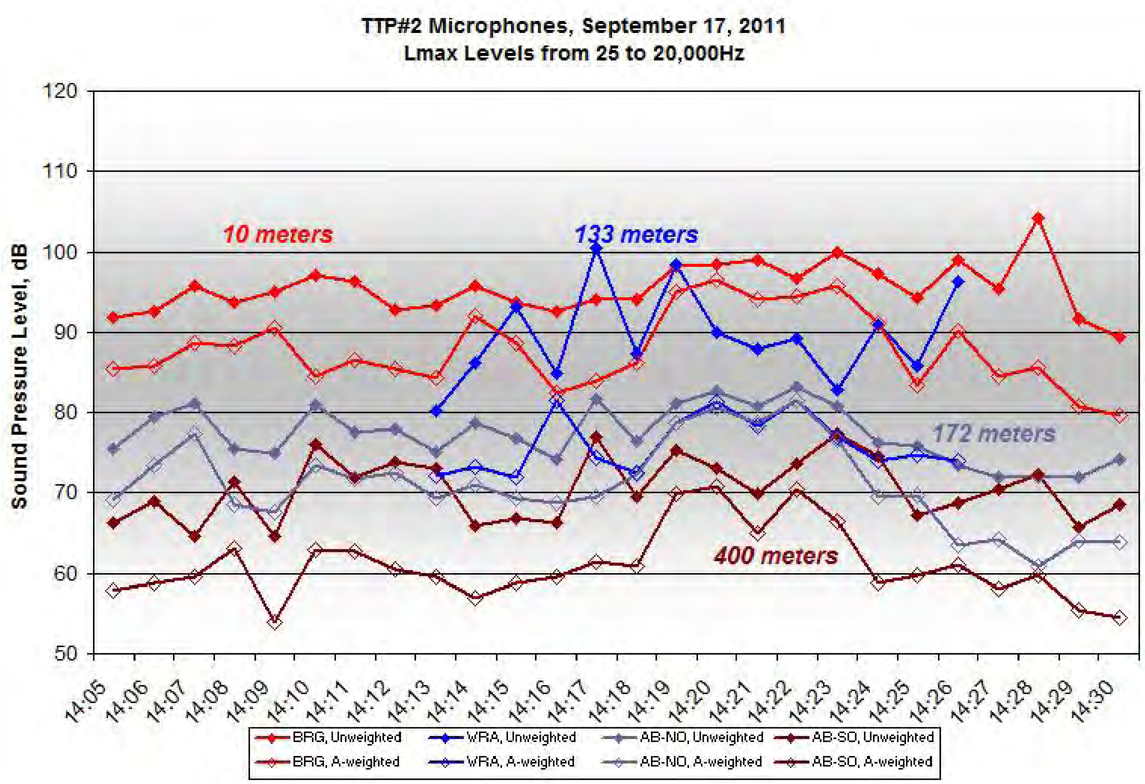

Figure C105. One-minute Unweighted and A-weighted Lmax Level at TTP#2, 14:09-14:24, on September 17, 2011

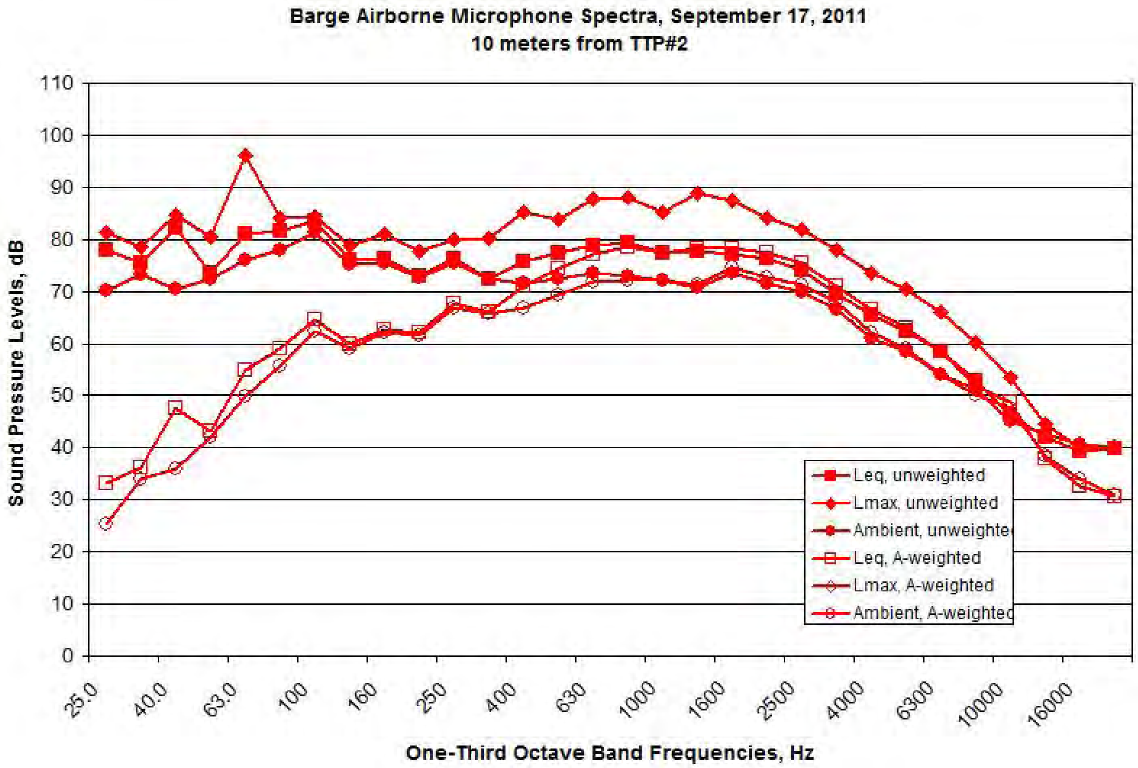

Figure C106. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#2, 14:09-14:24, on September 17, 2011

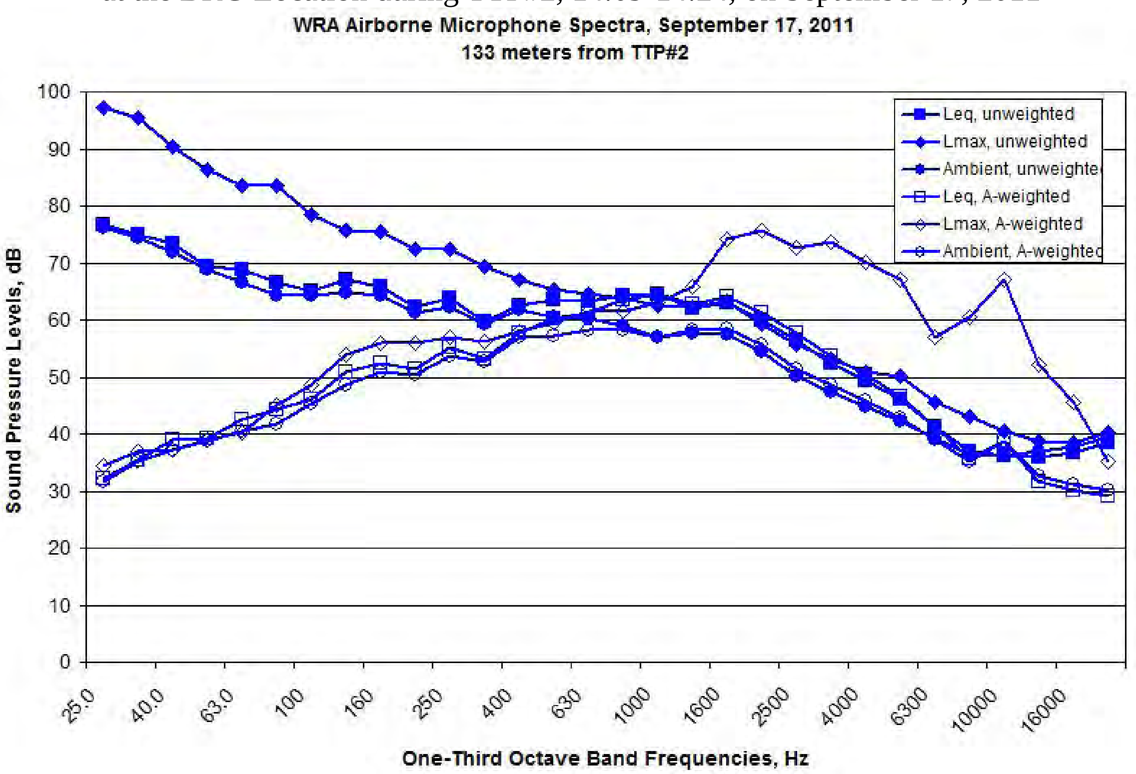

Figure C107. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#2, 14:09-14:24, on September 17, 2011

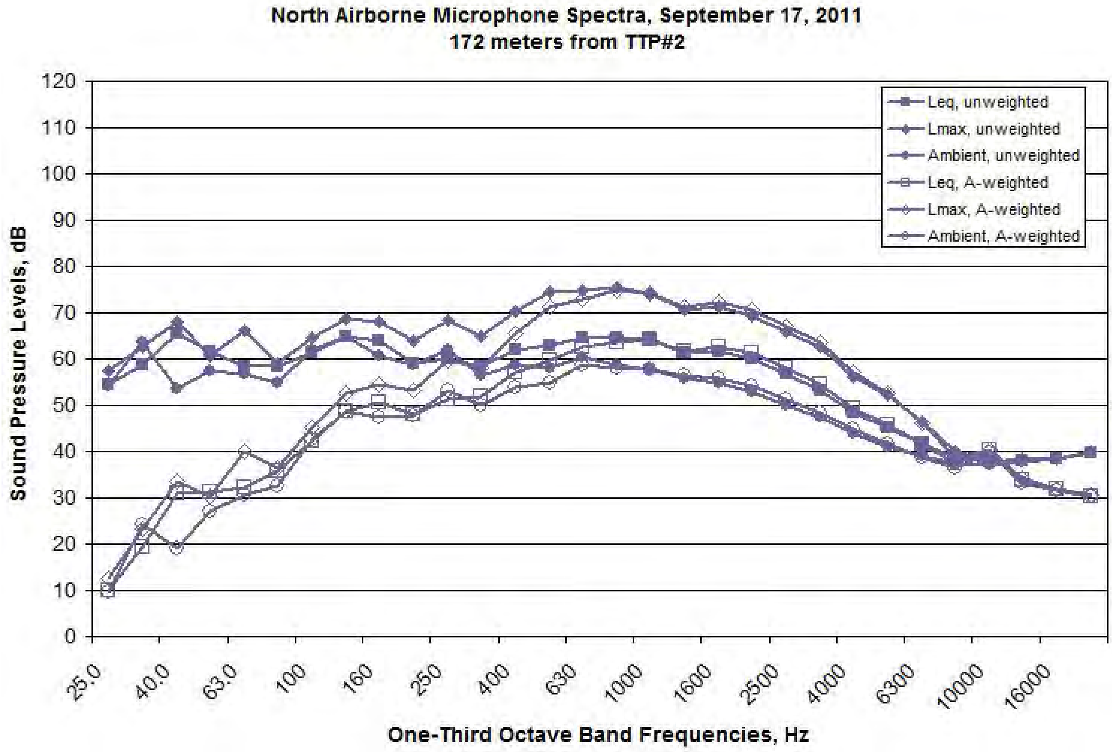

Figure C108. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#2, 14:09-14:24, on September 17, 2011

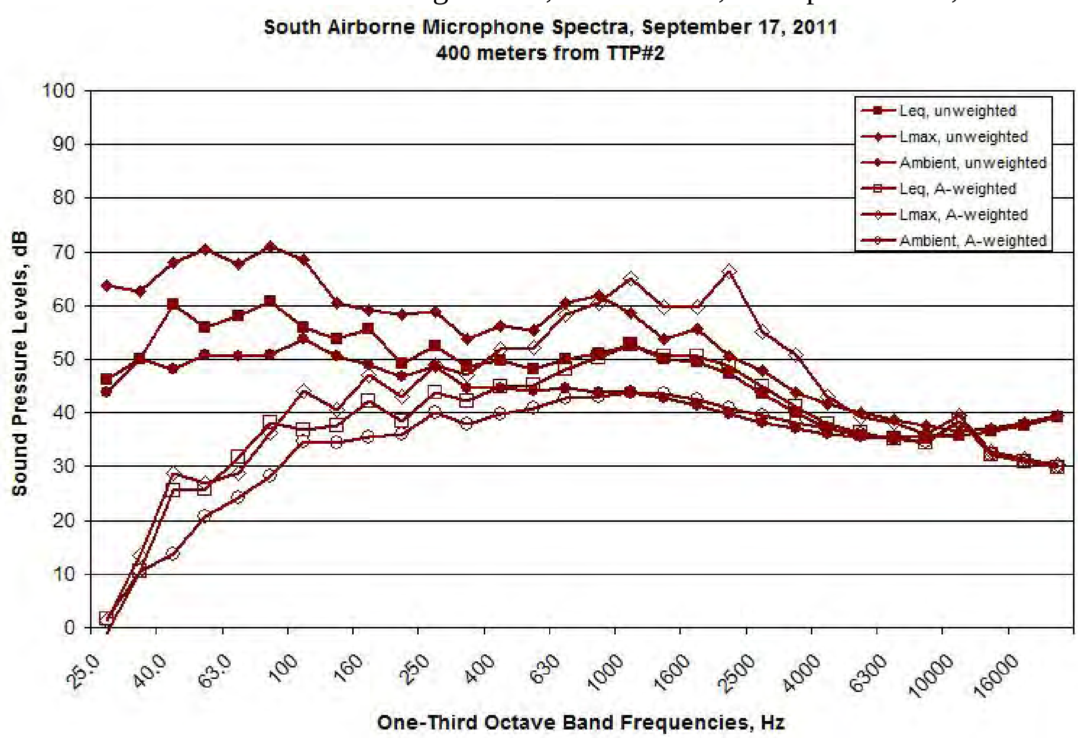

Figure C109. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#2, 14:09-14:24, on September 17, 2011

TP#3 MP#3

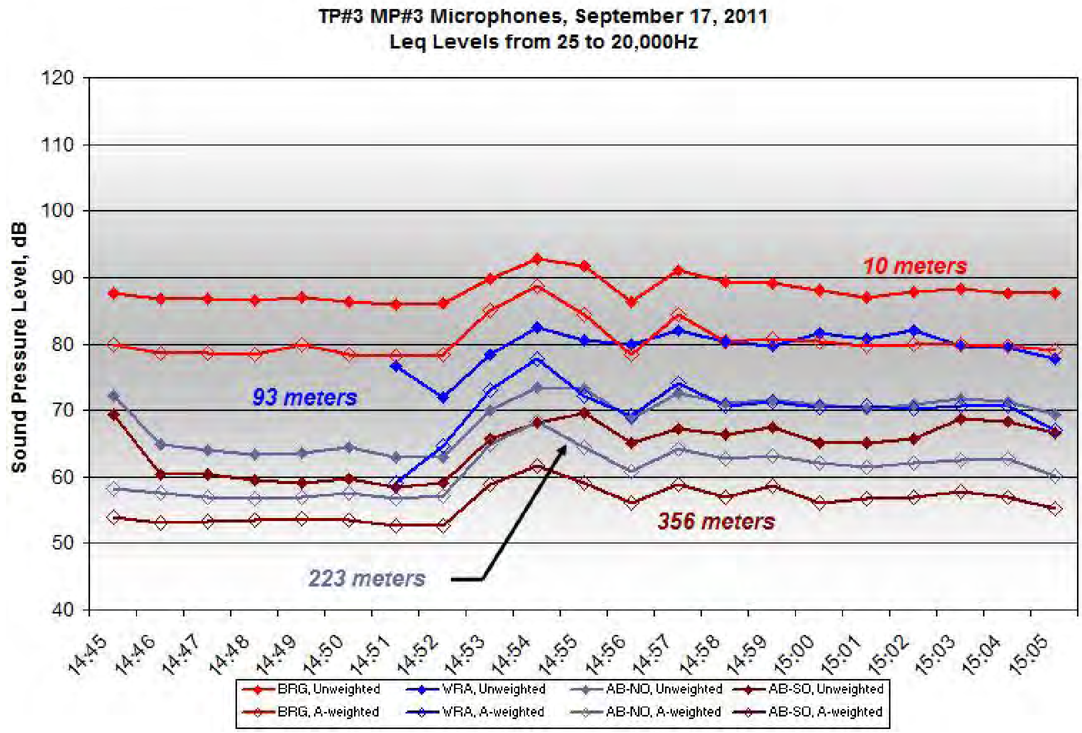

Figure C110. One-minute Unweighted and A-weighted Leq Level at TP#3 MP#3, 14:52-15:02, on September 17, 2011

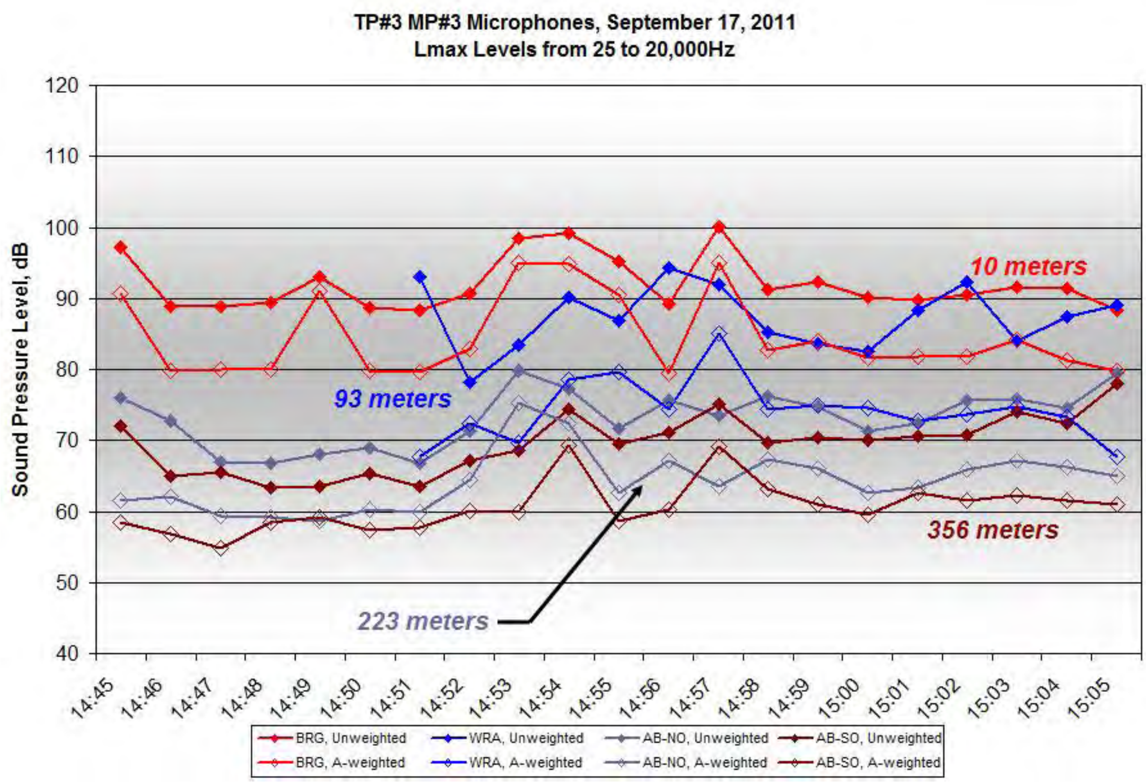

Figure C111. One-minute Unweighted and A-weighted Lmax Level at TP#3 MP#3, 14:52-15:02, on September 17, 2011

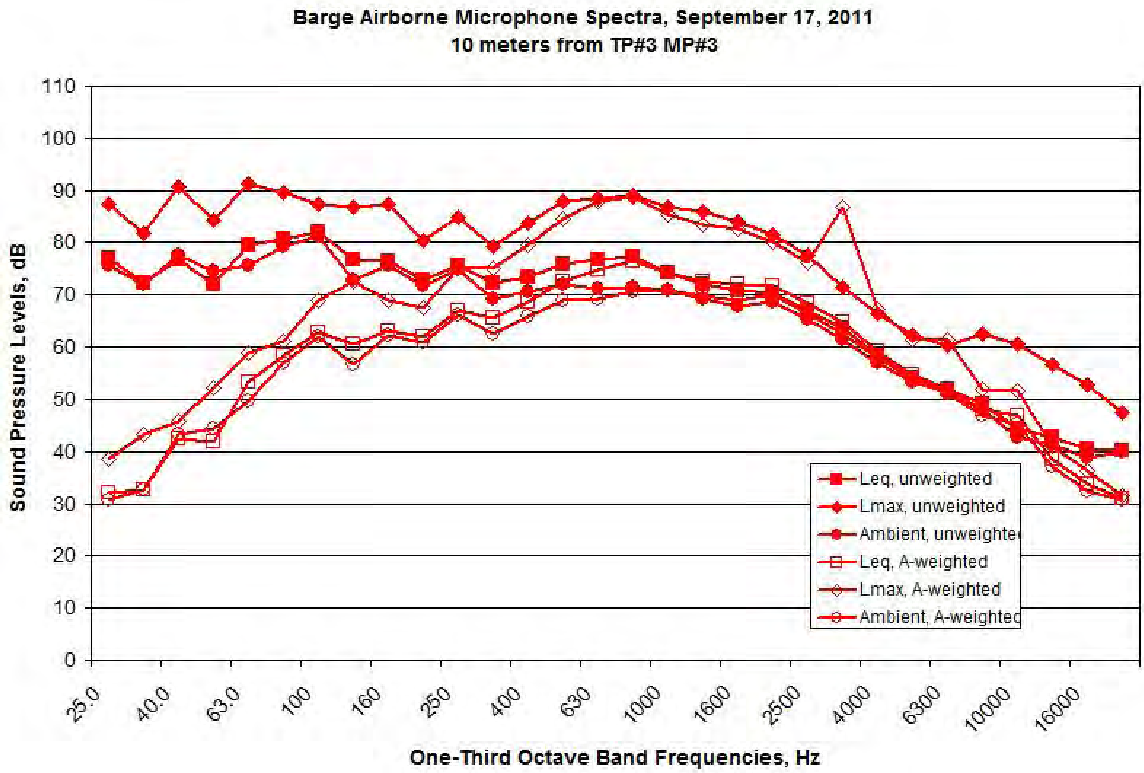

Figure C112. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 MP#3, 14:52-15:02, on September 17, 2011

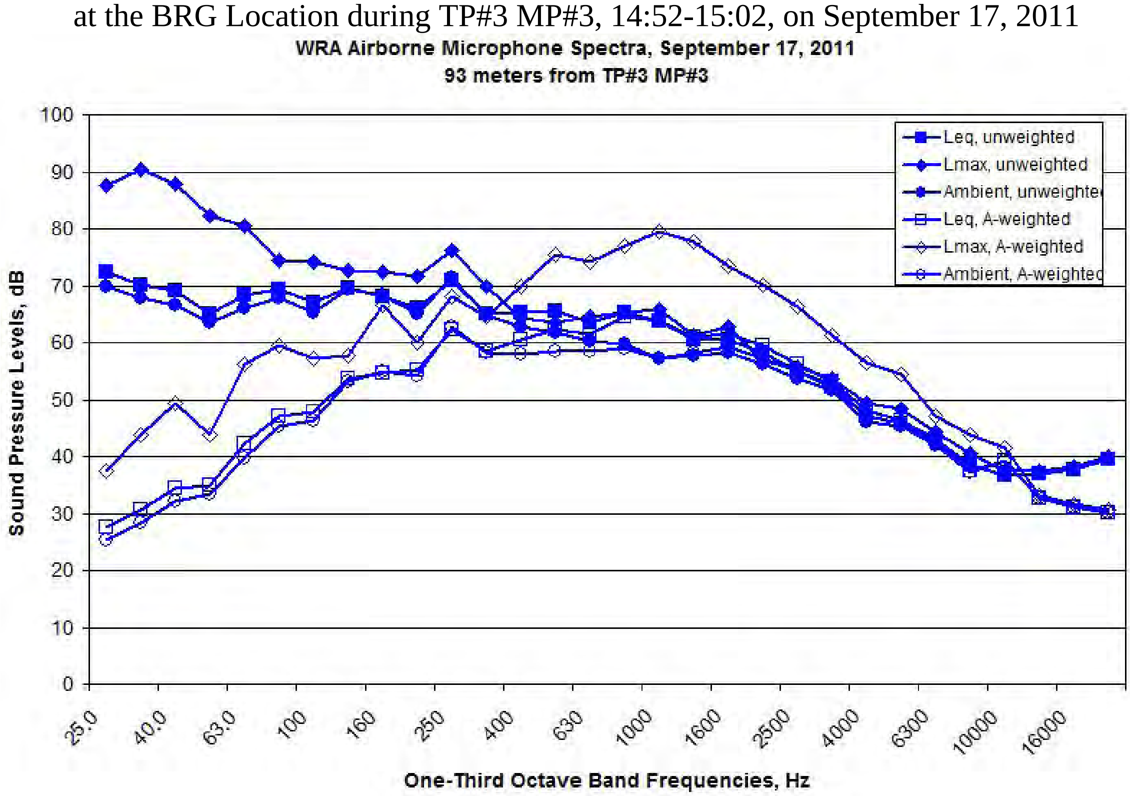

Figure C113. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 MP#3, 14:52-15:02, on September 17, 2011

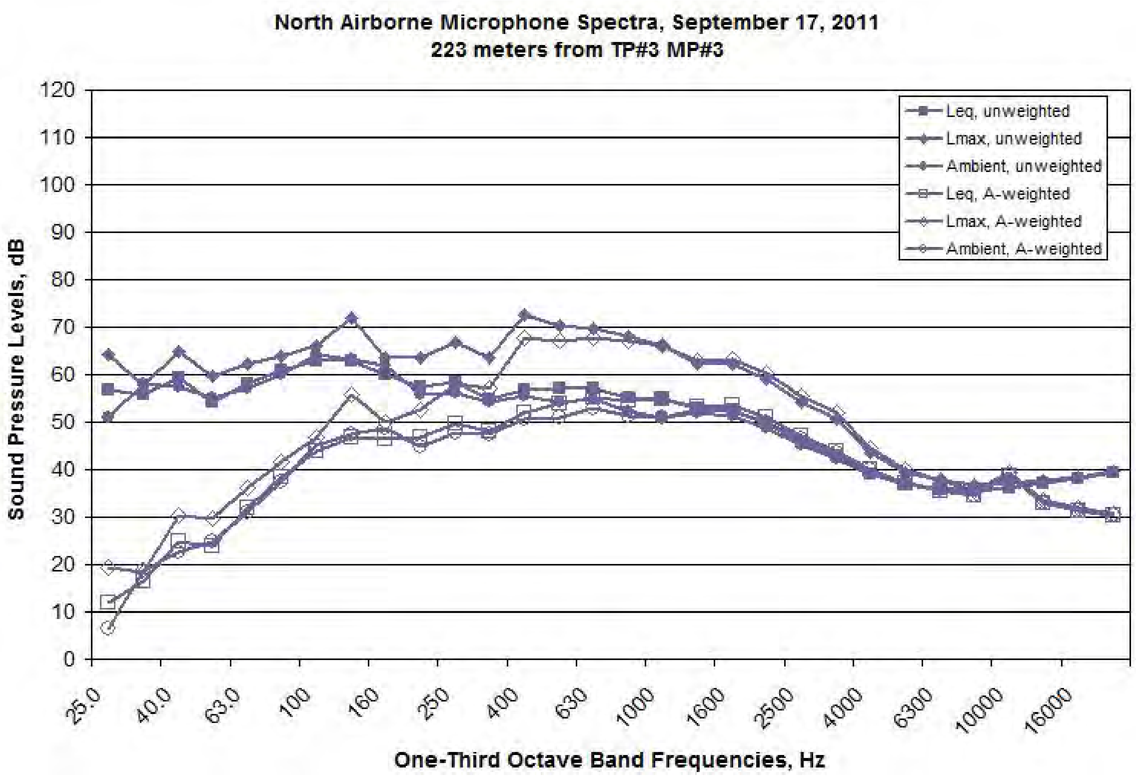

Figure C114. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 MP#3, 14:52-15:02, on September 17, 2011

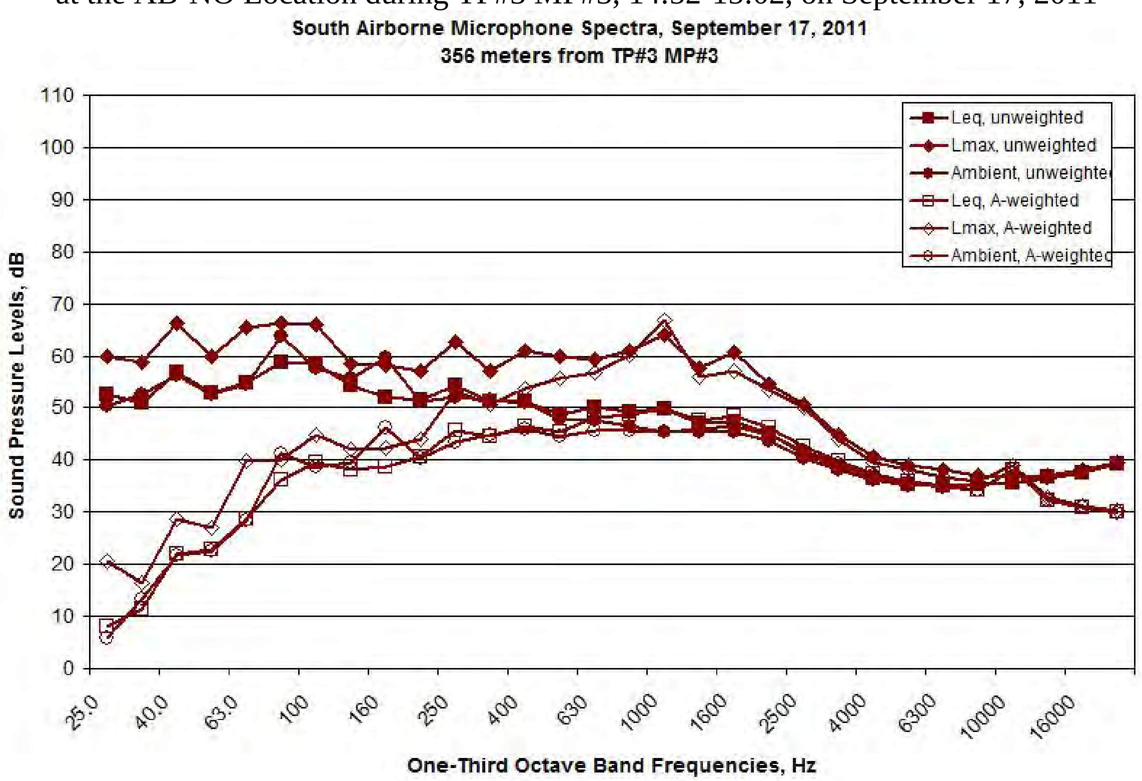

Figure C115. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 MP#3, 14:52-15:02, on September 17, 2011

TP#7

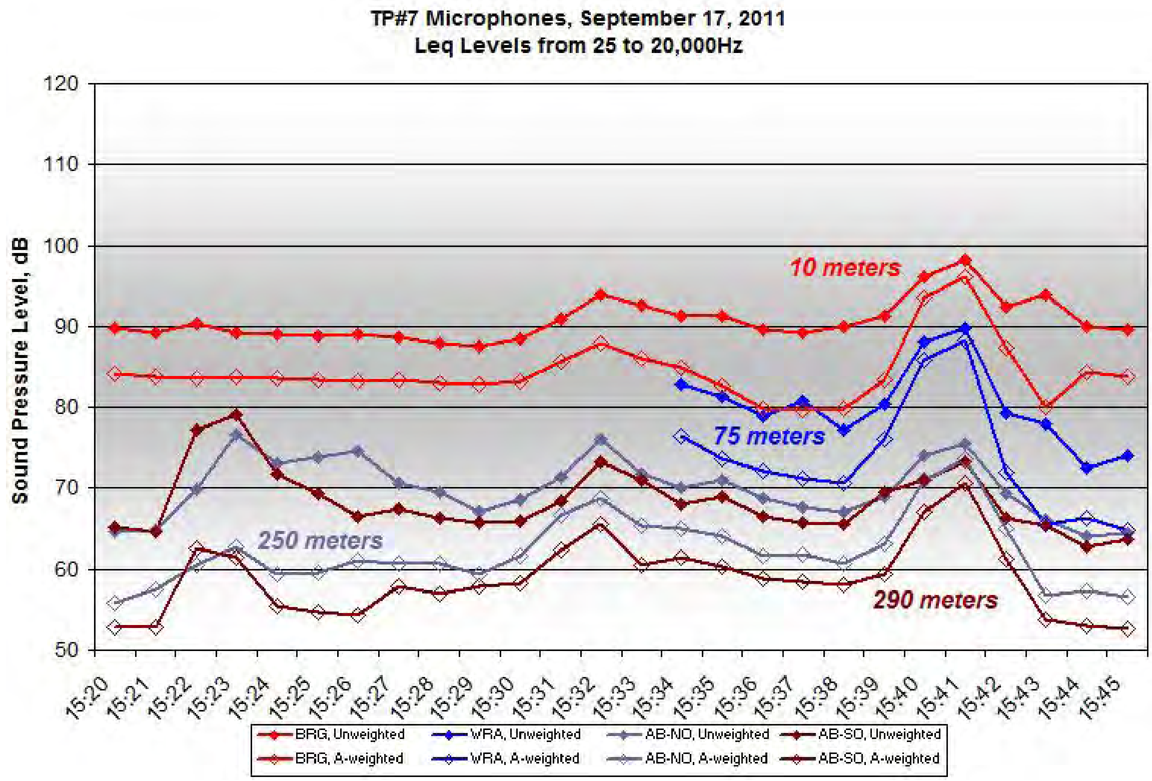

Figure C116. One-minute Unweighted and A-weighted Leq Level at TP#7, 15:28-15:40, on September 17, 2011

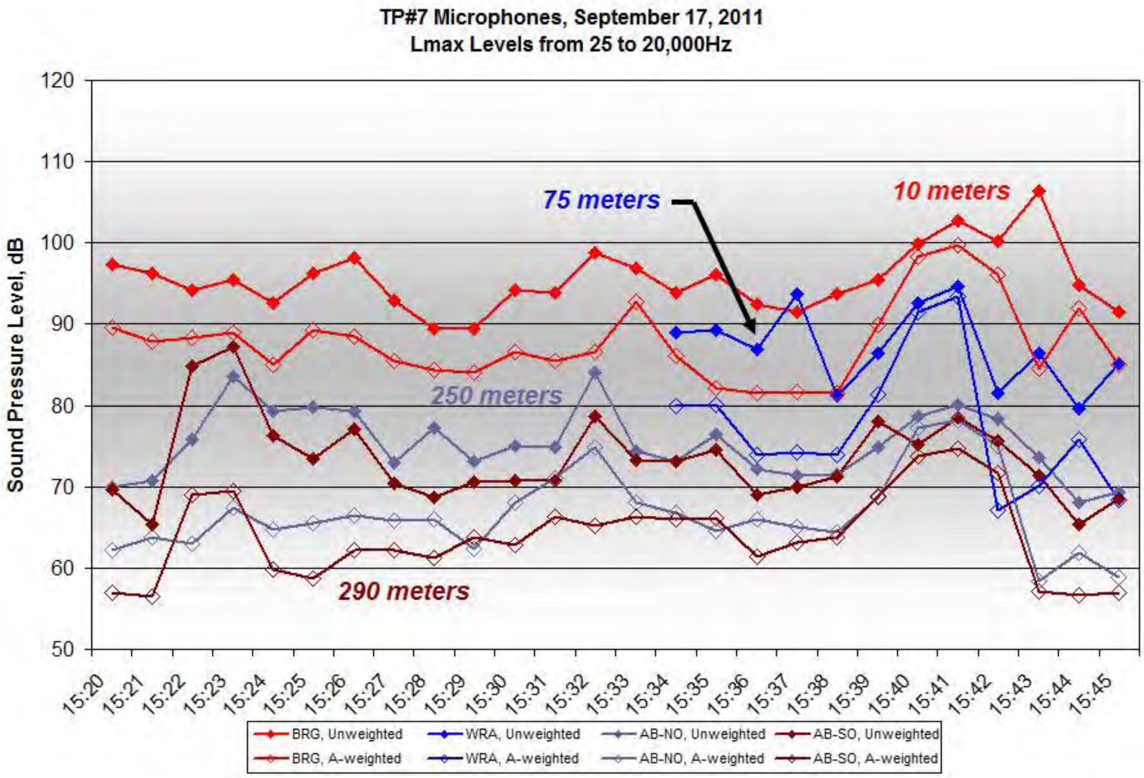

Figure C117. One-minute Unweighted and A-weighted Lmax Level at TP#7, 15:28-15:40, on September 17, 2011

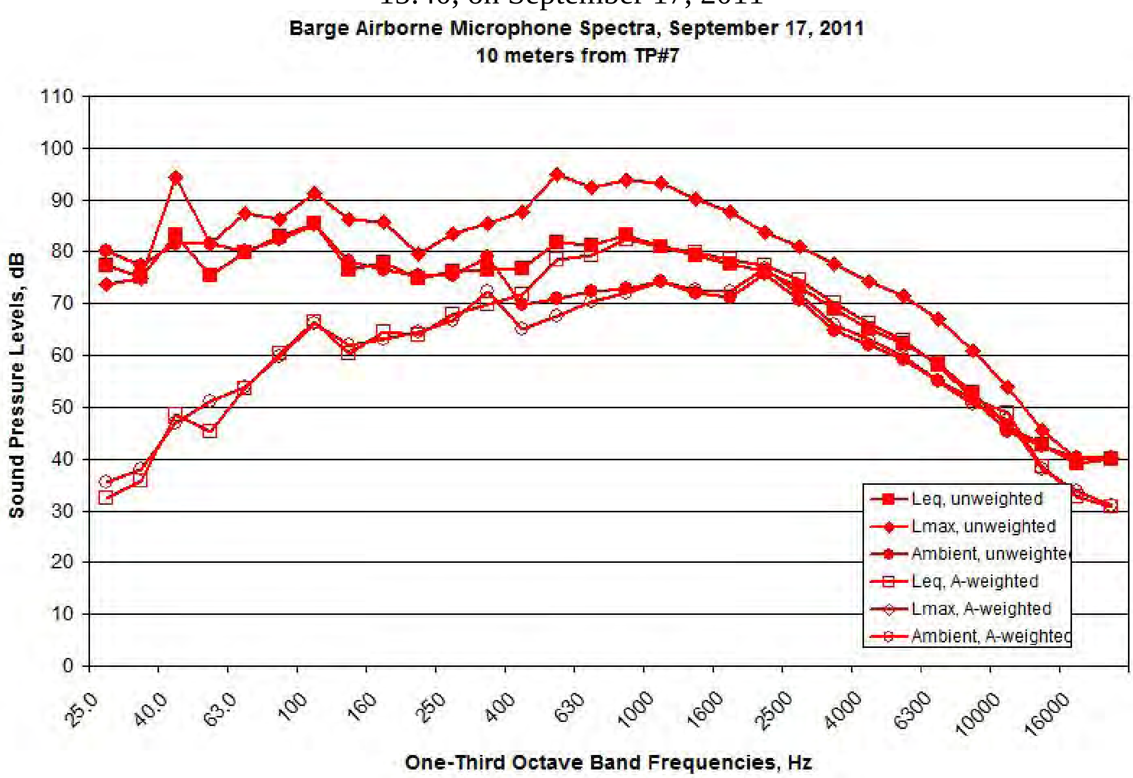

Figure C118. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#7, 15:28-15:40, on September 17, 2011

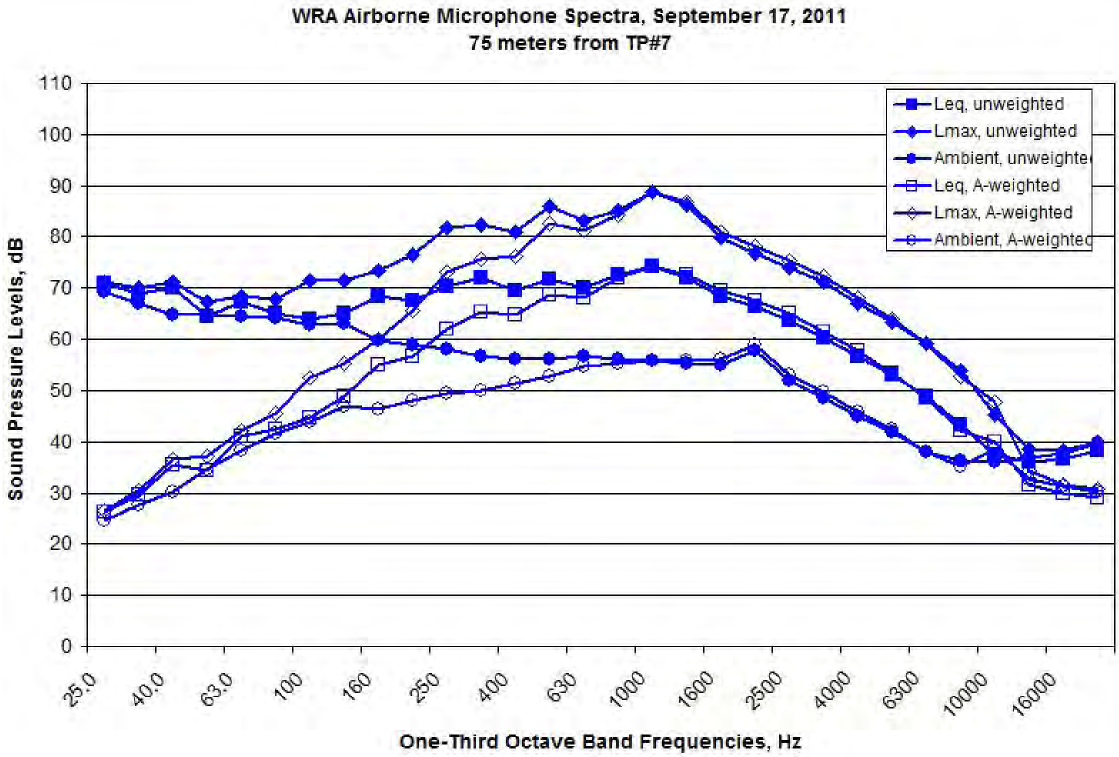

Figure C119. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#7, 15:28-15:40, on September 17, 2011

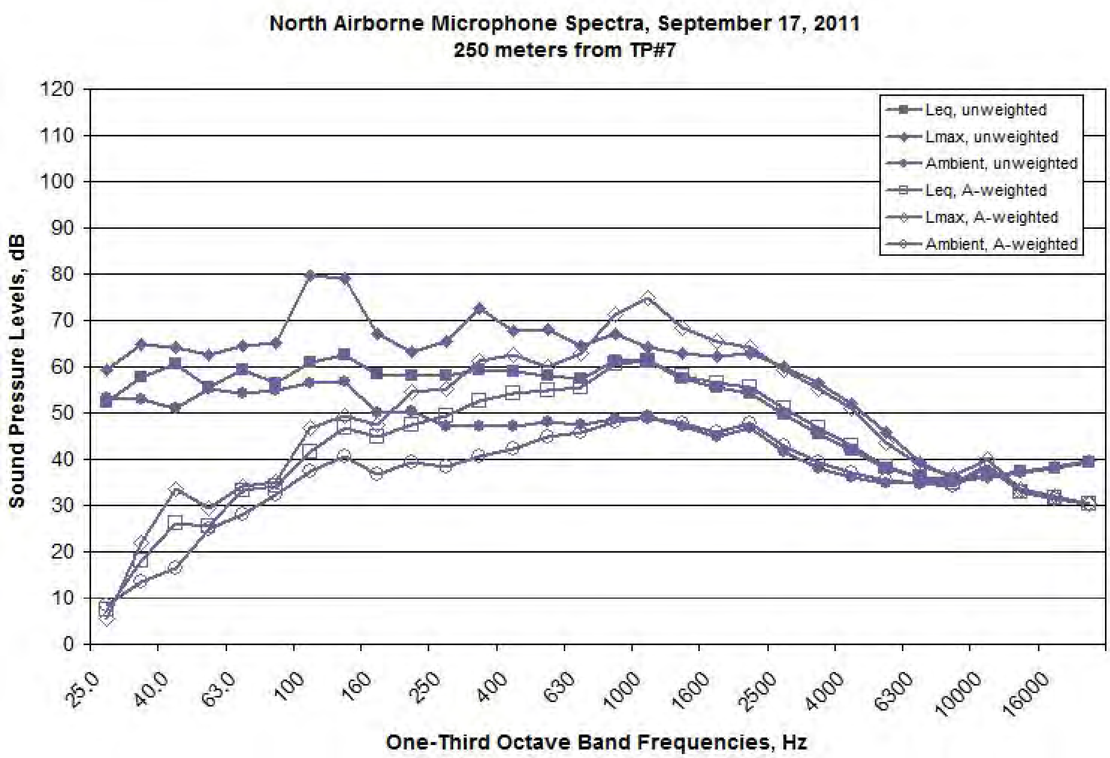

Figure C120. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#7, 15:28-15:40, on September 17, 2011

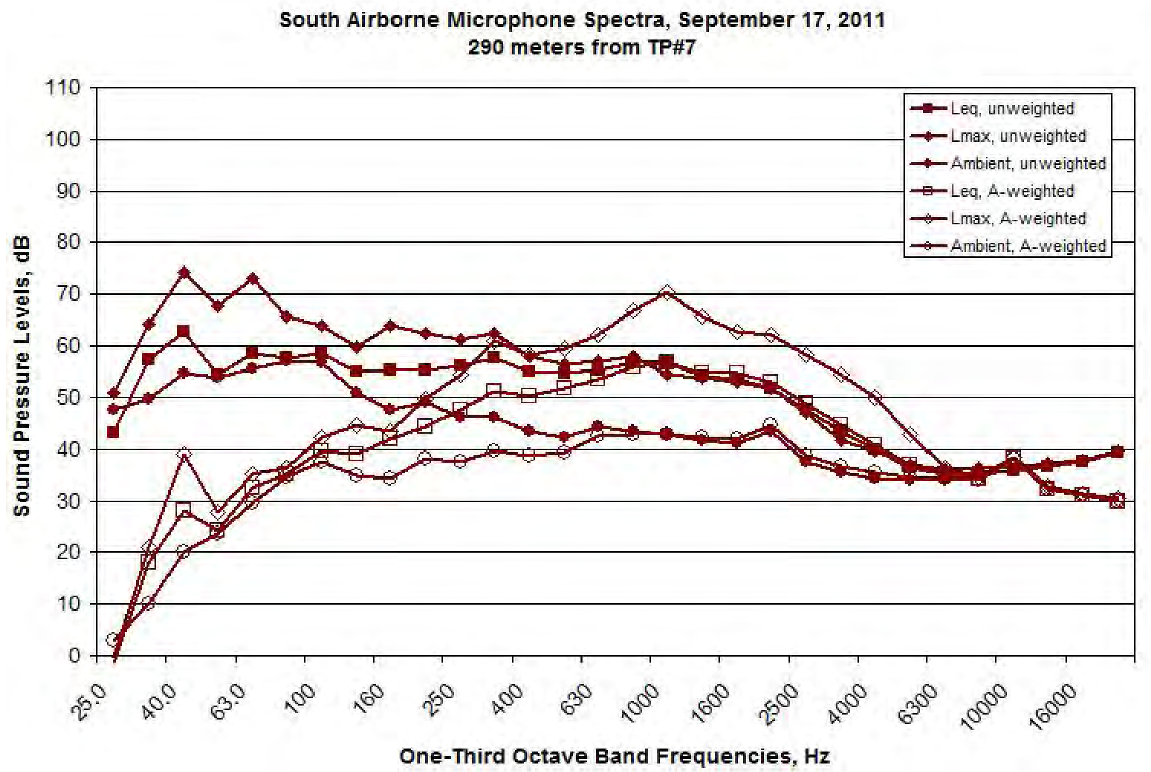

Figure C121. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#7, 15:28-15:40, on September 17, 2011

TP#3 MP#2

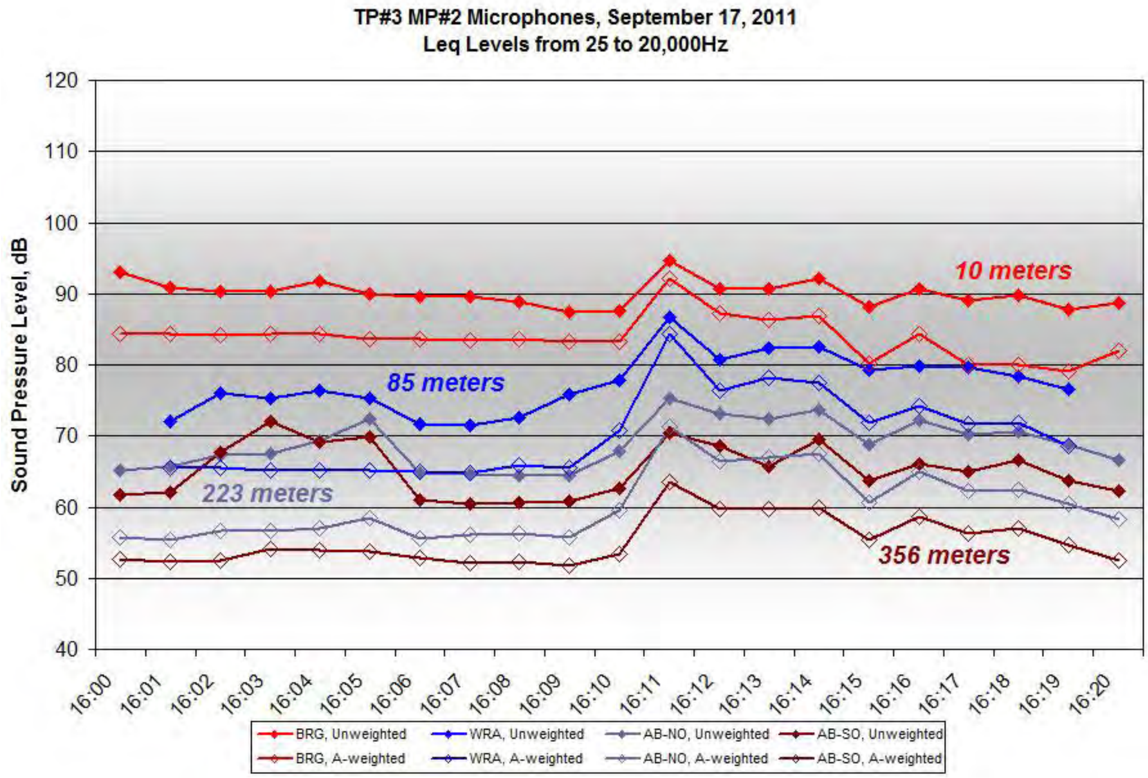

Figure C122. One-minute Unweighted and A-weighted Leq Level at TP#3 MP#2, 16:09-16:17, on September 17, 2011

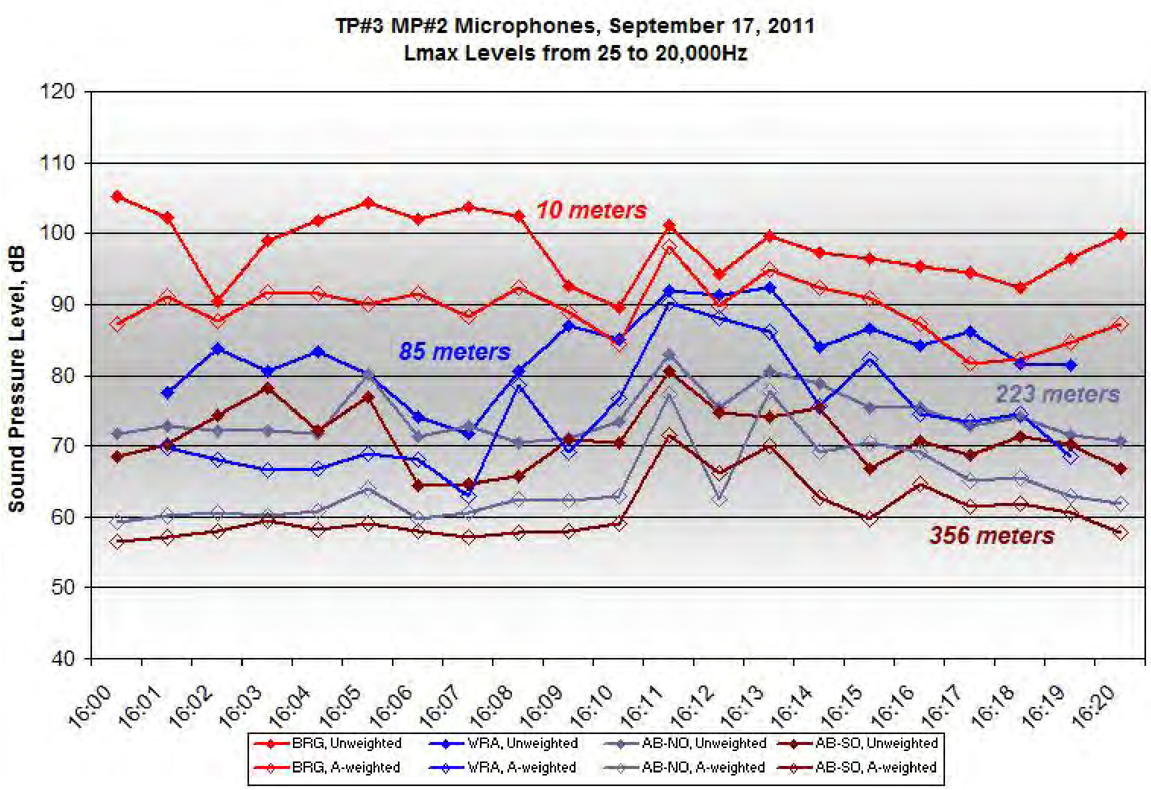

Figure C123. One-minute Unweighted and A-weighted Lmax Level at TP#3 MP#2, 16:09-16:17, on September 17, 2011

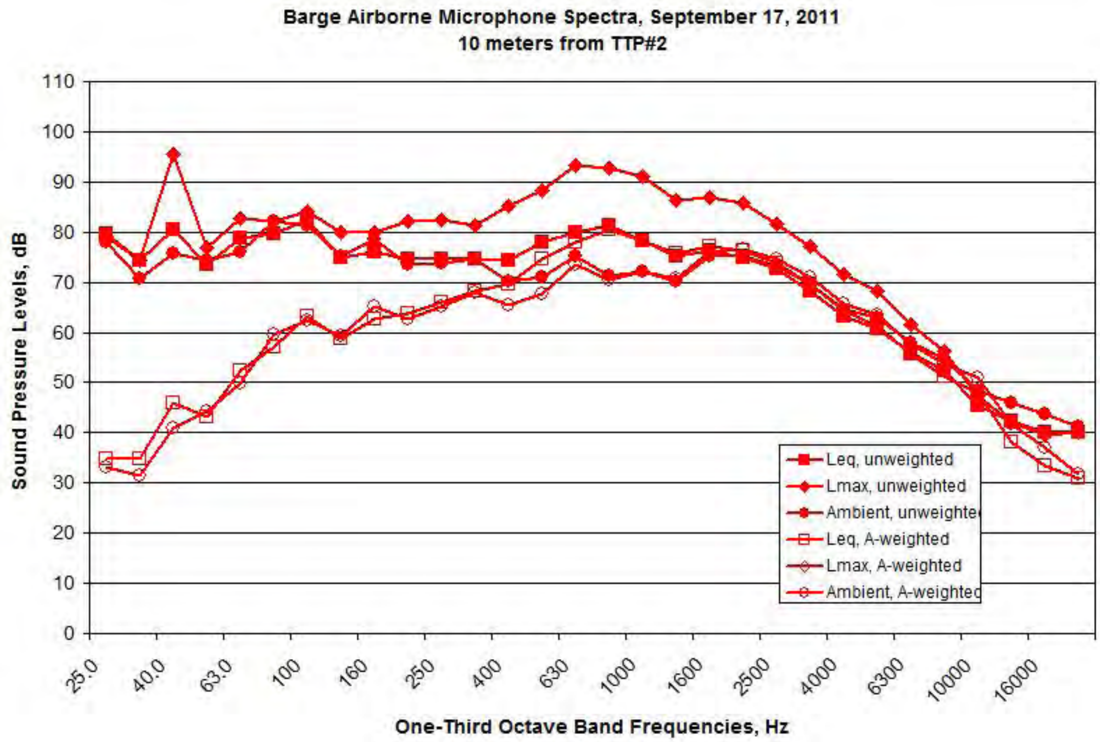

Figure C124. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 MP#2, 16:09-16:17, on September 17, 2011

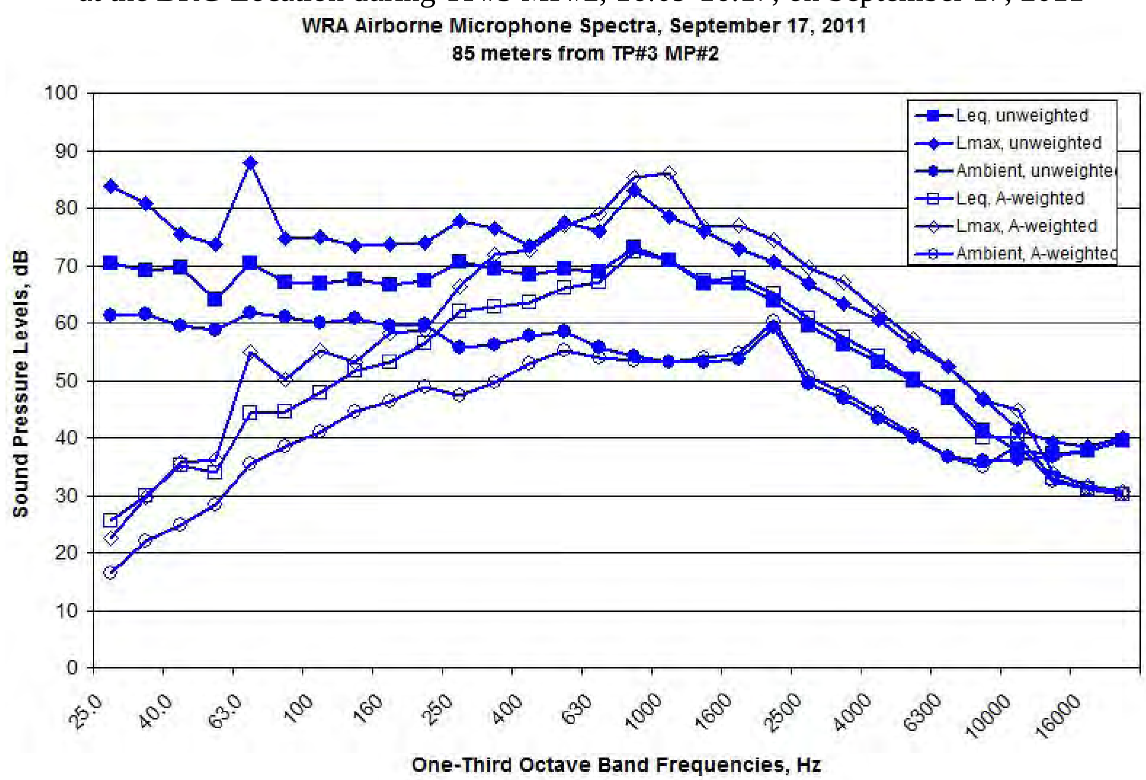

Figure C125. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 MP#2, 16:09-16:17, on September 17, 2011

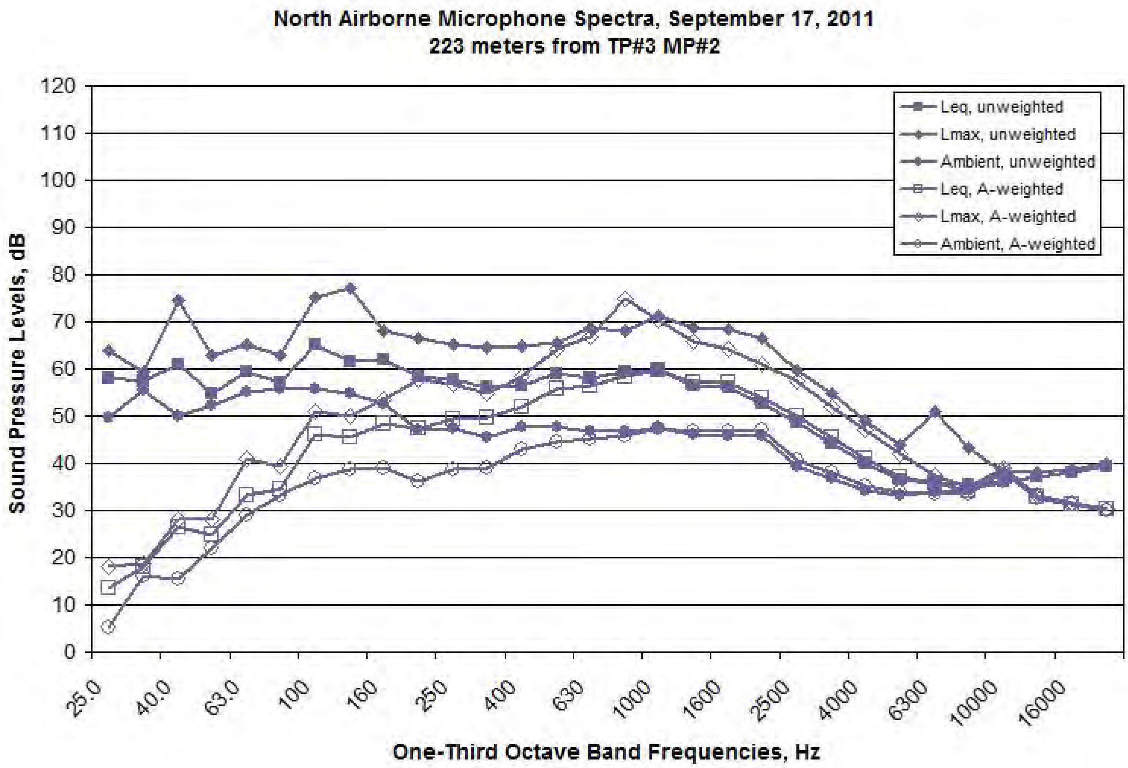

Figure C126. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 MP#2, 16:09-16:17, on September 17, 2011

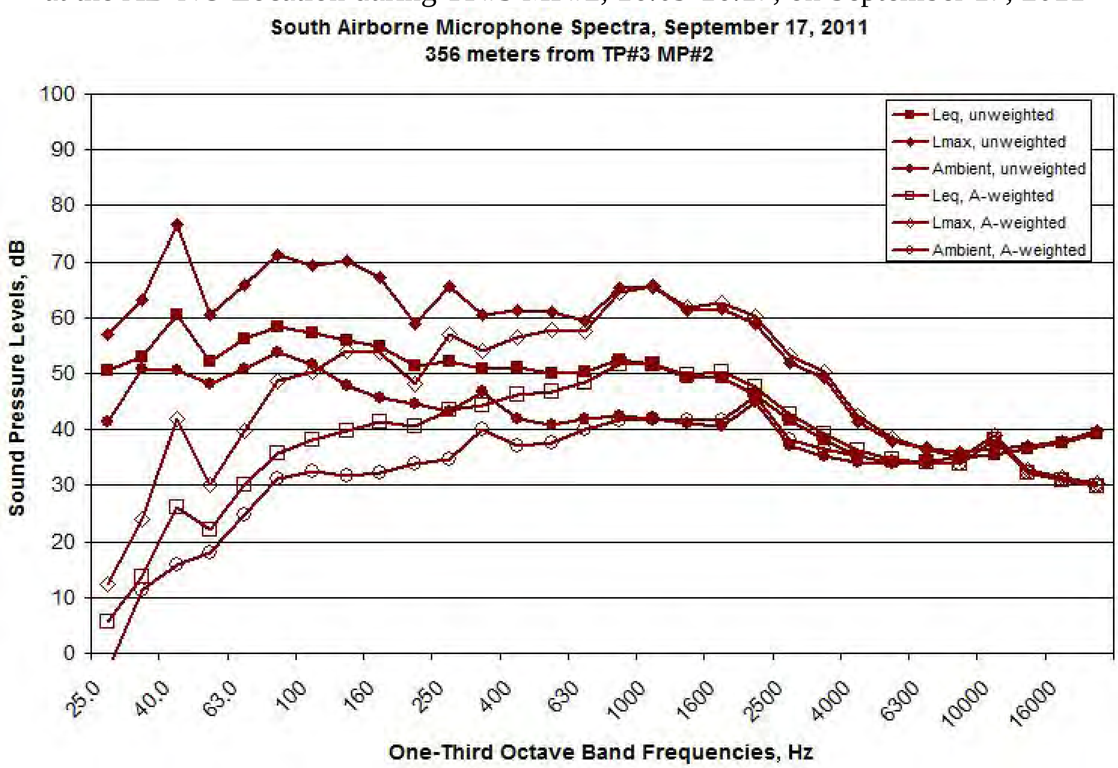

Figure C127. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 MP#2, 16:09-16:17, on September 17, 2011

9/21/2011 – TP#10, 13:42-13:48

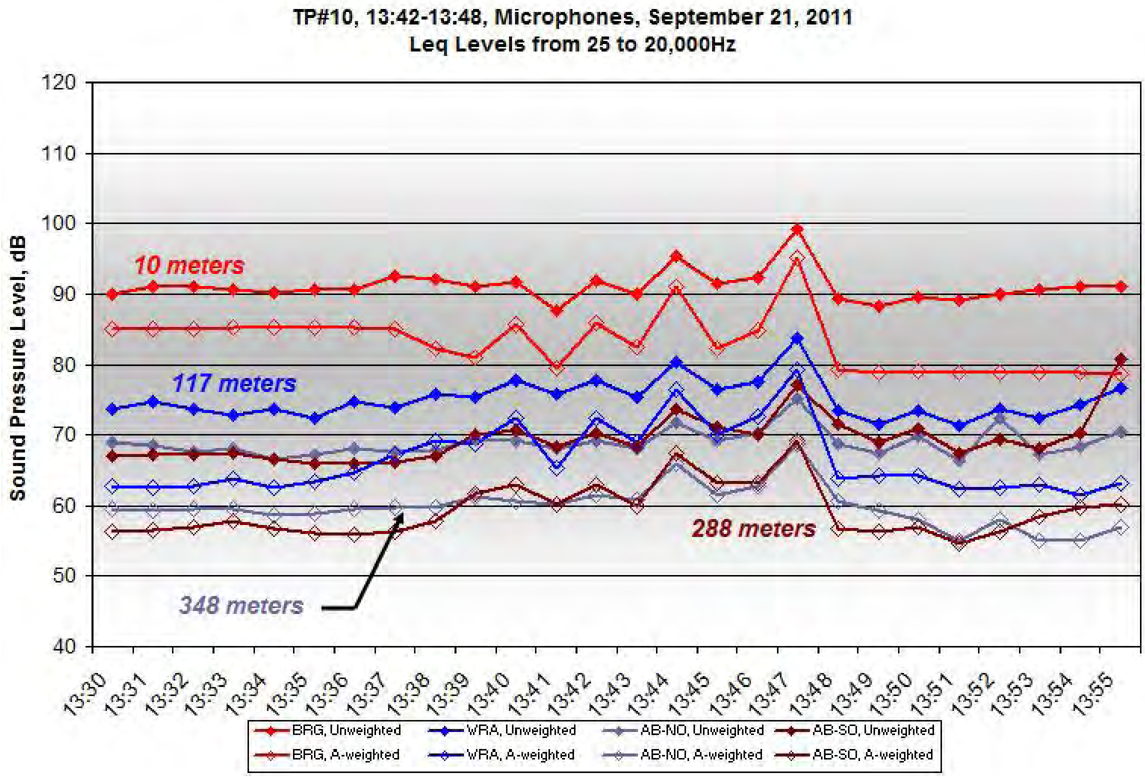

Figure C128. One-minute Unweighted and A-weighted Leq Level at TP#10, 13:42-13:48, on September 21, 2011

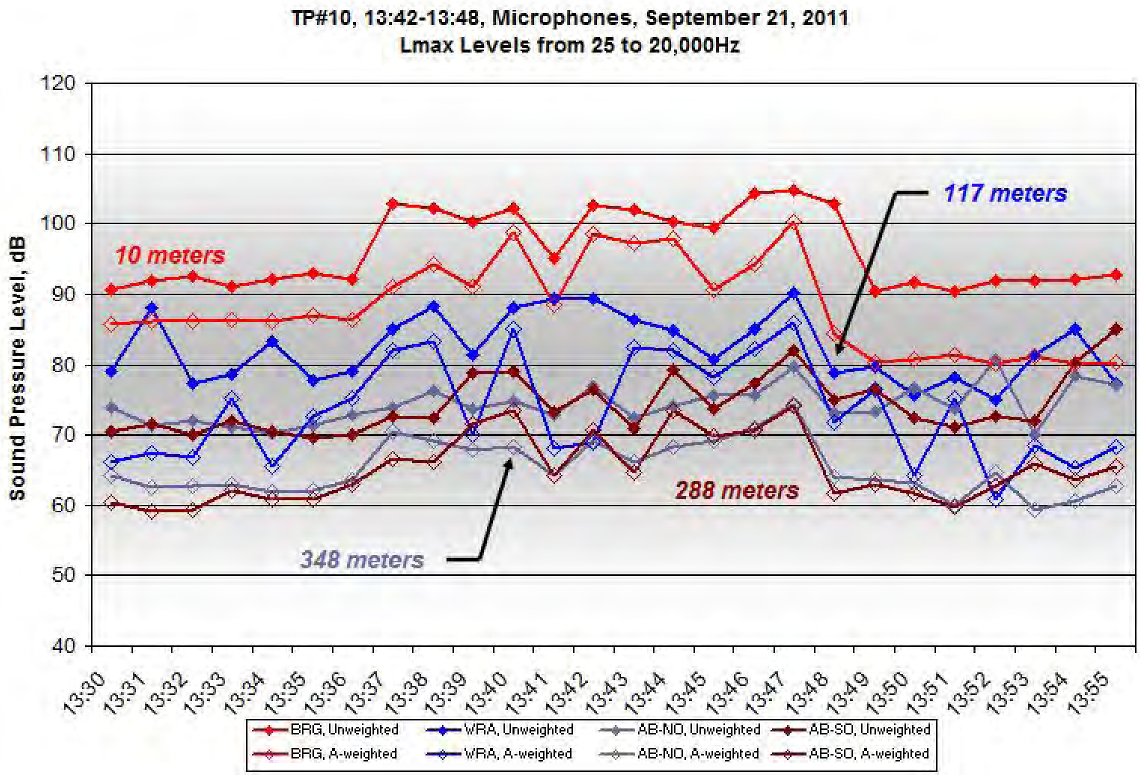

Figure C129. One-minute Unweighted and A-weighted Lmax Level at TP#10, 13:42-13:48, on September 21, 2011

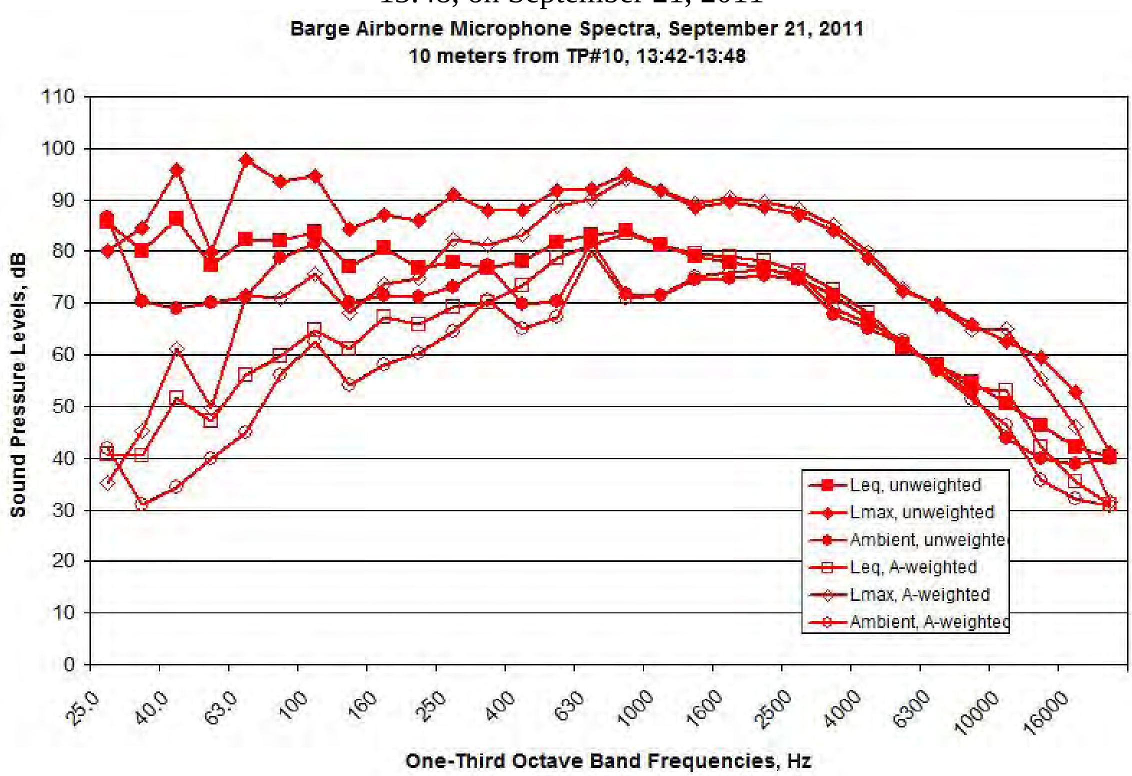

Figure C130. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#10, 13:42-13:48, on September 21, 2011

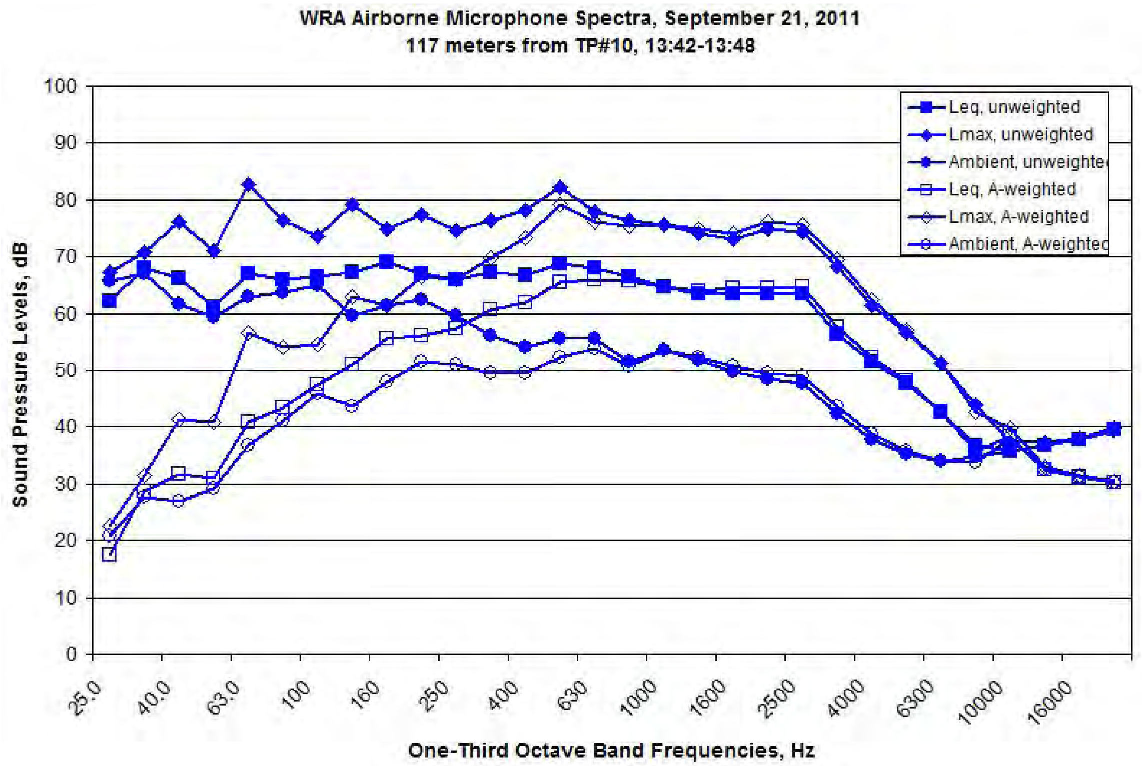

Figure C131. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#10, 13:42-13:48, on September 21, 2011

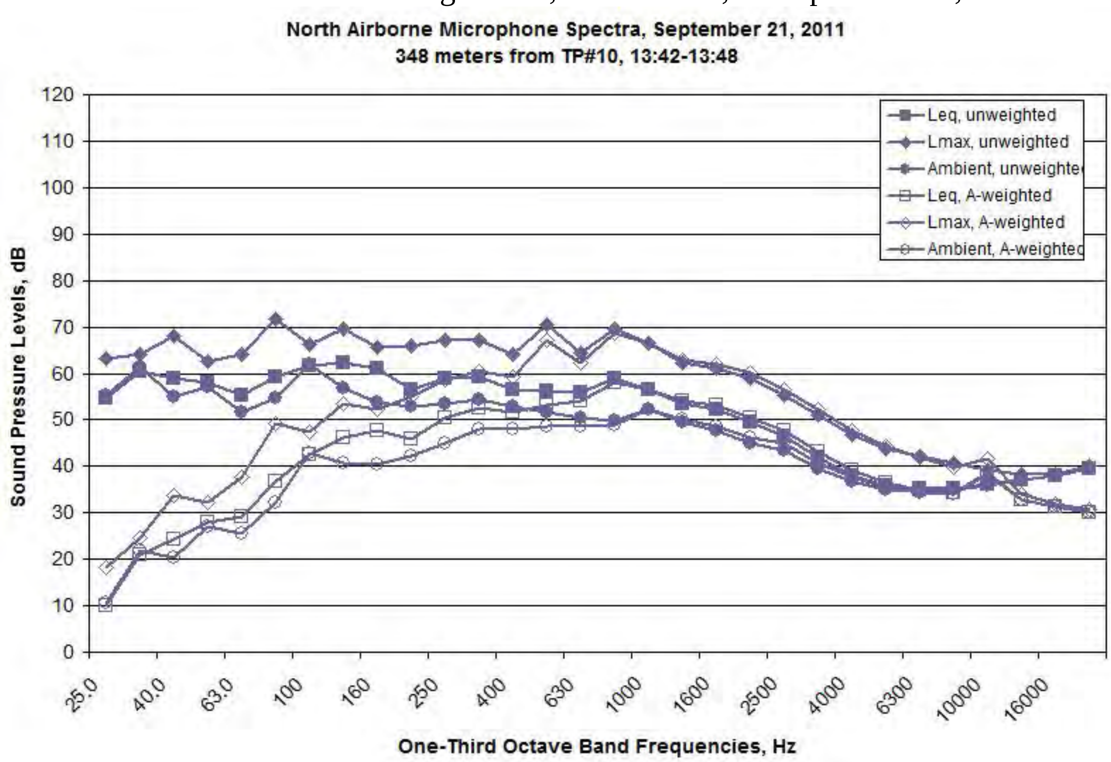

Figure C132. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#10, 13:42-13:48, on September 21, 2011

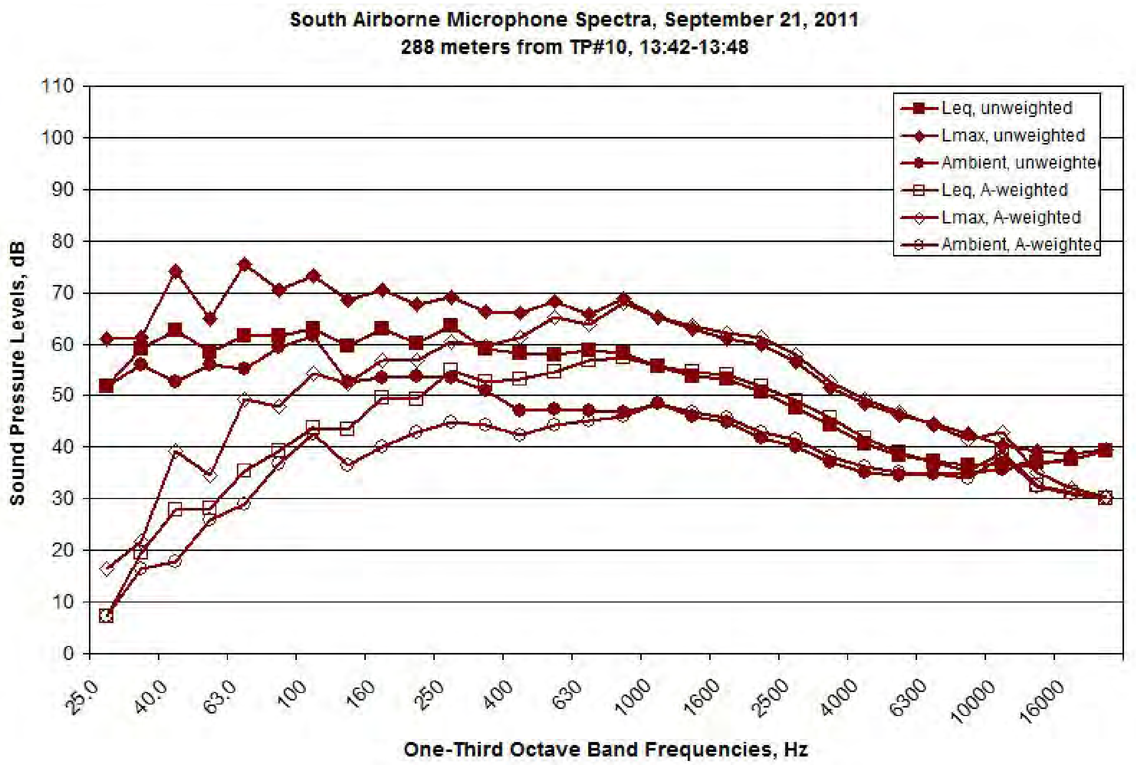

Figure C133. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#10, 13:42-13:48, on September 21, 2011

TP #10, 15:03-15:14

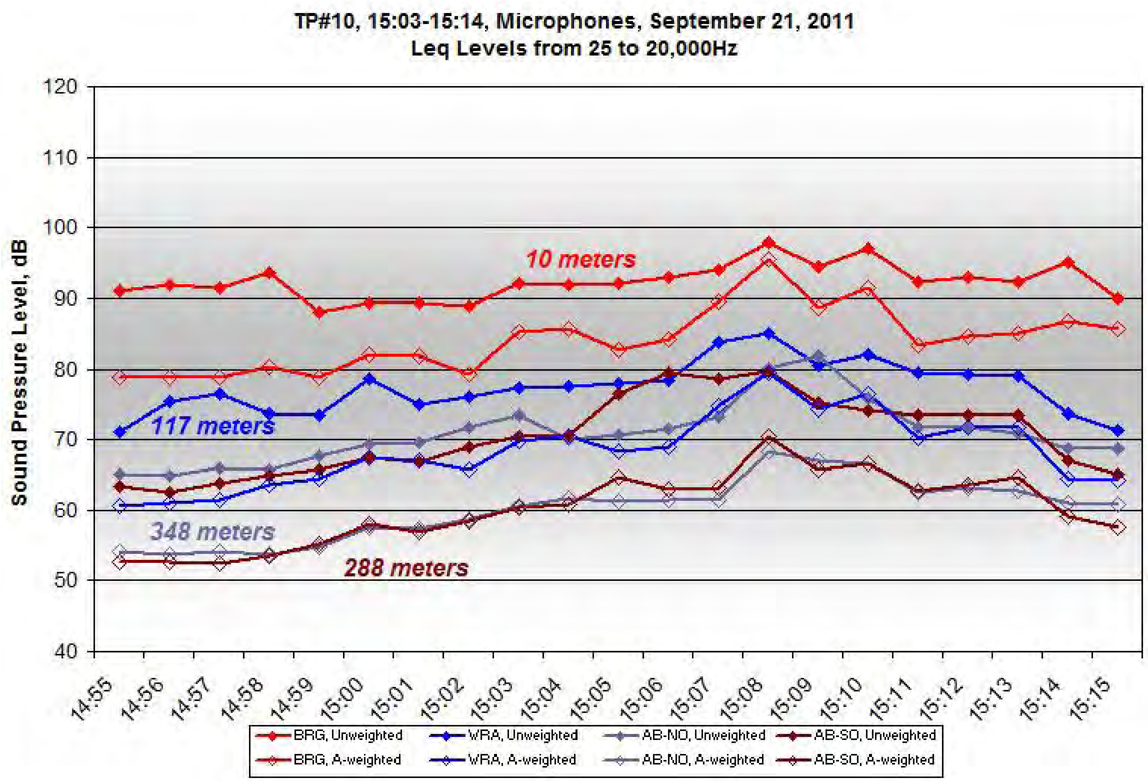

Figure C134. One-minute Unweighted and A-weighted Leq Level at TP#10, 15:03-15:14, on September 21, 2011

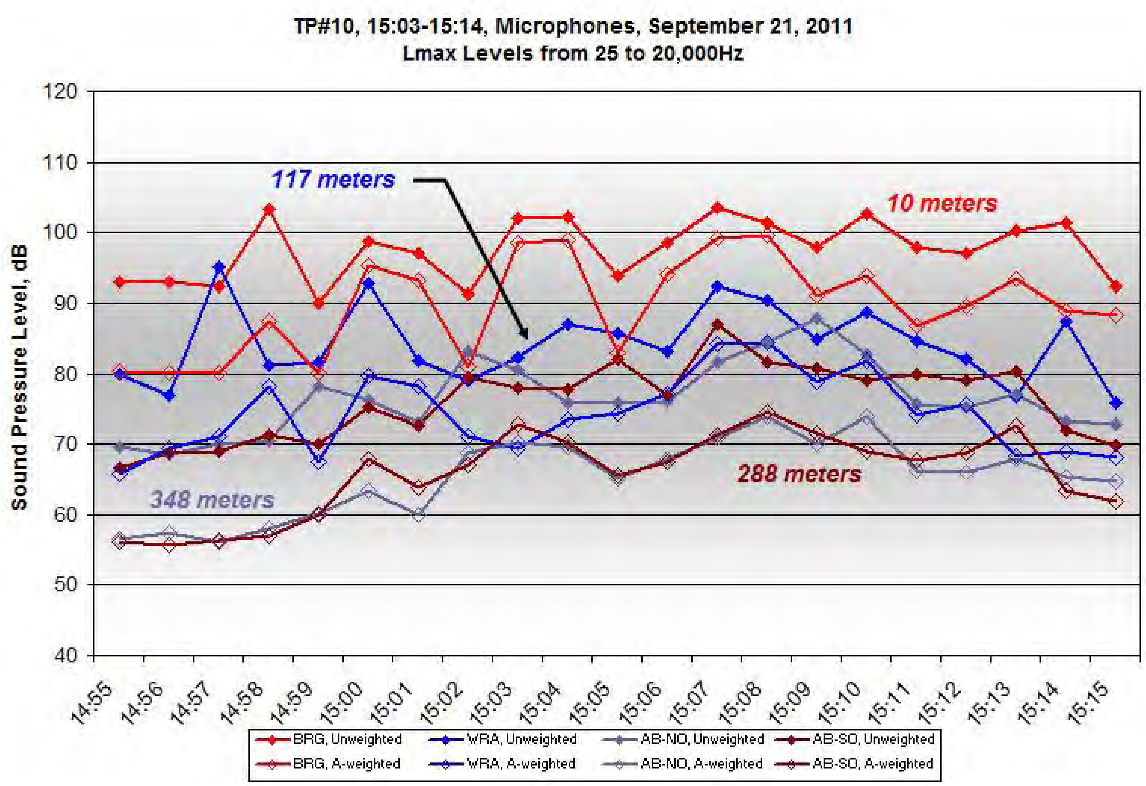

Figure C135. One-minute Unweighted and A-weighted Lmax Level at TP#10, 15:03-15:14, on September 21, 2011

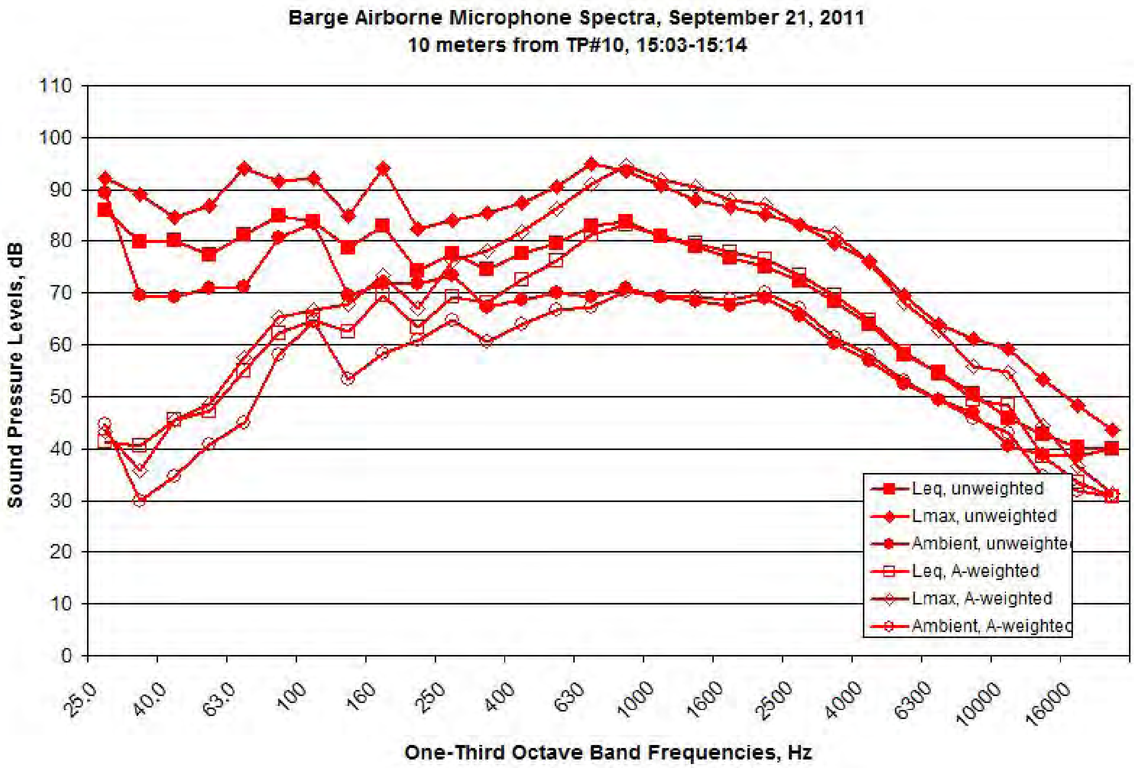

Figure C136. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#10, 15:03-15:14, on September 21, 2011

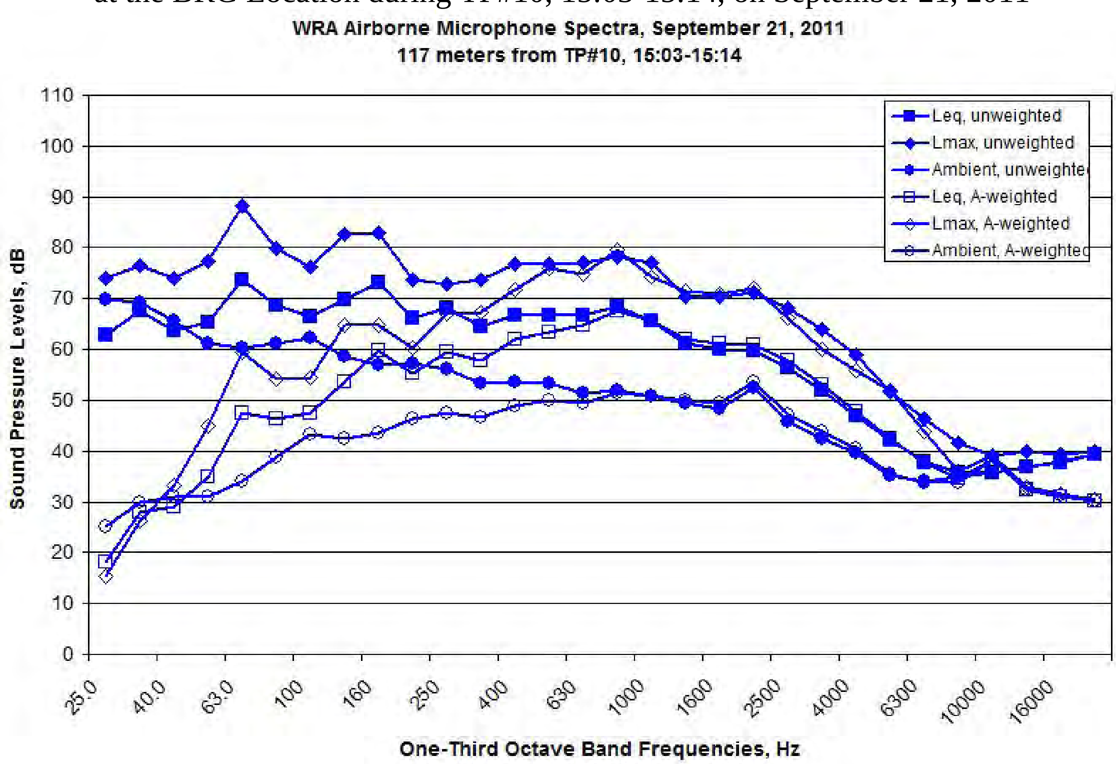

Figure C137. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#10, 15:03-15:14, on September 21, 2011

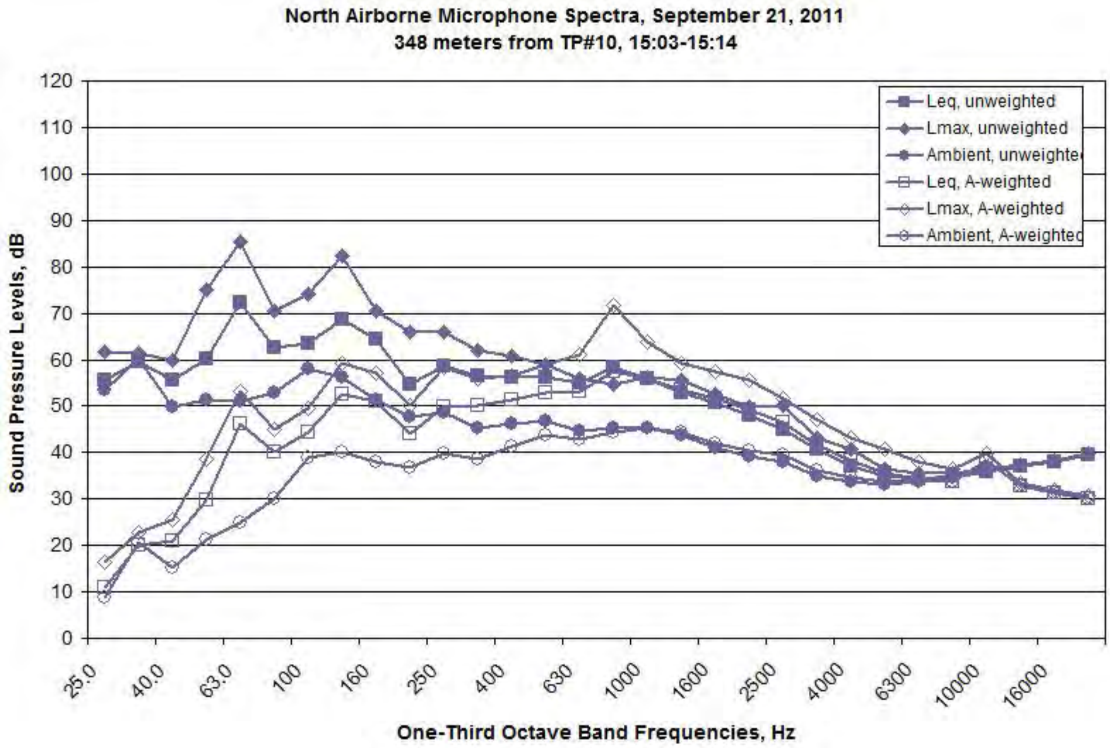

Figure C138. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#10, 15:03-15:14, on September 21, 2011

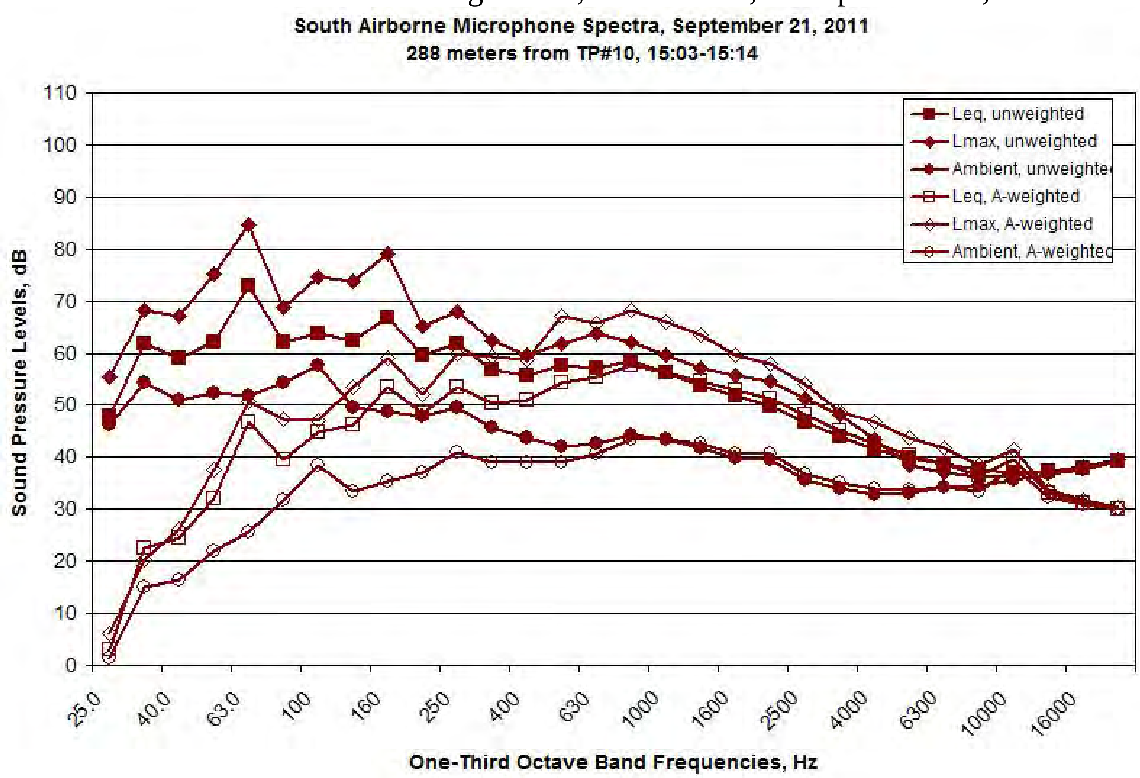

Figure C139. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#10, 15:03-15:14, on September 21, 2011

TP#9

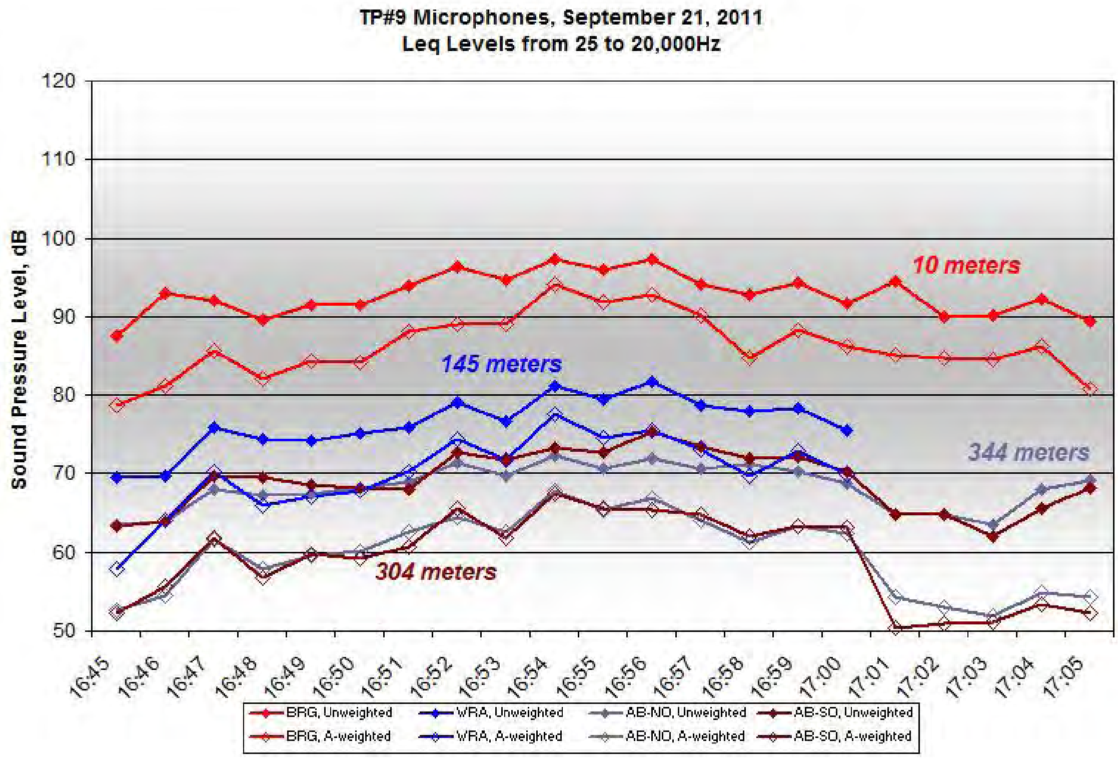

Figure C140. One-minute Unweighted and A-weighted Leq Level at TP#9, 16:49-17:00, on September 21, 2011

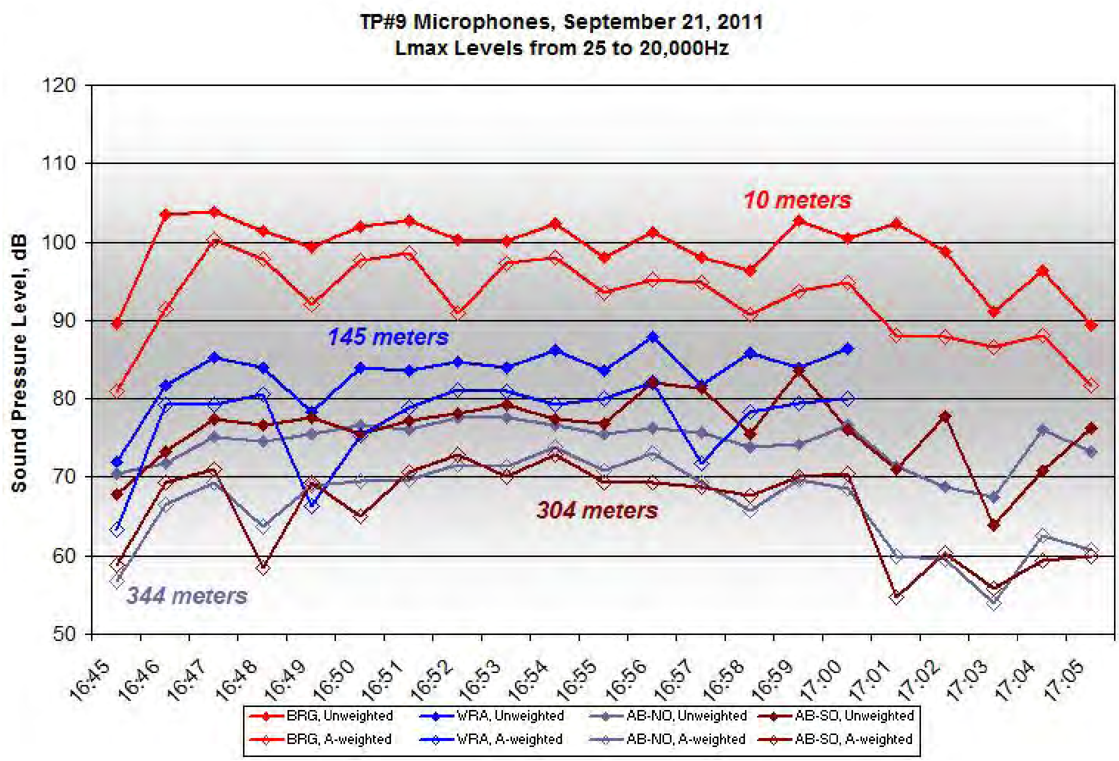

Figure C141. One-minute Unweighted and A-weighted Lmax Level at TP#9, 16:49-17:00, on September 21, 2011

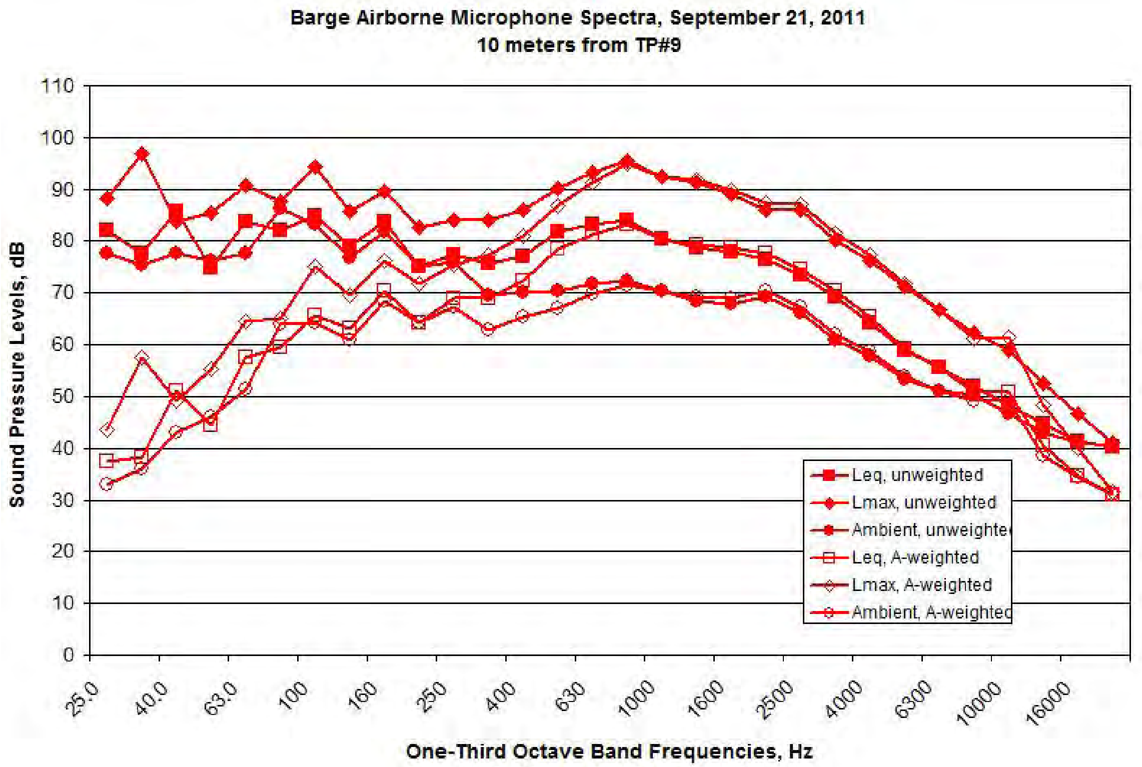

Figure C142. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9, 16:49-17:00, on September 21, 2011

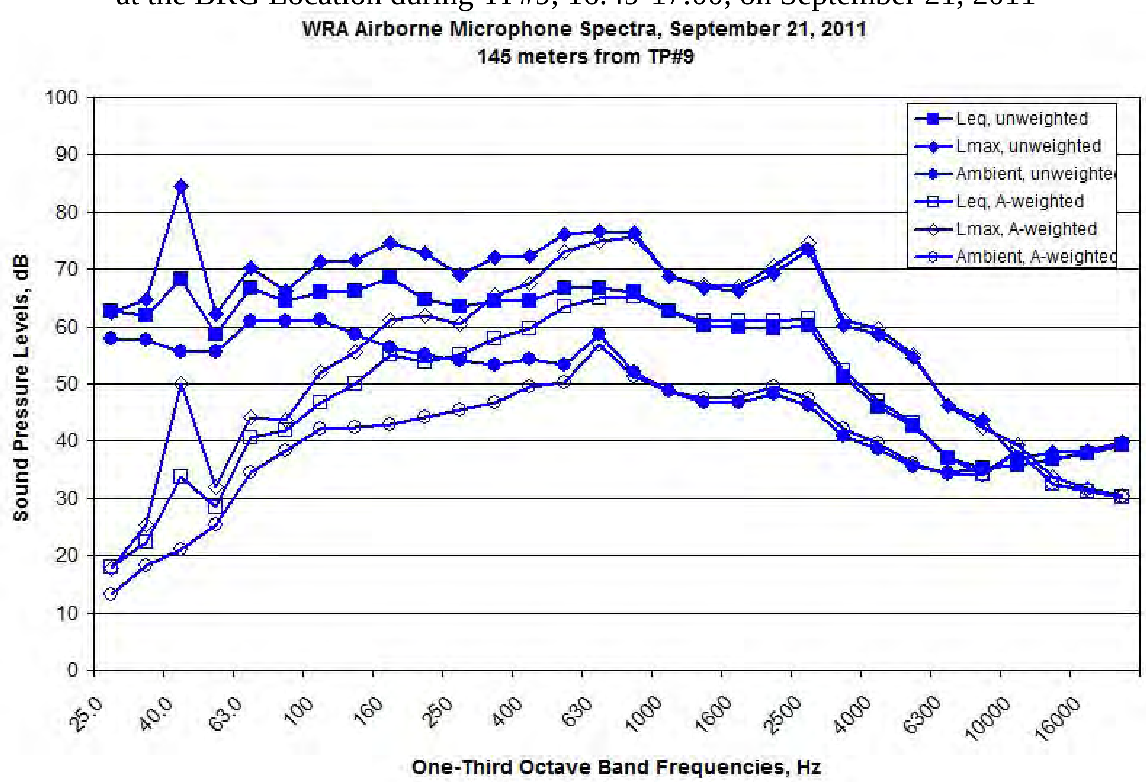

Figure C143. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9, 16:49-17:00, on September 21, 2011

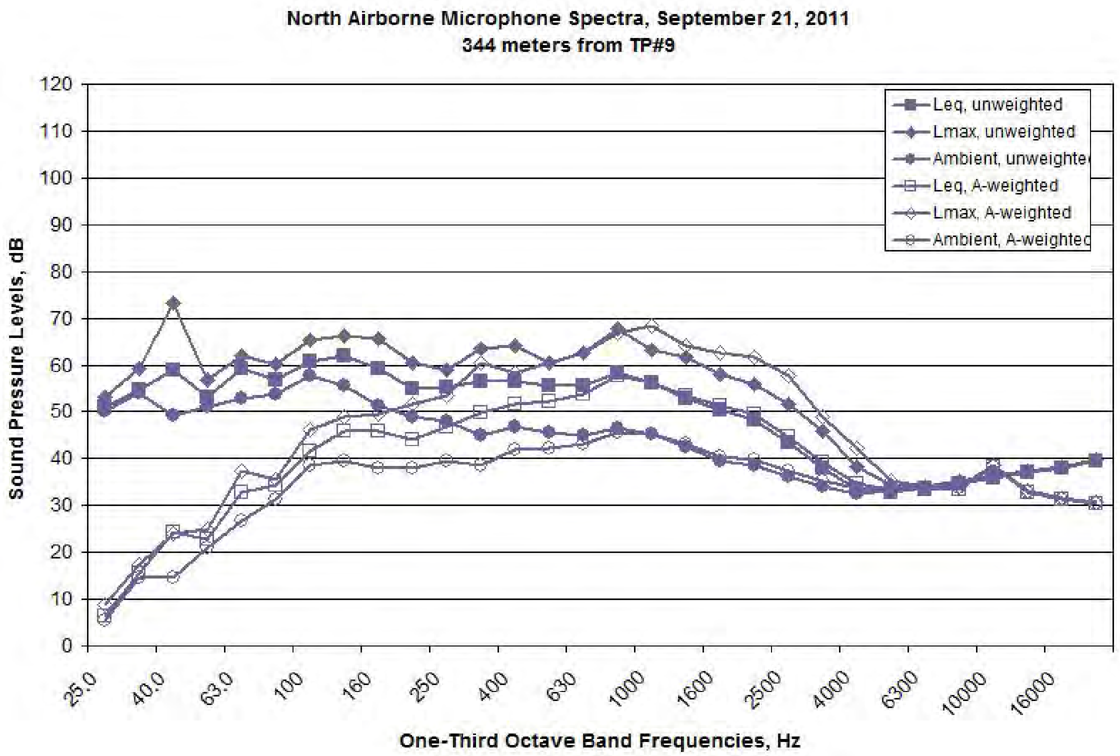

Figure C144. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9, 16:49-17:00, on September 21, 2011

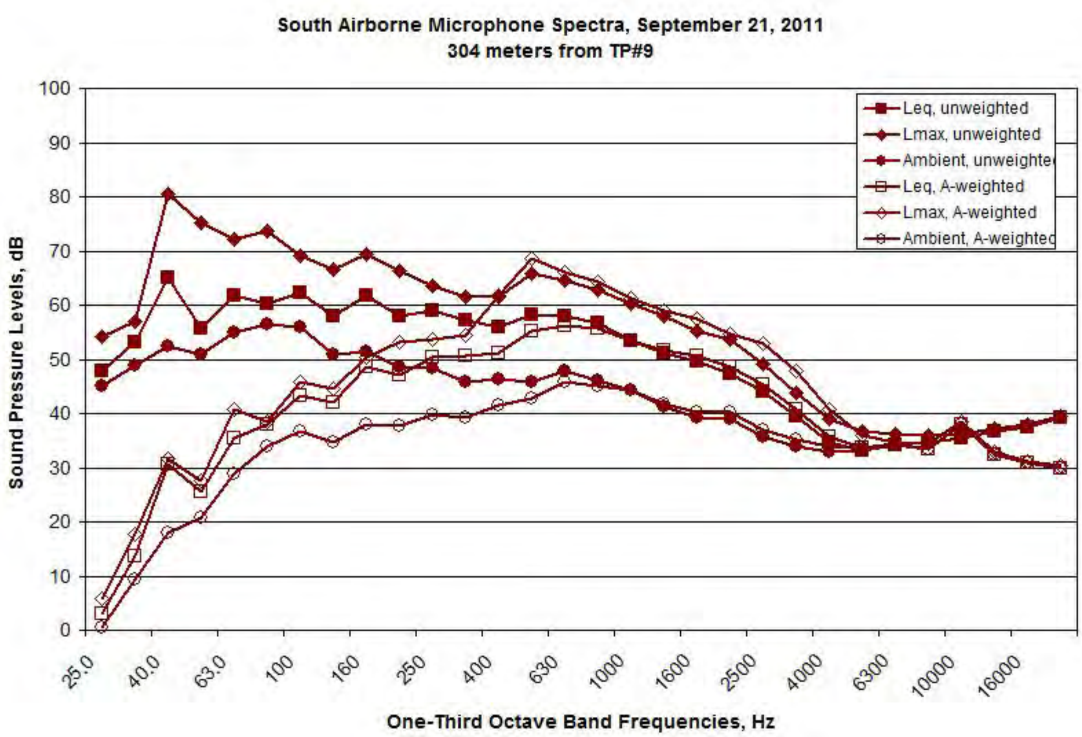

Figure C145. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9, 16:49-17:00, on September 21, 2011

9/22/2011 – TP#8

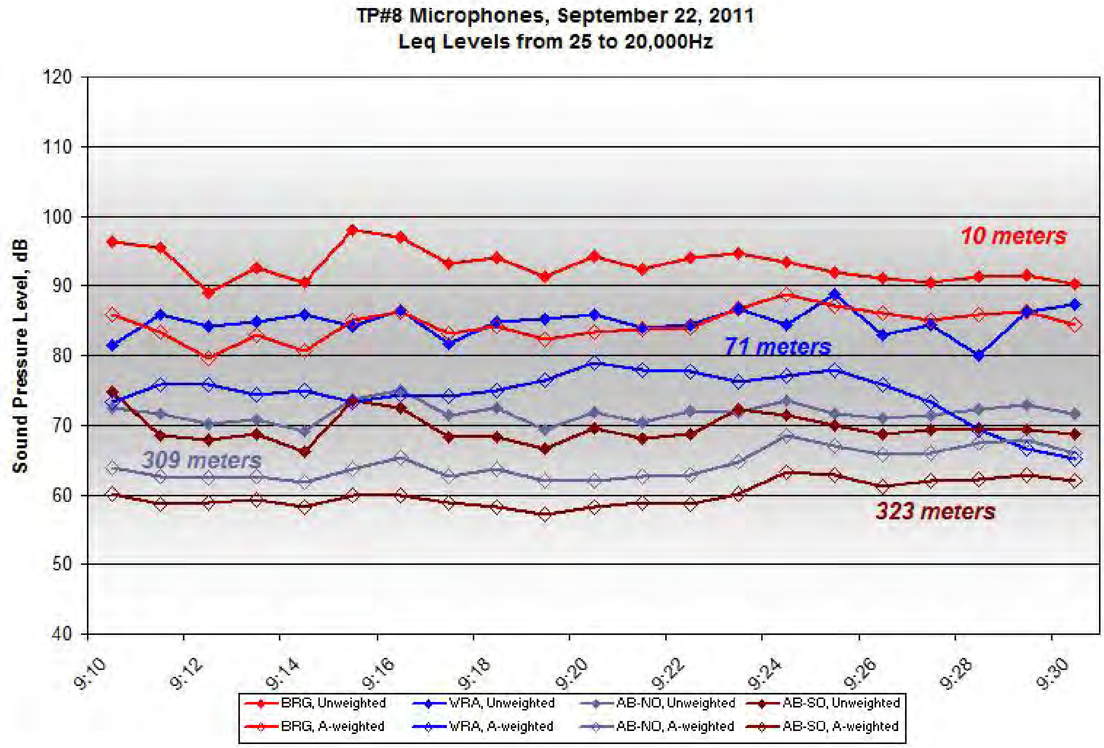

Figure C146. One-minute Unweighted and A-weighted Leq Level at TP#8, 9:13-9:29, on September 22, 2011

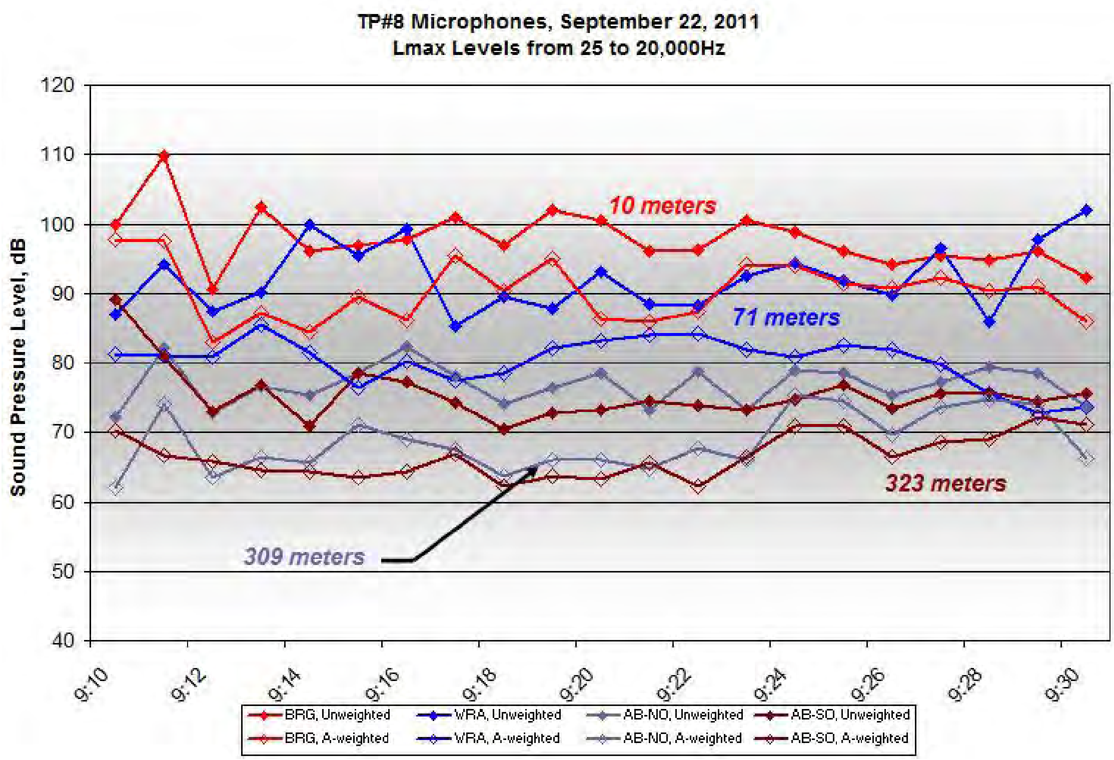

Figure C147. One-minute Unweighted and A-weighted Lmax Level at TP#8, 9:13-9:29, on September 22, 2011

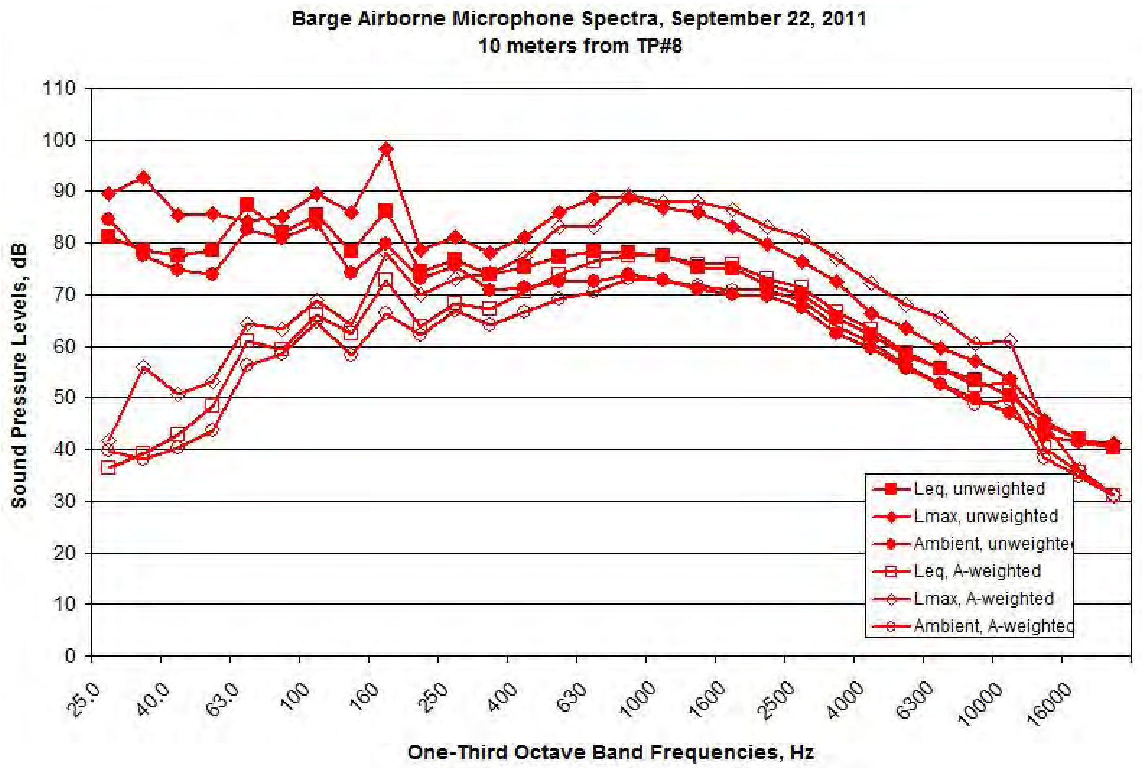

Figure C148. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#8, 9:13-9:29, on September 22, 2011

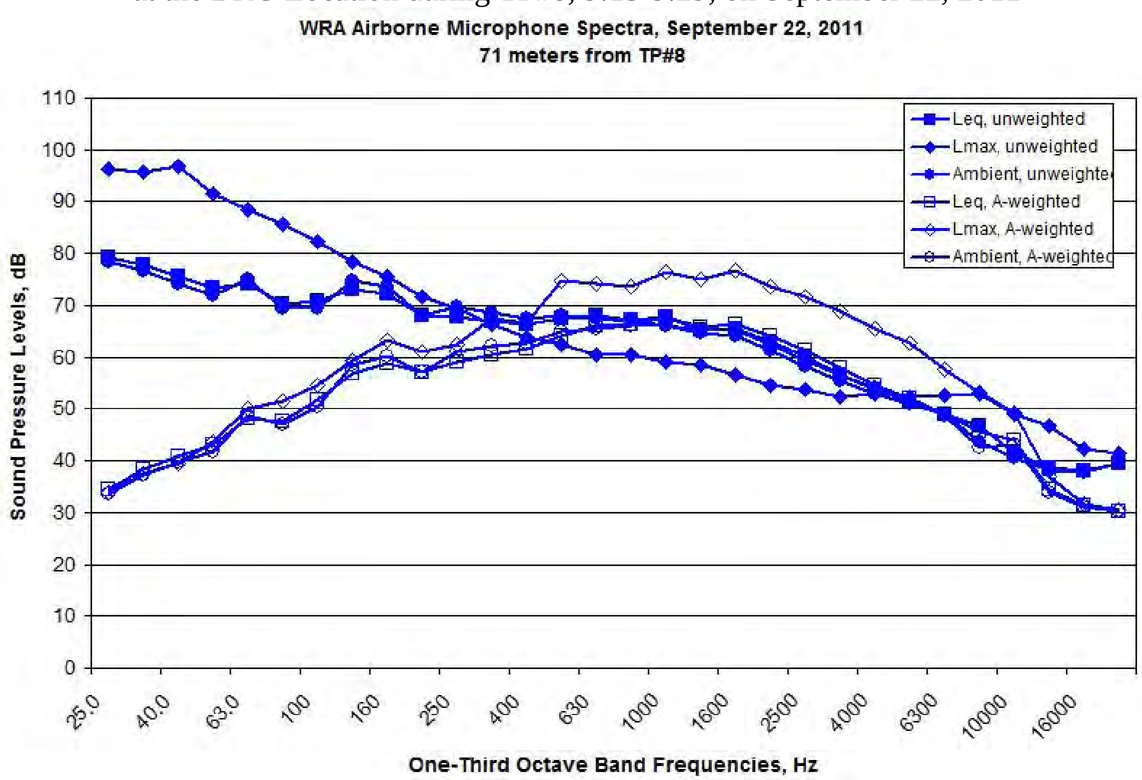

Figure C149. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#8, 9:13-9:29, on September 22, 2011

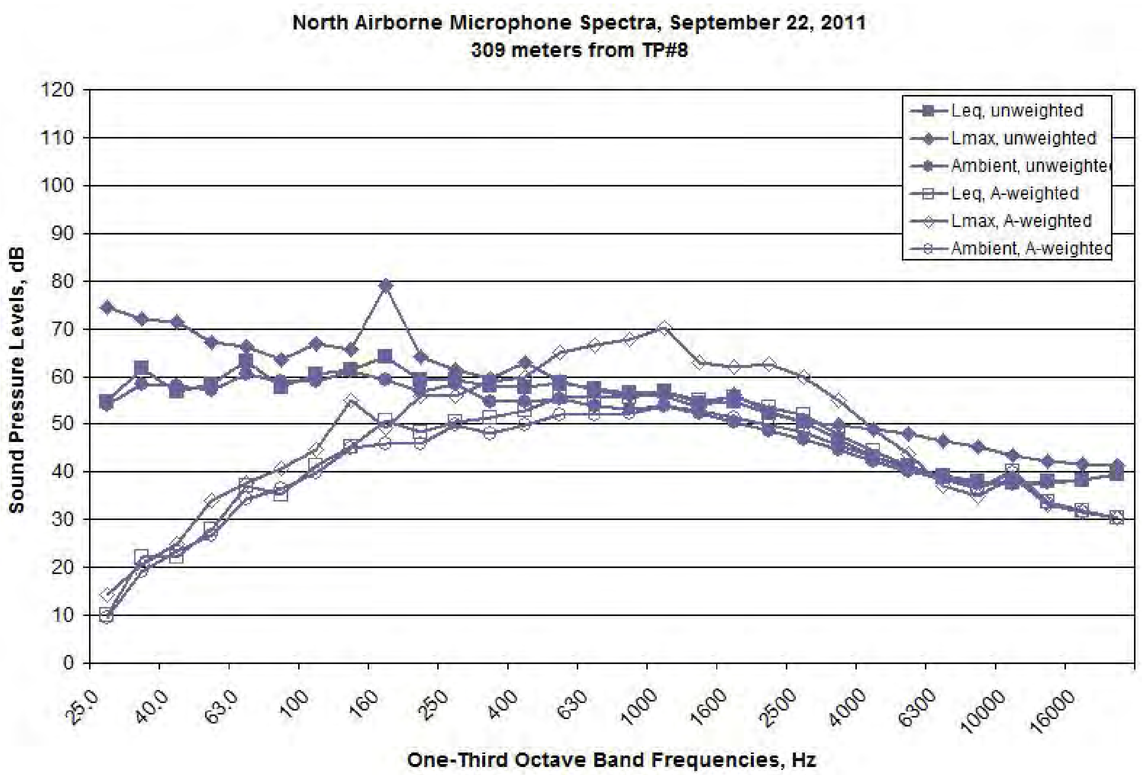

Figure C150. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#8, 9:13-9:29, on September 22, 2011

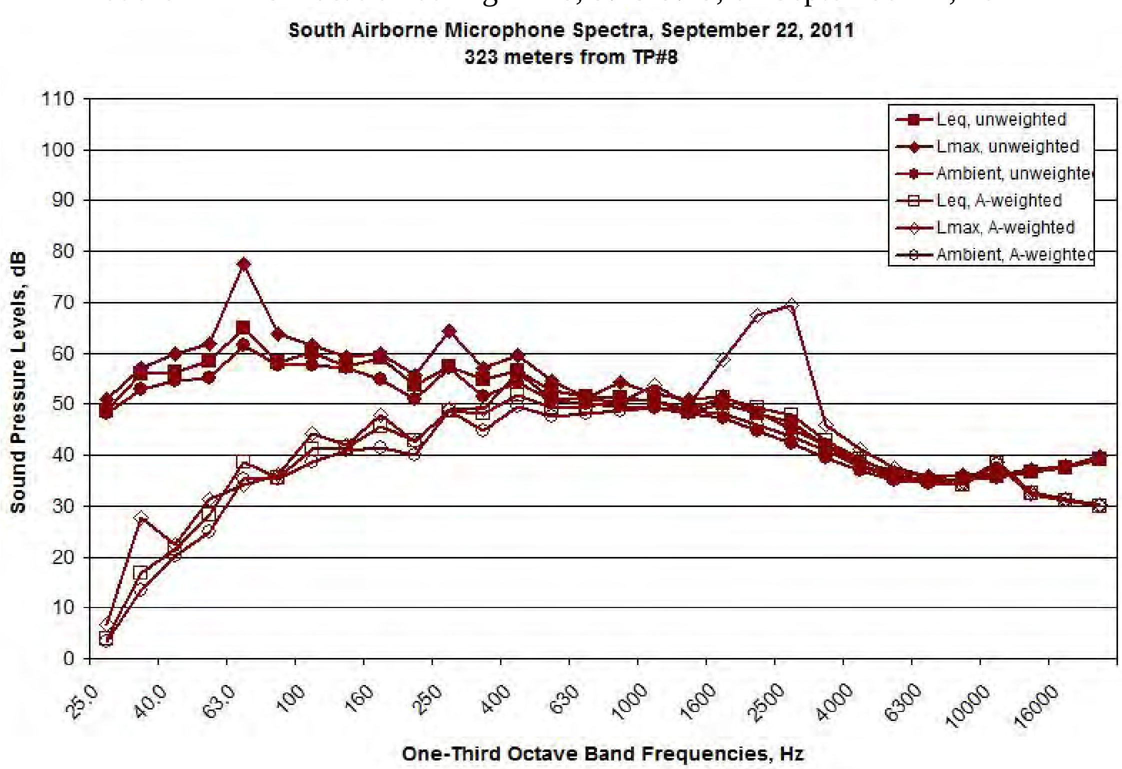

Figure C151. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#8, 9:13-9:29, on September 22, 2011

TP #11

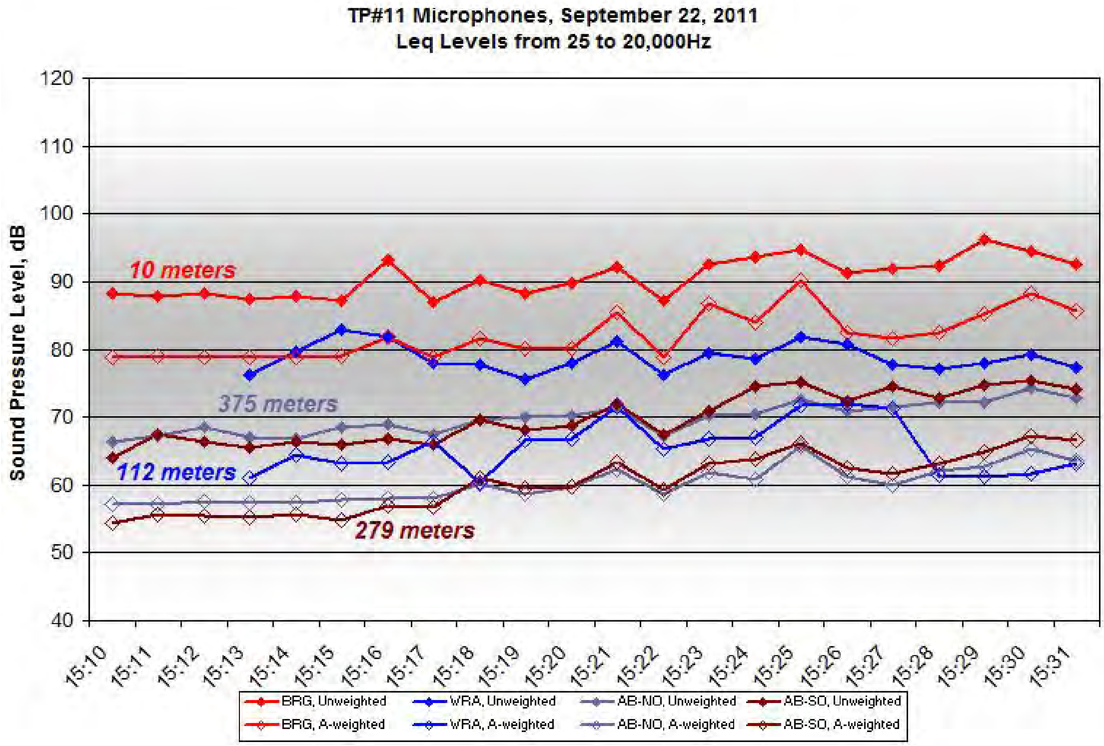

Figure C152. One-minute Unweighted and A-weighted Leq Level at TP#11, 15:21-15:28, on September 22, 2011

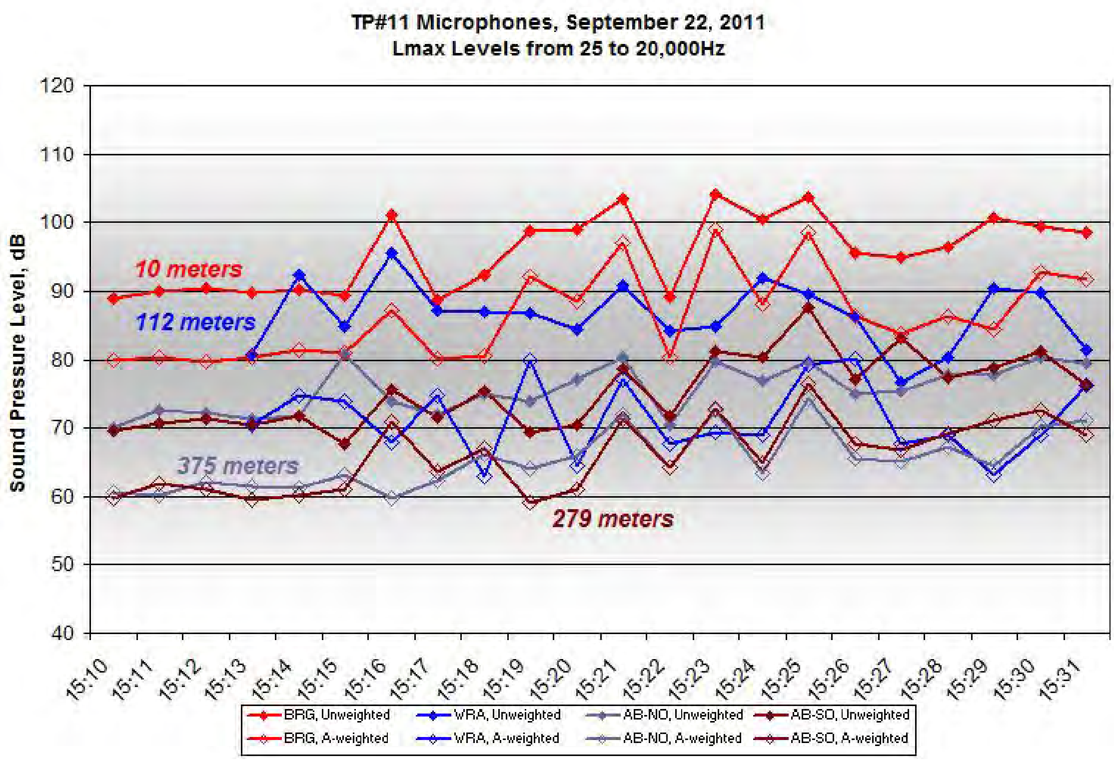

Figure C153. One-minute Unweighted and A-weighted Lmax Level at TP#11, 15:21-15:28, on September 22, 2011

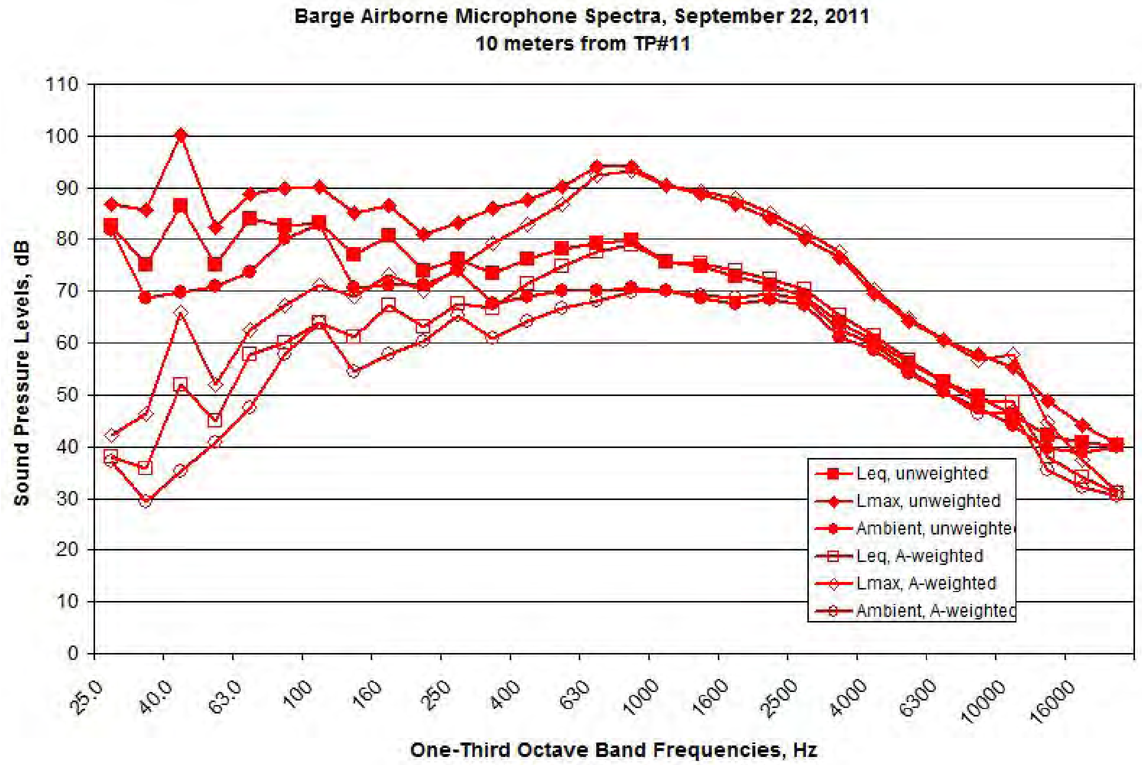

Figure C154. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#11, 15:21-15:28, on September 22, 2011

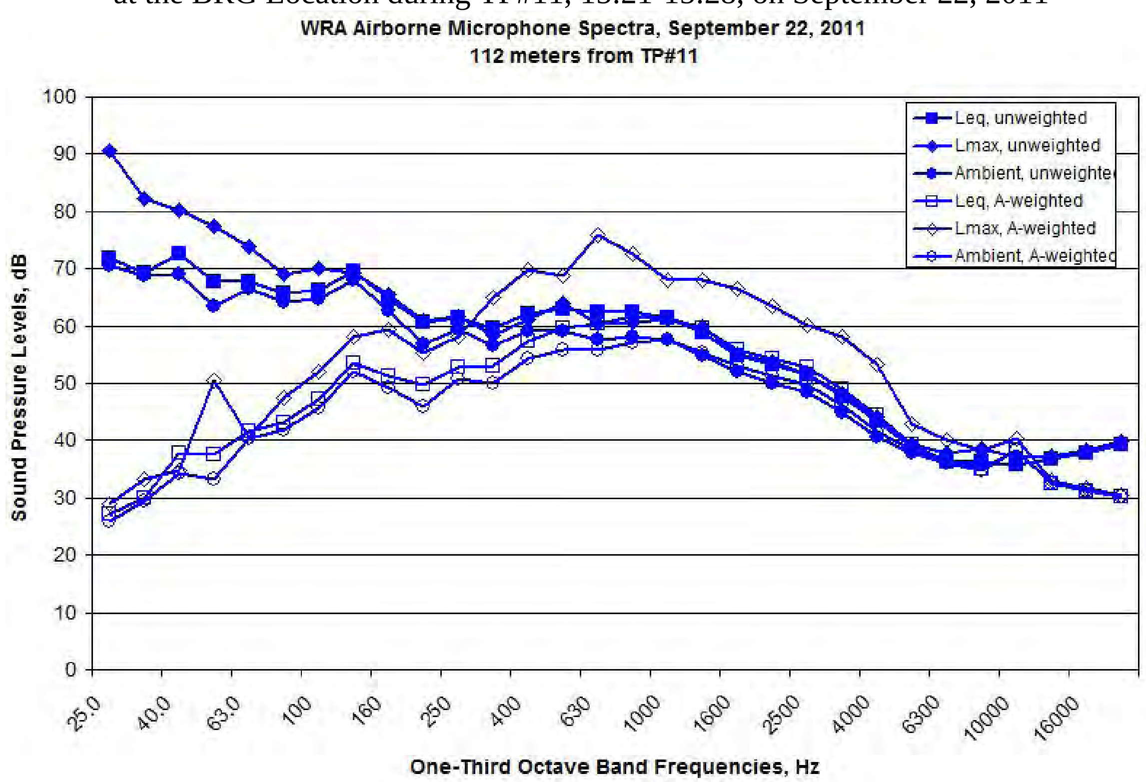

Figure C155. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#11, 15:21-15:28, on September 22, 2011

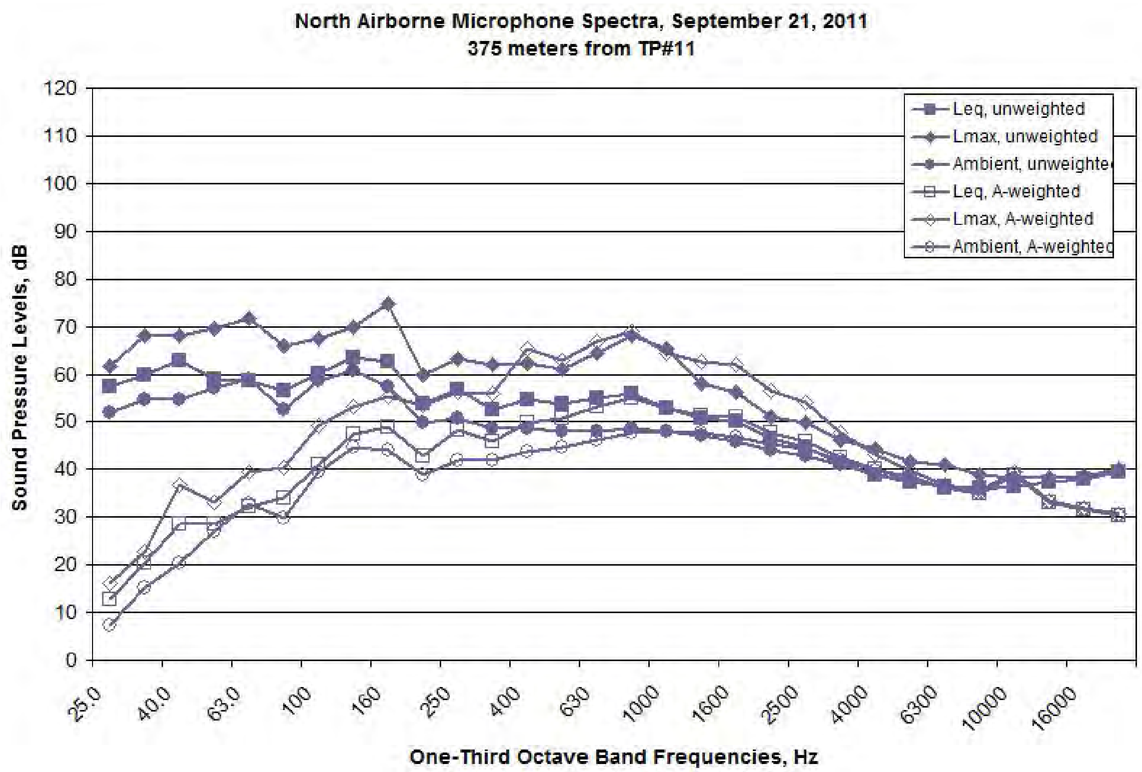

Figure C156. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#11, 15:21-15:28, on September 22, 2011

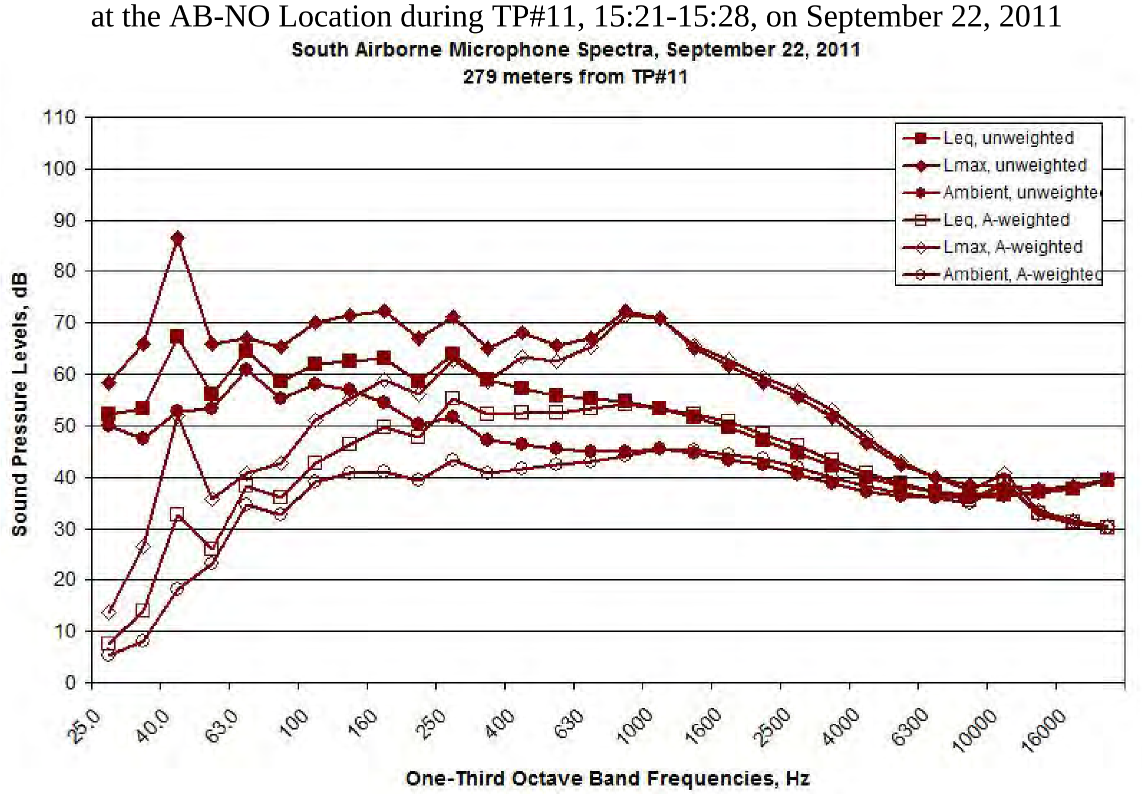

Figure C157. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#11, 15:21-15:28, on September 22, 2011

9/23/2011 – TP#6

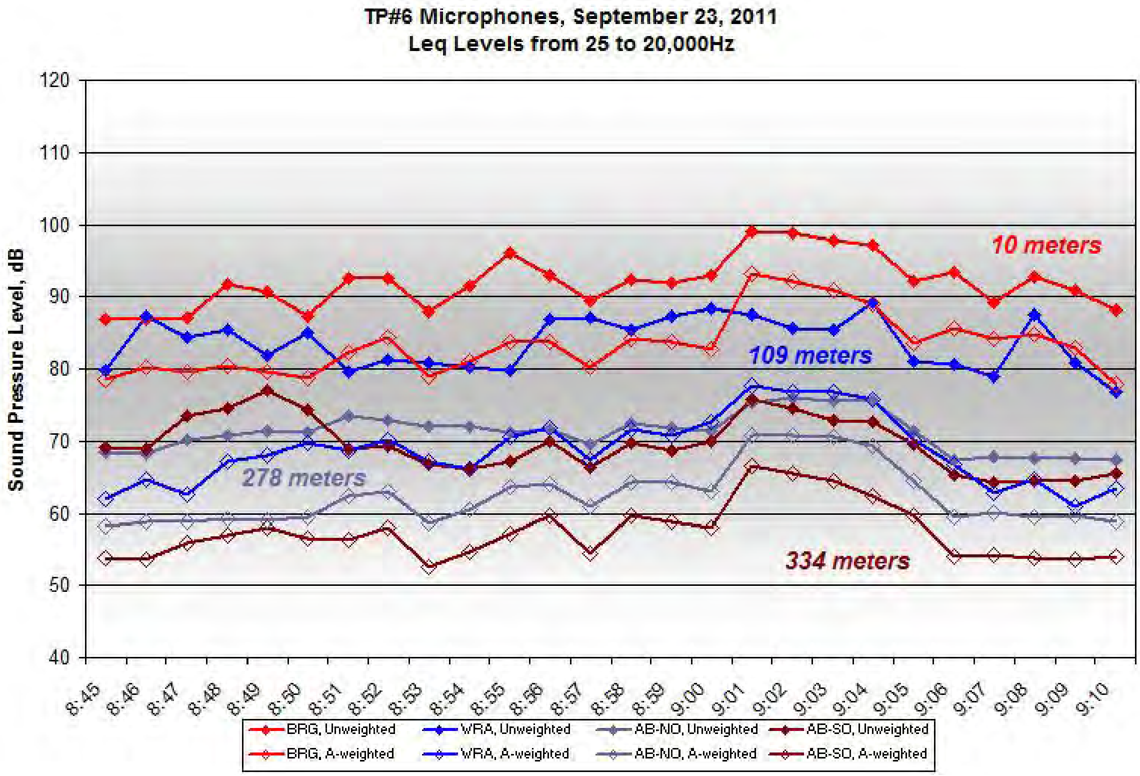

Figure C158. One-minute Unweighted and A-weighted Leq Level at TP#6, 8:54-9:04, on September 23, 2011

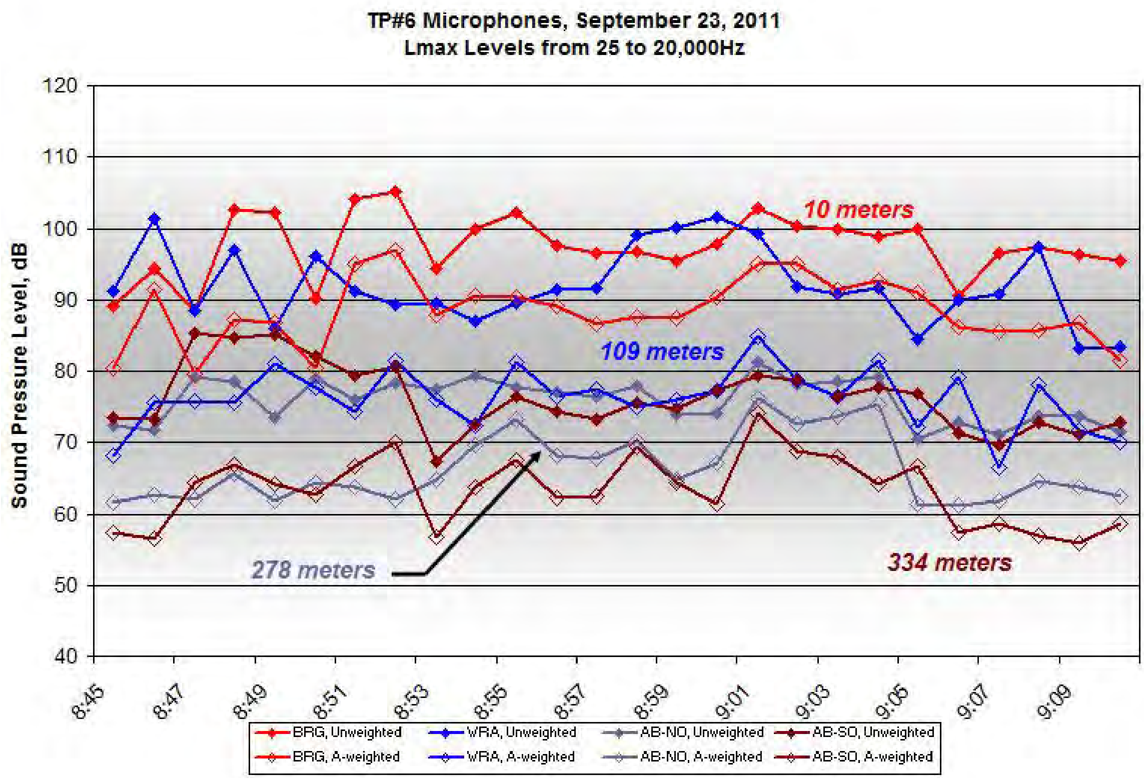

Figure C159. One-minute Unweighted and A-weighted Lmax Level at TP#6, 8:54-9:04, on September 23, 2011

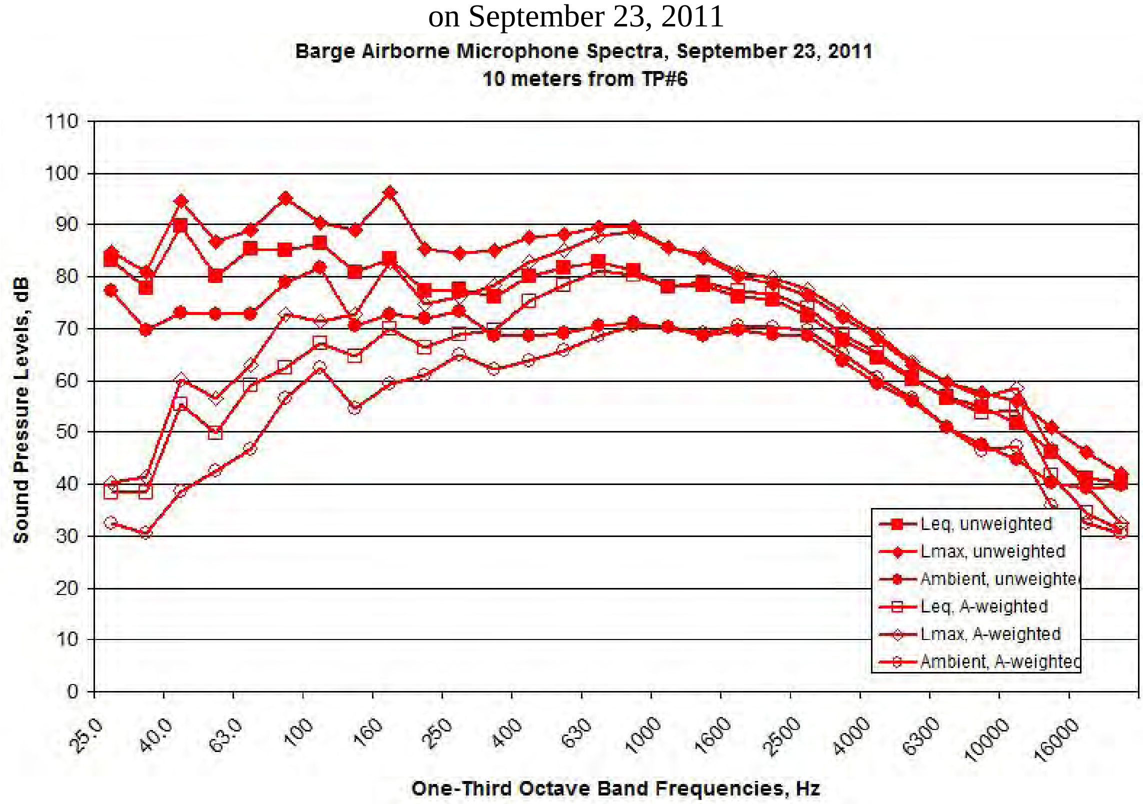

Figure C160. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#6, 8:54-9:04, on September 23, 2011

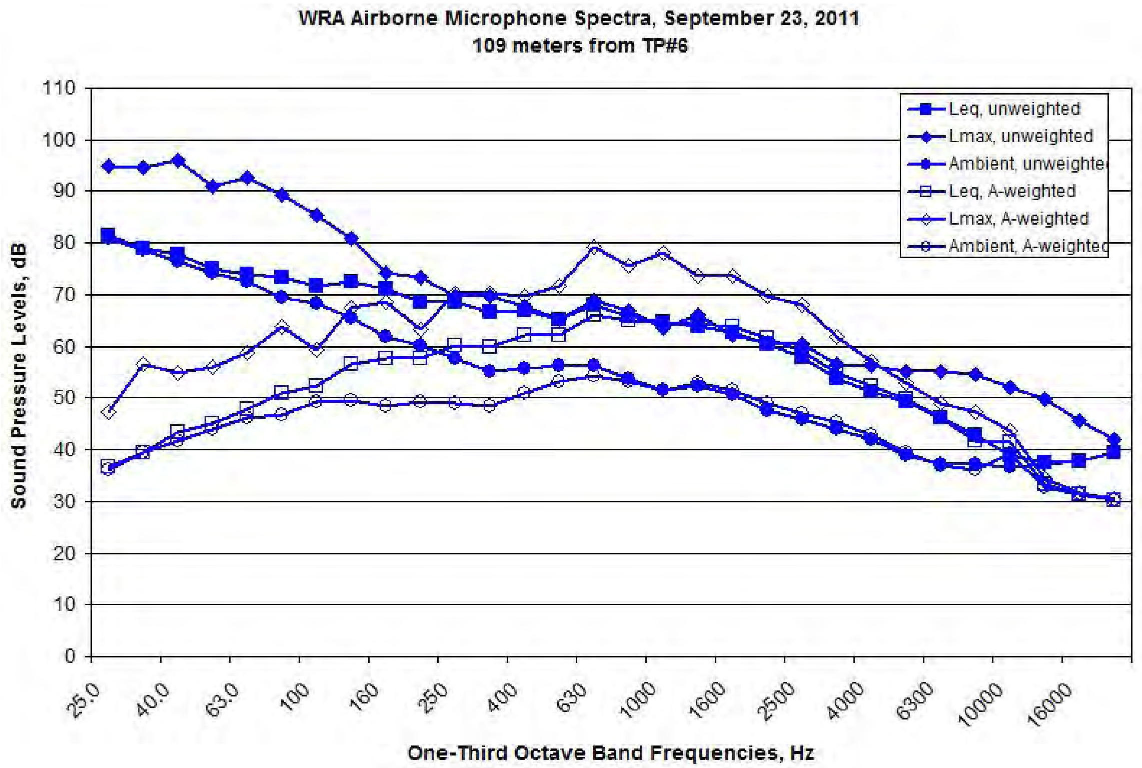

Figure C161. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#6, 8:54-9:04, on September 23, 2011

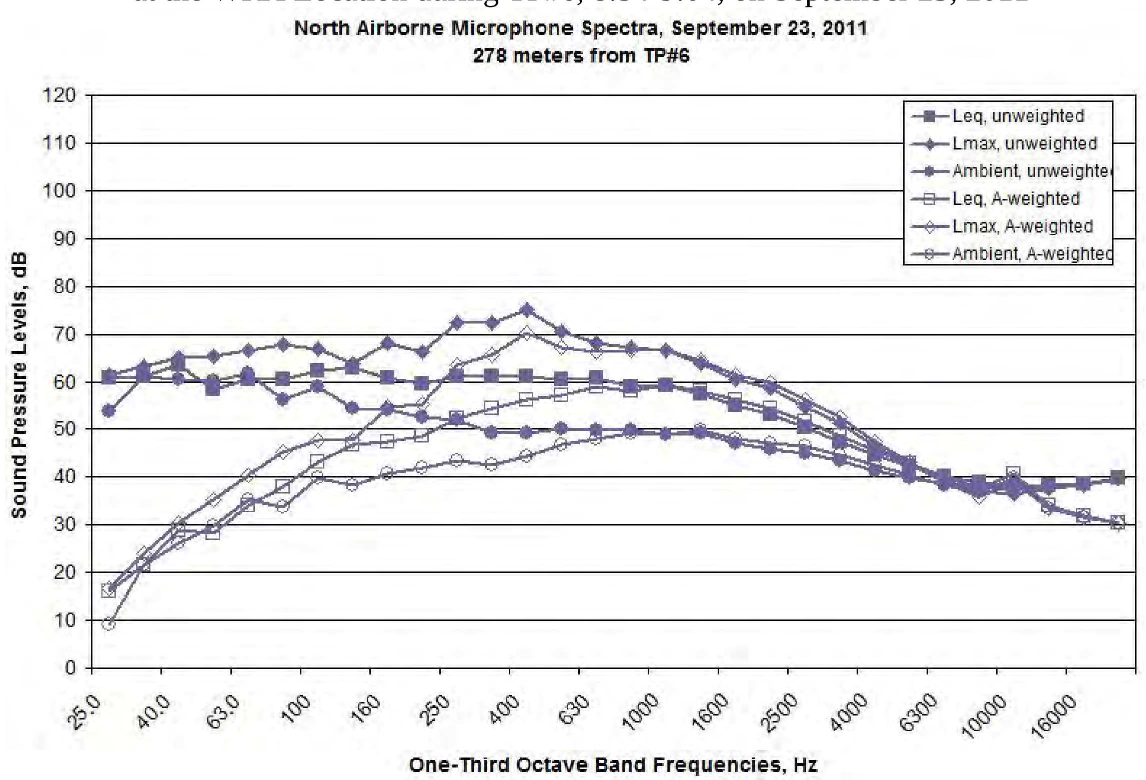

Figure C162. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#6, 8:54-9:04, on September 23, 2011

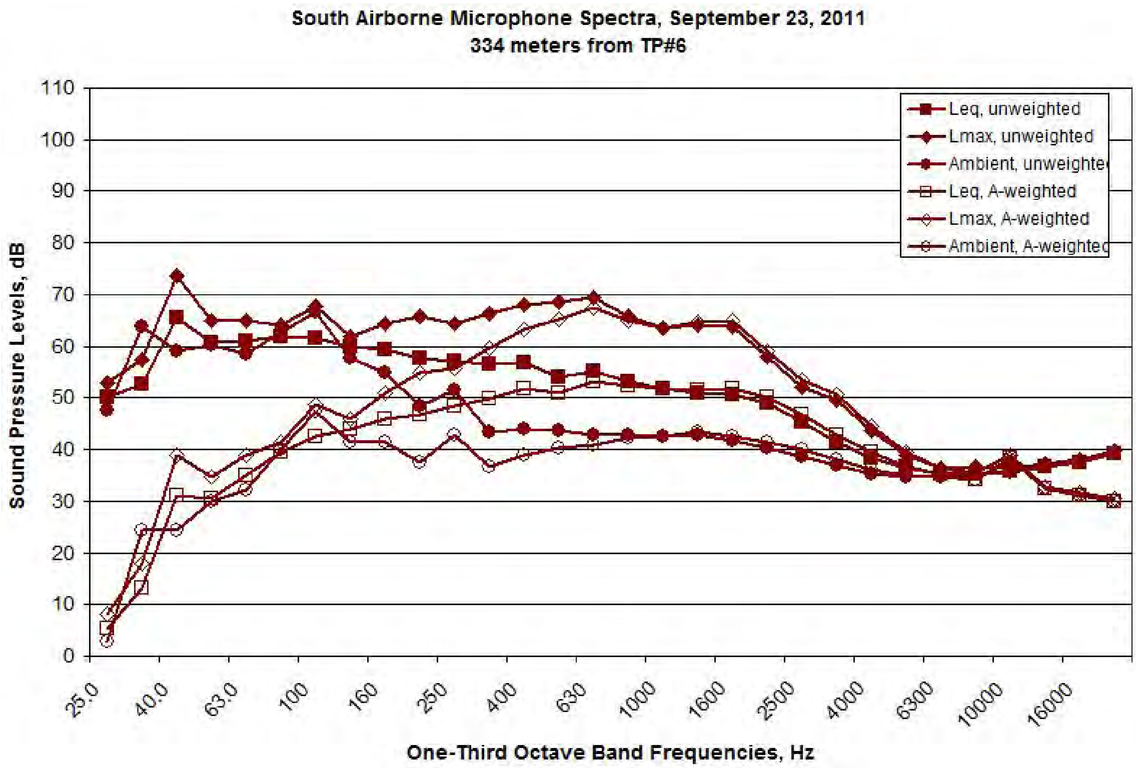

Figure C163. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#6, 8:54-9:04, on September 23, 2011

TP #5

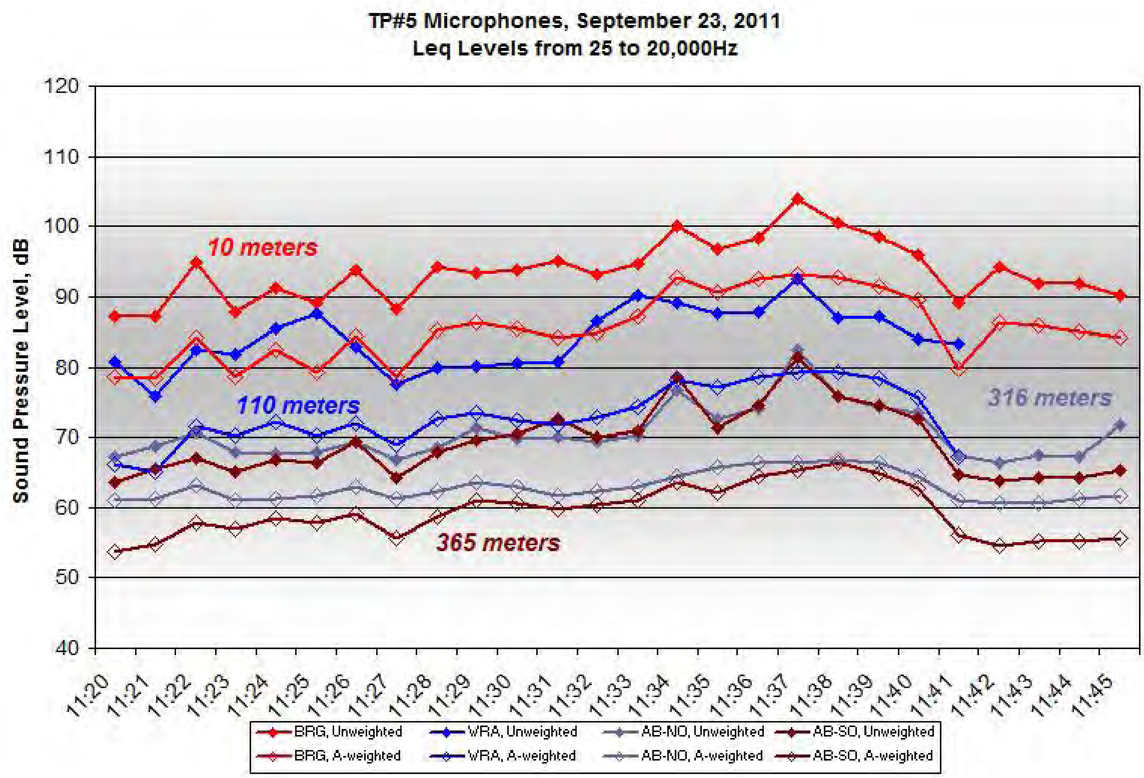

Figure C164. One-minute Unweighted and A-weighted Leq Level at TP#5, 11:26-11:39, on September 23, 2011

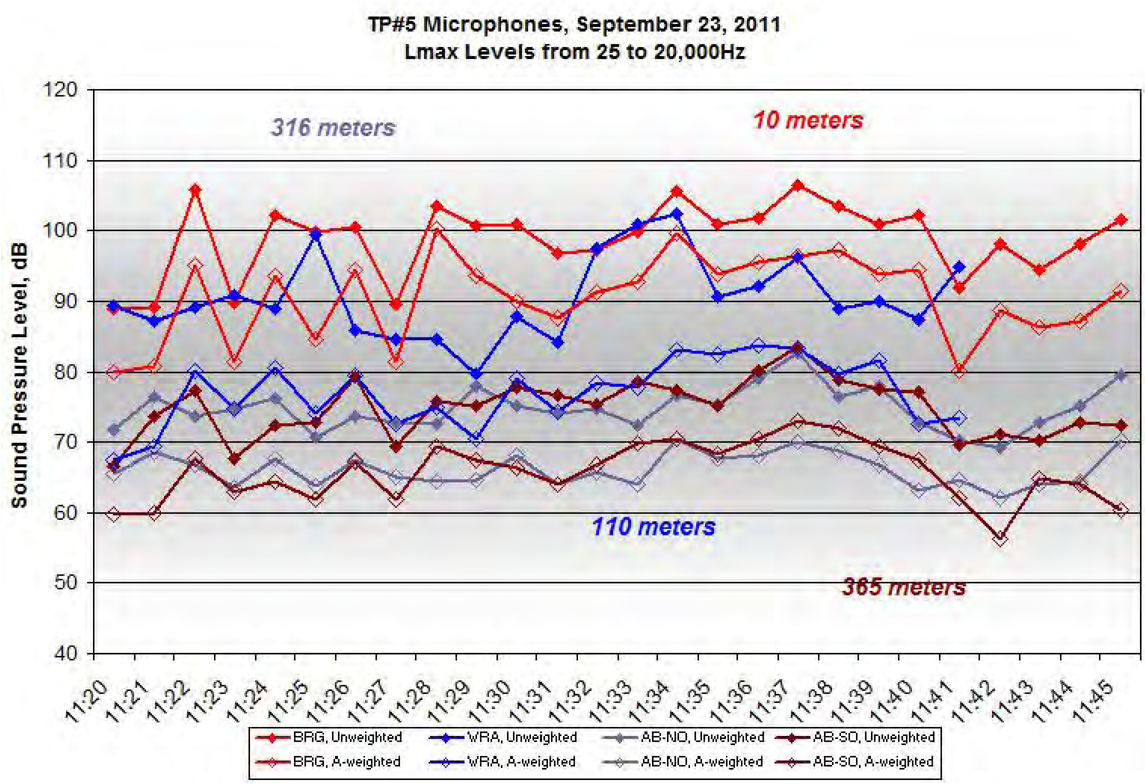

Figure C165. One-minute Unweighted and A-weighted Lmax Level at TP#5, 11:26-11:39, on September 23, 2011

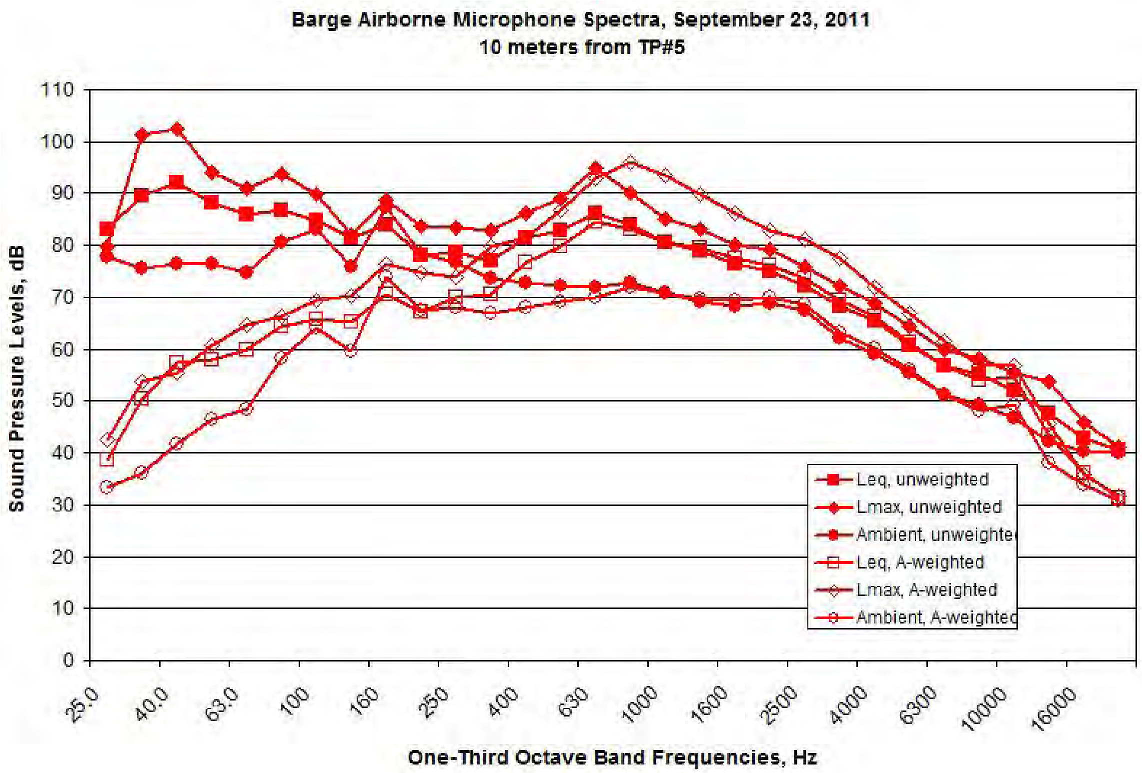

Figure C166. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#5, 11:26-11:39, on September 23, 2011

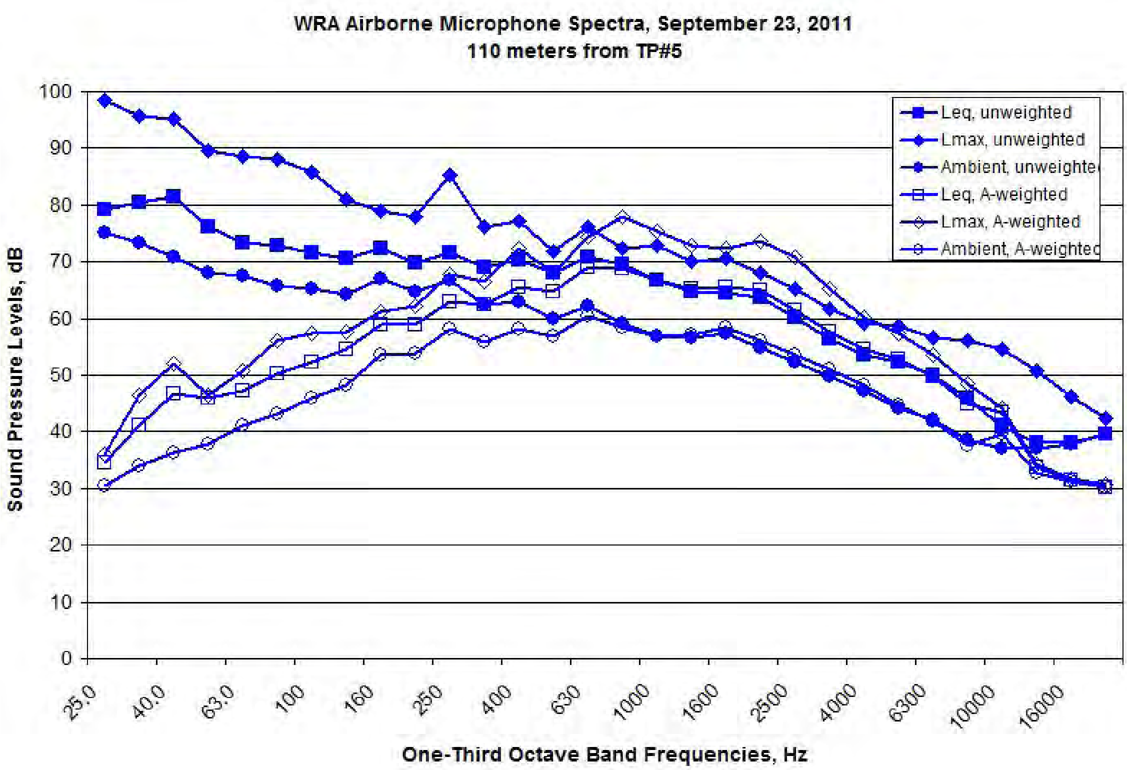

Figure C167. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#5, 11:26-11:39, on September 23, 2011

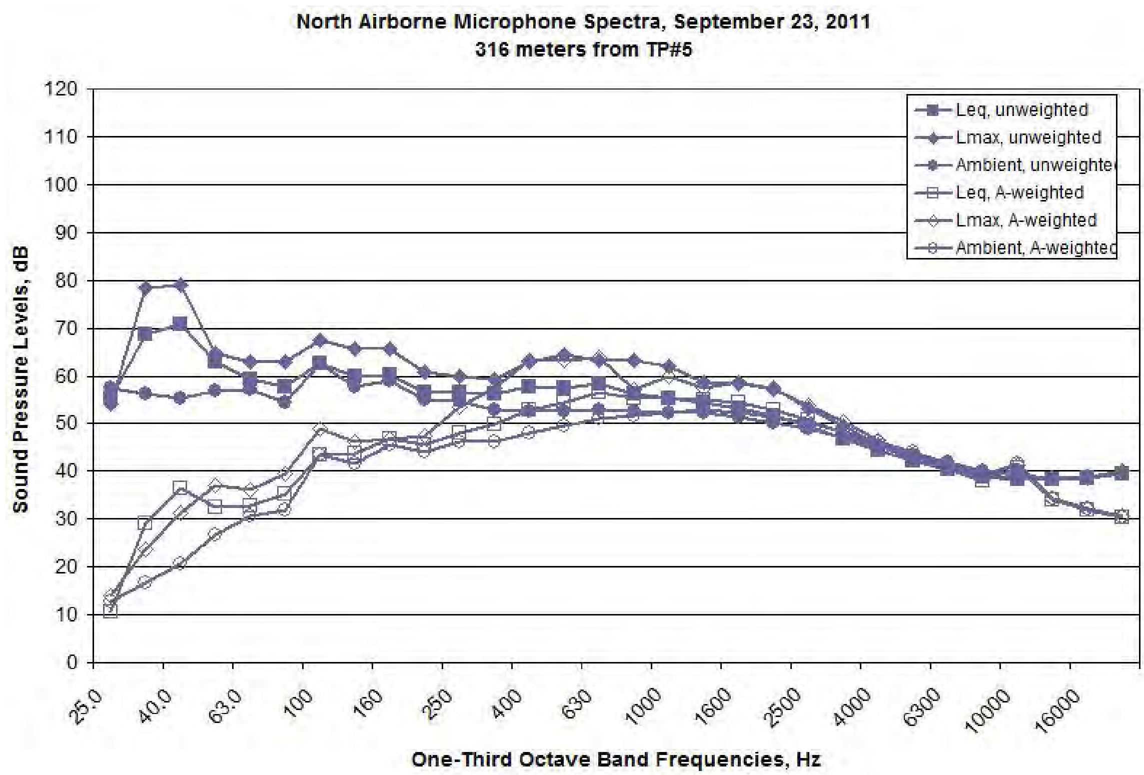

Figure C168. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#5, 11:26-11:39, on September 23, 2011

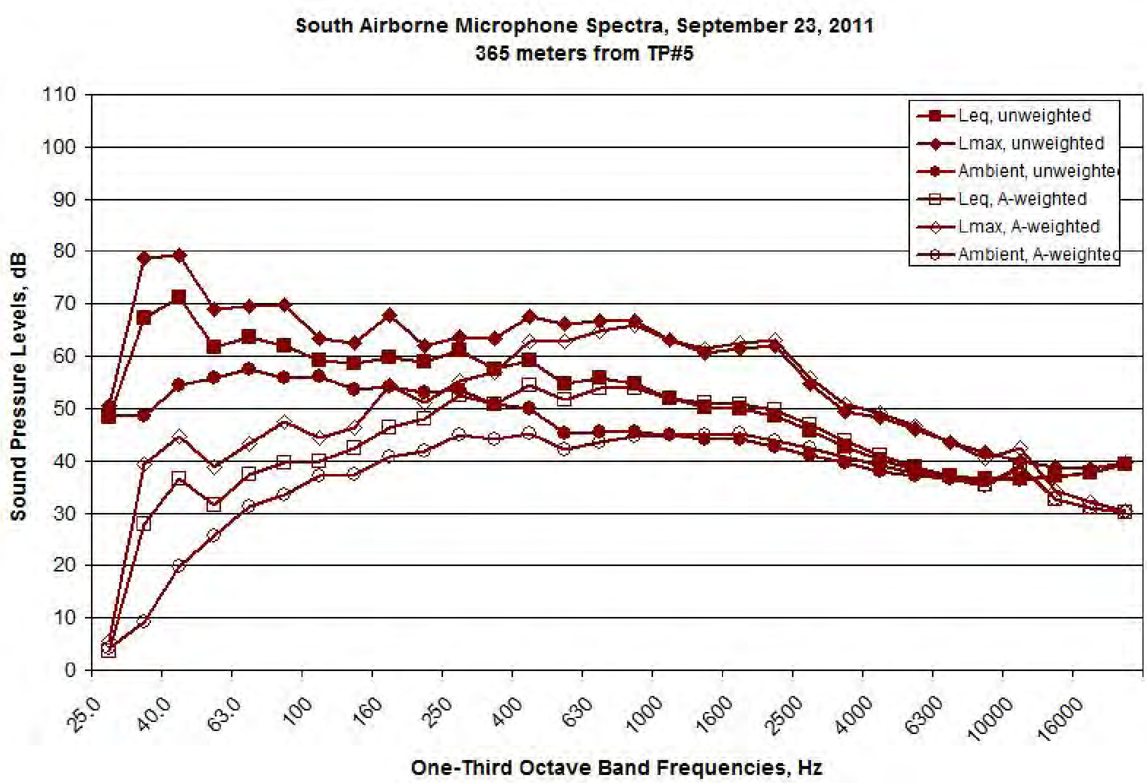

Figure C169. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#5, 11:26-11:39, on September 23, 2011

TP #4, Batter Pile

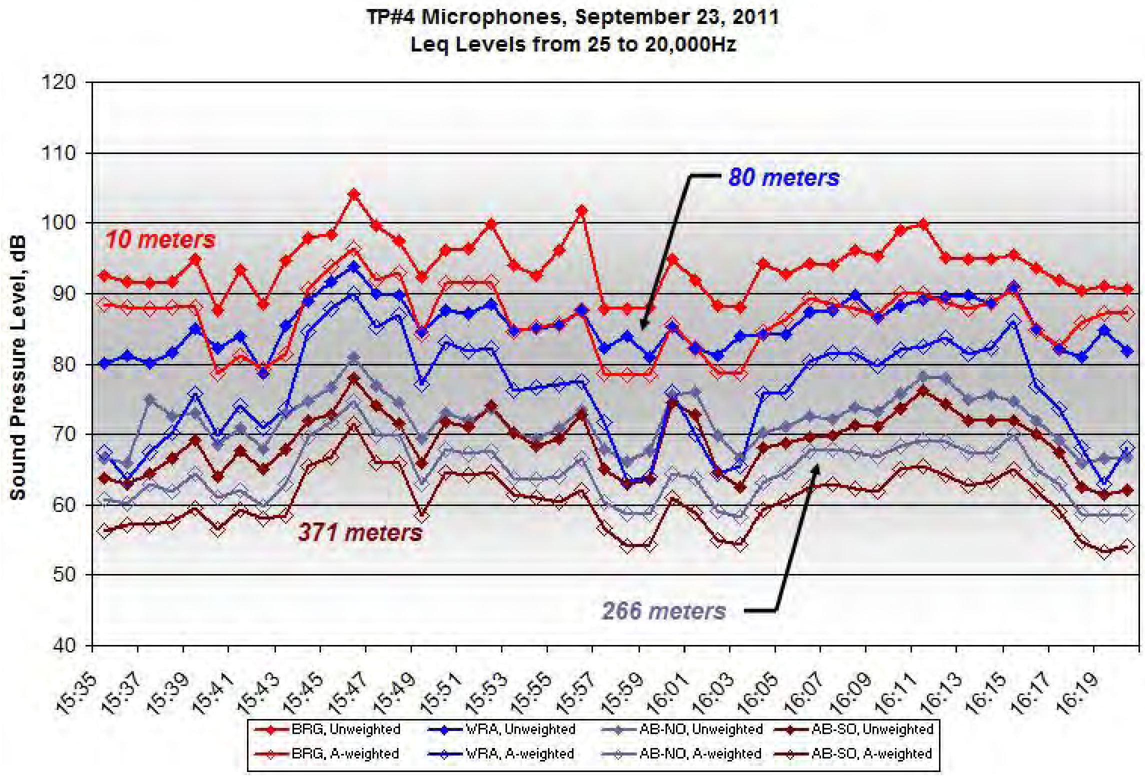

Figure C170. One-minute Unweighted and A-weighted Leq Level at TP#4 Batter Pile, 15:42-16:16, on September 23, 2011

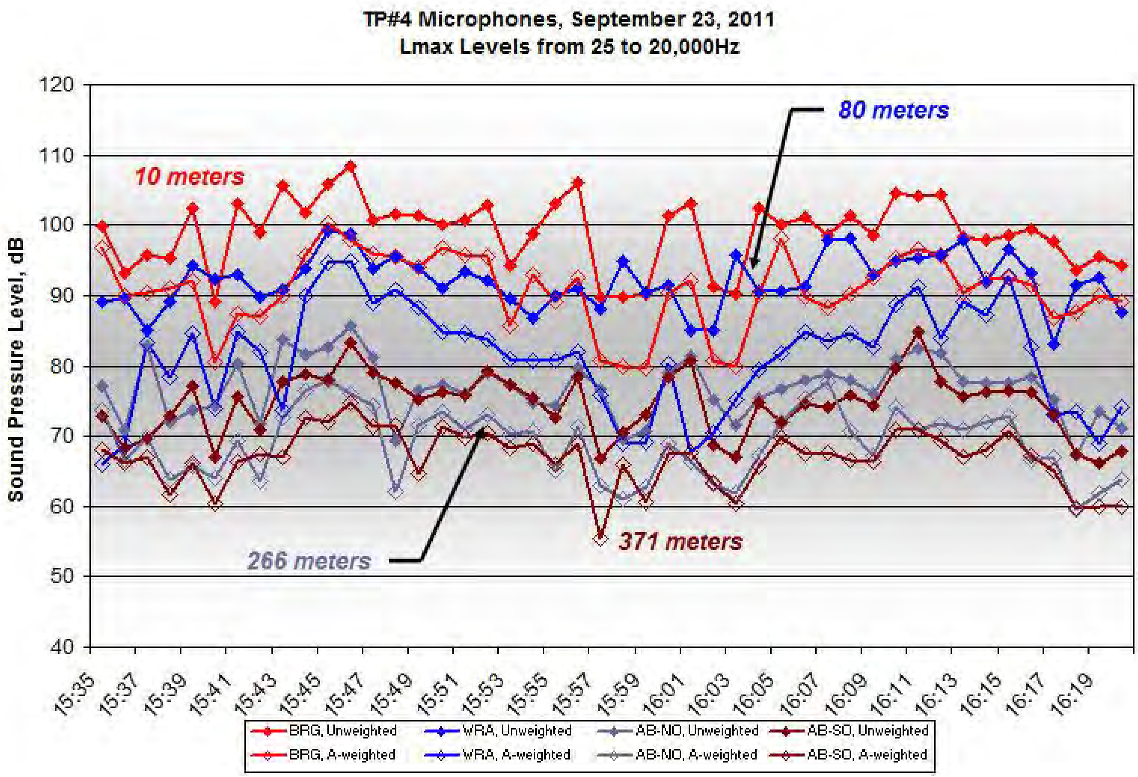

Figure C171. One-minute Unweighted and A-weighted Lmax Level at TP#4 Batter Pile, 15:42-16:16, on September 23, 2011

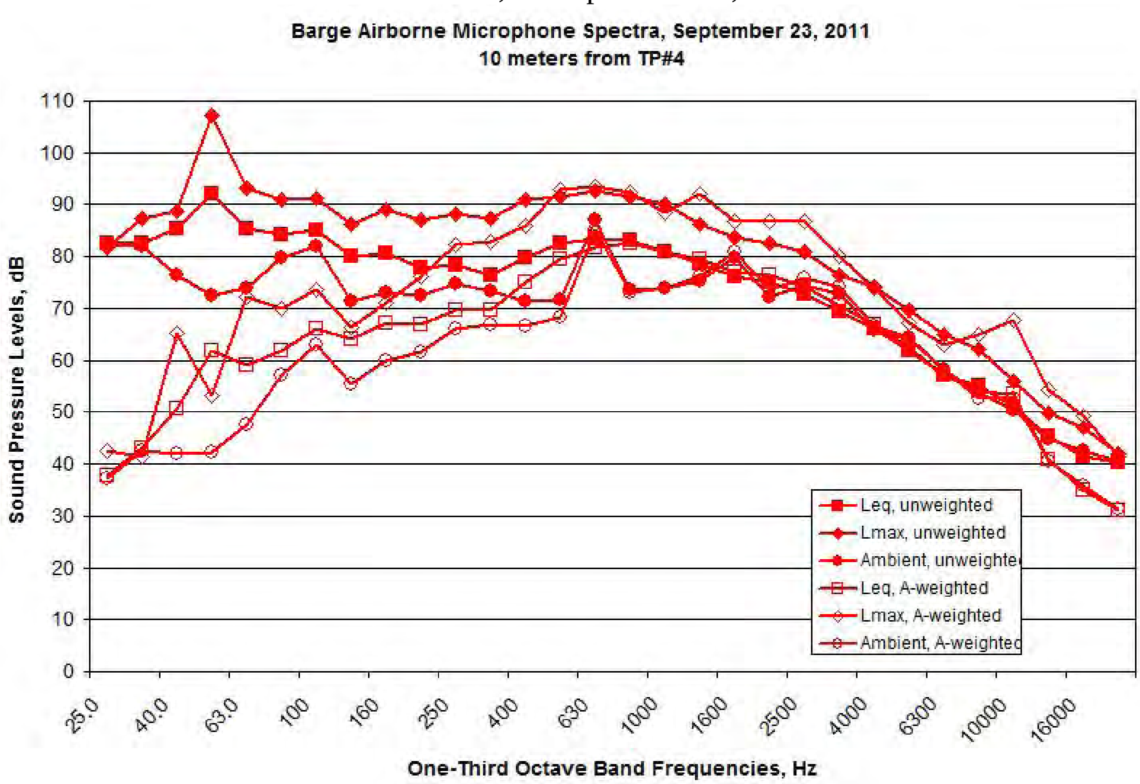

Figure C172. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#4 Batter Pile, 15:42-16:16, on September 23, 2011

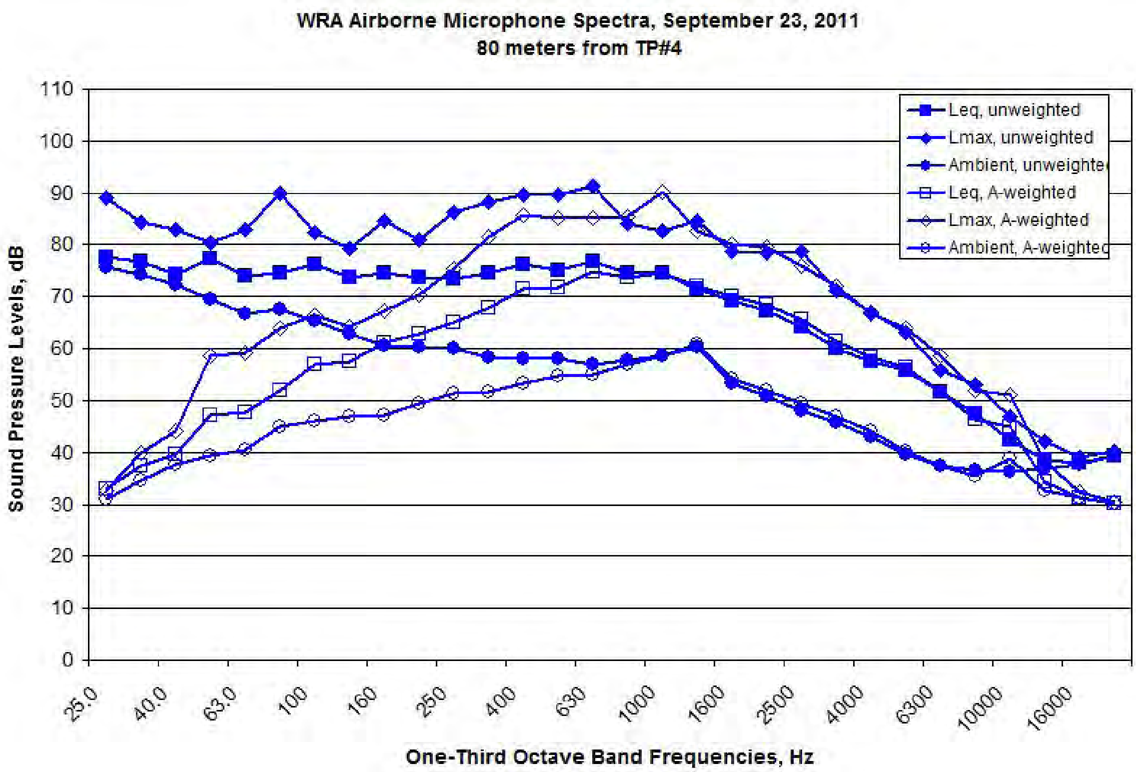

Figure C173. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#4 Batter Pile, 15:42-16:16, on September 23, 2011

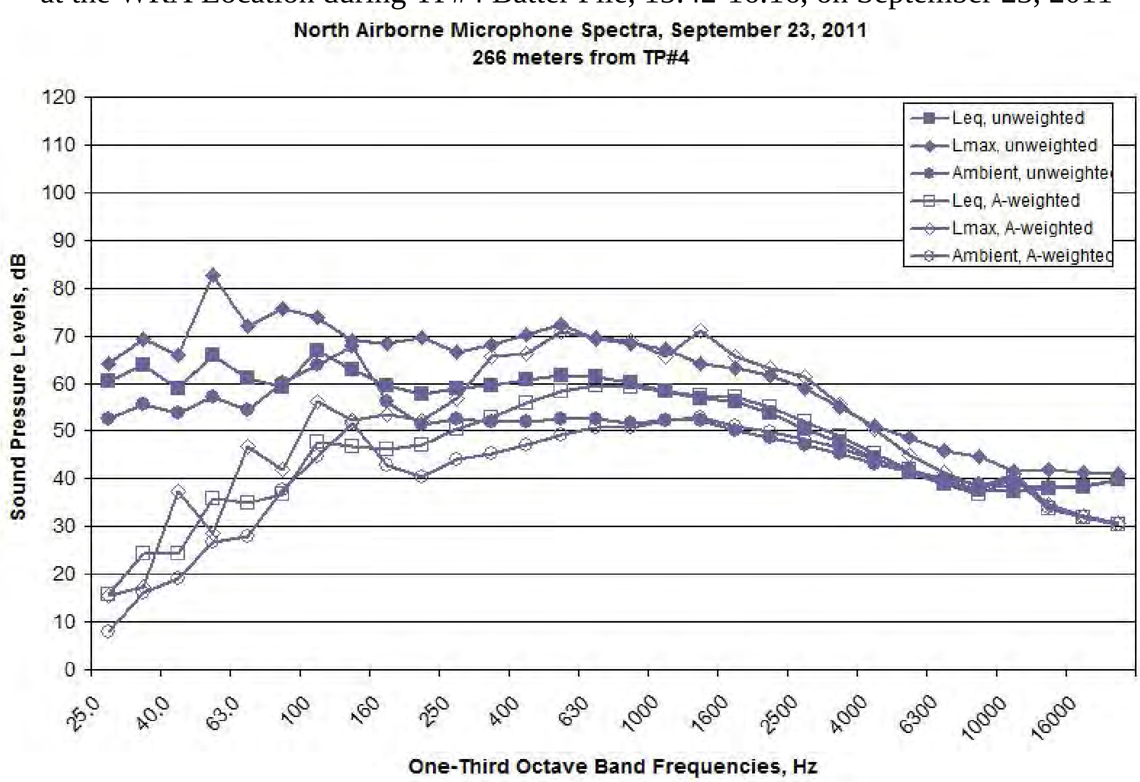

Figure C174. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#4 Batter Pile, 15:42-16:16, on September 23, 2011

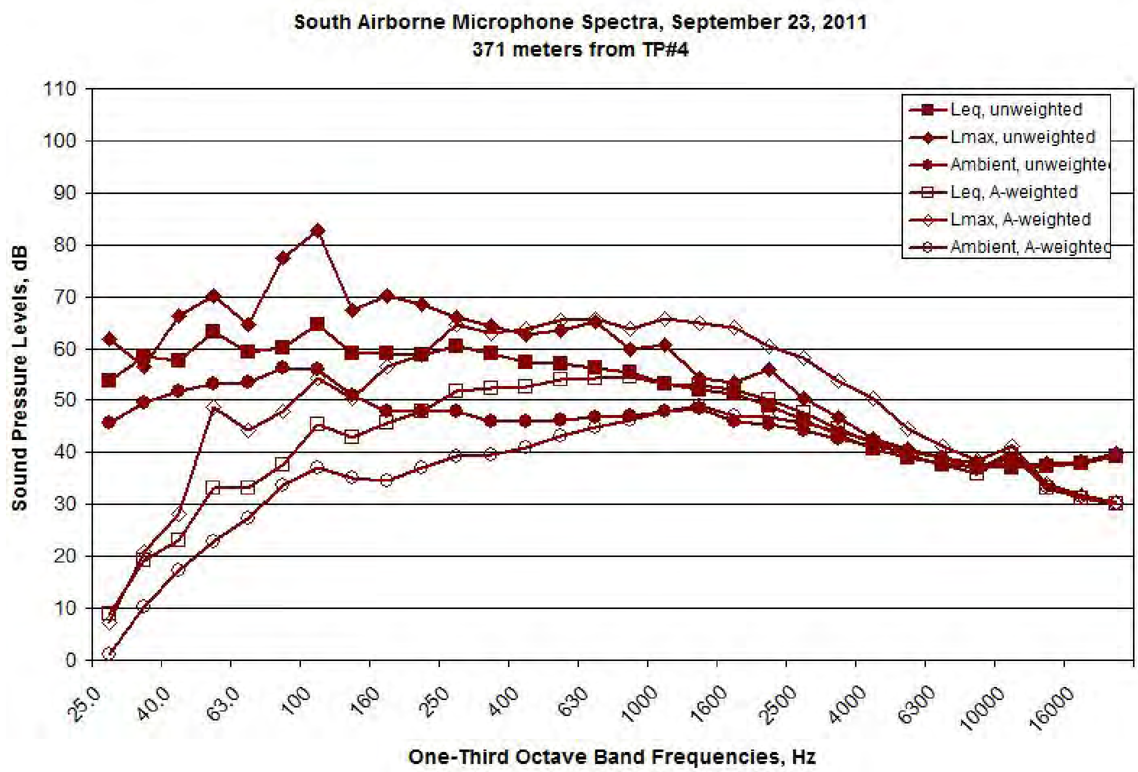

Figure C175. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#4 Batter Pile, 15:42-16:16, on September 23, 2011

9/24/2011 – TP#10

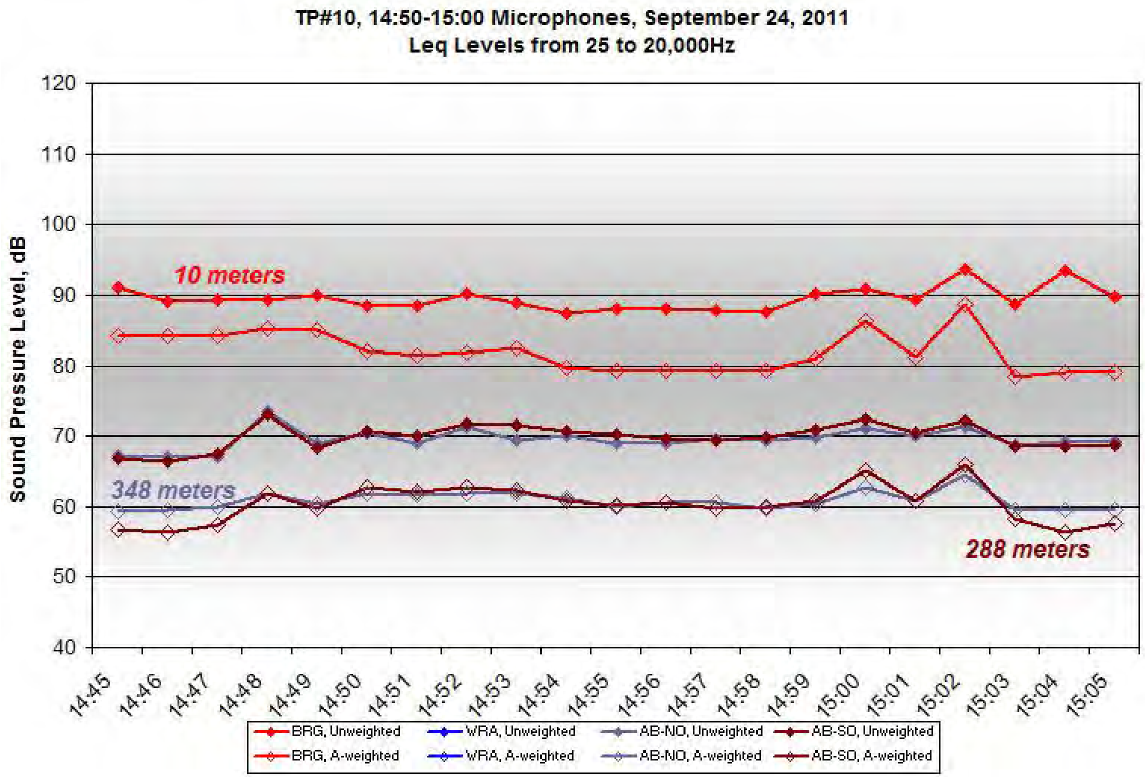

Figure C176. One-minute Unweighted and A-weighted Leq Level at TP#10, 14:50-15:00, on September 24, 2011

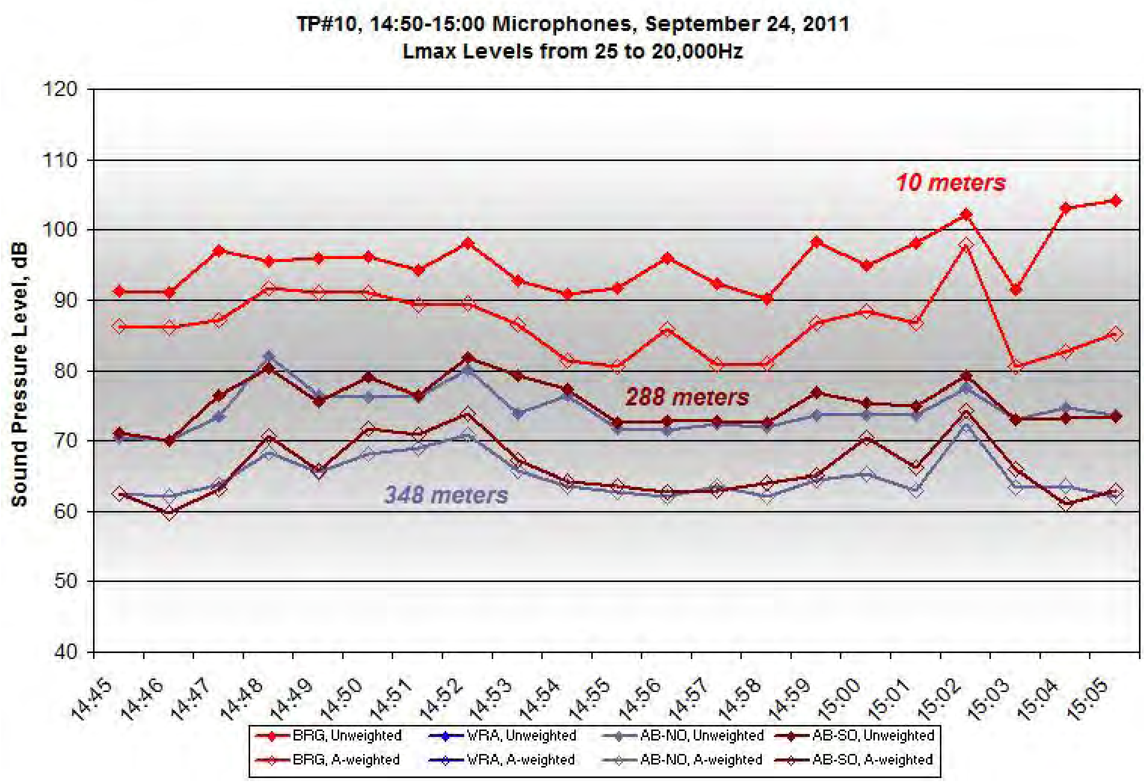

Figure C177. One-minute Unweighted and A-weighted Lmax Level at TP#10, 14:50-15:00, on September 24, 2011

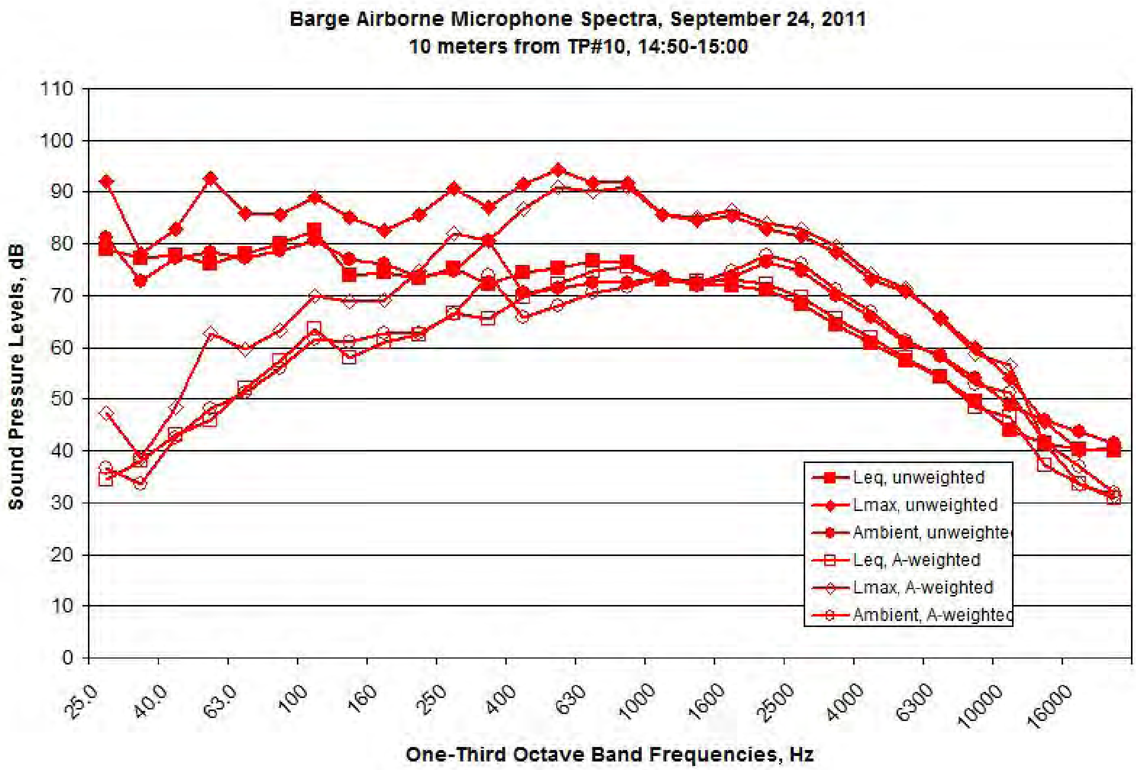

Figure C178. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#10, 14:50-15:00, on September 24, 2011

NO DATA AVAILABLE

Figure C179. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#10, 14:50-15:00, on September 24, 2011

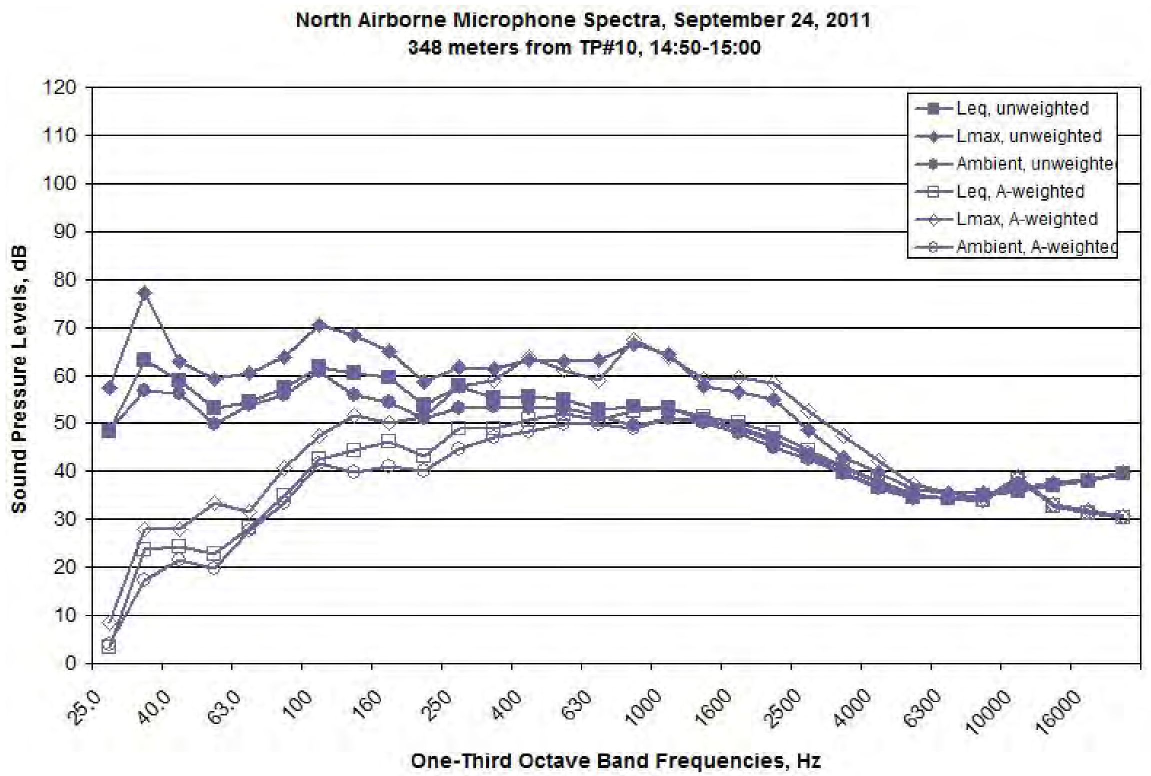

Figure C180. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#10, 14:50-15:00, on September 24, 2011

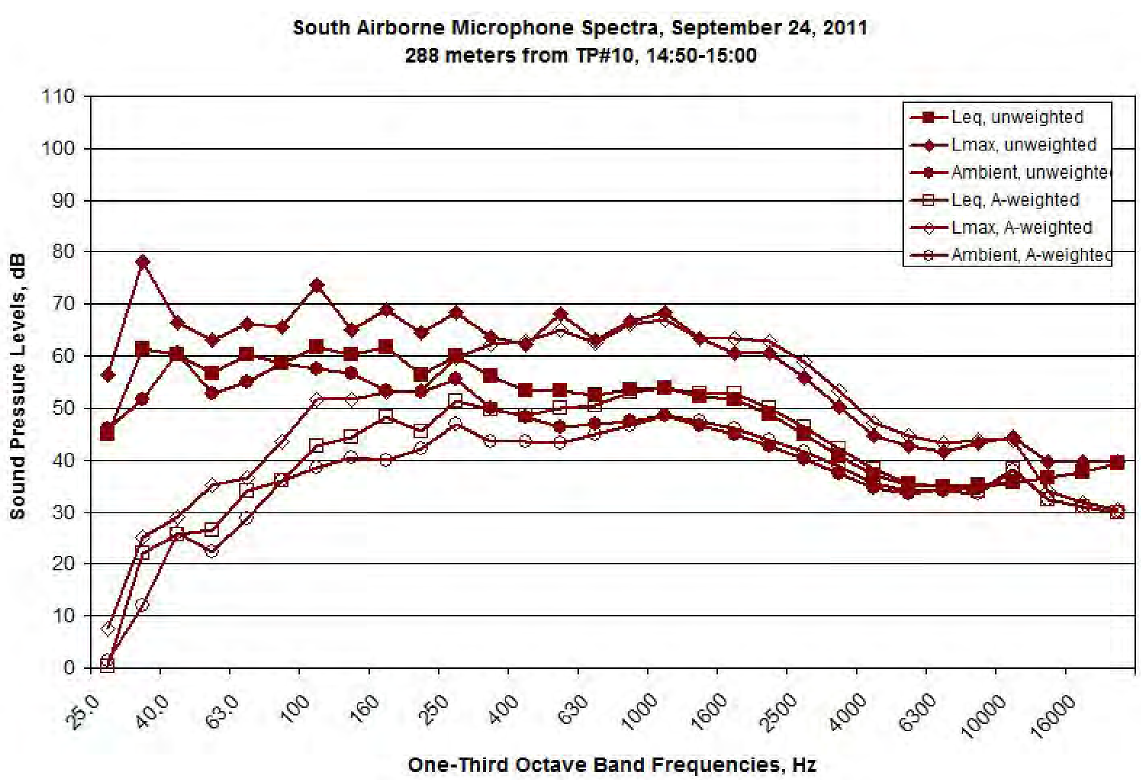

Figure C181. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#10, 14:50-15:00, on September 24, 2011

TP#9 RP#3

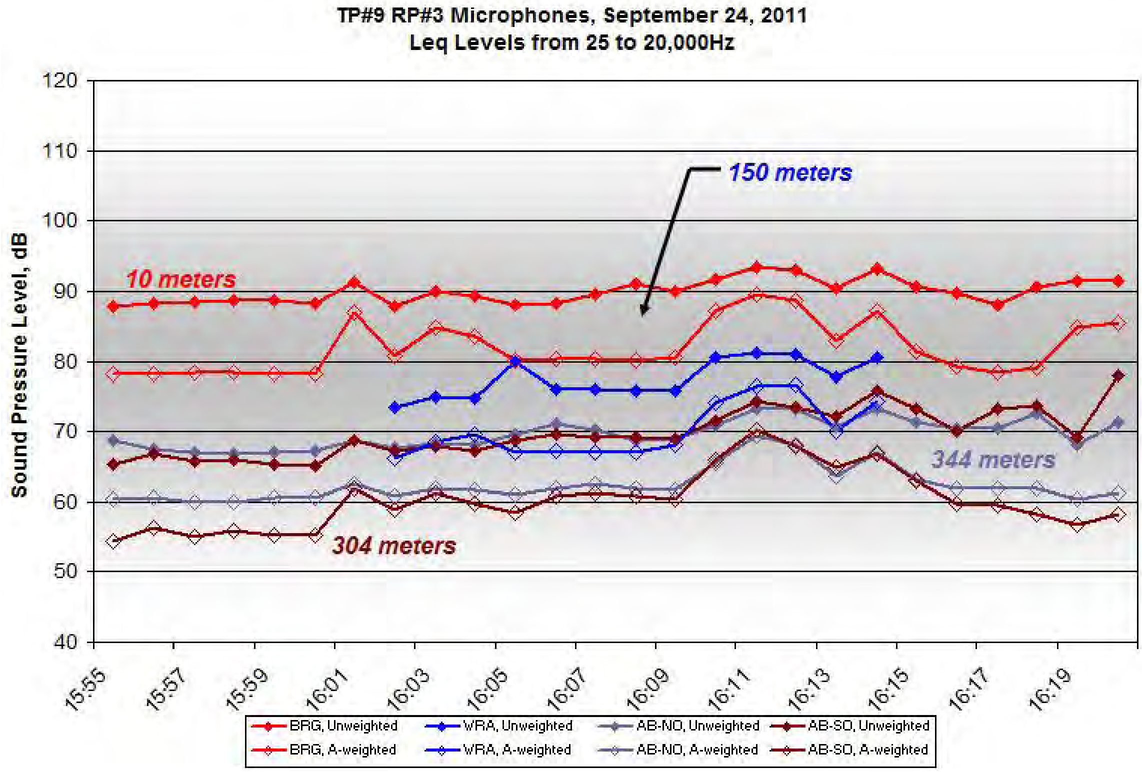

Figure C182. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#3, 16:03-16:13, on September 24, 2011

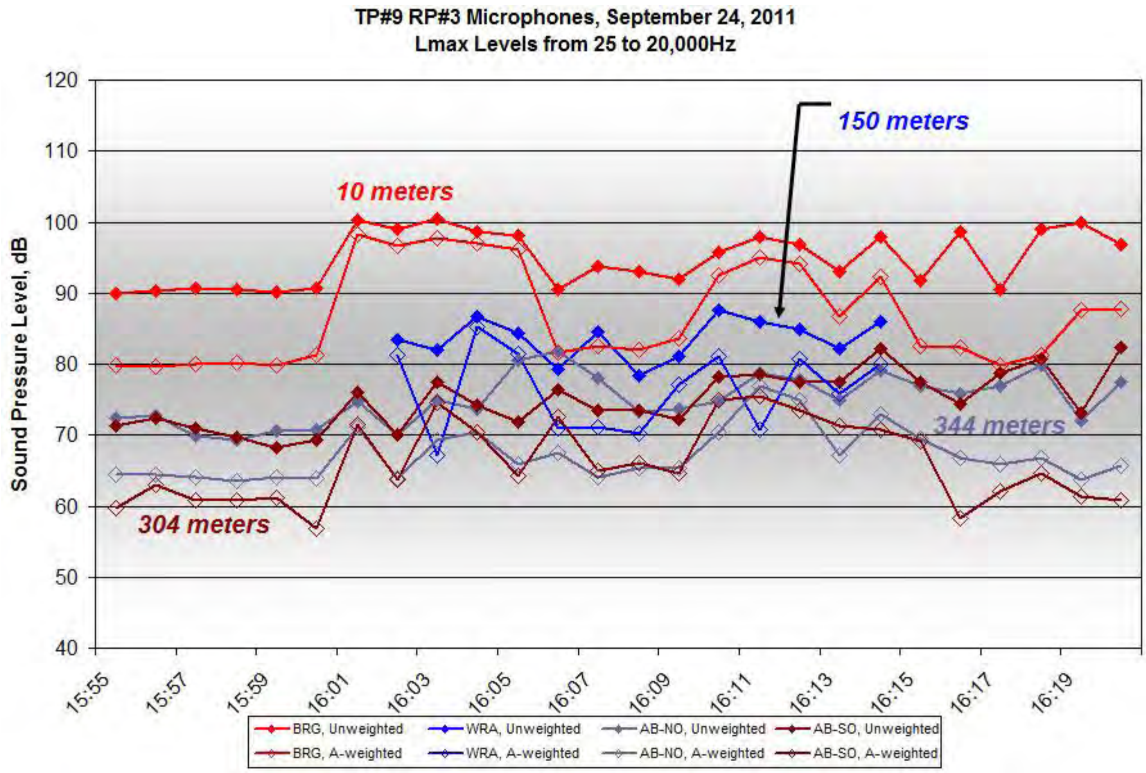

Figure C183. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#3, 16:03-16:13, on September 24, 2011

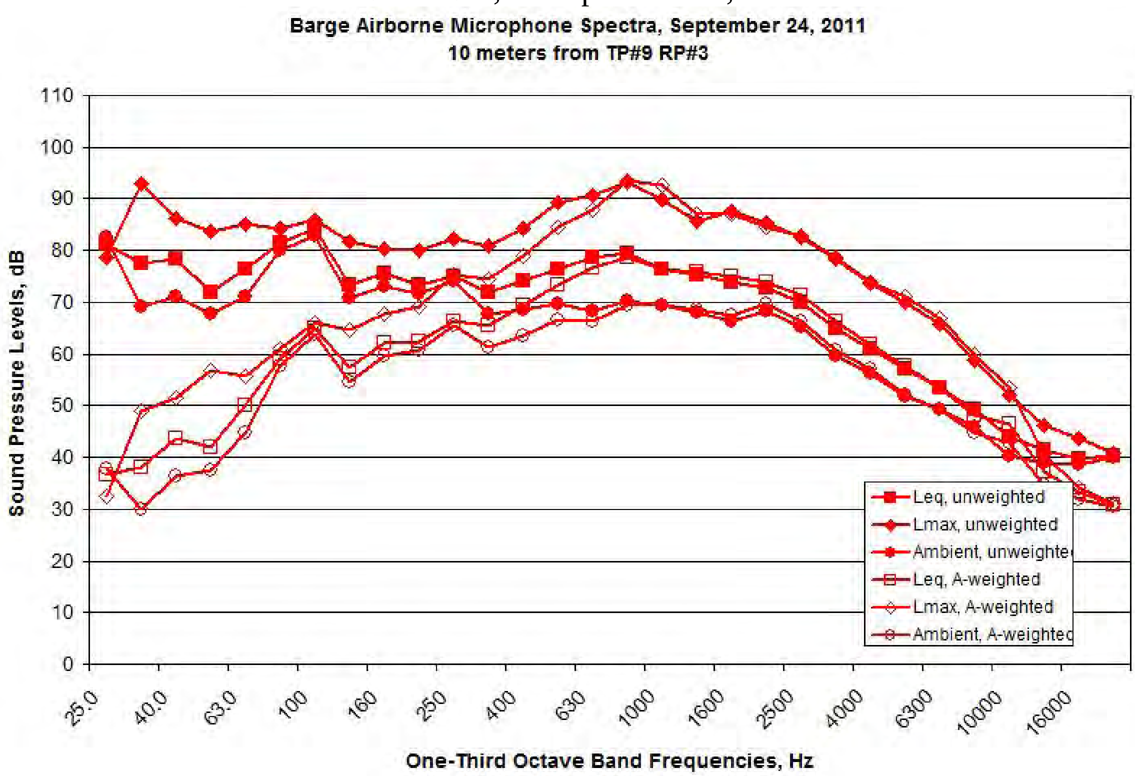

Figure C184. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#3, 16:03-16:13, on September 24, 2011

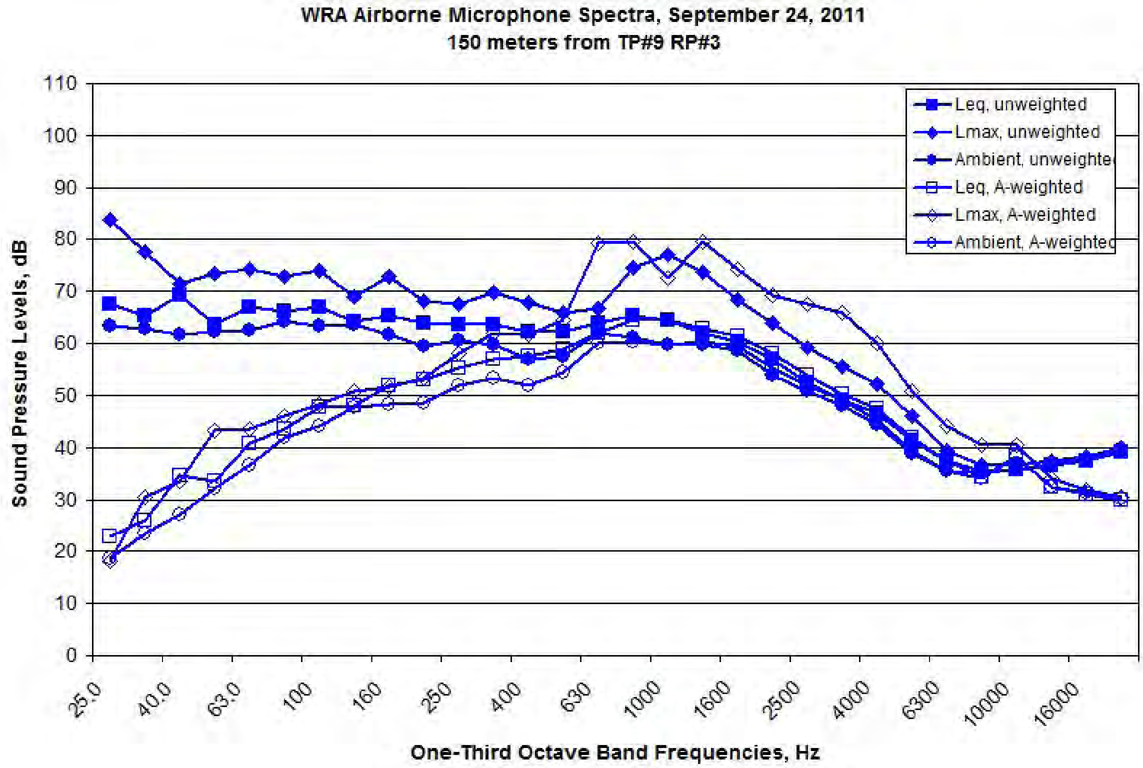

Figure C185. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#3, 16:03-16:13, on September 24, 2011

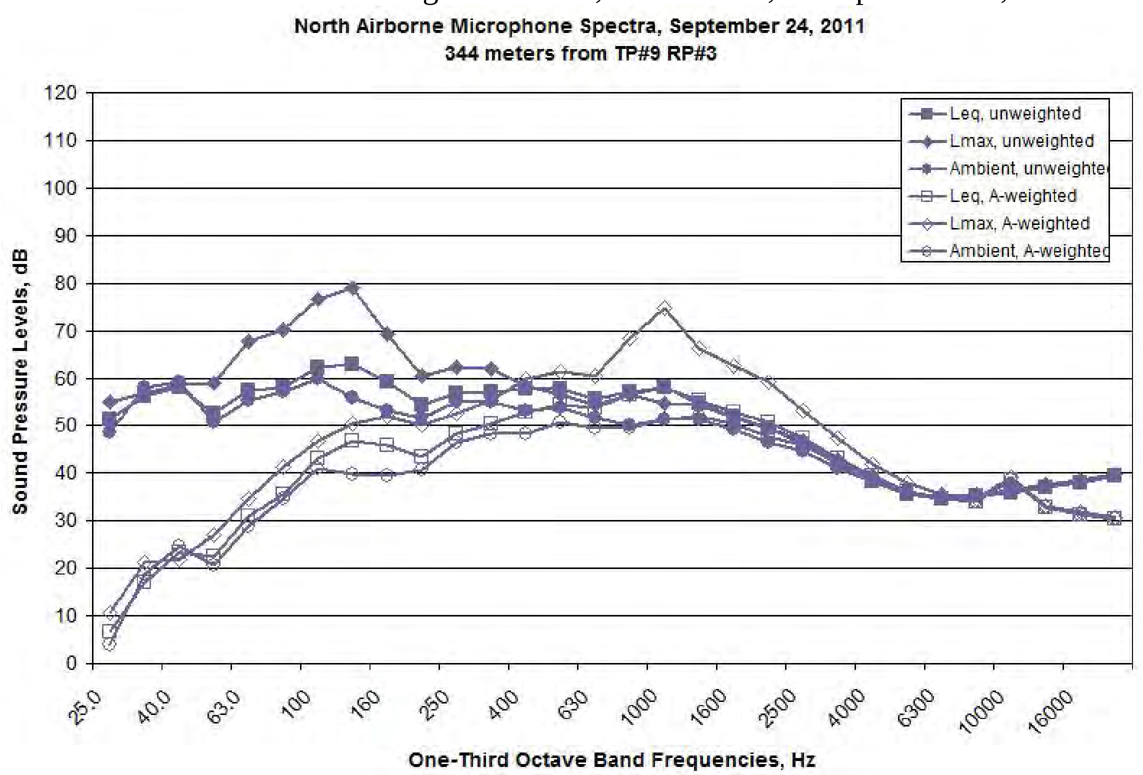

Figure C186. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#3, 16:03-16:13, on September 24, 2011

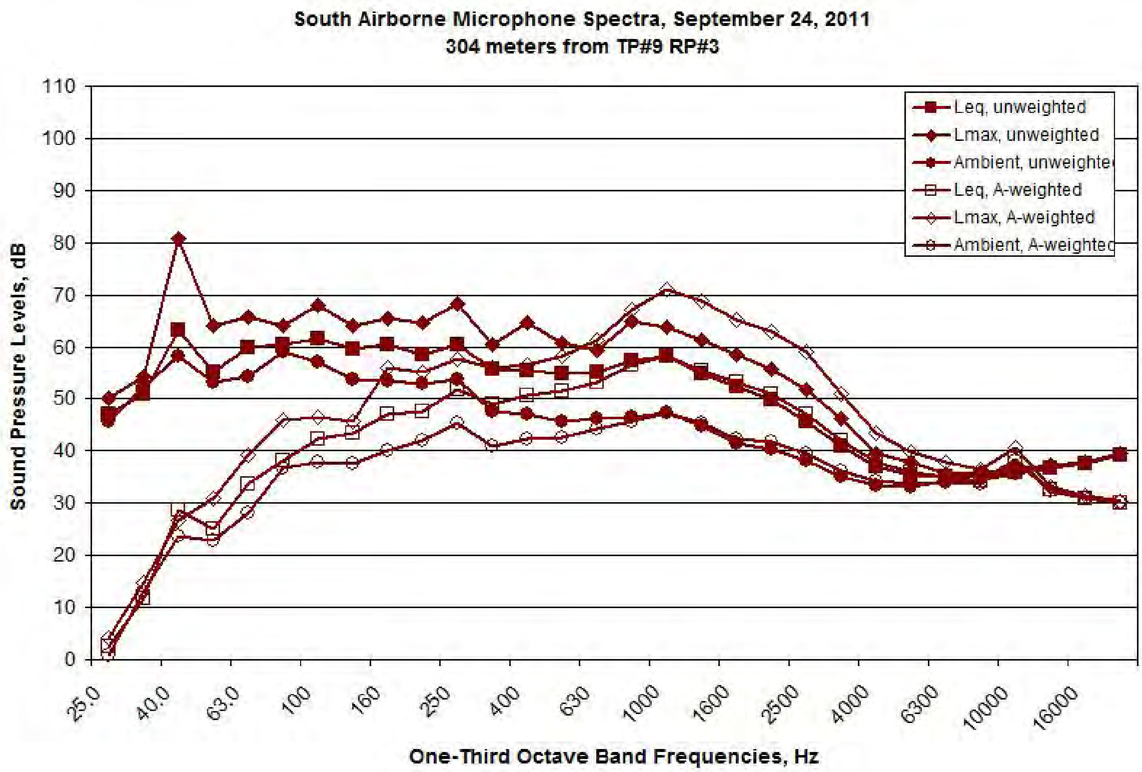

Figure C187. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#3, 16:03-16:13, on September 24, 2011

9/26/2011 – TP#8

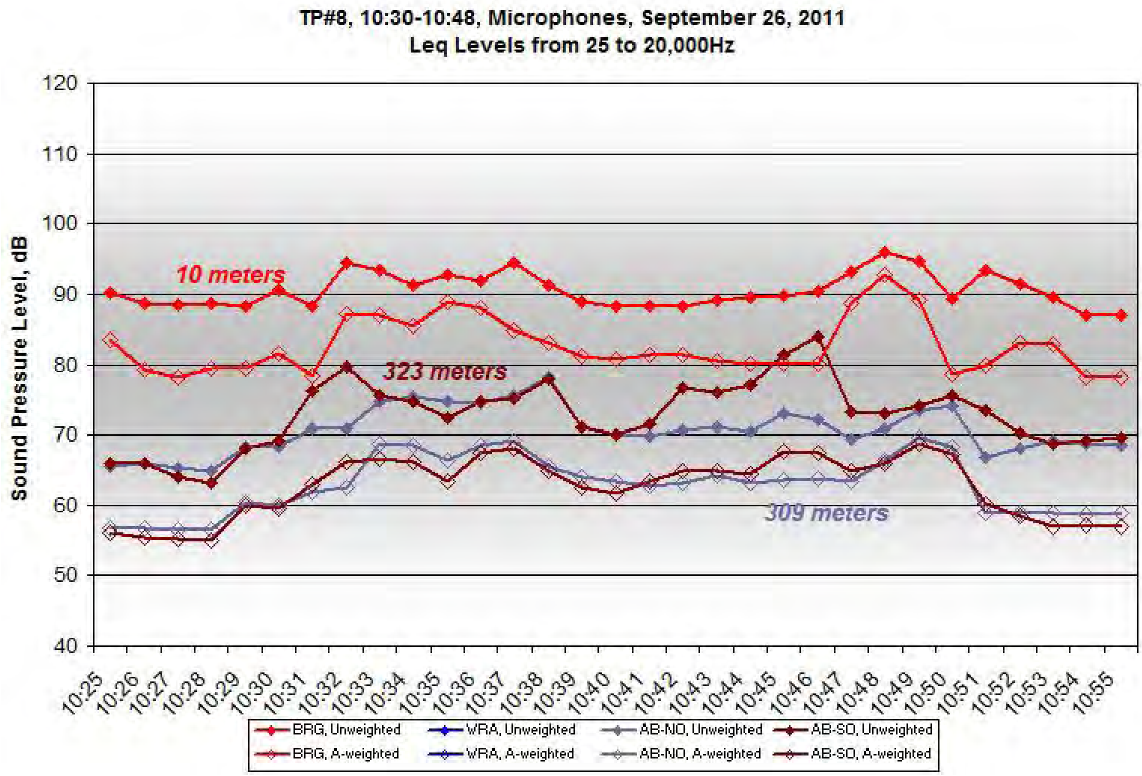

Figure C188. One-minute Unweighted and A-weighted Leq Level at TP#8, 10:30-10:48, on September 26, 2011

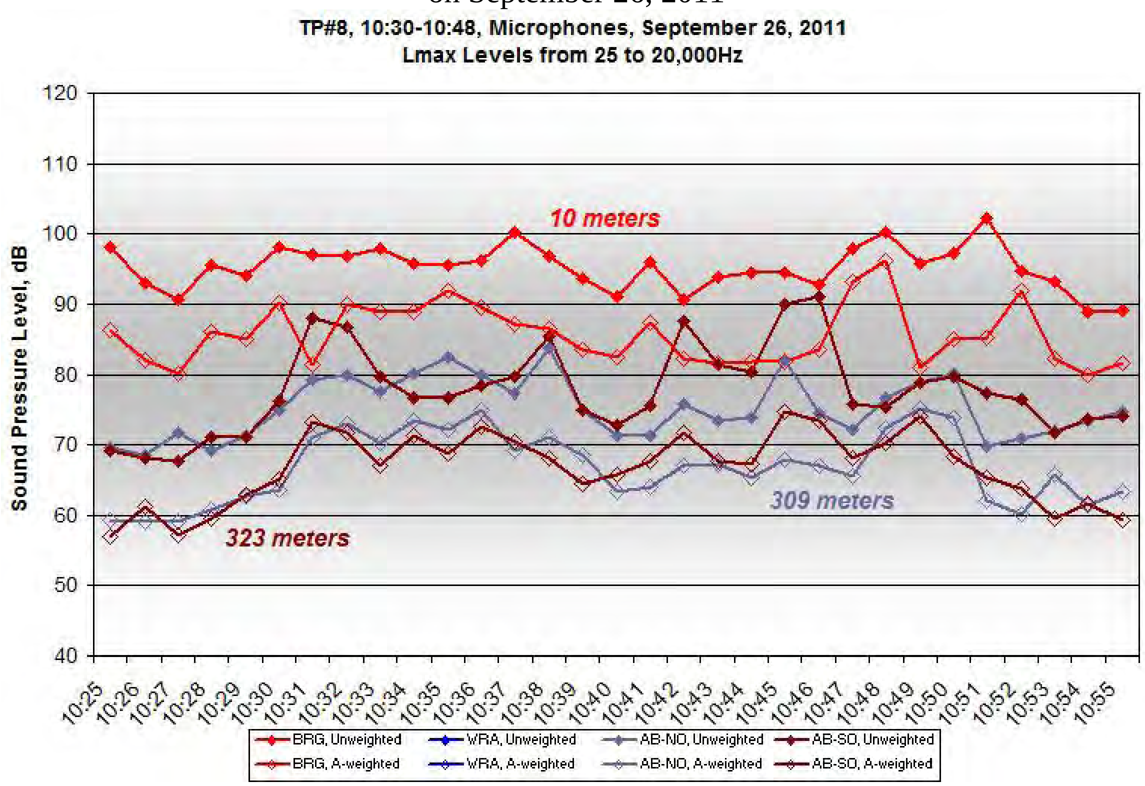

Figure C189. One-minute Unweighted and A-weighted Lmax Level at TP#8, 10:30-10:48, on September 26, 2011

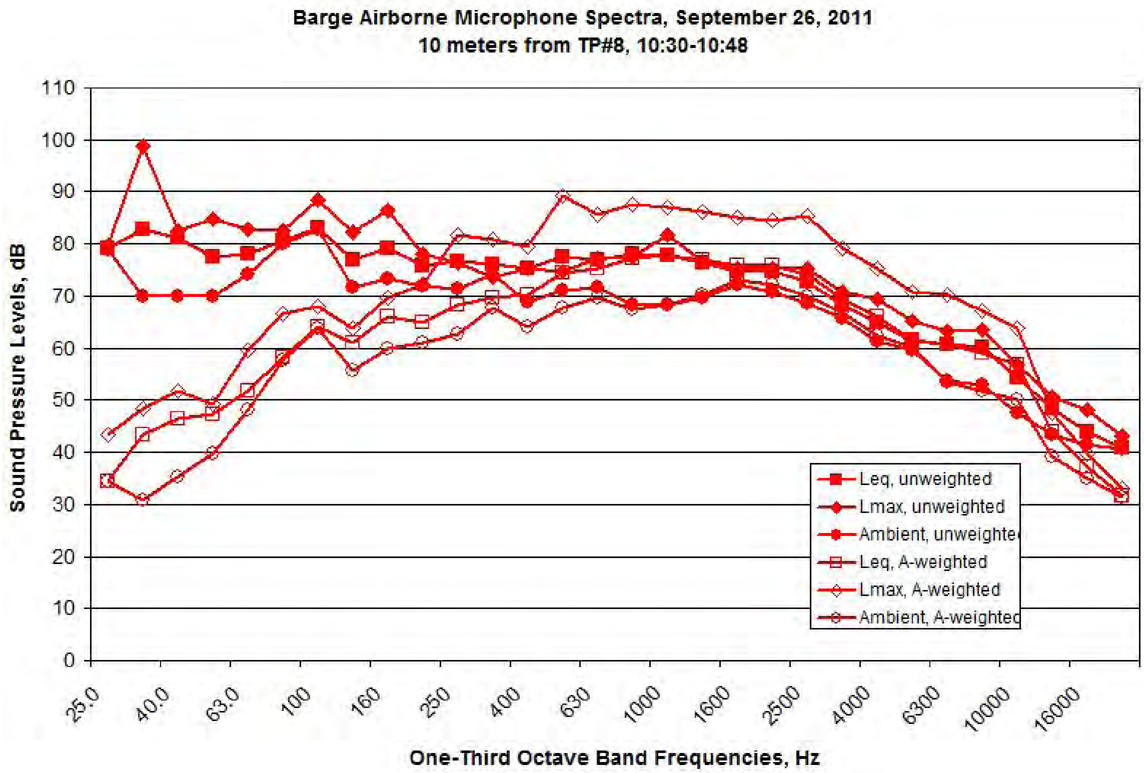

Figure C190. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#8, 10:30-10:48, on September 26, 2011

NO DATA AVAILABLE

Figure C191. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#8, 10:30-10:48, on September 26, 2011

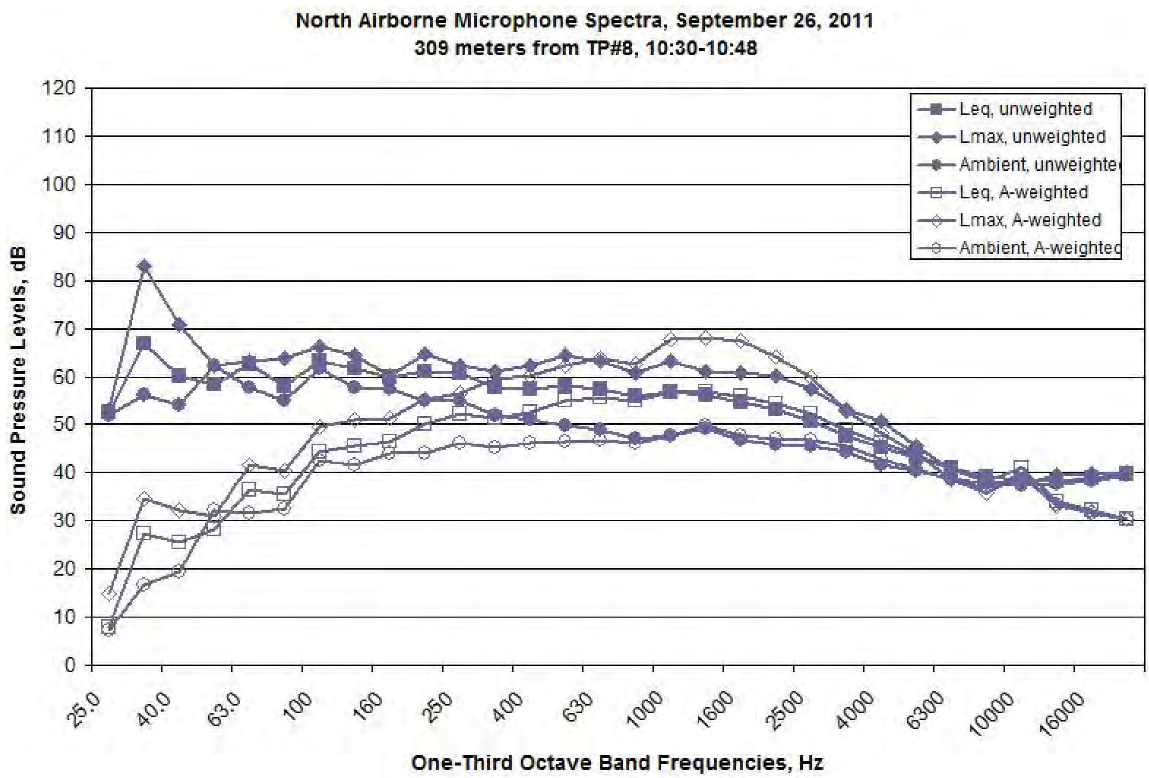

Figure C192. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#8, 10:30-10:48, on September 26, 2011

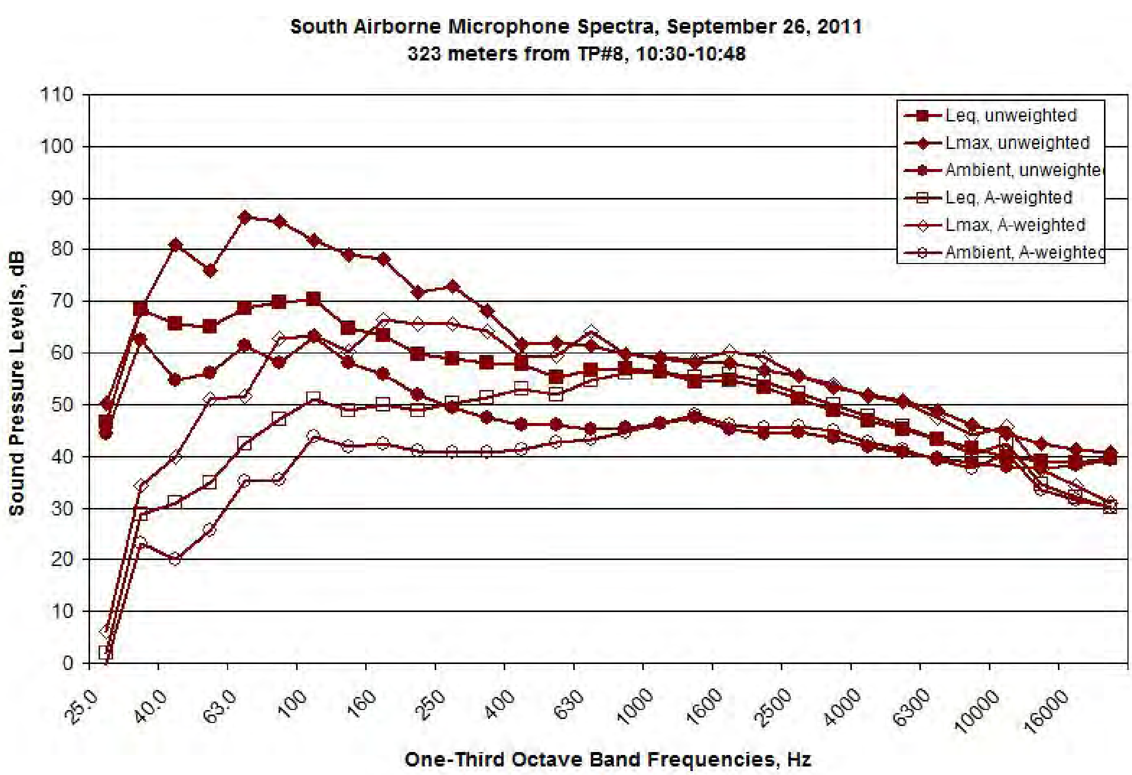

Figure C193. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#8, 10:30-10:48, on September 26, 2011

TP#9 RP#1

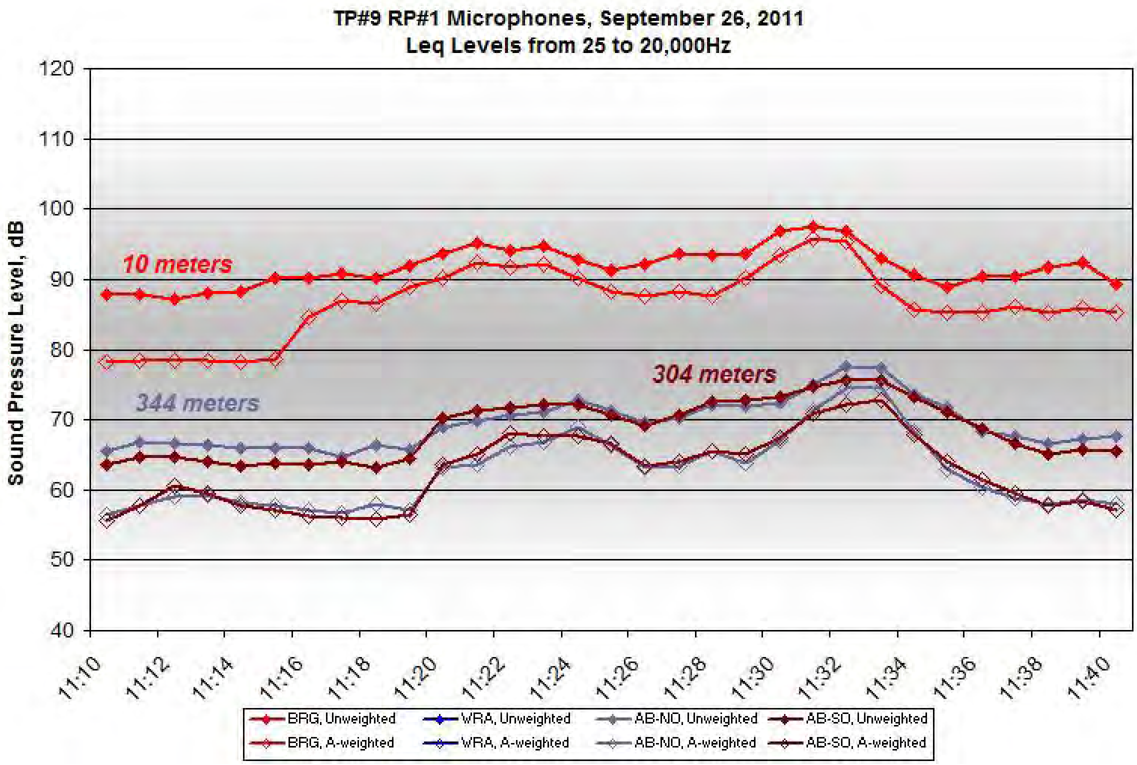

Figure C194. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#1, 11:18-11:33, on September 26, 2011

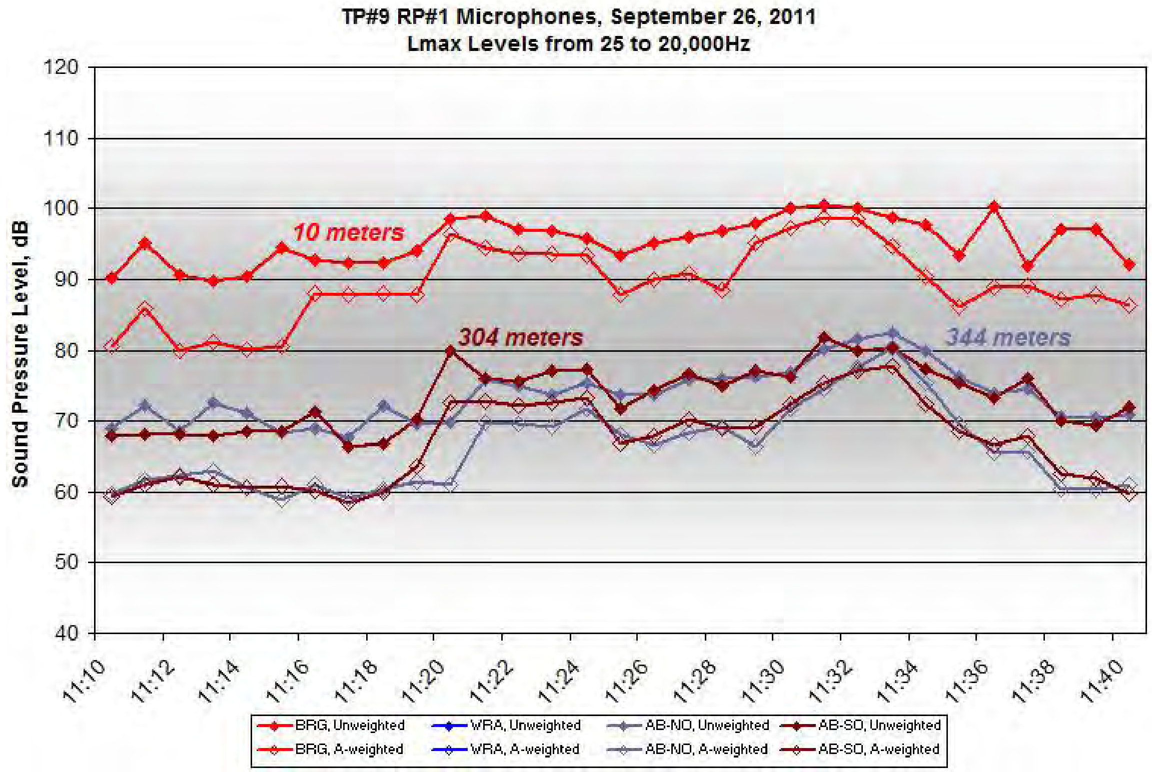

Figure C195. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#1, 11:18-11:33, on September 26, 2011

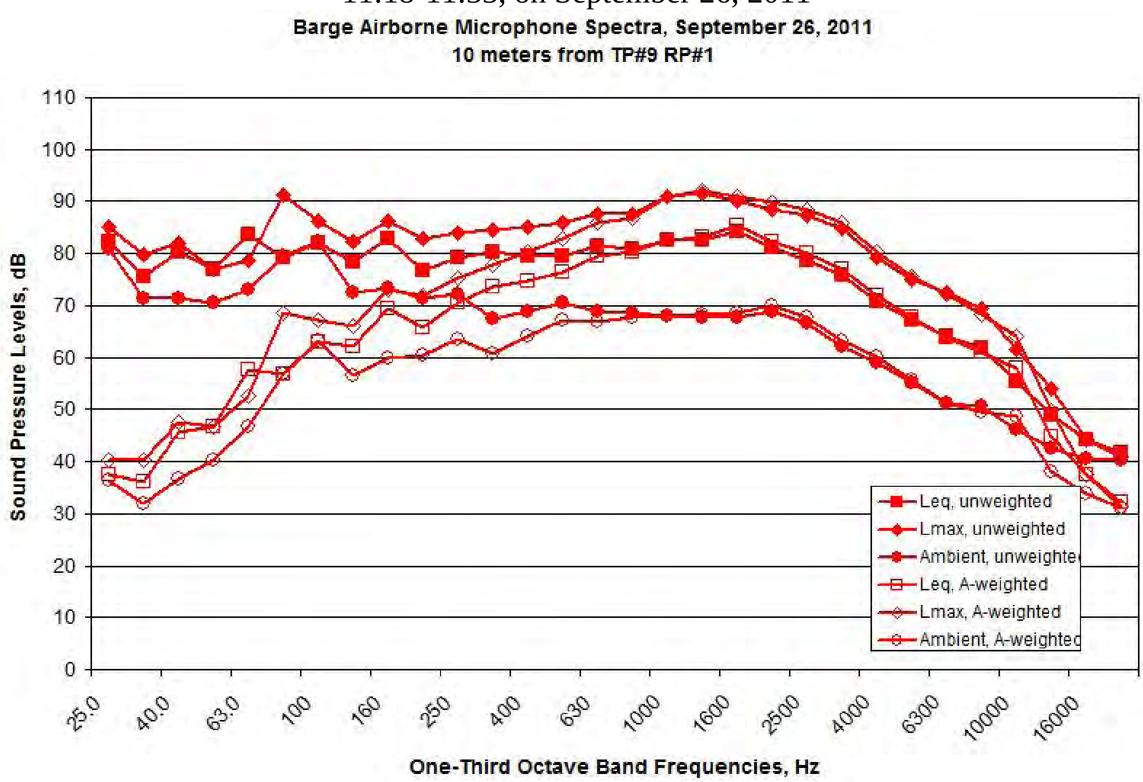

Figure C196. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#1, 11:18-11:33, on September 26, 2011

NO DATA AVAILABLE

Figure C197. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#1, 11:18-11:33, on September 26, 2011

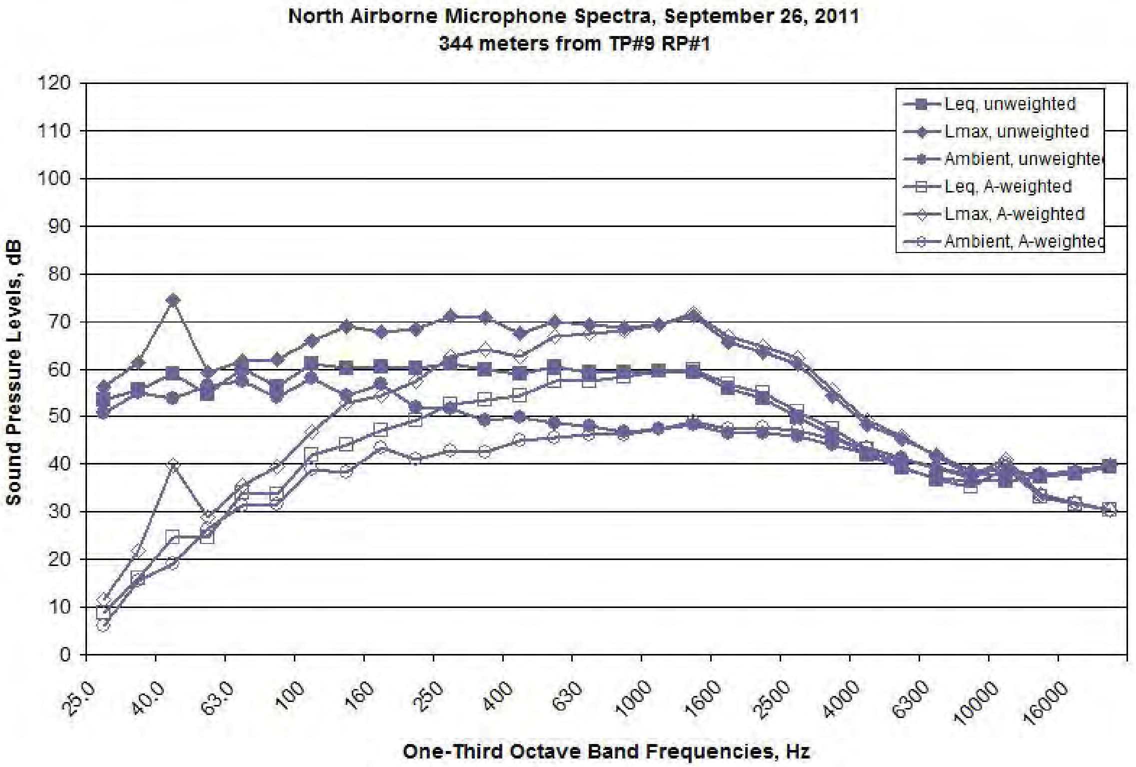

Figure C198. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#1, 11:18-11:33, on September 26, 2011

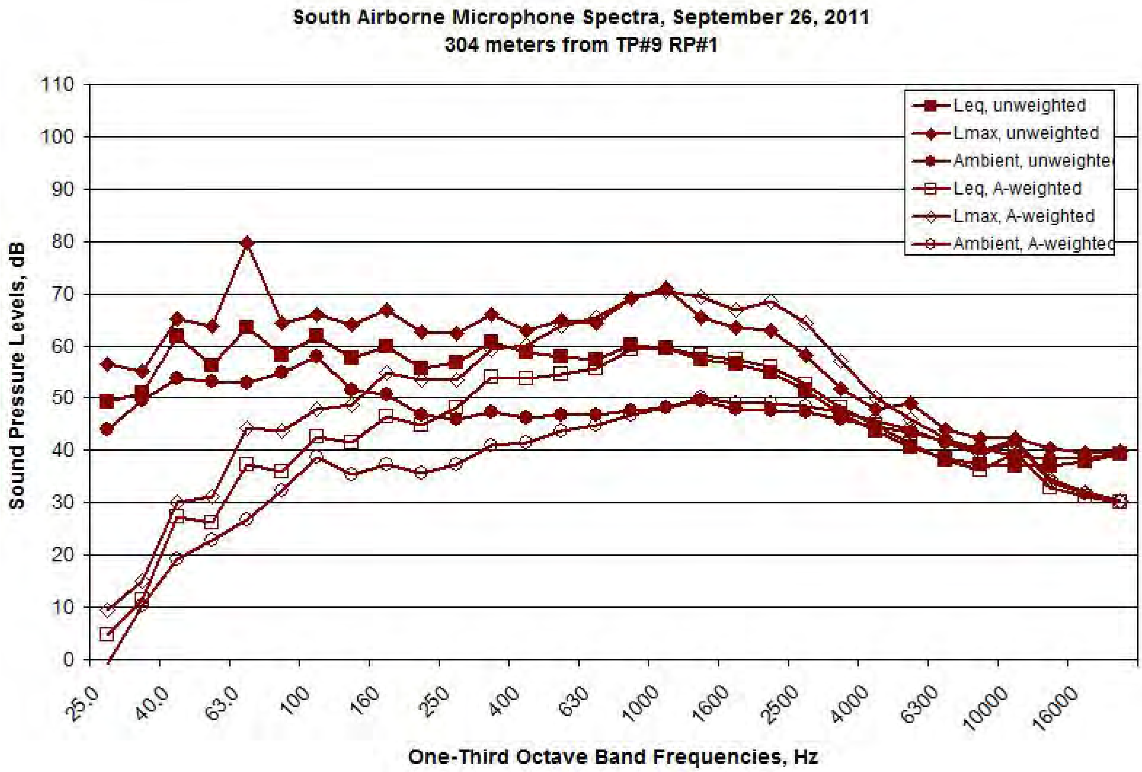

Figure C199. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#1, 11:18-11:33, on September 26, 2011

9/29/2011 – TP#12

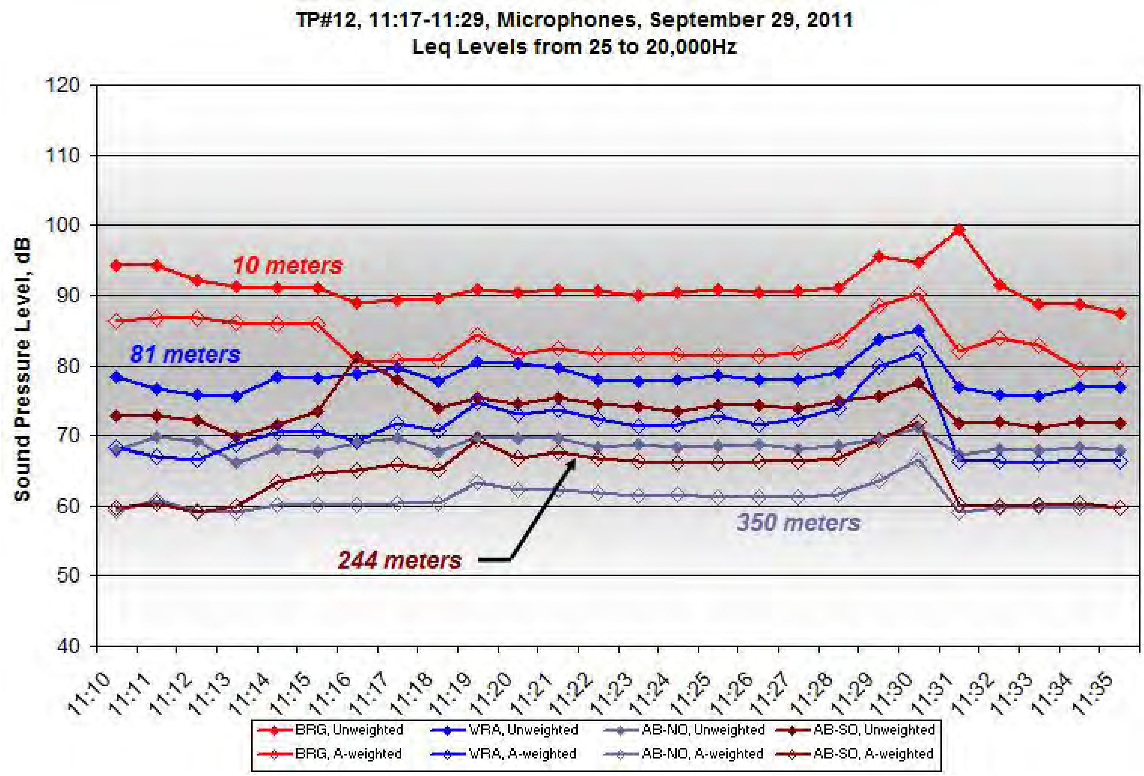

Figure C200. One-minute Unweighted and A-weighted Leq Level at TP#12, 11:17-11:29, on September 29, 2011

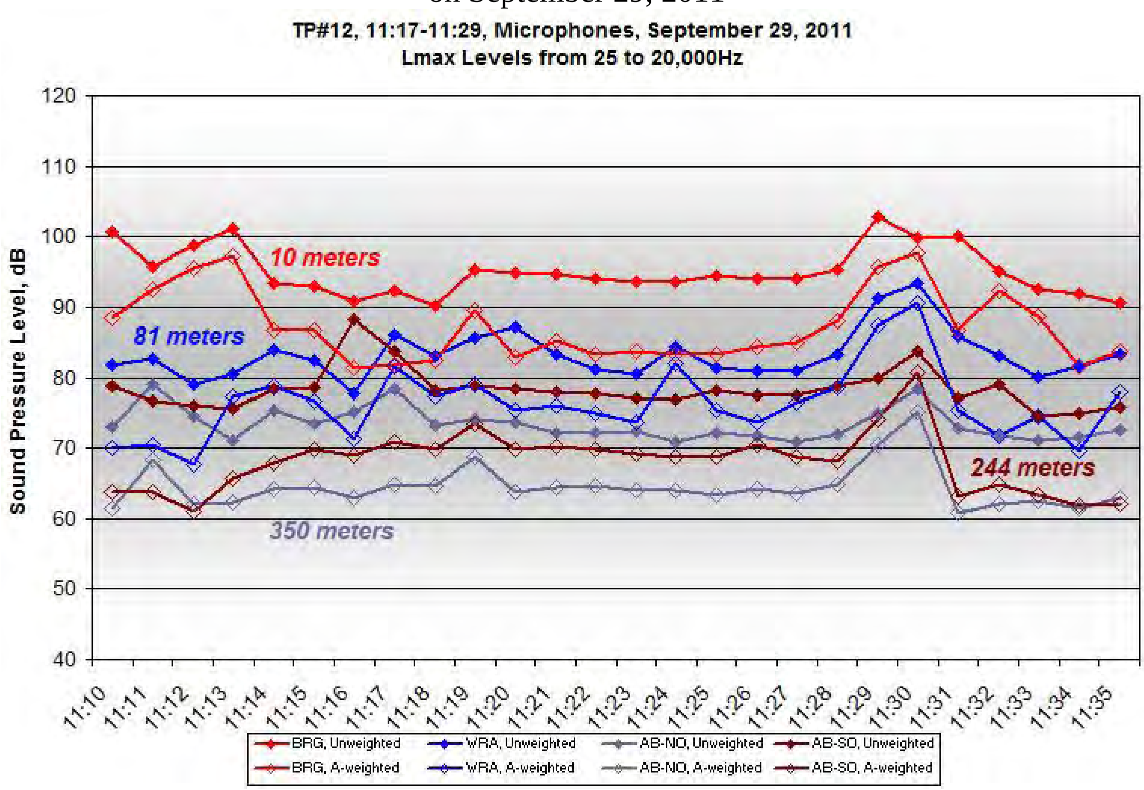

Figure C201. One-minute Unweighted and A-weighted Lmax Level at TP#12, 11:17-11:29, on September 29, 2011

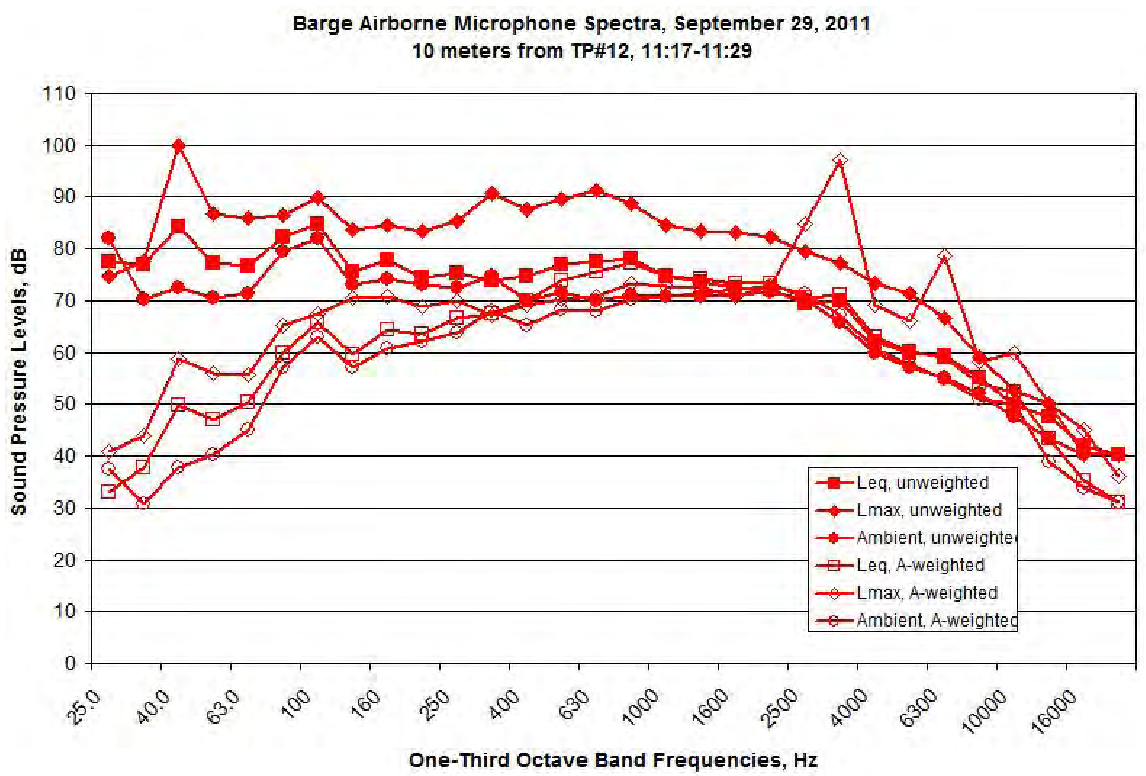

Figure C202. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#12, 11:17-11:29, on September 29, 2011

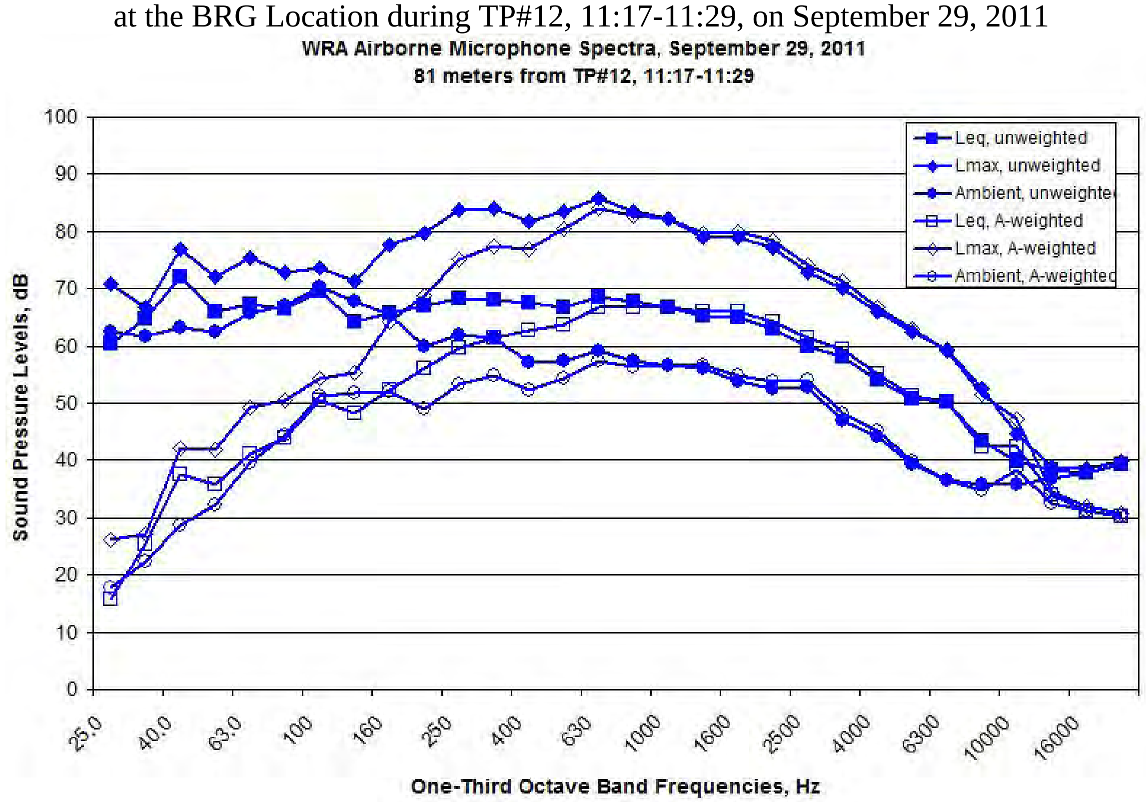

Figure C203. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#12, 11:17-11:29, on September 29, 2011

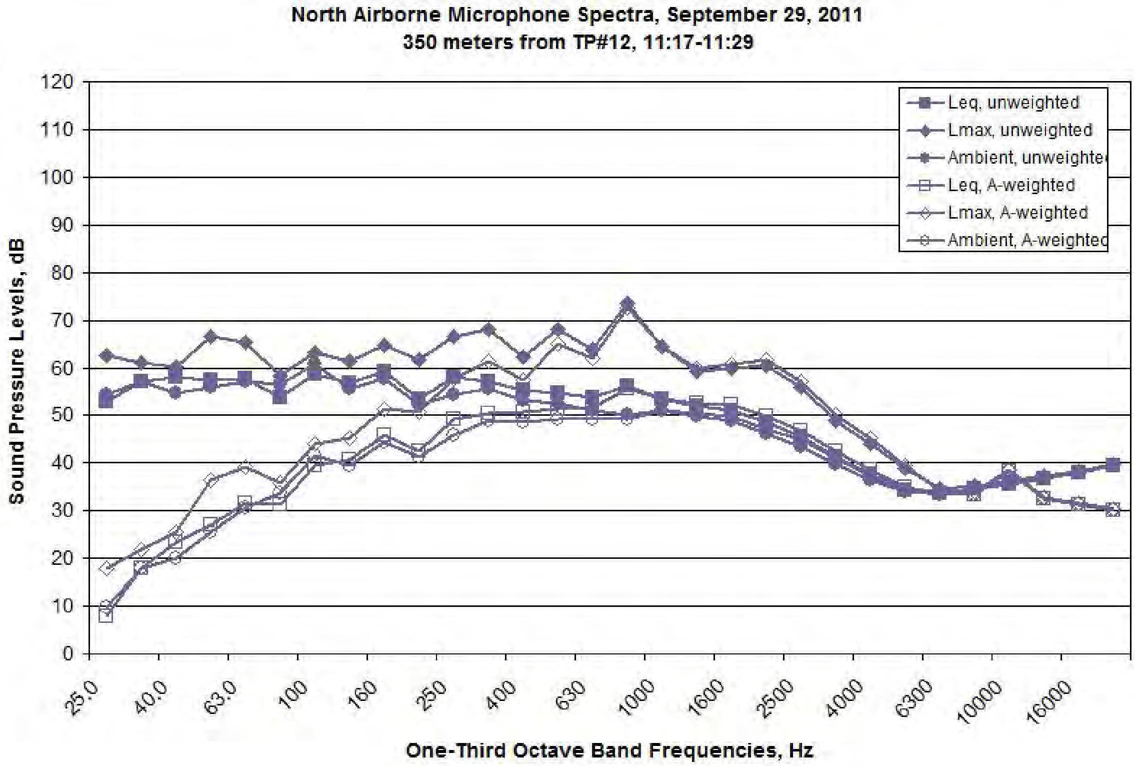

Figure C204. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#12, 11:17-11:29, on September 29, 2011

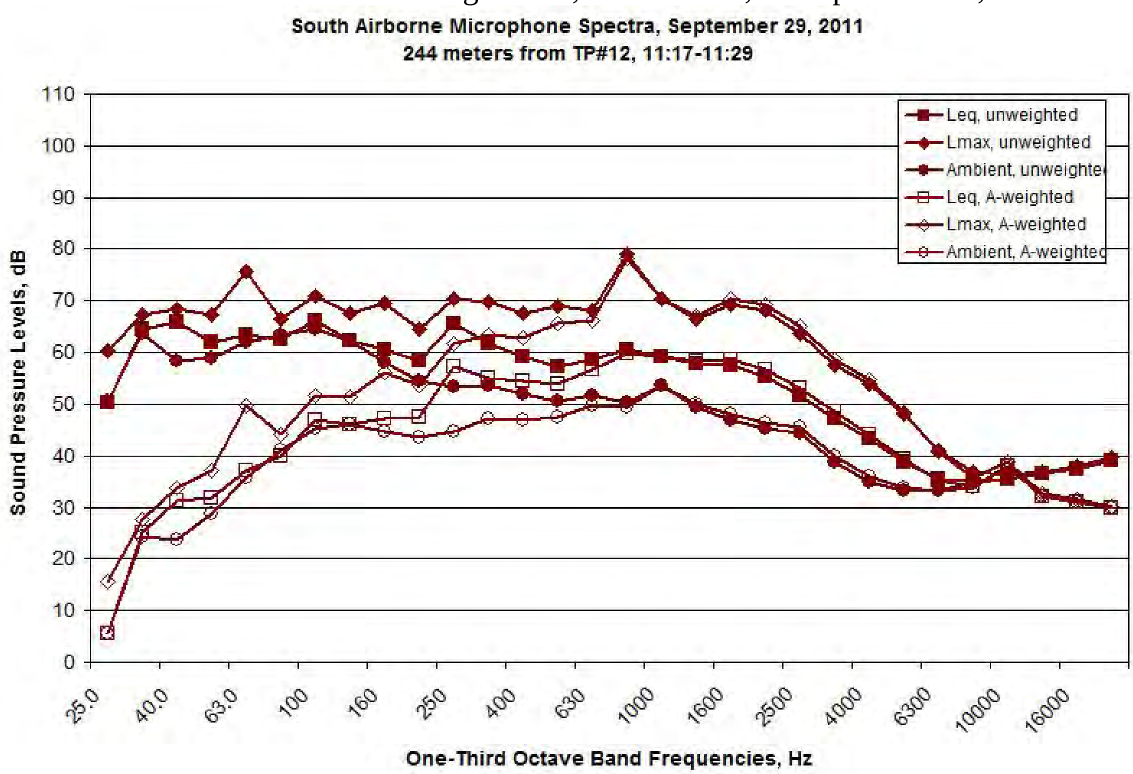

Figure C205. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#12, 11:17-11:29, on September 29, 2011

TP#9 RP#2

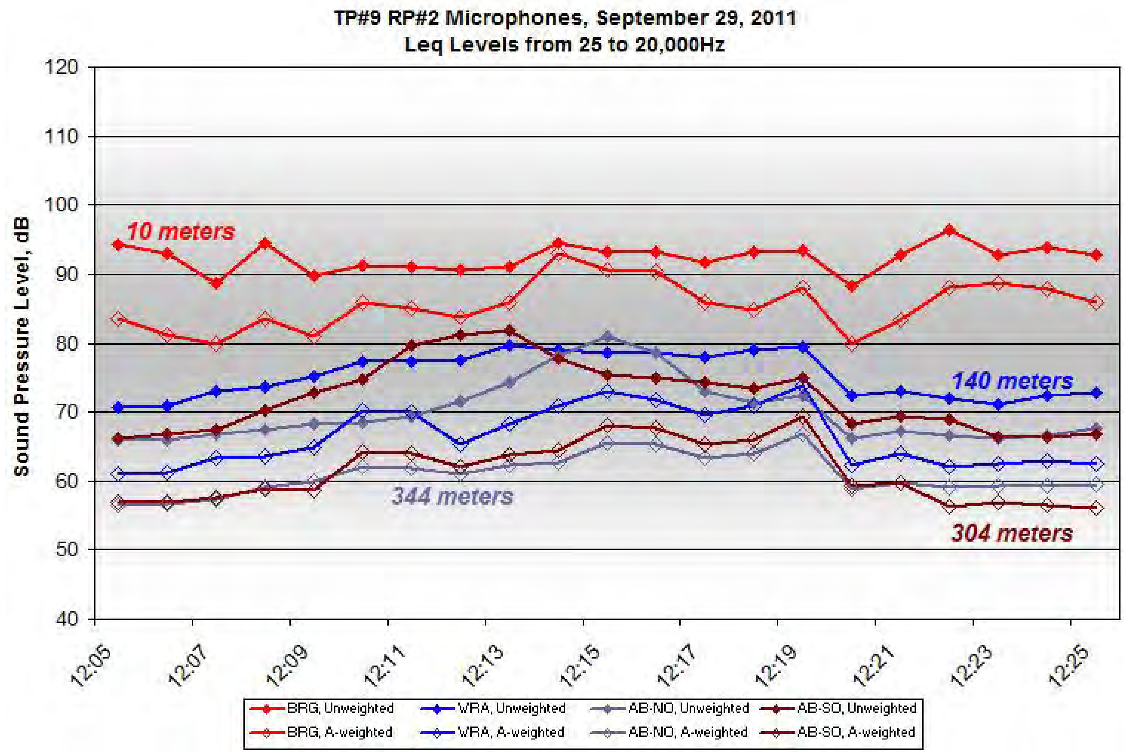

Figure C206. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#2, 12:12-12:18, on September 29, 2011

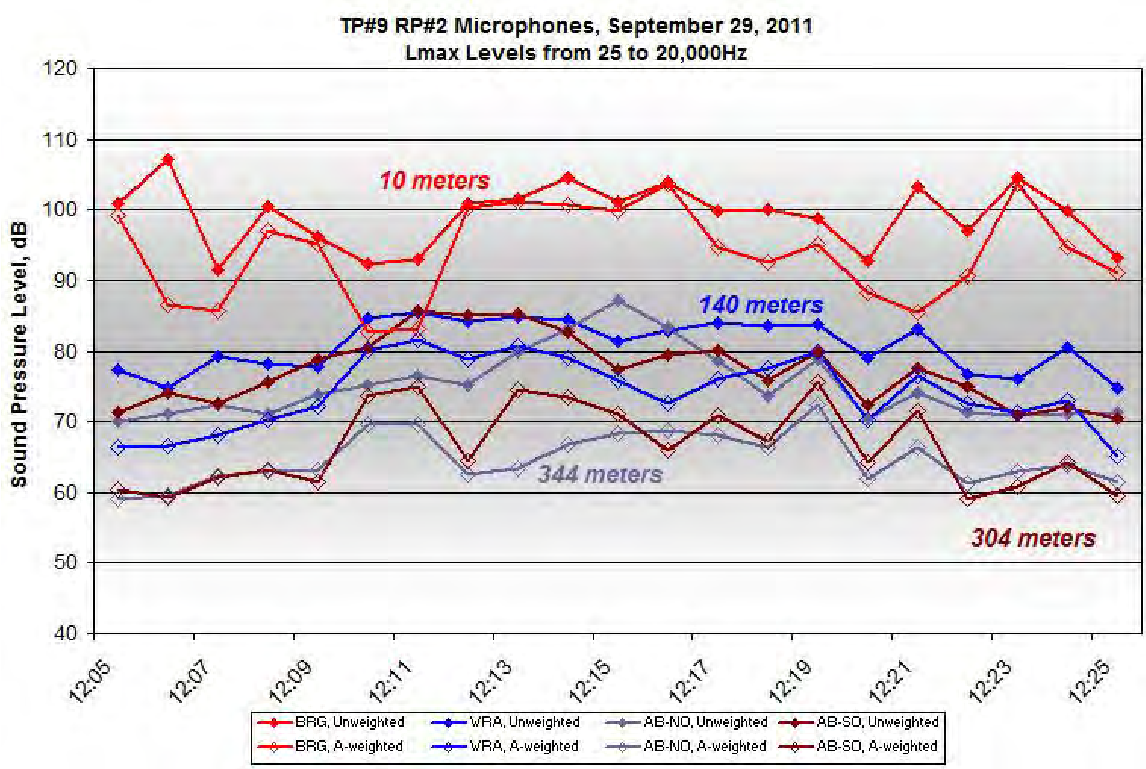

Figure C207. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#2, 12:12-12:18, on September 29, 2011

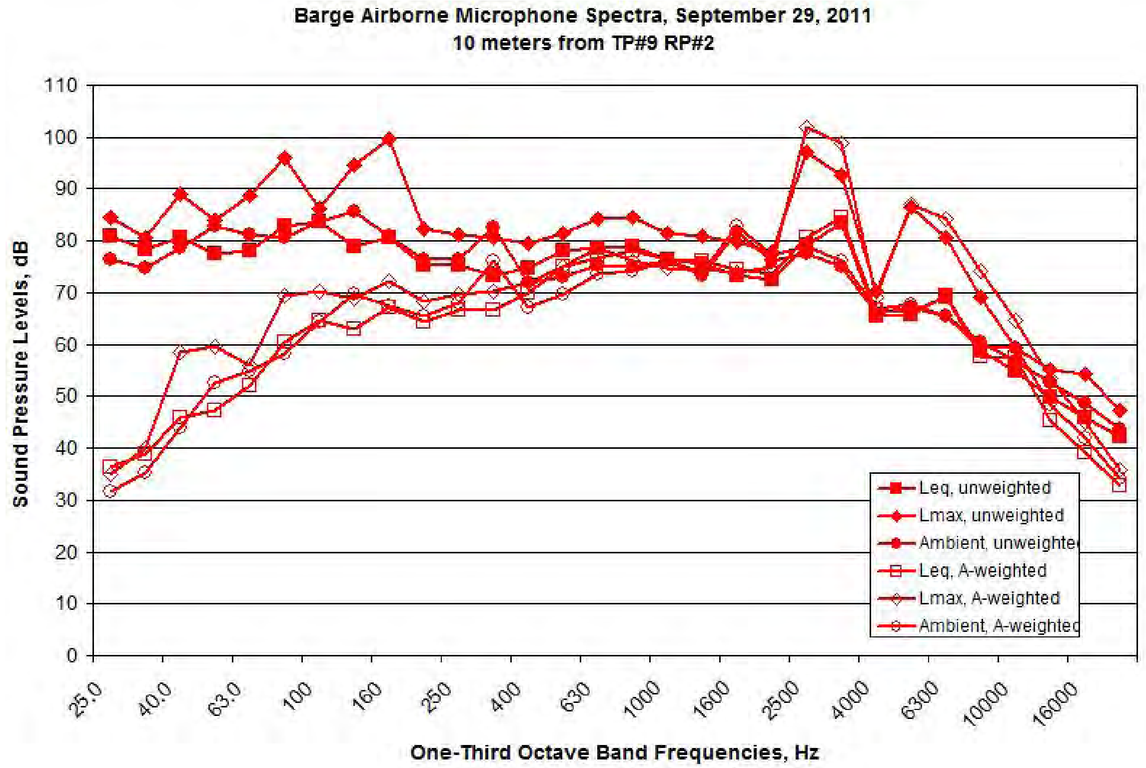

Figure C208. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#2, 12:12-12:18, on September 29, 2011

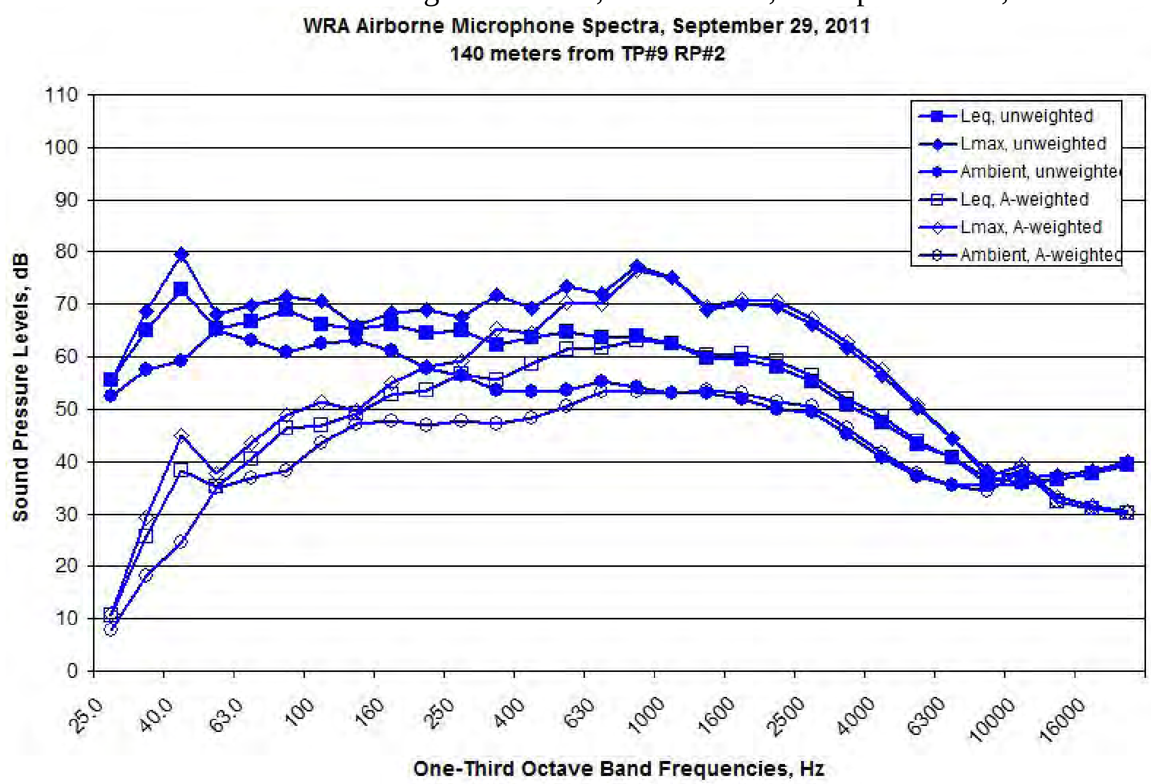

Figure C209. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#2, 12:12-12:18, on September 29, 2011

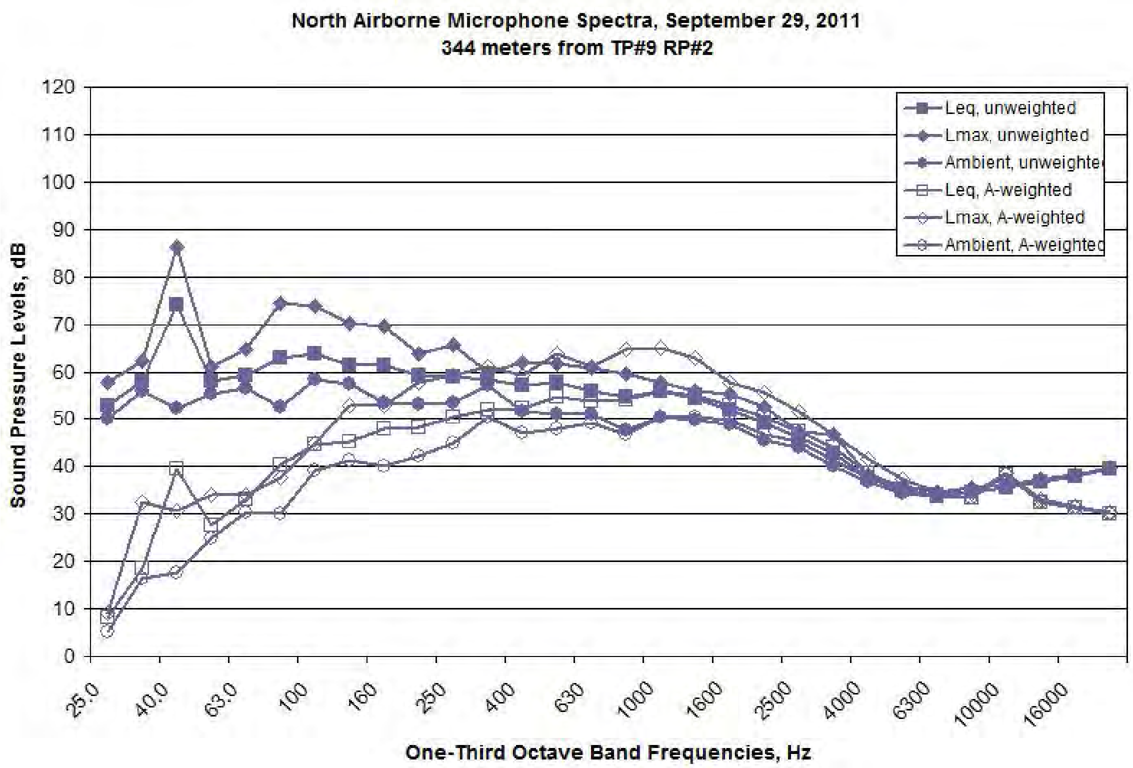

Figure C210. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#2, 12:12-12:18, on September 29, 2011

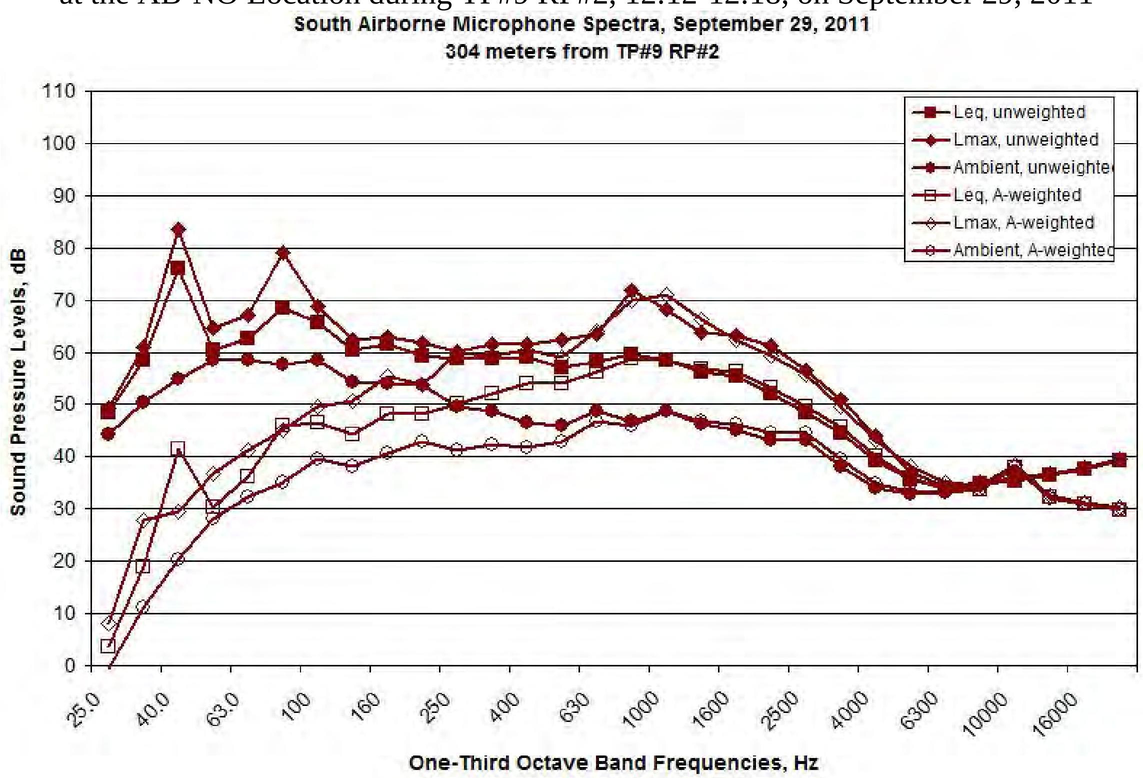

Figure C211. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#2, 12:12-12:18, on September 29, 2011

TP#11

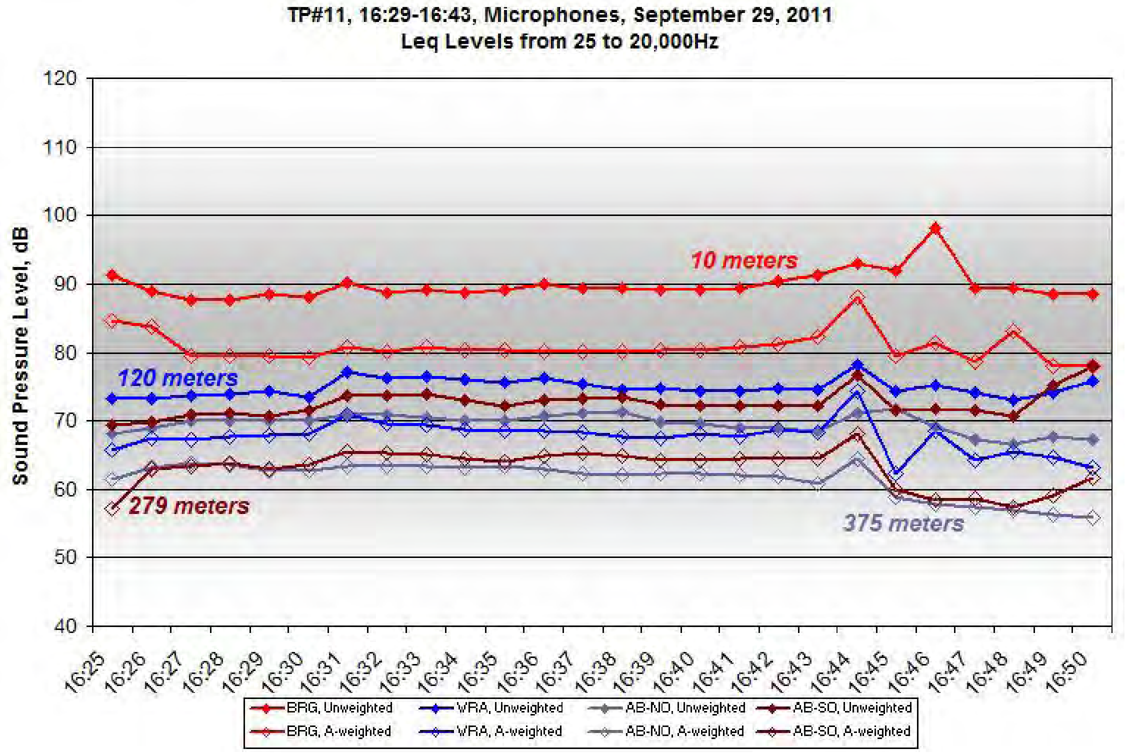

Figure C212. One-minute Unweighted and A-weighted Leq Level at TP#11, 16:29-16:43, on September 29, 2011

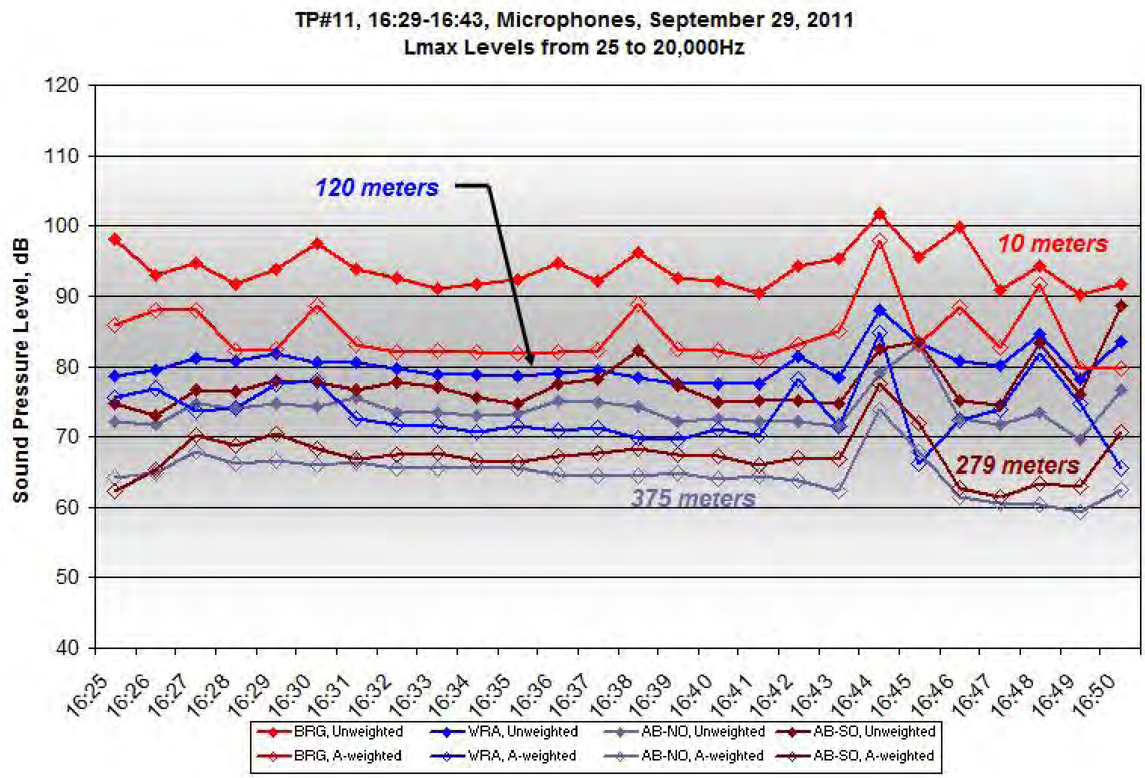

Figure C213. One-minute Unweighted and A-weighted Lmax Level at TP#11, 16:29-16:43, on September 29, 2011

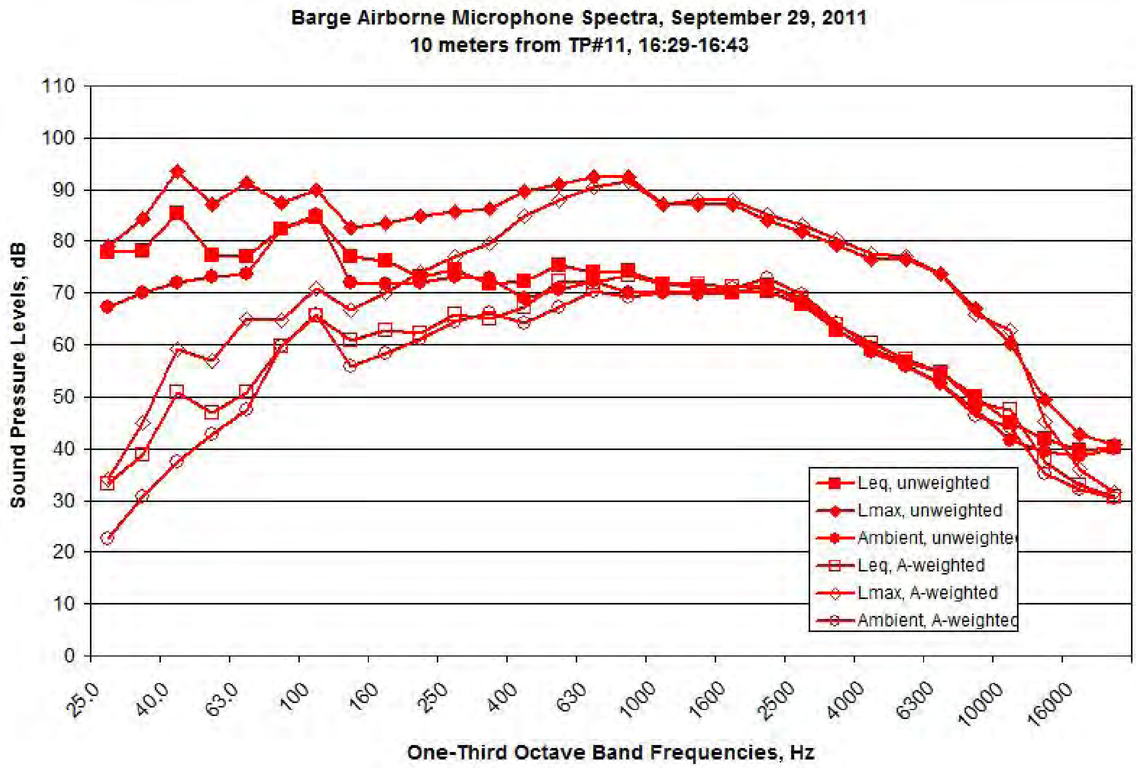

Figure C214. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#11, 16:29-16:43, on September 29, 2011

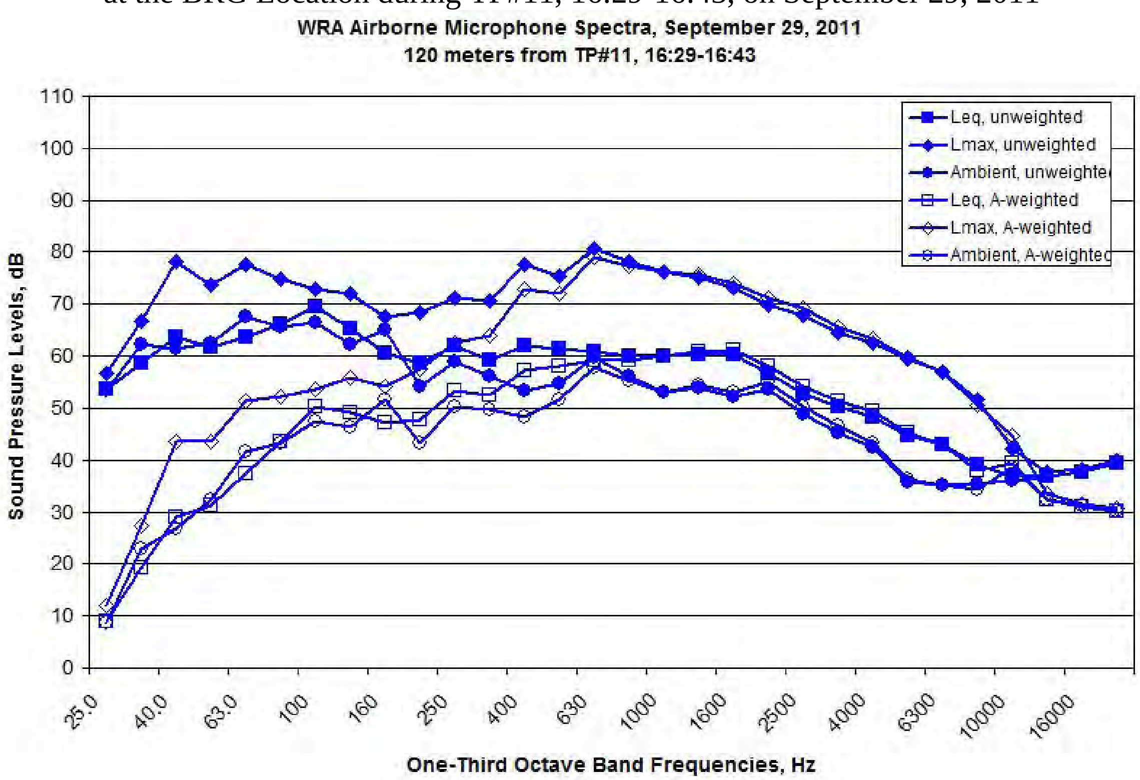

Figure C215. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#11, 16:29-16:43, on September 29, 2011

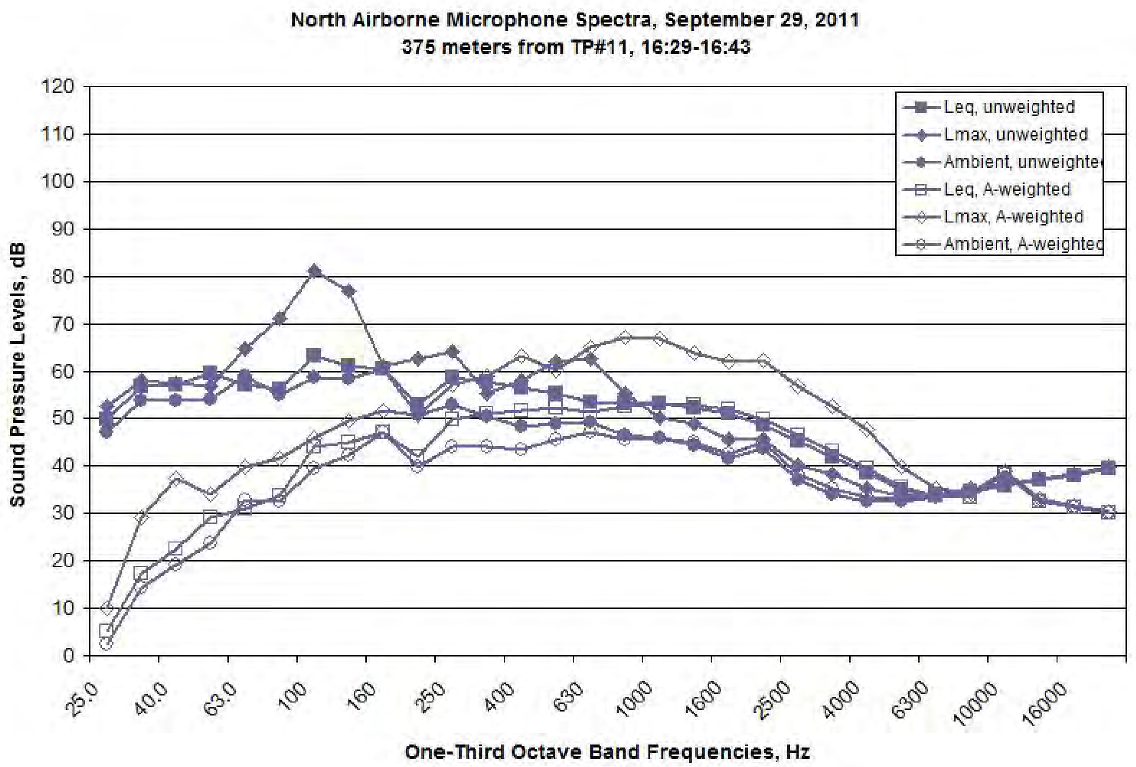

Figure C216. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#11, 16:29-16:43, on September 29, 2011

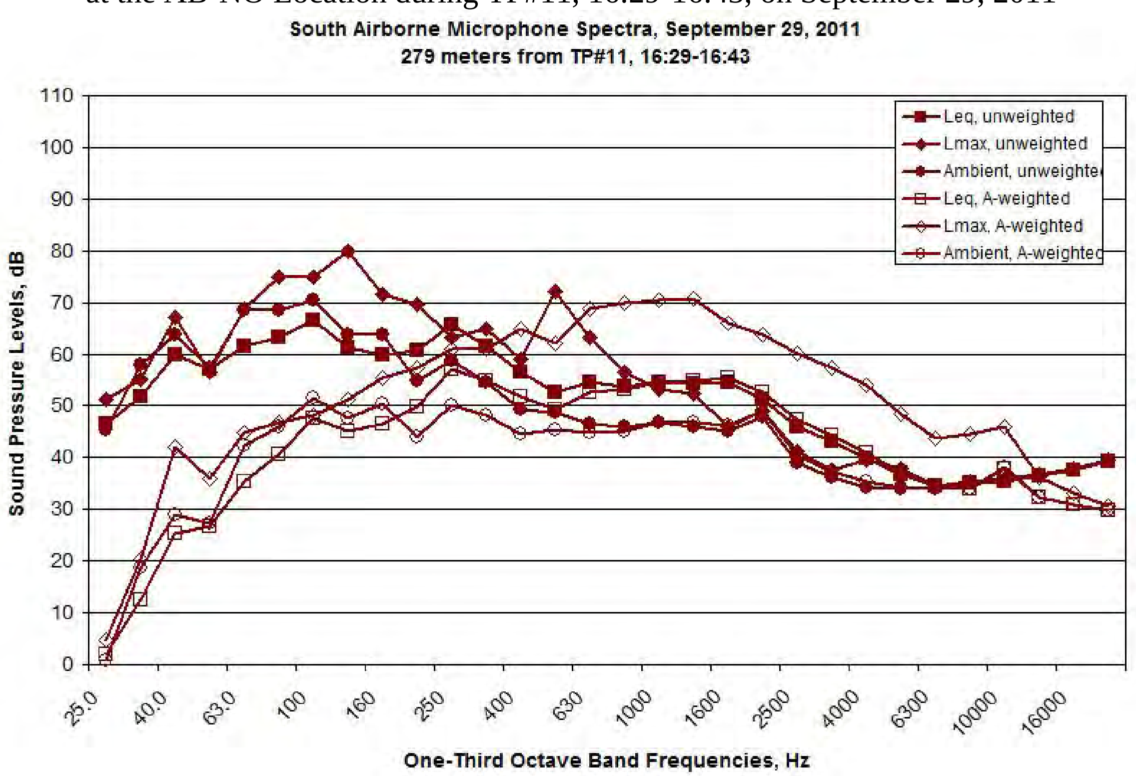

Figure C217. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#11, 16:29-16:43, on September 29, 2011

TP#9 MP#1

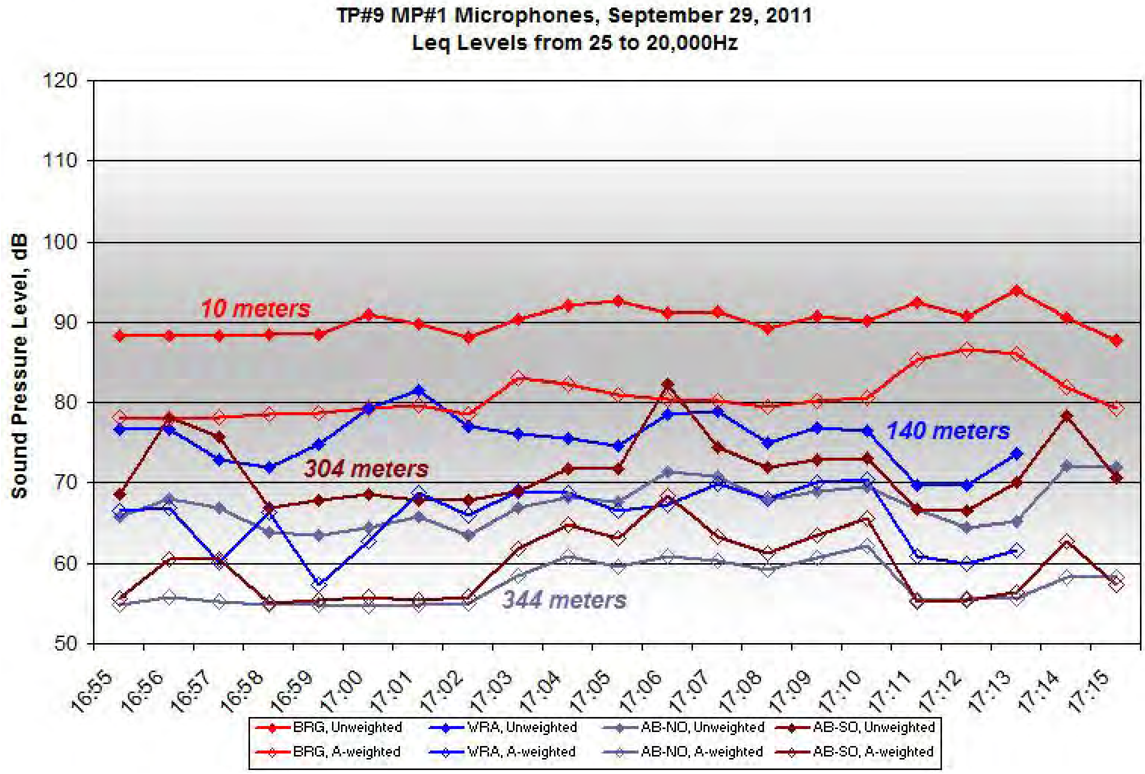

Figure C218. One-minute Unweighted and A-weighted Leq Level at TP#9 MP#1, 17:02-17:09, on September 29, 2011

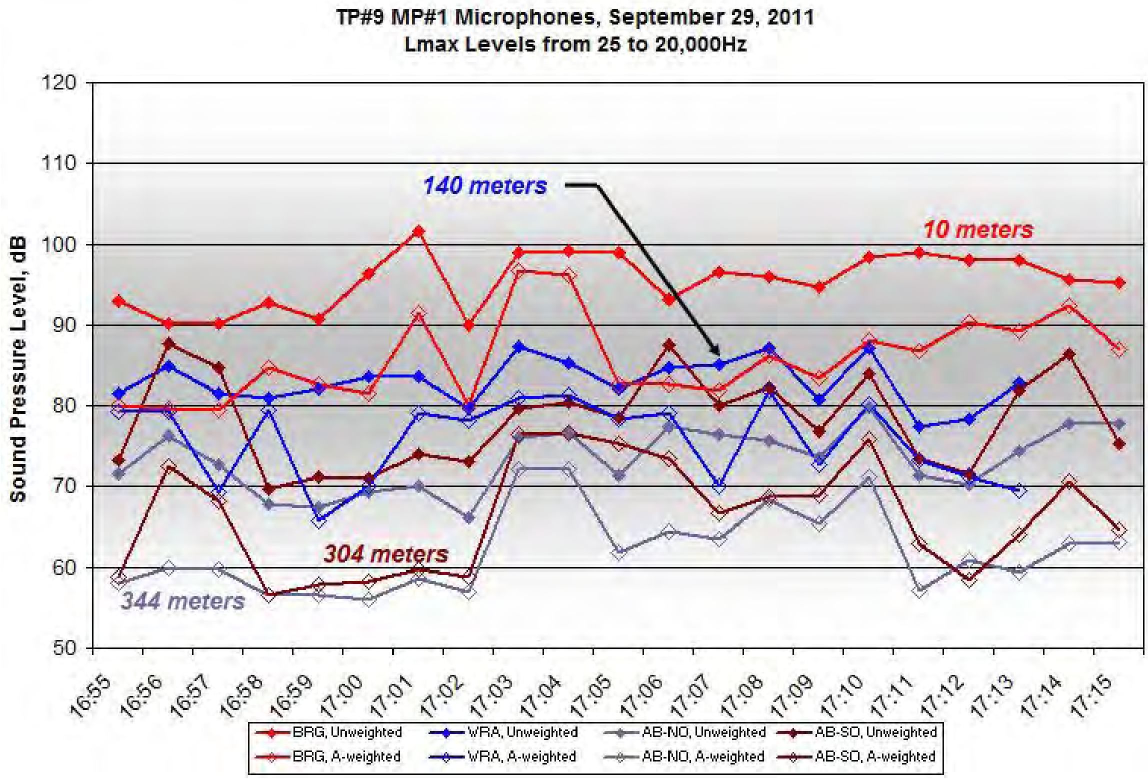

Figure C219. One-minute Unweighted and A-weighted Lmax Level at TP#9 MP#1, 17:02-17:09, on September 29, 2011

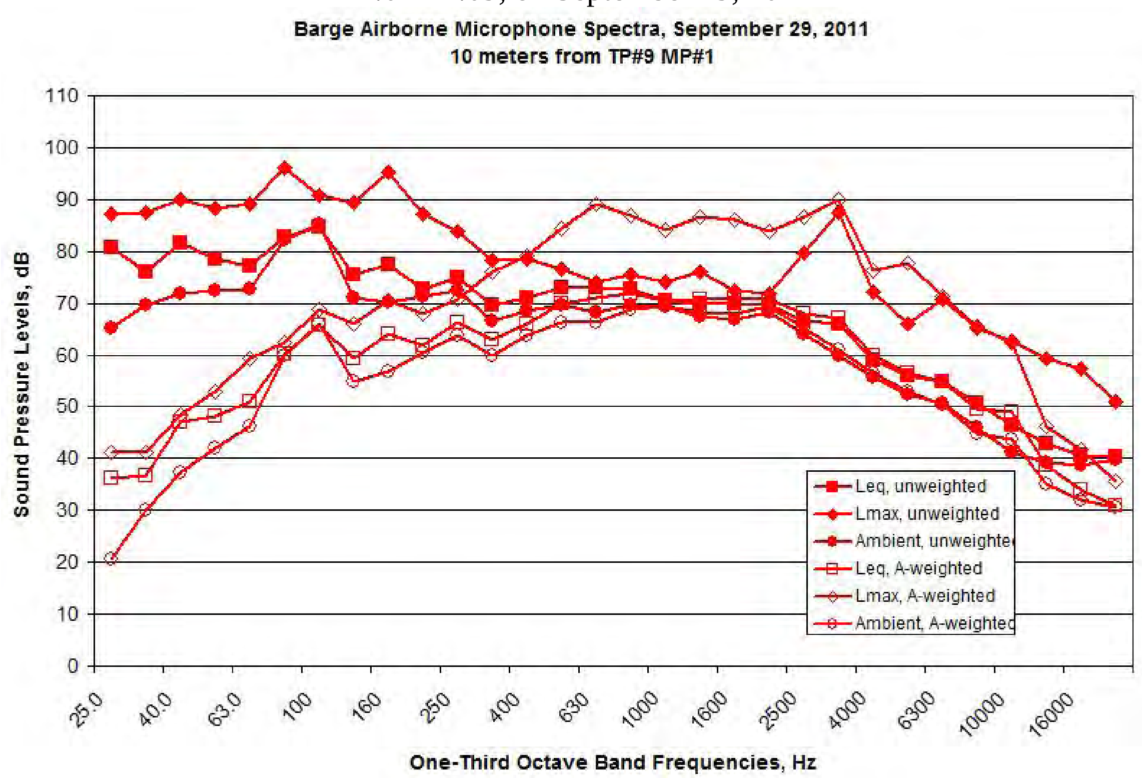

Figure C220. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 MP#1, 17:02-17:09, on September 29, 2011

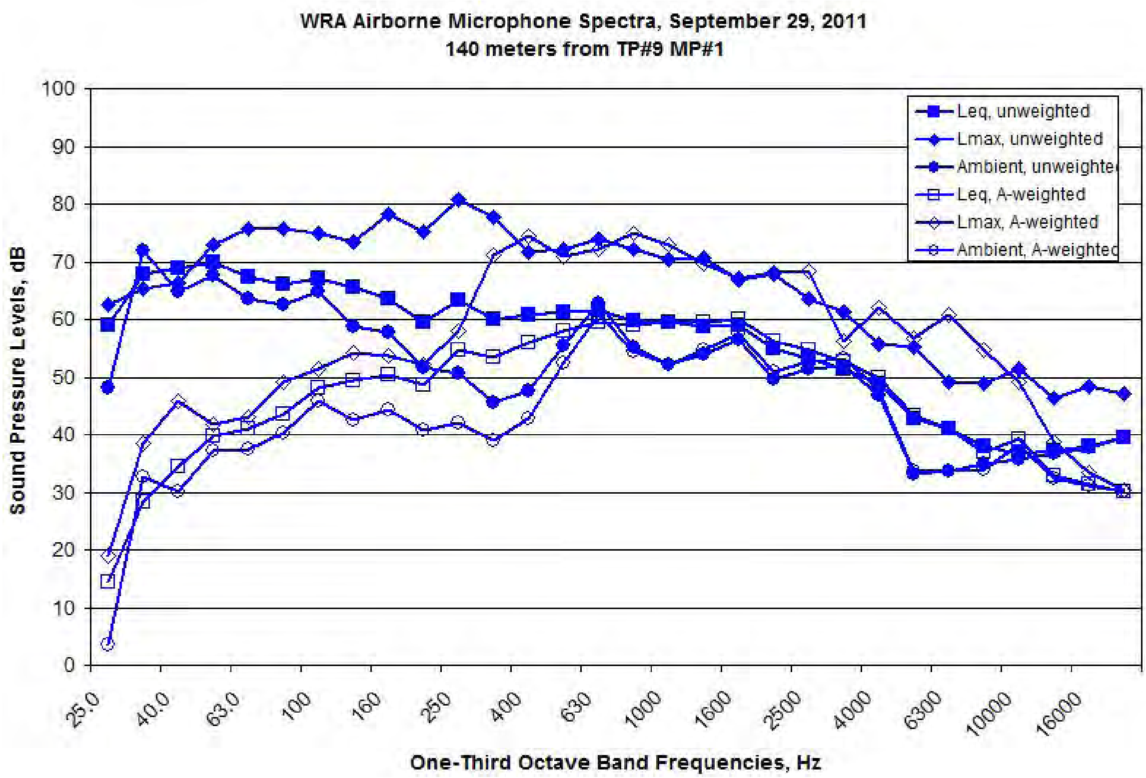

Figure C221. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 MP#1, 17:02-17:09, on September 29, 2011

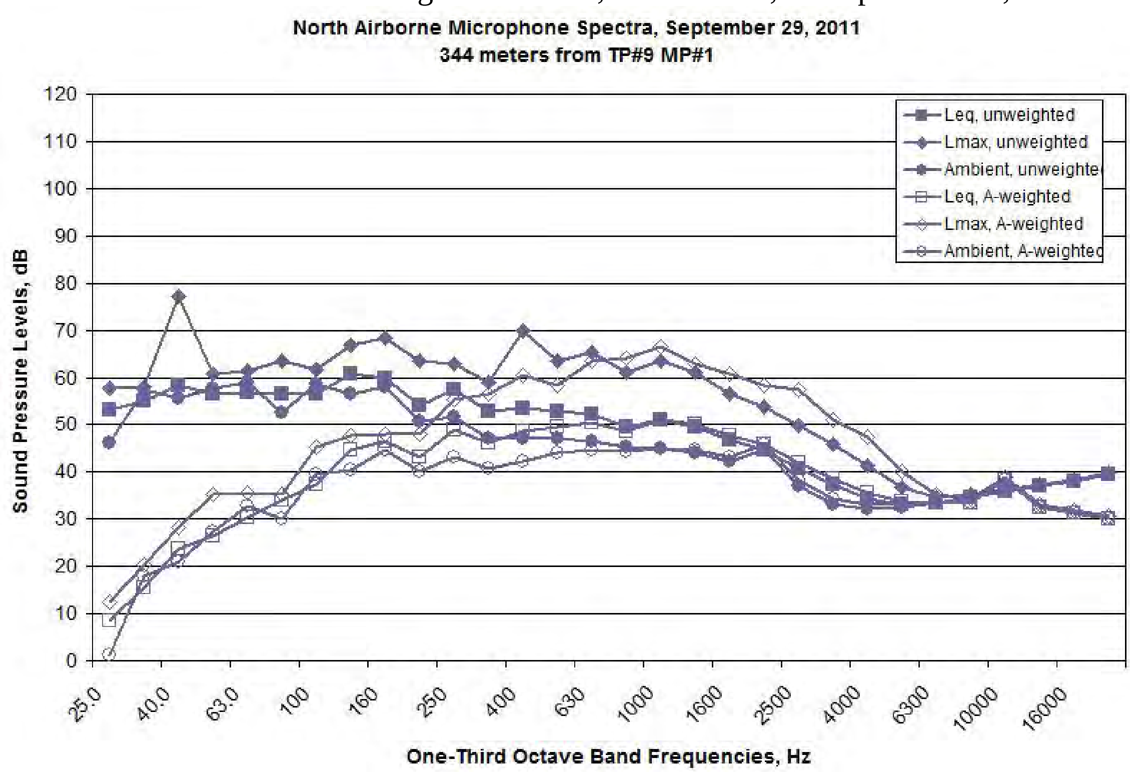

Figure C222. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 MP#1, 17:02-17:09, on September 29, 2011

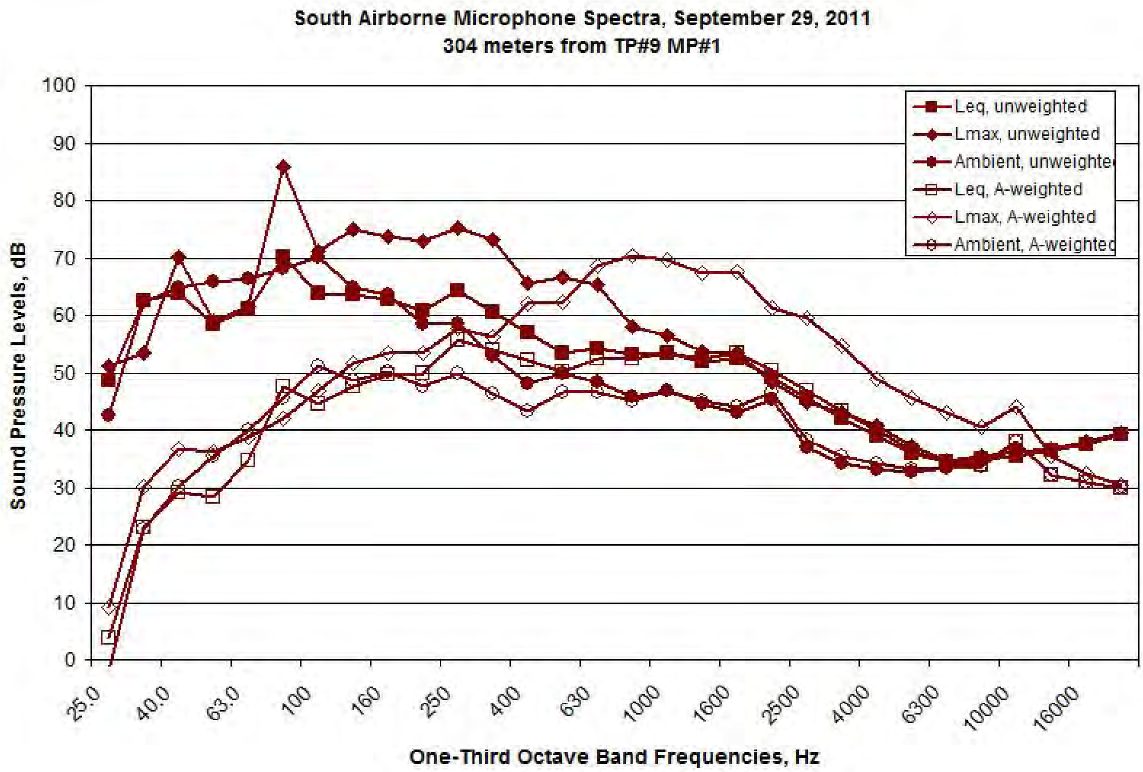

Figure C223. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 MP#1, 17:02-17:09, on September 29, 2011

9/30/2011 – TP#13

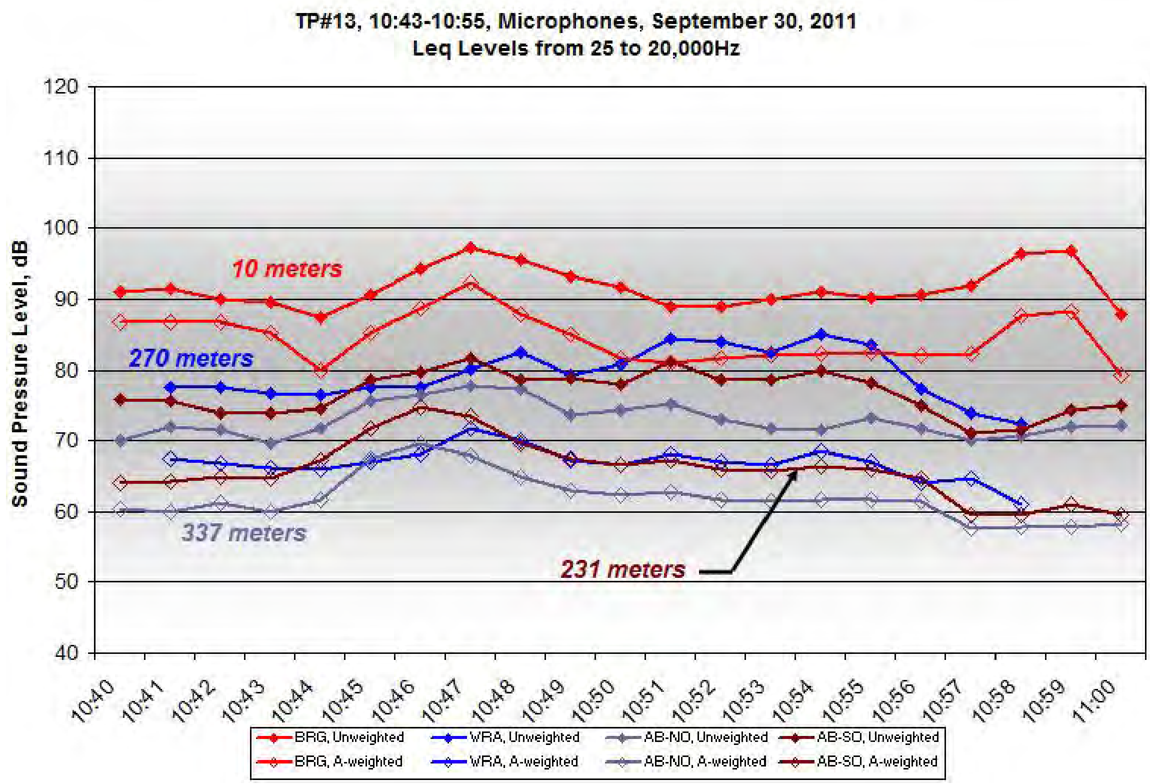

Figure C224. One-minute Unweighted and A-weighted Leq Level at TP#13, 10:43-10:55, on September 30, 2011

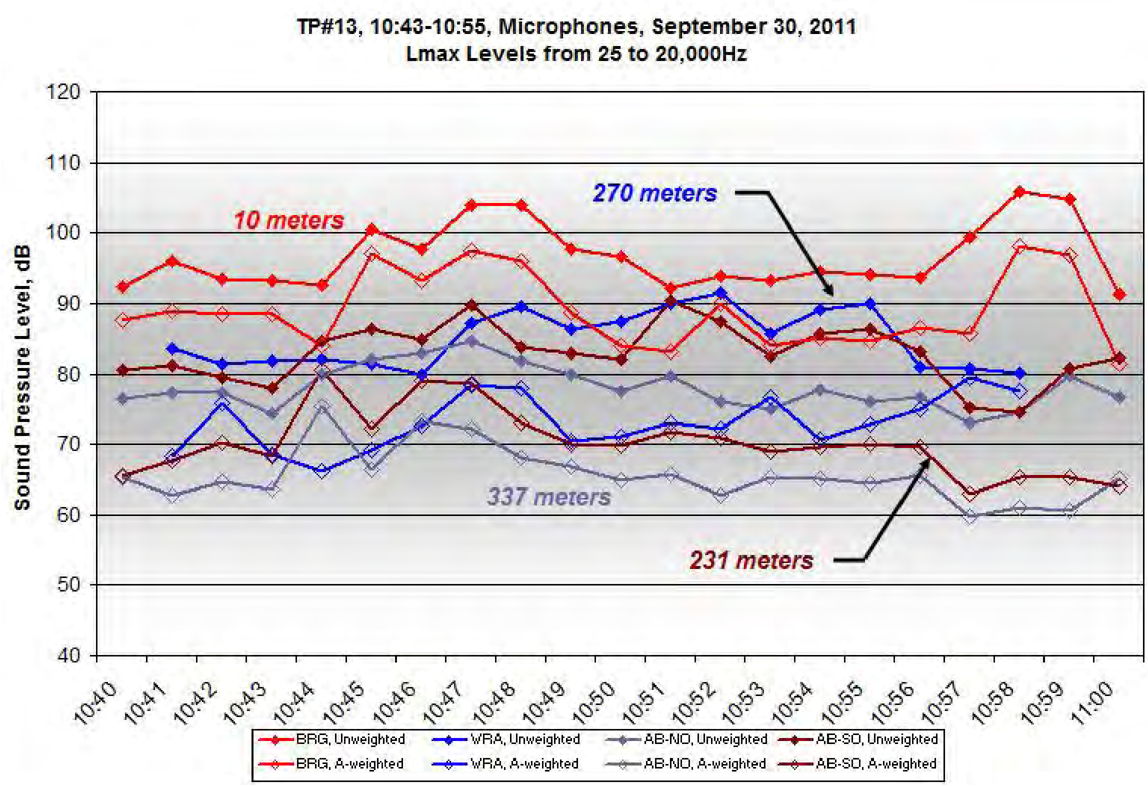

Figure C225. One-minute Unweighted and A-weighted Lmax Level at TP#13, 10:43-10:55, on September 30, 2011

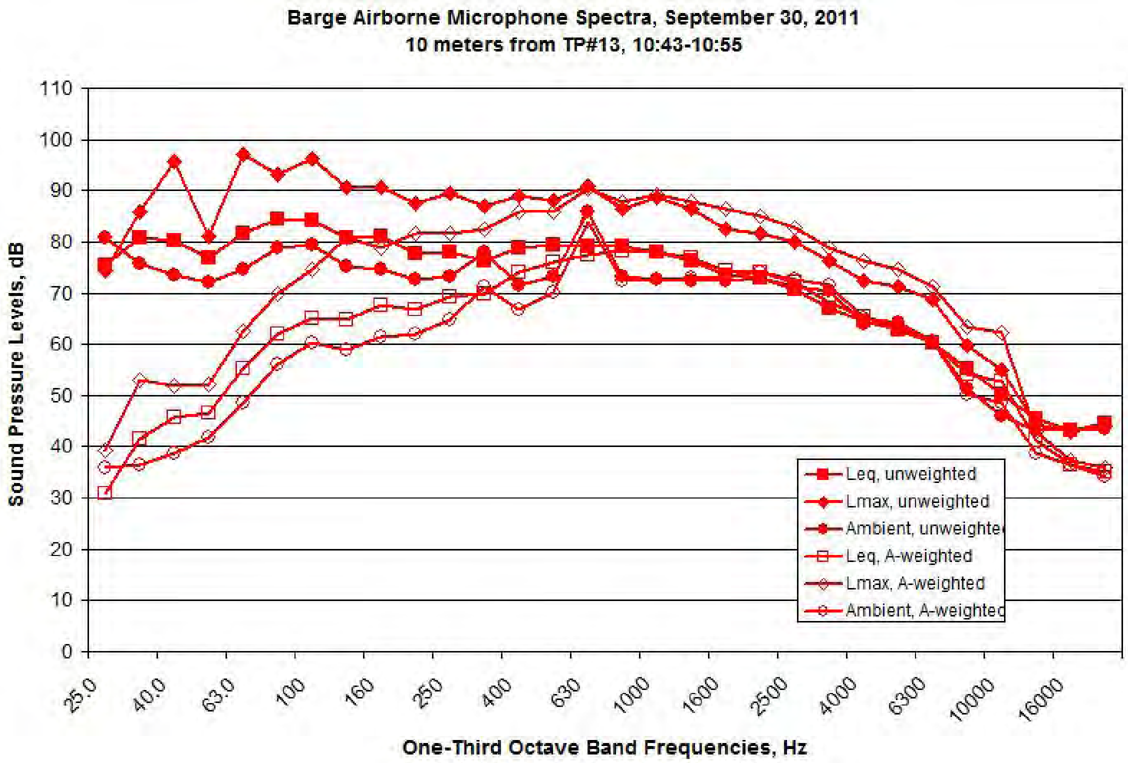

Figure C226. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#13, 10:43-10:55, on September 30, 2011

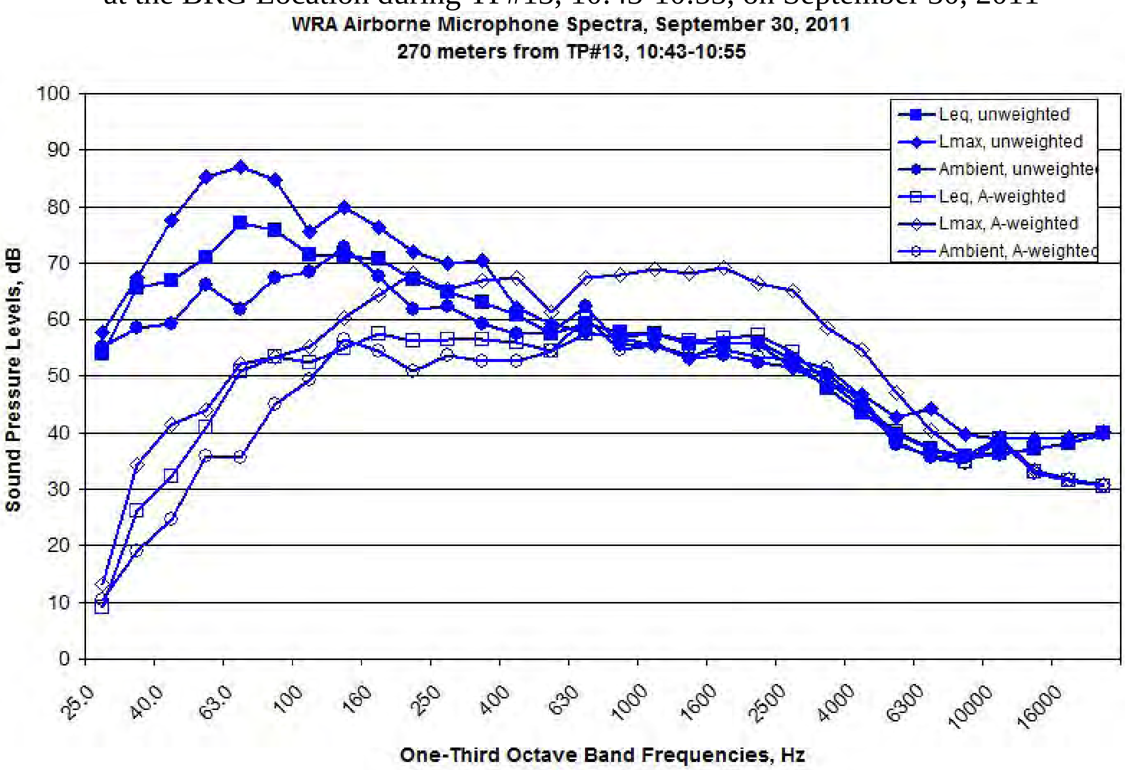

Figure C227. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#13, 10:43-10:55, on September 30, 2011

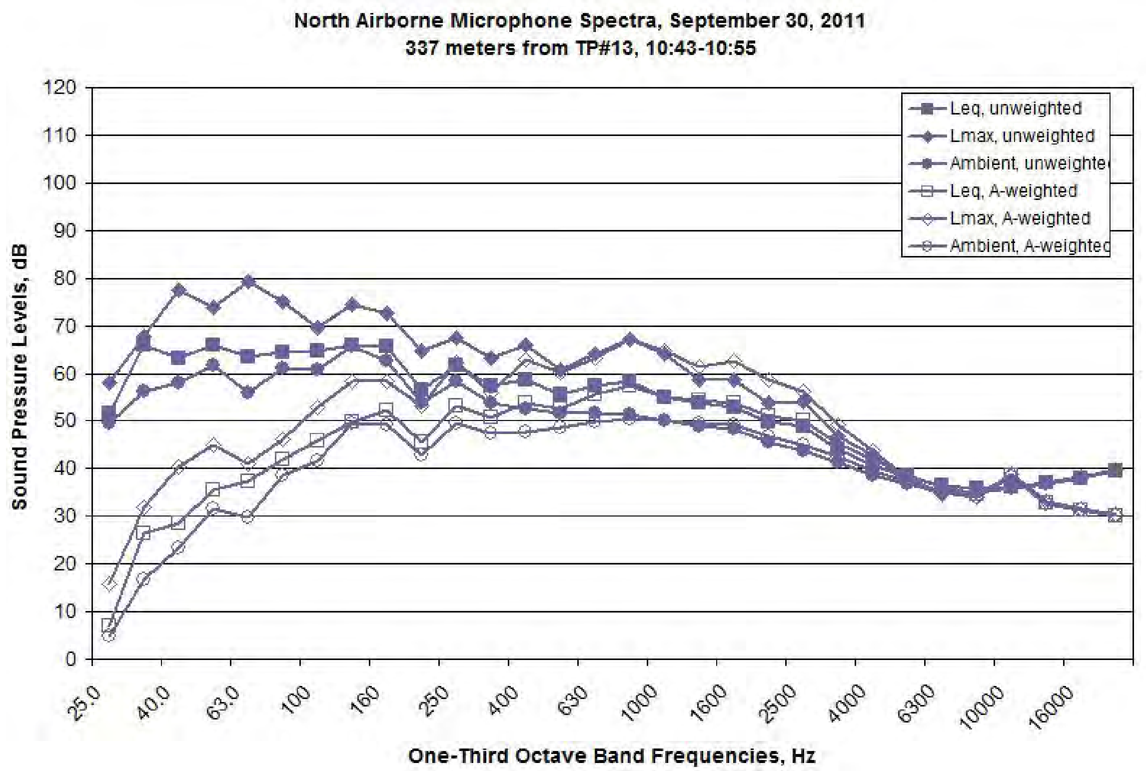

Figure C228. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#13, 10:43-10:55, on September 30, 2011

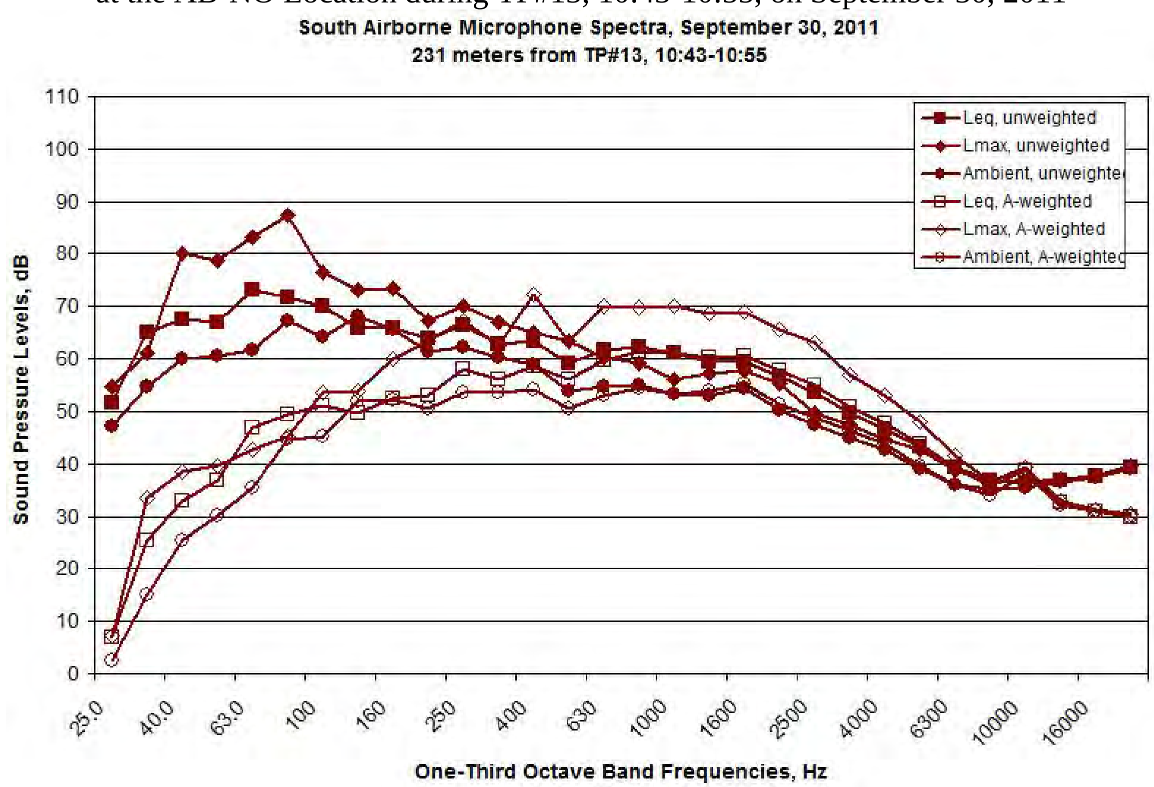

Figure C229. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#13, 10:43-10:55, on September 30, 2011

TP#9 MP#2

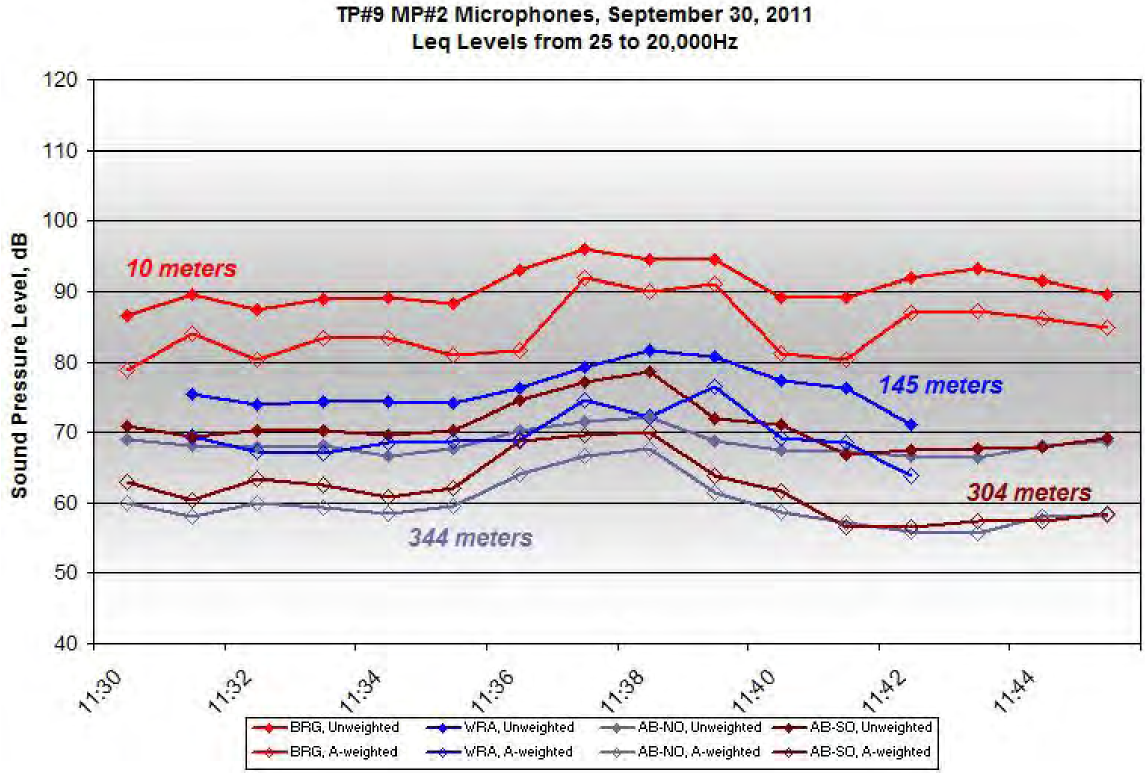

Figure C230. One-minute Unweighted and A-weighted Leq Level at TP#9 MP#2, 11:33-11:39, on September 30, 2011

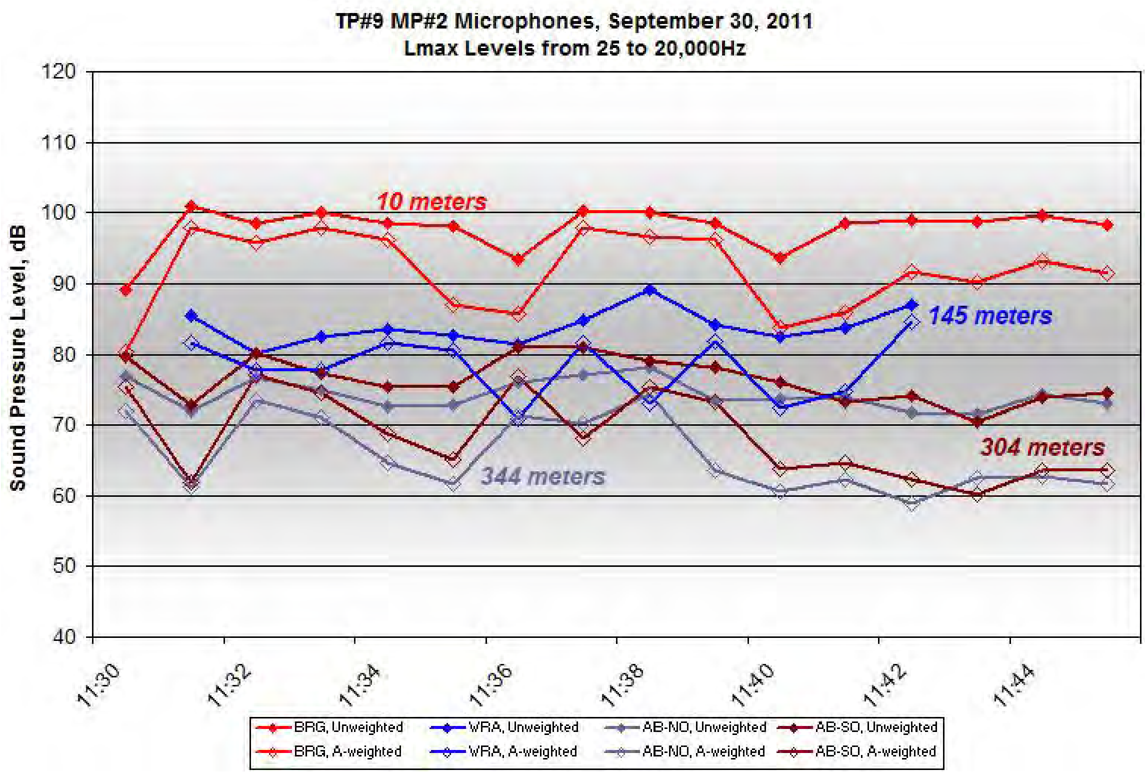

Figure C231. One-minute Unweighted and A-weighted Lmax Level at TP#9 MP#2, 11:33-11:39, on September 30, 2011

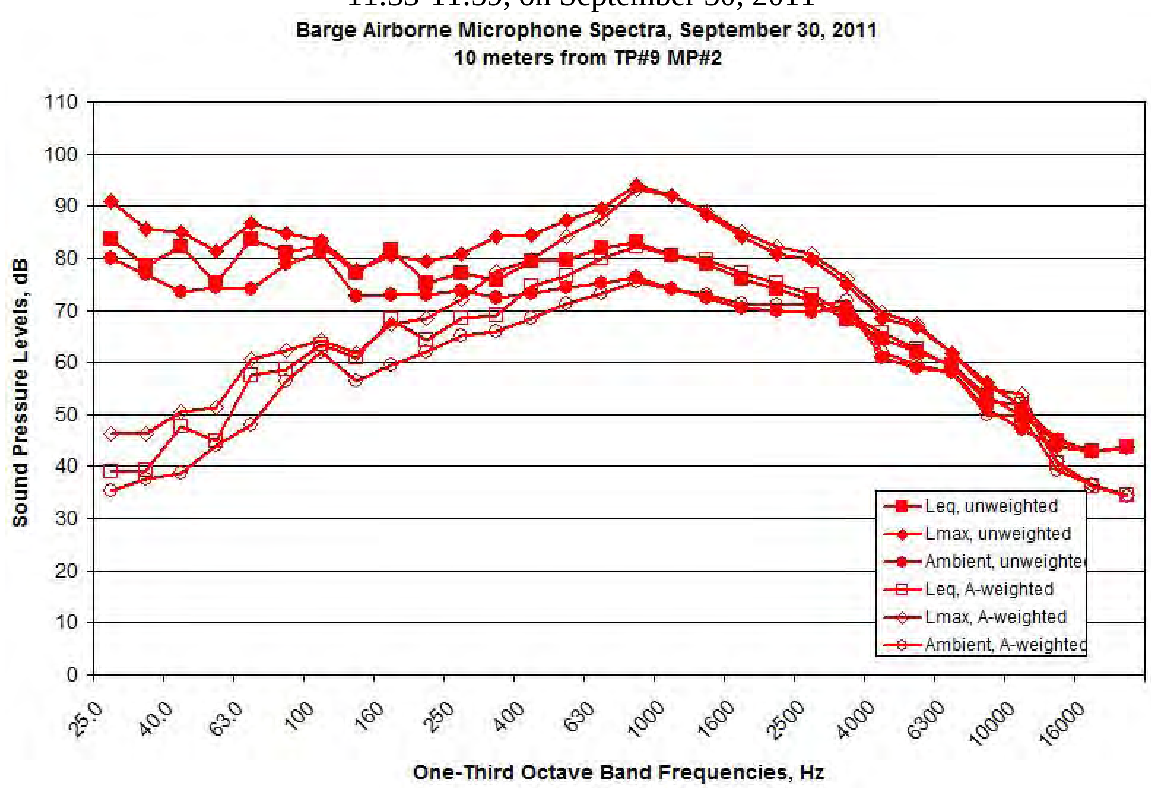

Figure C232. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 MP#2, 11:33-11:39, on September 30, 2011

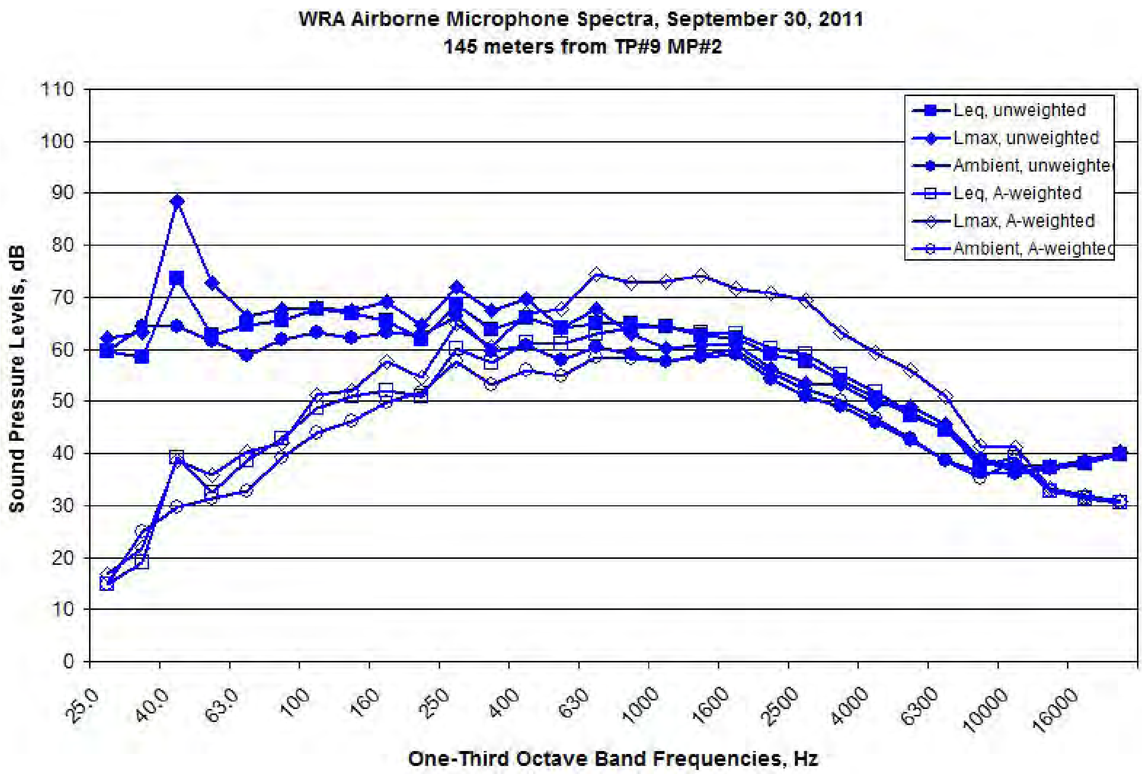

Figure C233. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 MP#2, 11:33-11:39, on September 30, 2011

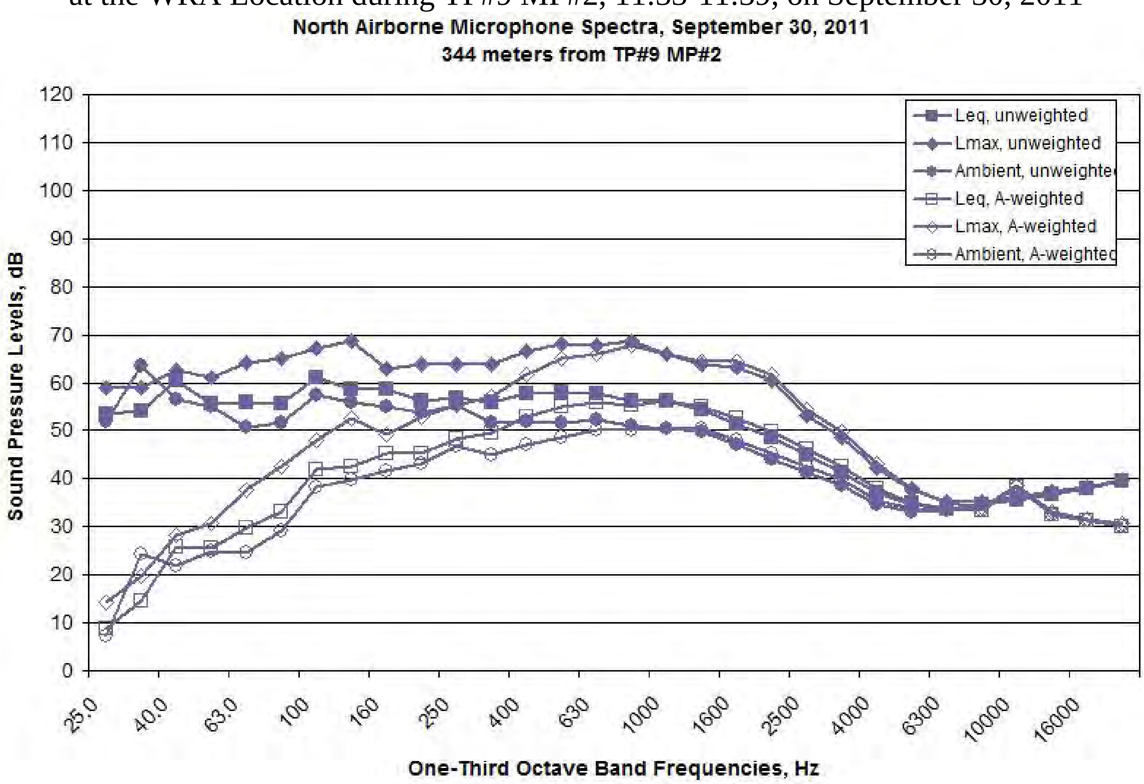

Figure C234. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 MP#2, 11:33-11:39, on September 30, 2011

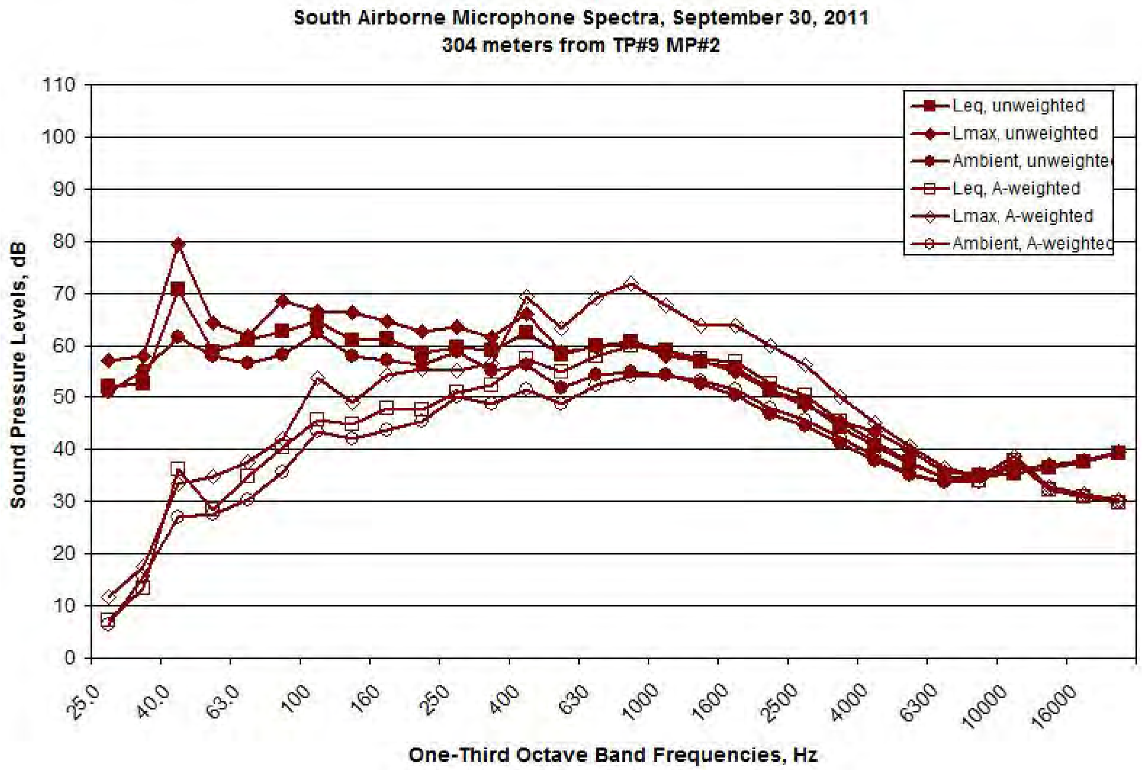

Figure C235. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 MP#2, 11:33-11:39, on September 30, 2011

TP#5

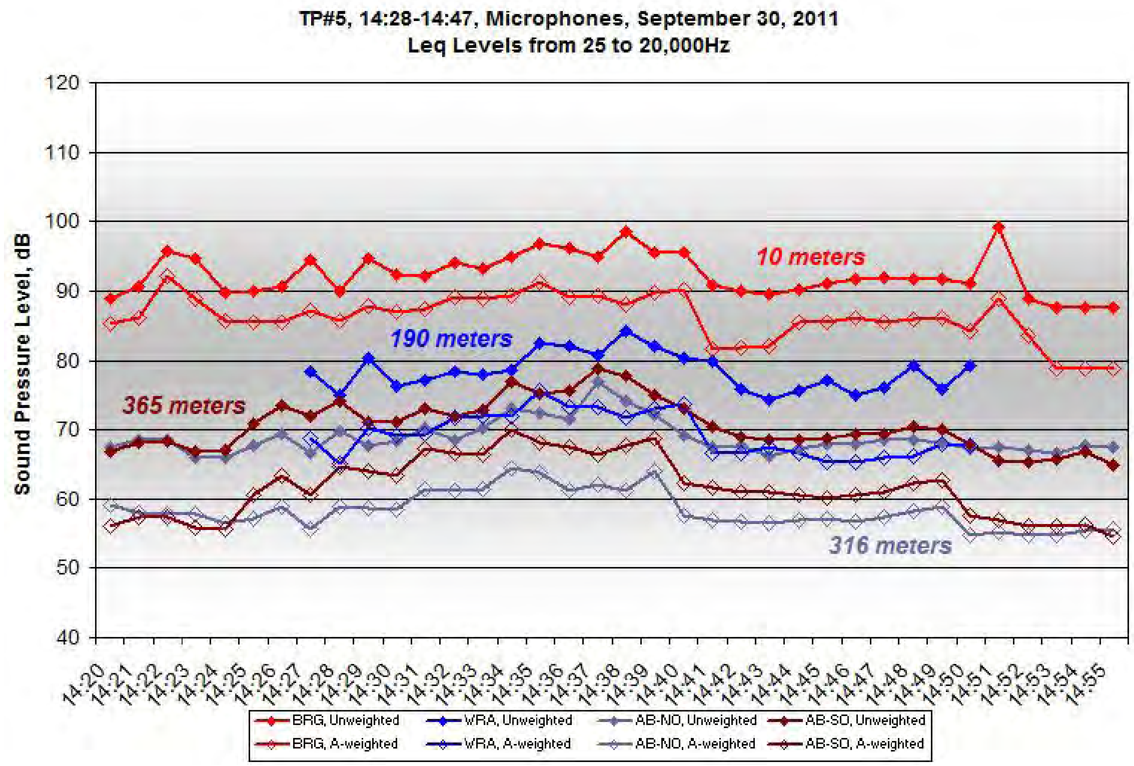

Figure C236. One-minute Unweighted and A-weighted Leq Level at TP#5, 14:28-14:47, on September 30, 2011

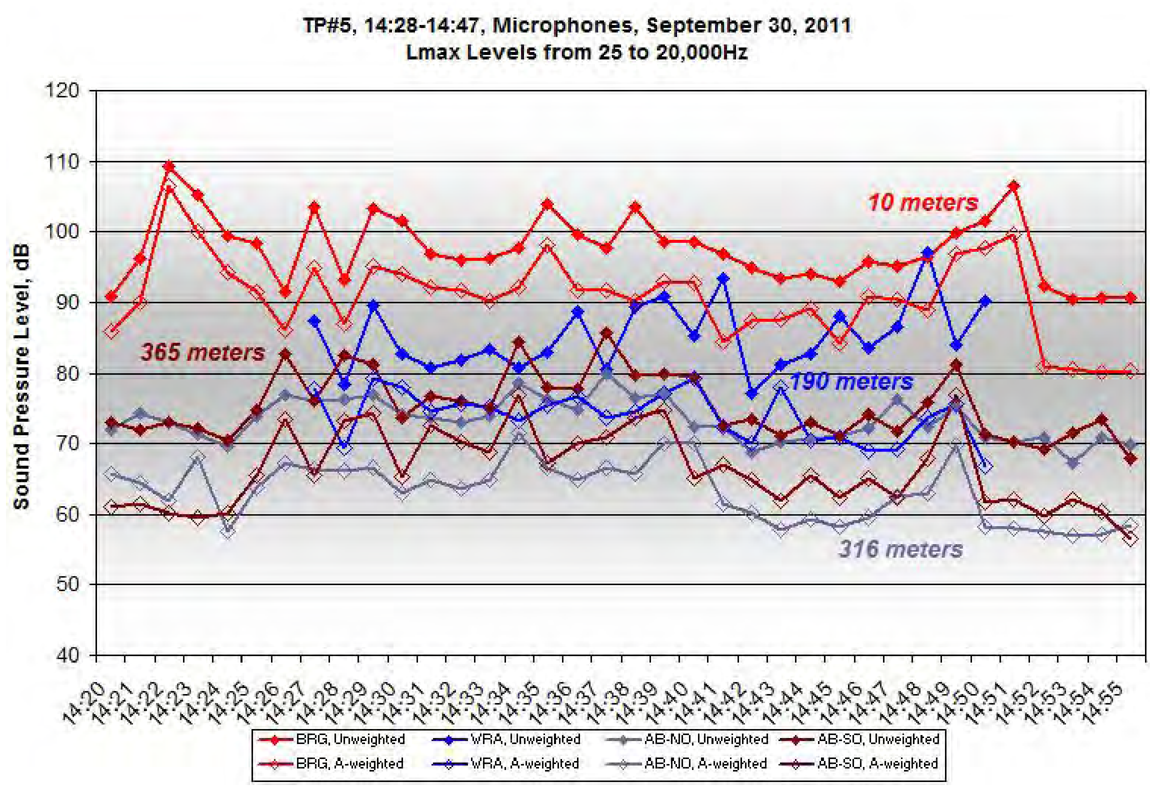

Figure C237. One-minute Unweighted and A-weighted Lmax Level at TP#5, 14:28-14:47, on September 30, 2011

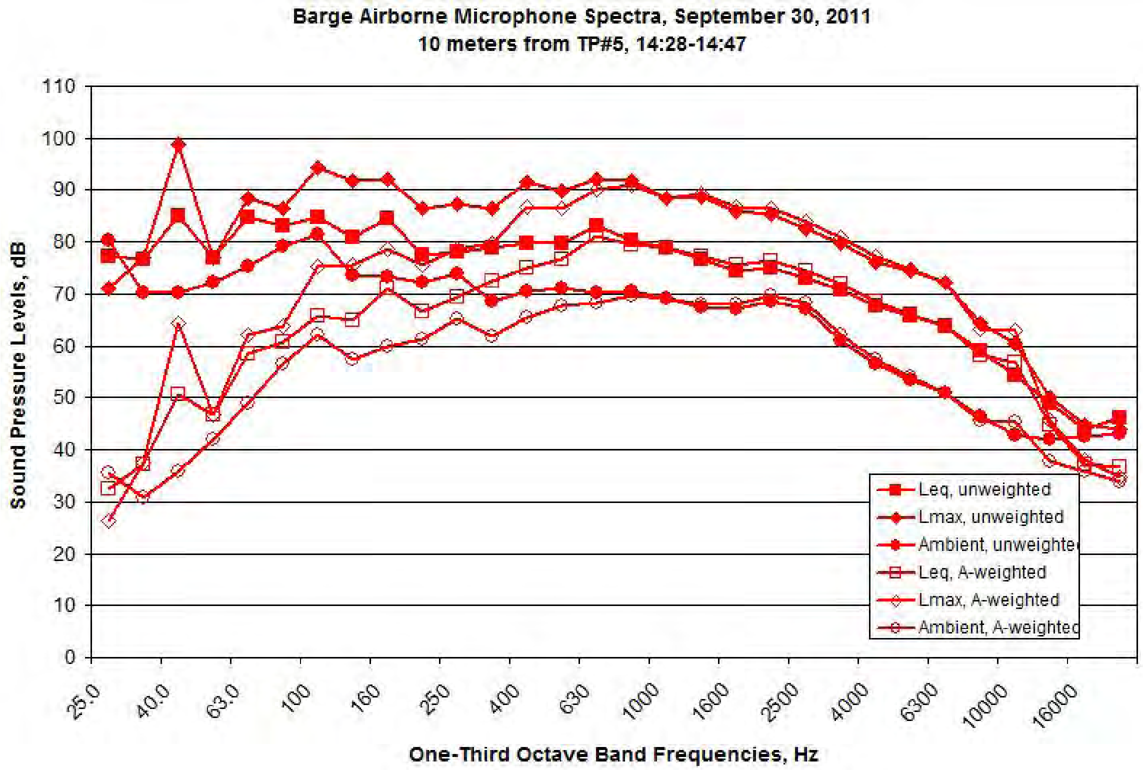

Figure C238. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#5, 14:28-14:47, on September 30, 2011

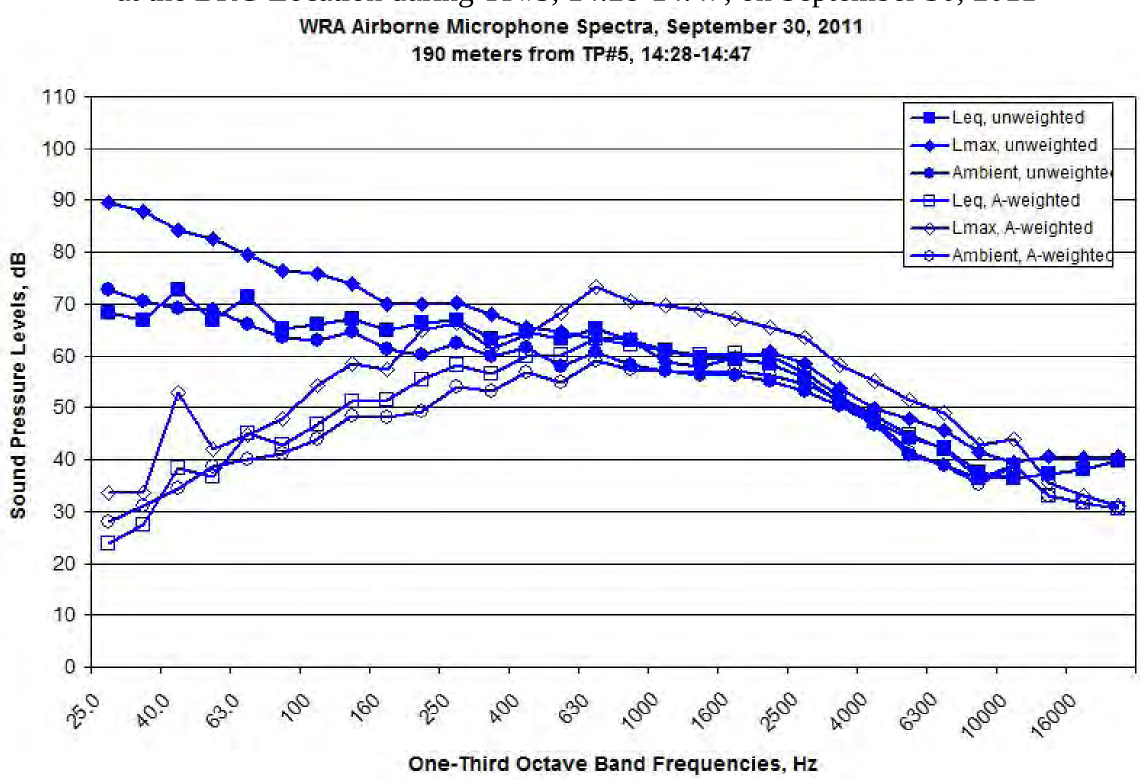

Figure C239. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#5, 14:28-14:47, on September 30, 2011

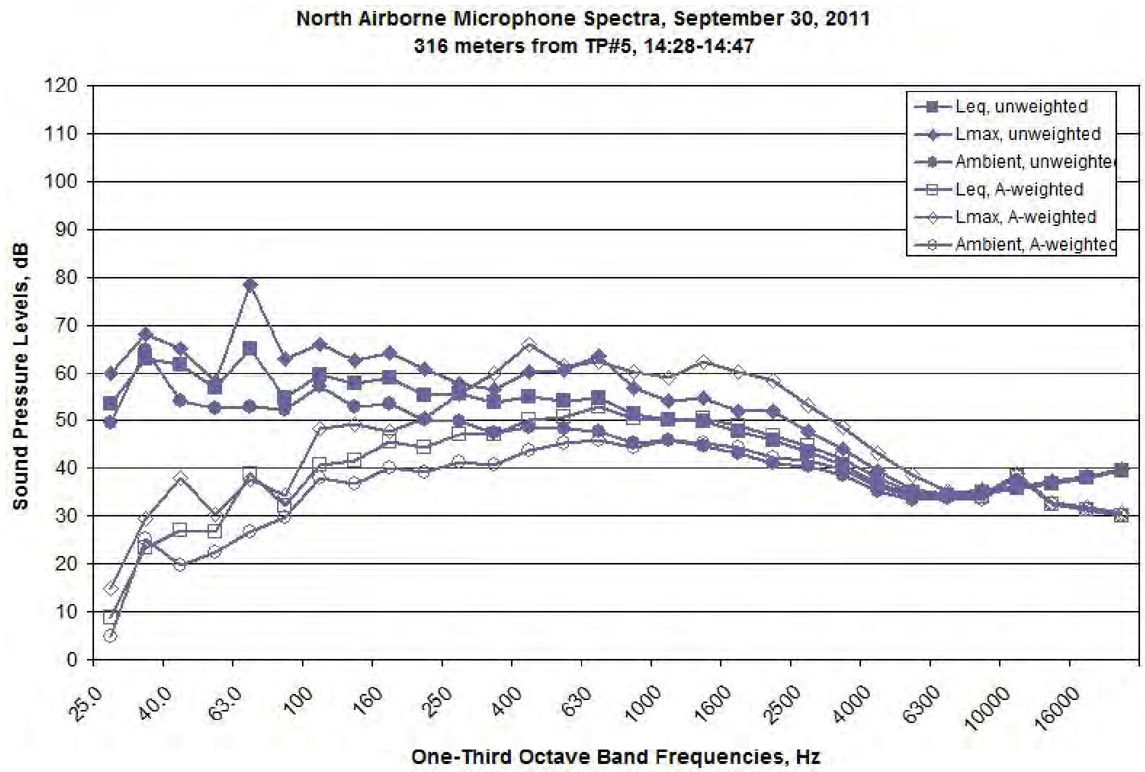

Figure C240. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#5, 14:28-14:47, on September 30, 2011

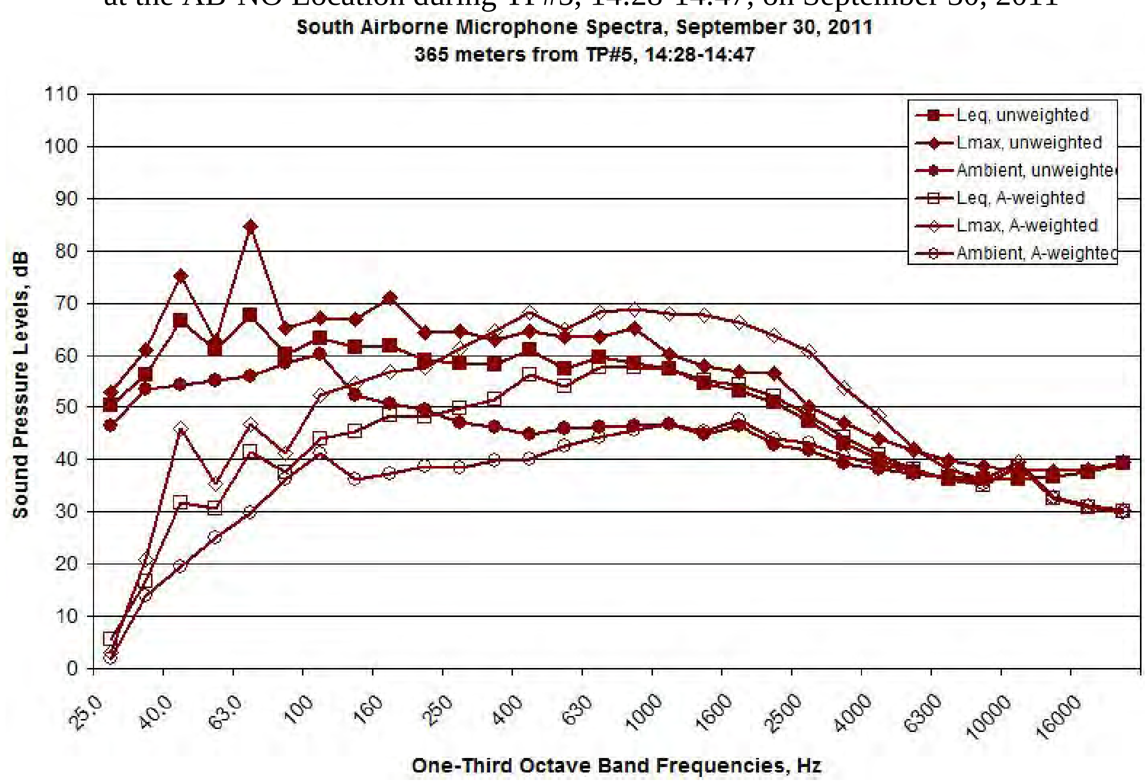

Figure C241. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#5, 14:28-14:47, on September 30, 2011

TP#9 MP#3

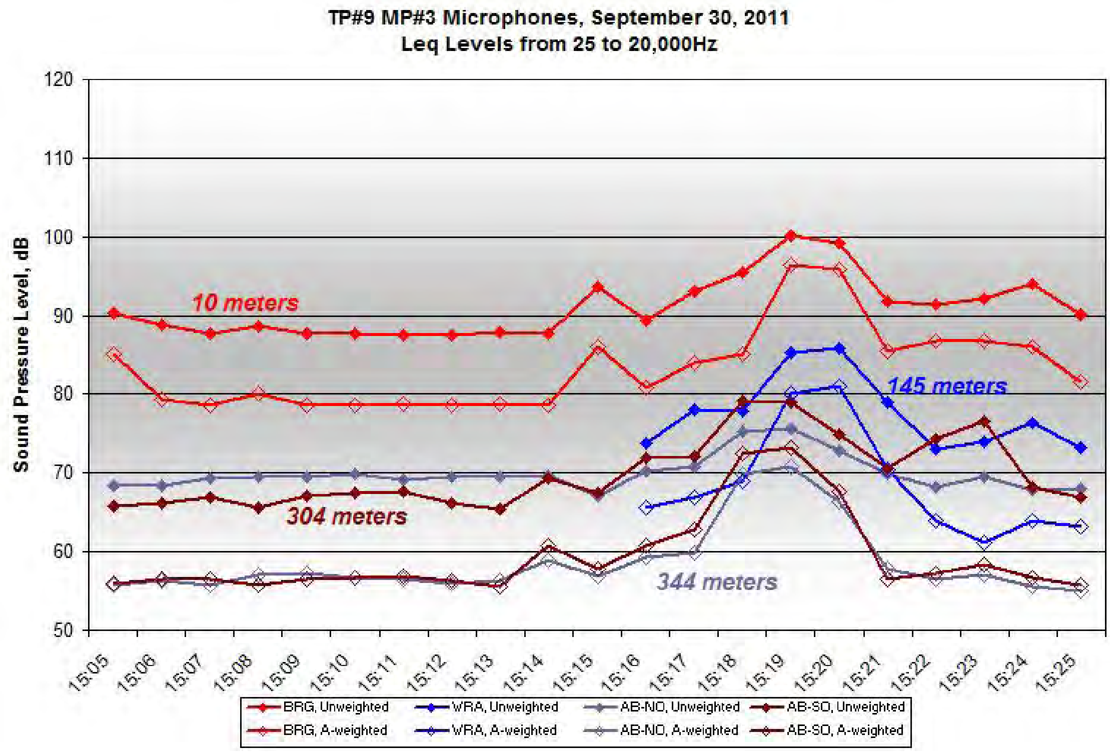

Figure C242. One-minute Unweighted and A-weighted Leq Level at TP#9 MP#3, 15:12-15:19, on September 30, 2011

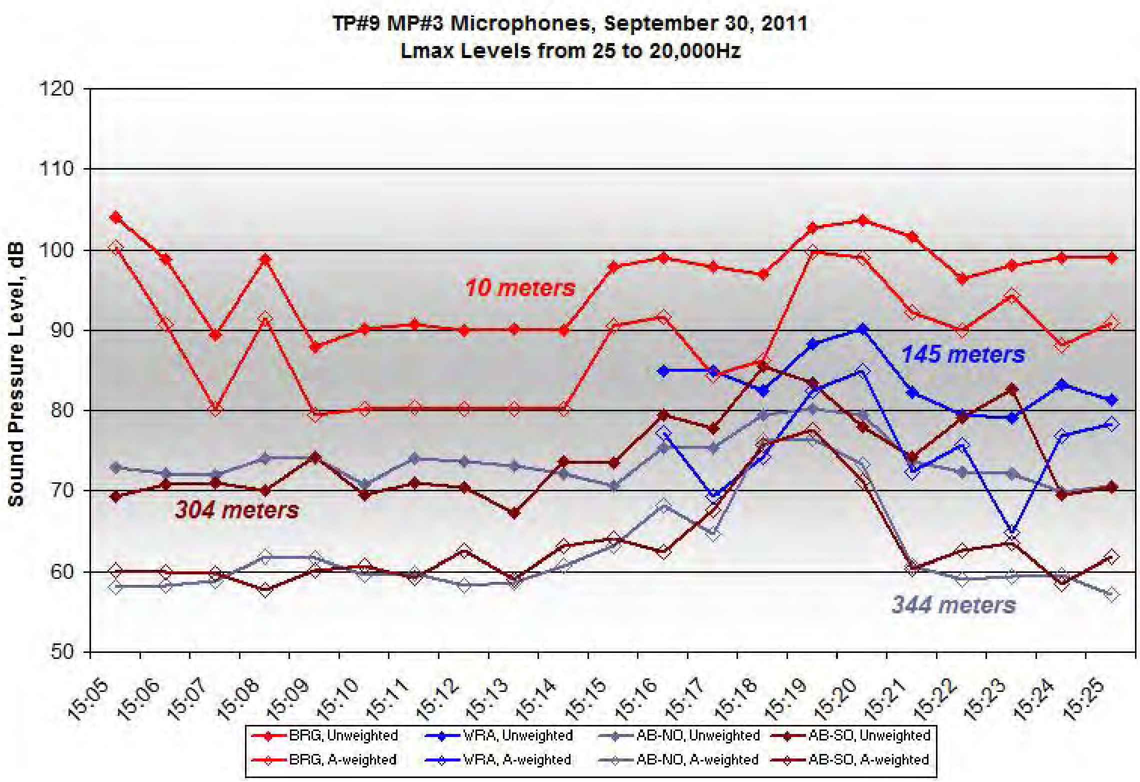

Figure C243. One-minute Unweighted and A-weighted Lmax Level at TP#9 MP#3, 15:12-15:19, on September 30, 2011

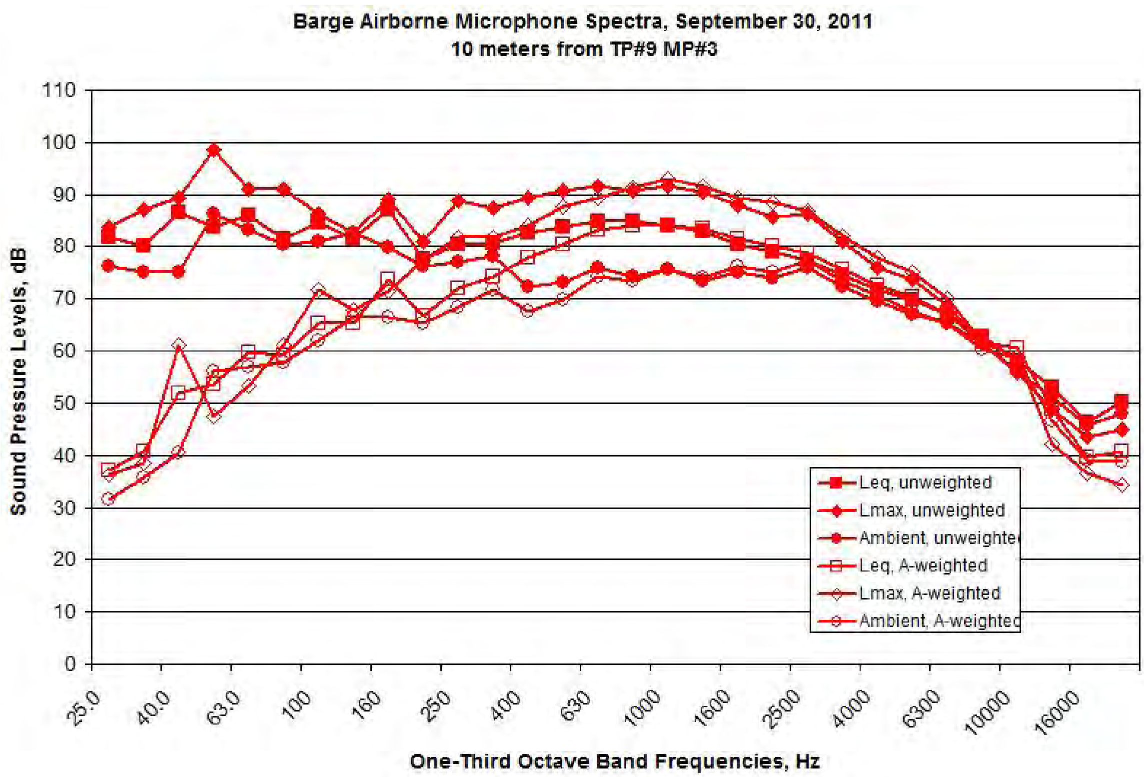

Figure C244. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 MP#3, 15:12-15:19, on September 30, 2011

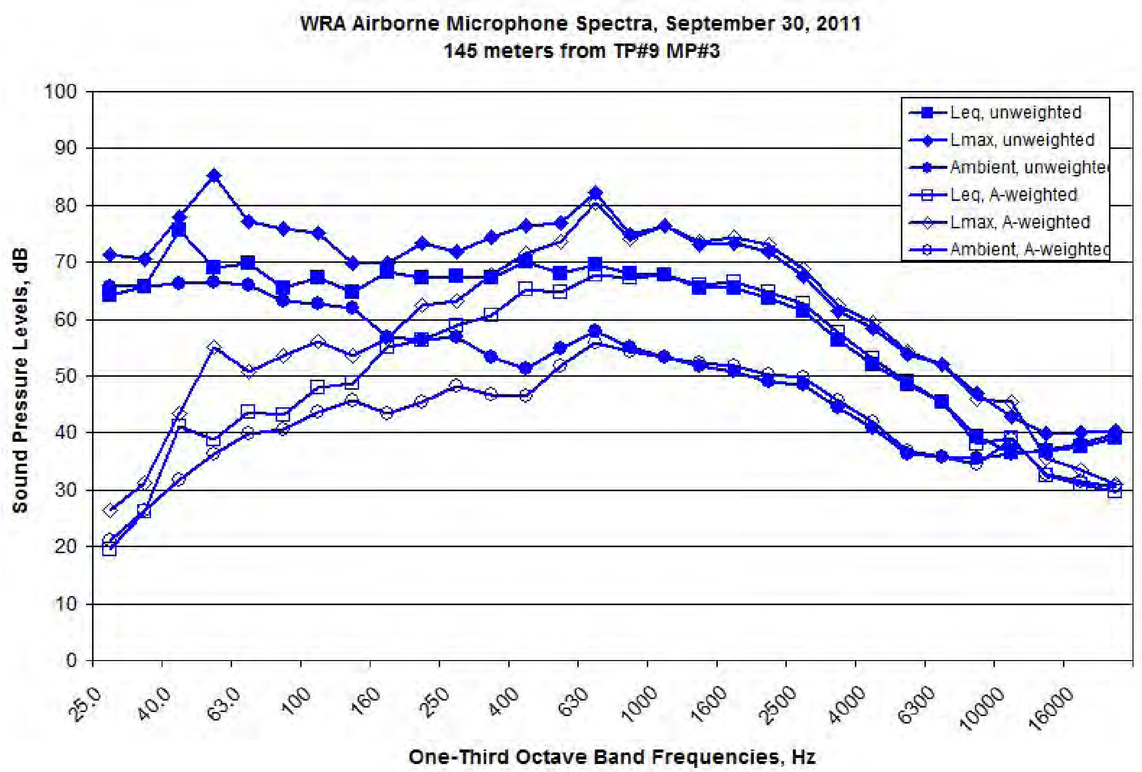

Figure C245. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 MP#3, 15:12-15:19, on September 30, 2011

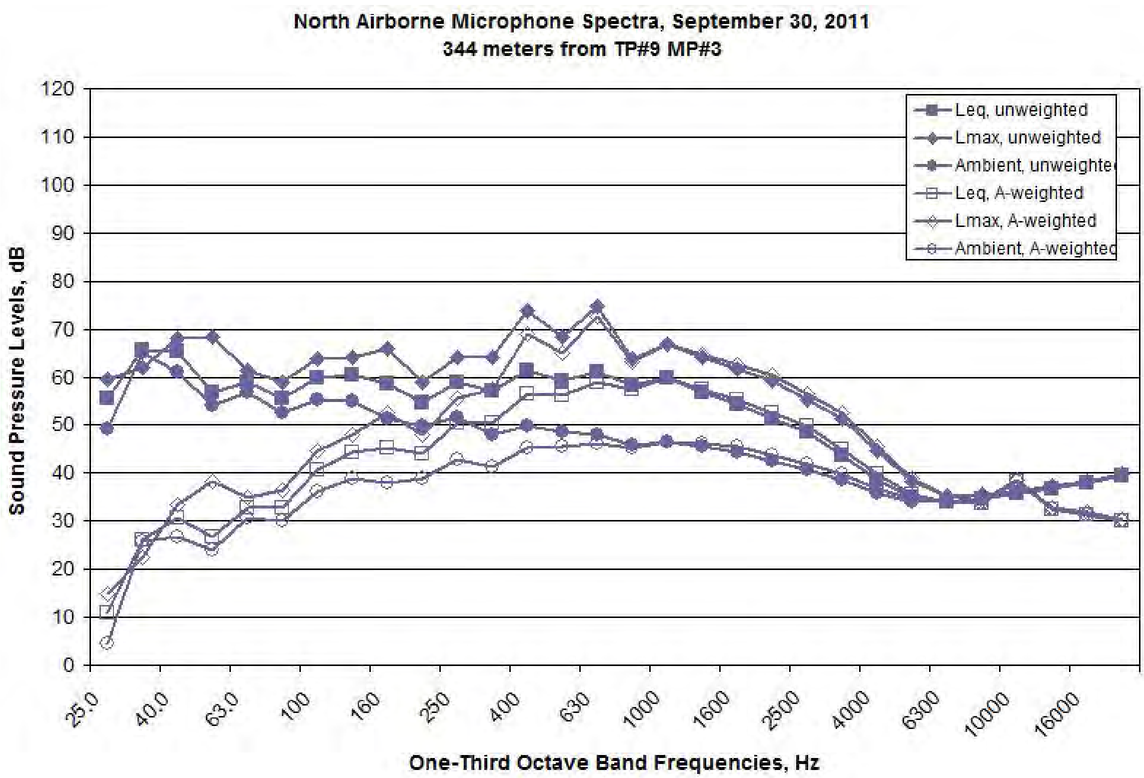

Figure C246. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 MP#3, 15:12-15:19, on September 30, 2011

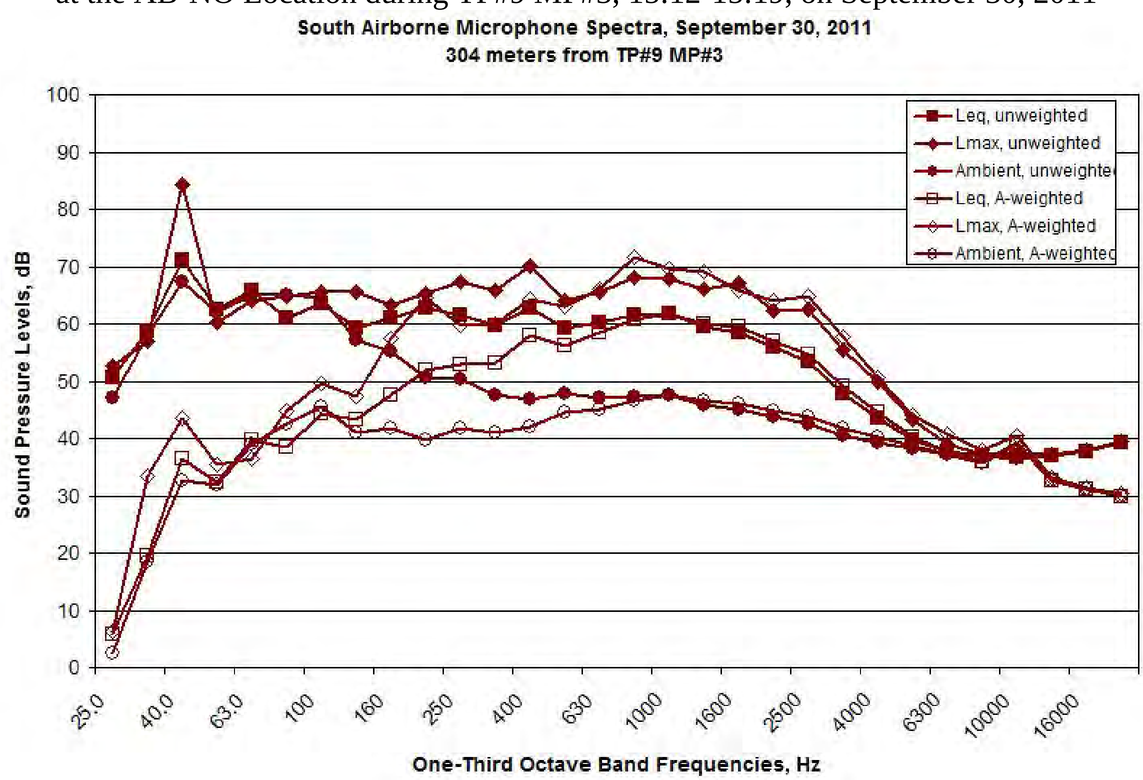

Figure C247. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 MP#3, 15:12-15:19, on September 30, 2011

10/3/2011 – TP#6

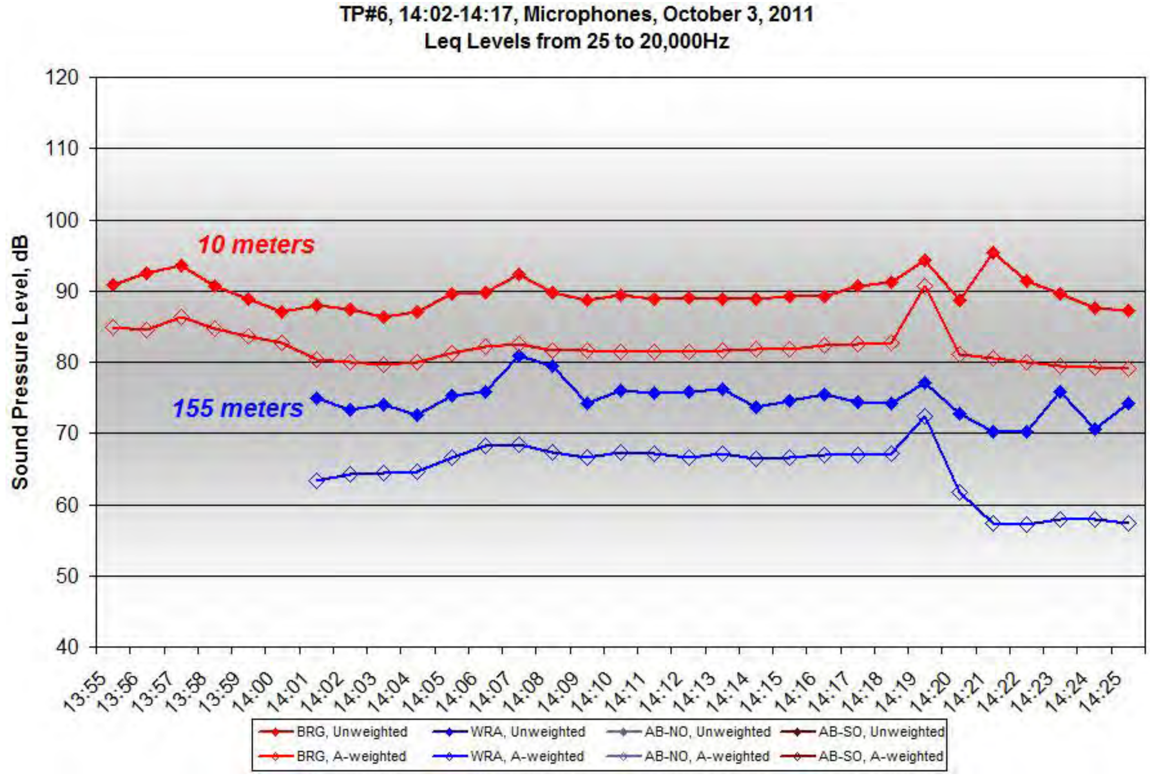

Figure C248. One-minute Unweighted and A-weighted Leq Level at TP#6, 14:02-14:17, on October 3, 2011

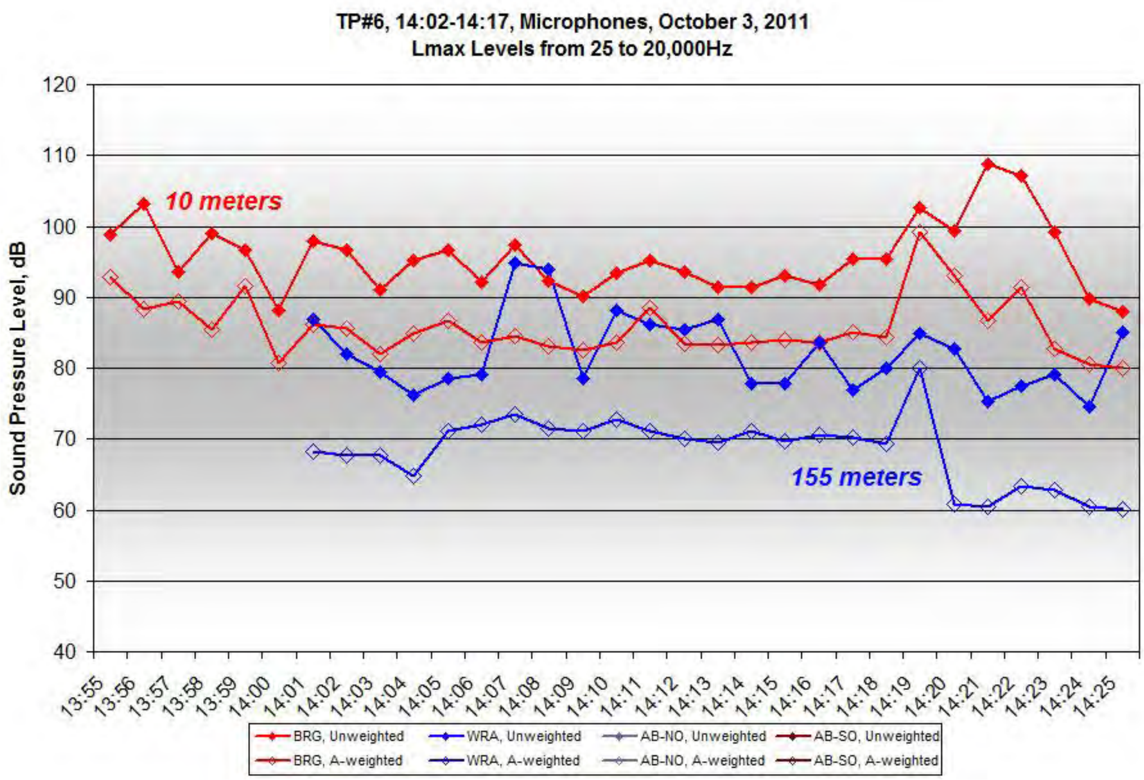

Figure C249. One-minute Unweighted and A-weighted Lmax Level at TP#6, 14:02-14:17, on October 3, 2011

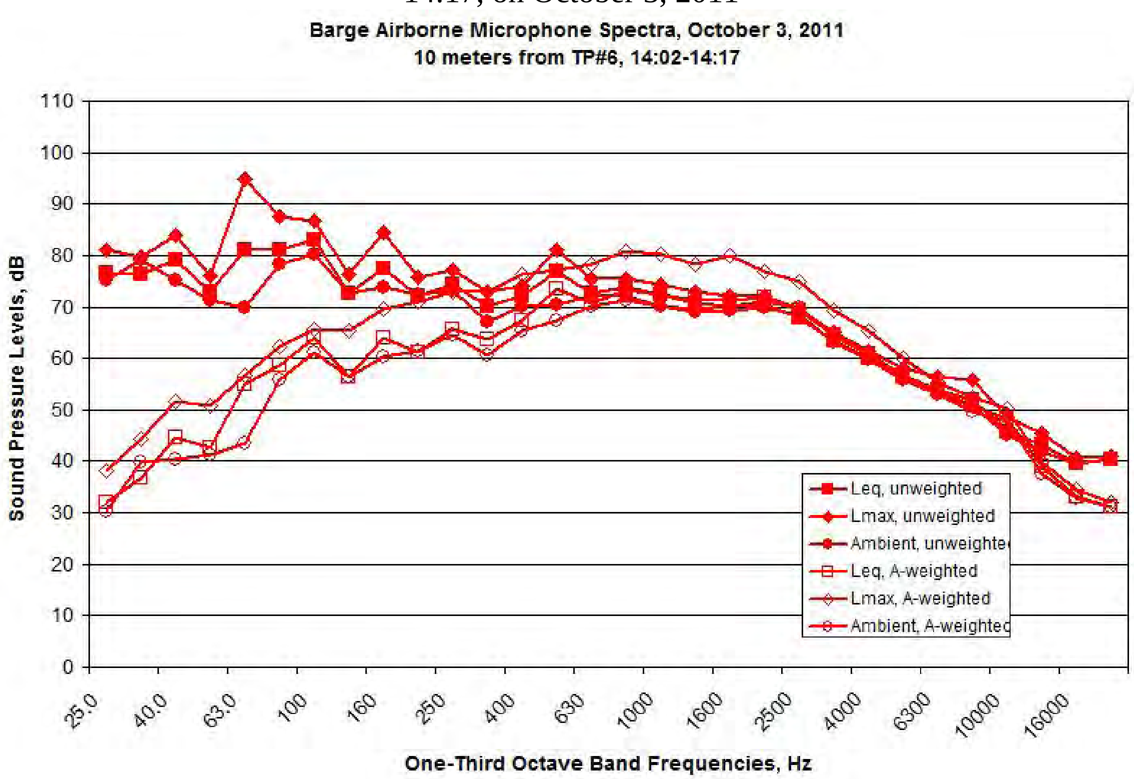

Figure C250. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#6, 14:02-14:17, on October 3, 2011

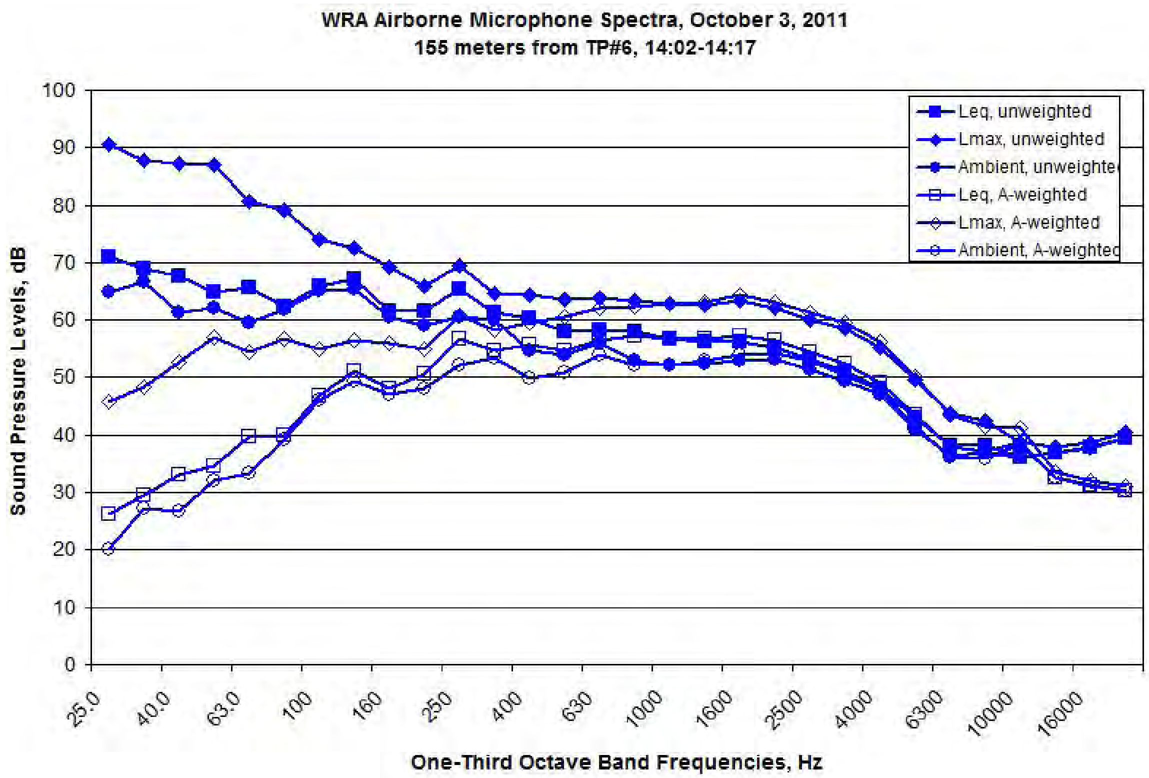

Figure C251. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#6, 14:02-14:17, on October 3, 2011

NO DATA AVAILABLE

Figure C252. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#6, 14:02-14:17, on October 3, 2011

NO DATA AVAILABLE

Figure C253. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#6, 14:02-14:17, on October 3, 2011

TP#4

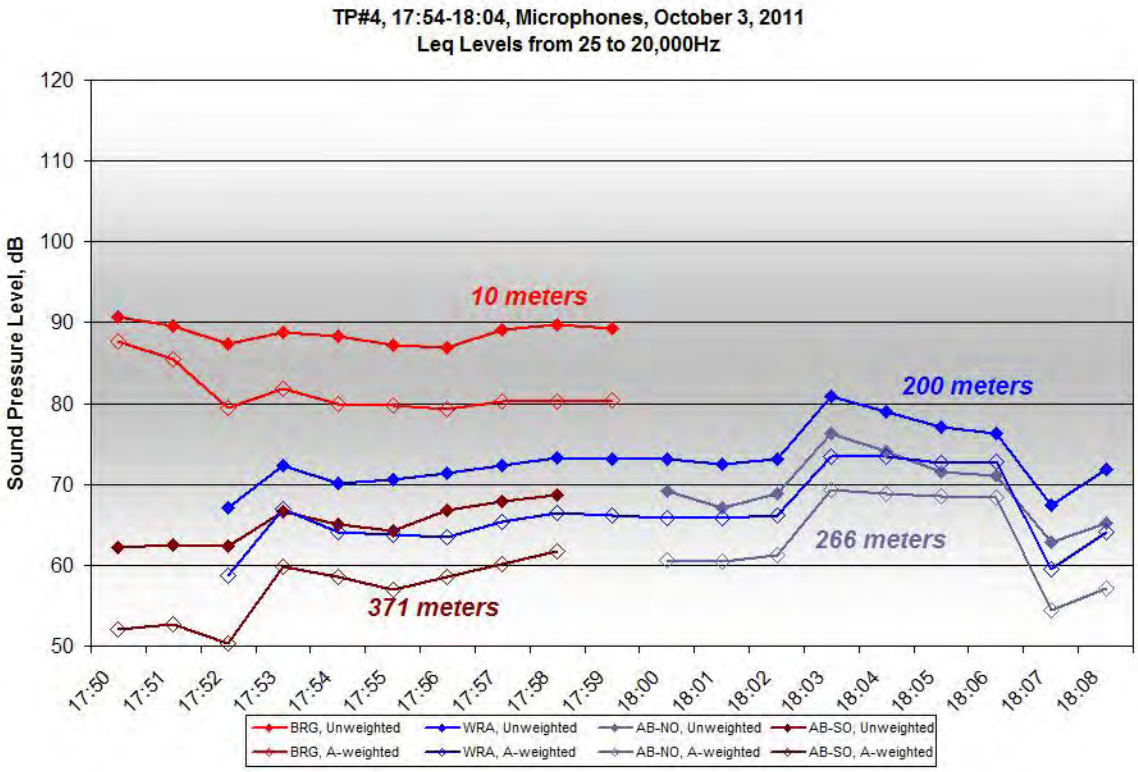

Figure C254. One-minute Unweighted and A-weighted Leq Level at TP#4, 17:54-18:04, on October 3, 2011

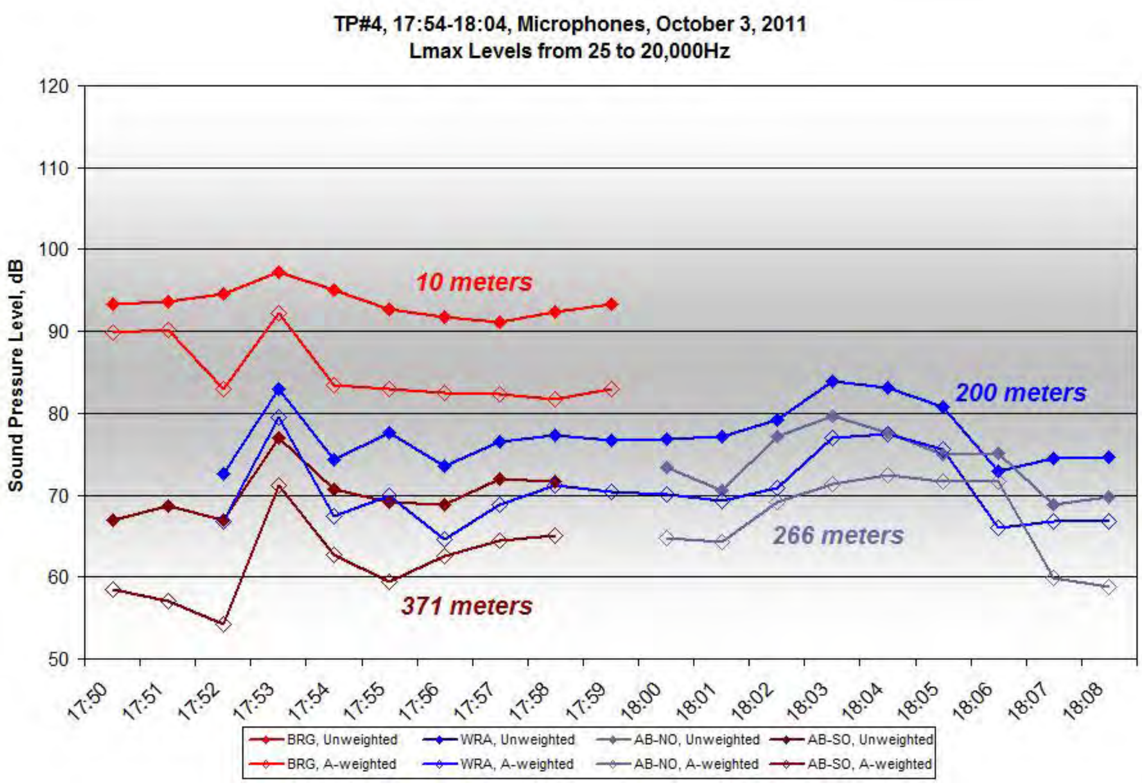

Figure C255. One-minute Unweighted and A-weighted Lmax Level at TP#4, 17:54-18:04, on October 3, 2011

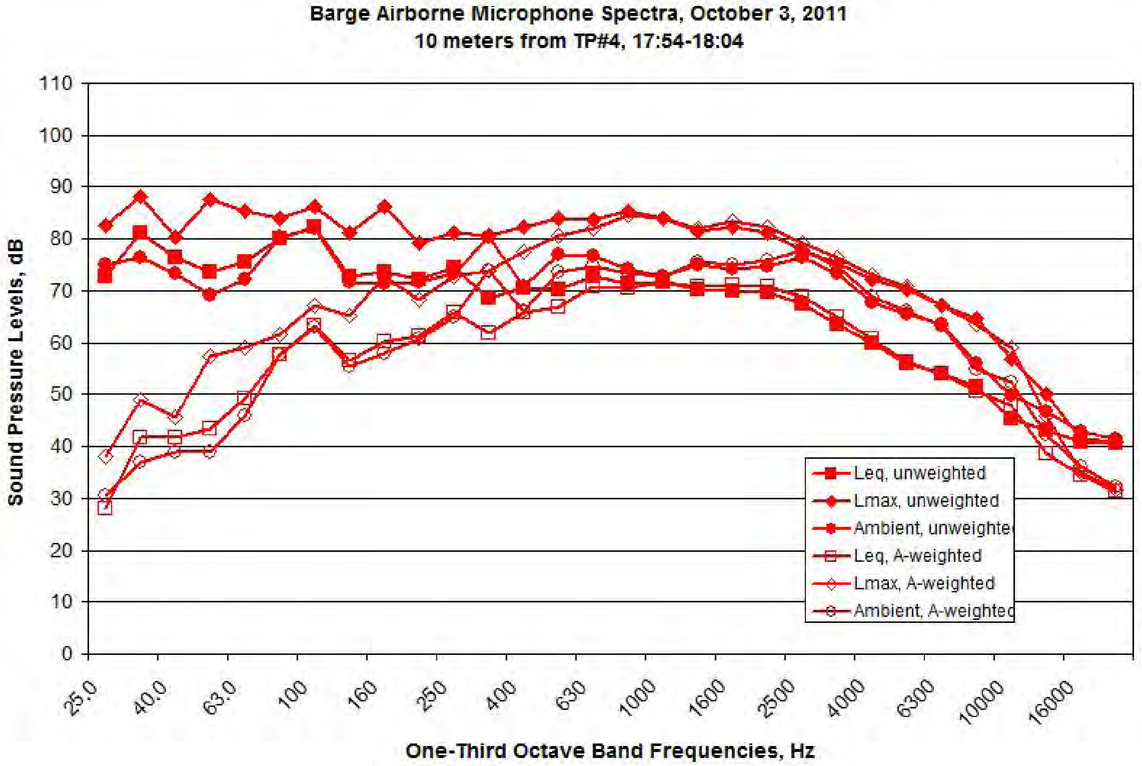

Figure C256. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#4, 17:54-18:04, on October 3, 2011

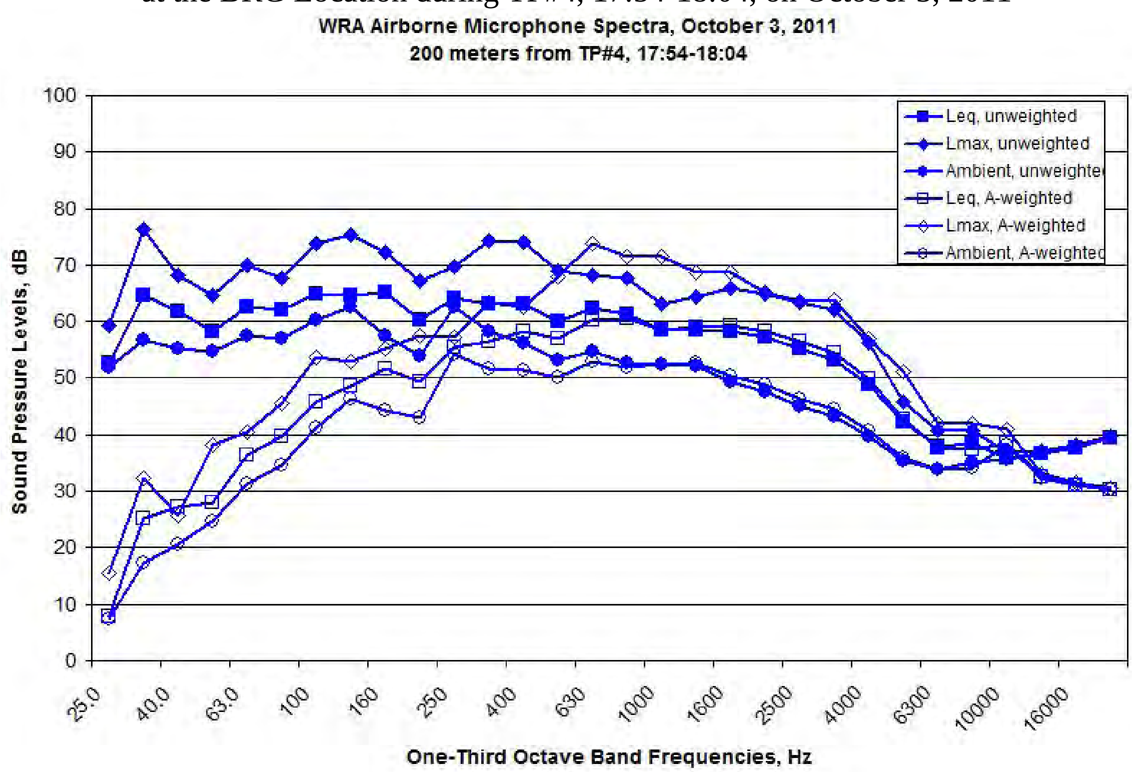

Figure C257. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#4, 17:54-18:04, on October 3, 2011

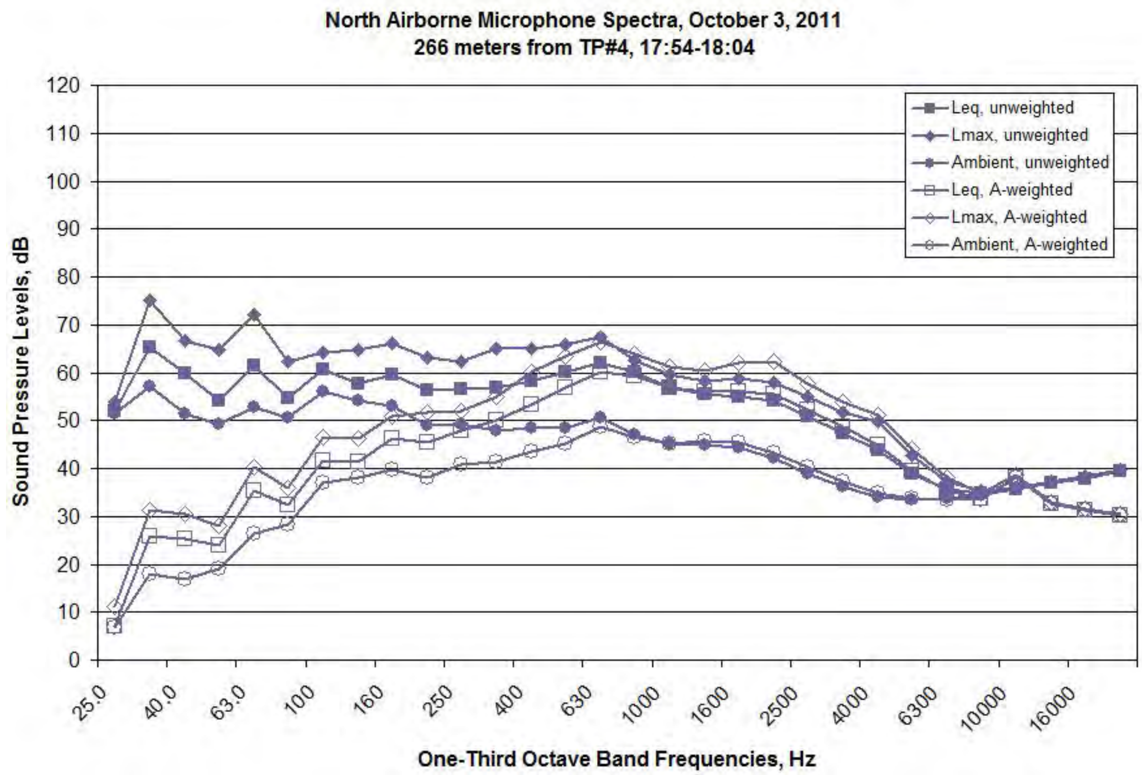

Figure C258. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#4, 17:54-18:04, on October 3, 2011

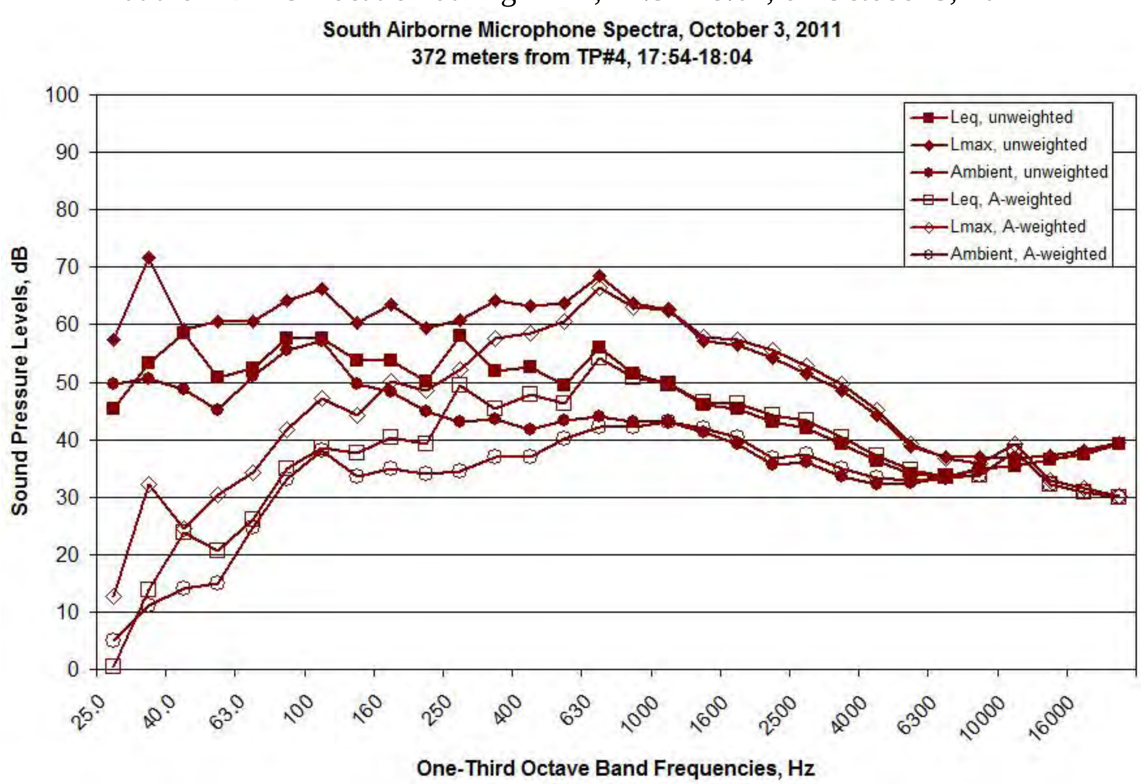

Figure C259. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#4, 17:54-18:04, on October 3, 2011

10/4/2011 – TP#4

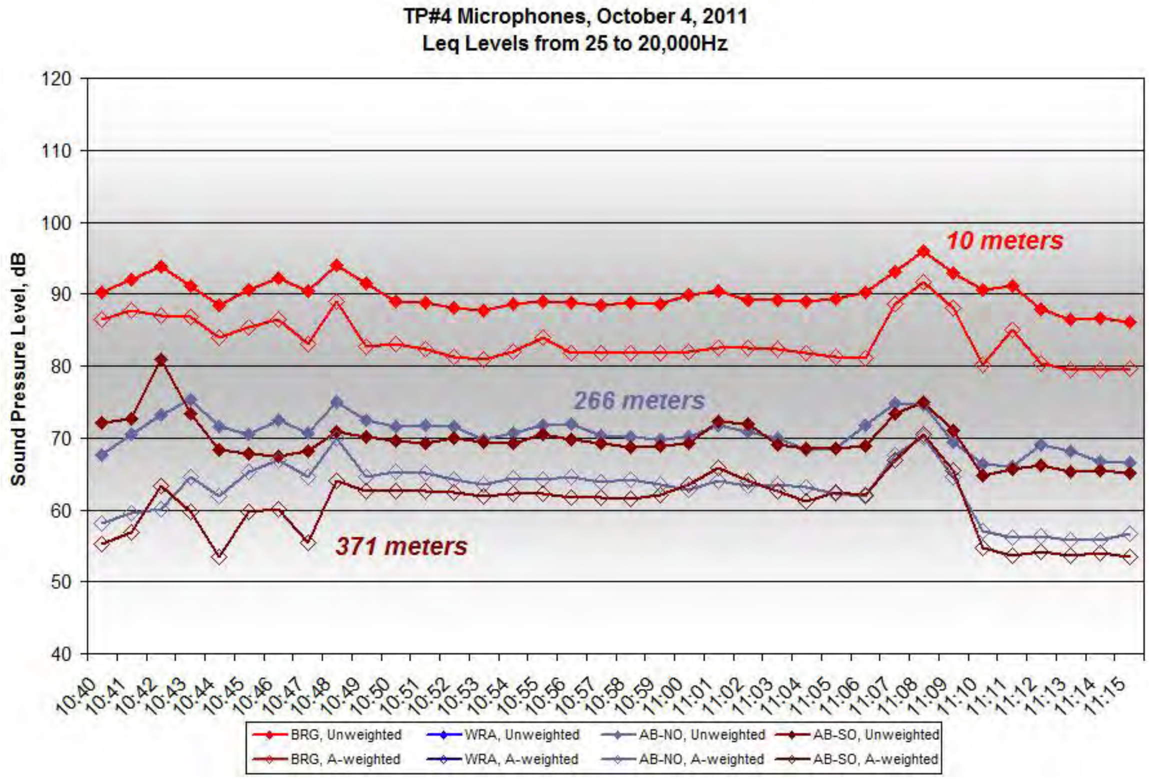

Figure C260. One-minute Unweighted and A-weighted Leq Level at TP#4, 10:45-11:07, on October 4, 2011

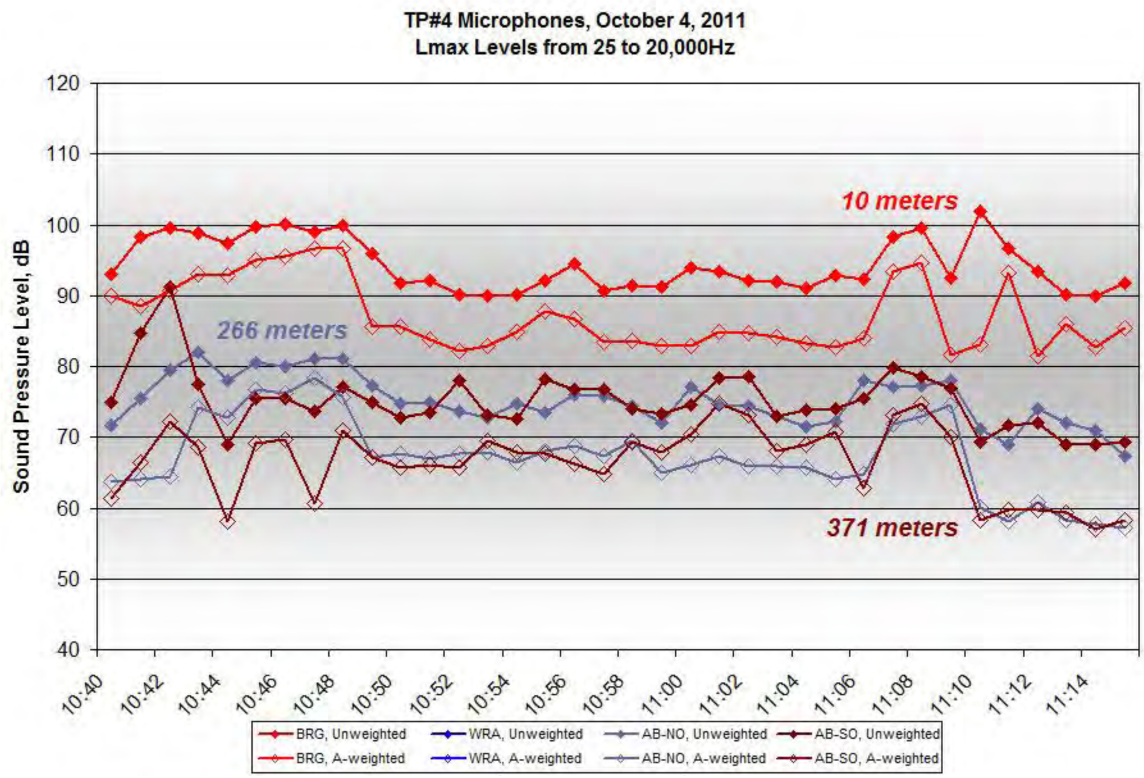

Figure C261. One-minute Unweighted and A-weighted Lmax Level at TP#4, 10:45-11:07, on October 4, 2011

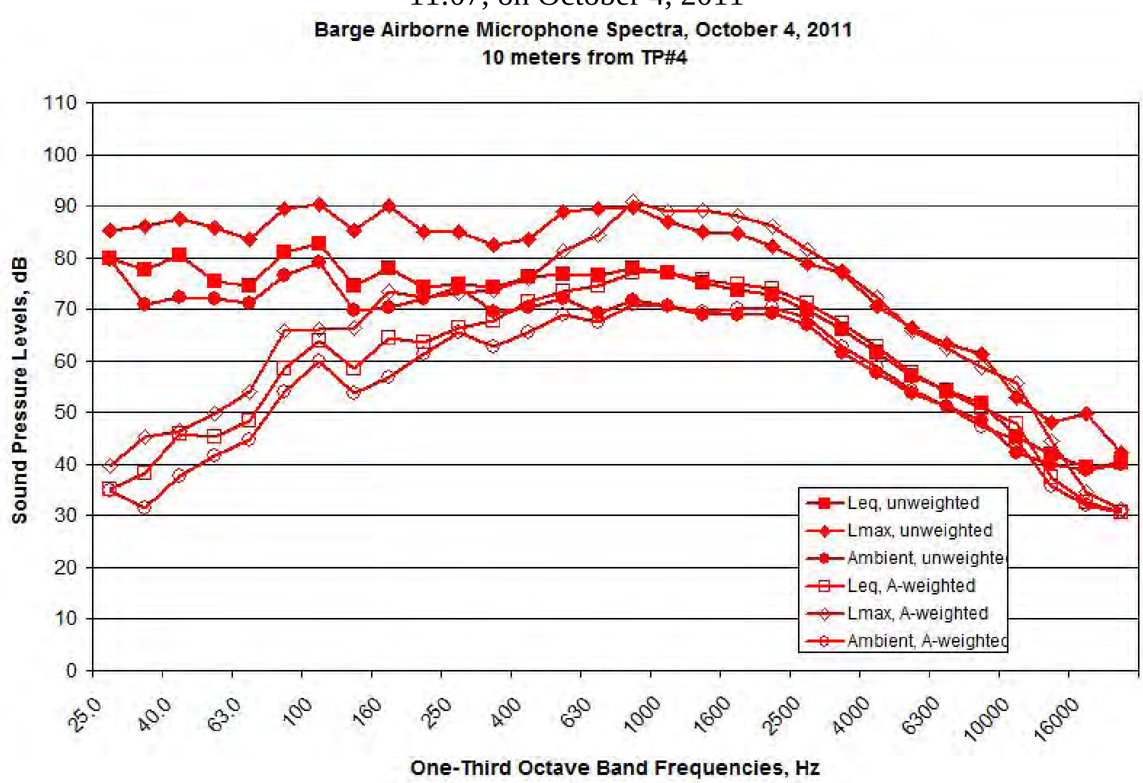

Figure C262. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#4, 10:45-11:07, on October 4, 2011

NO DATA AVAILABLE

Figure C263. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#4, 10:45-11:07, on October 4, 2011

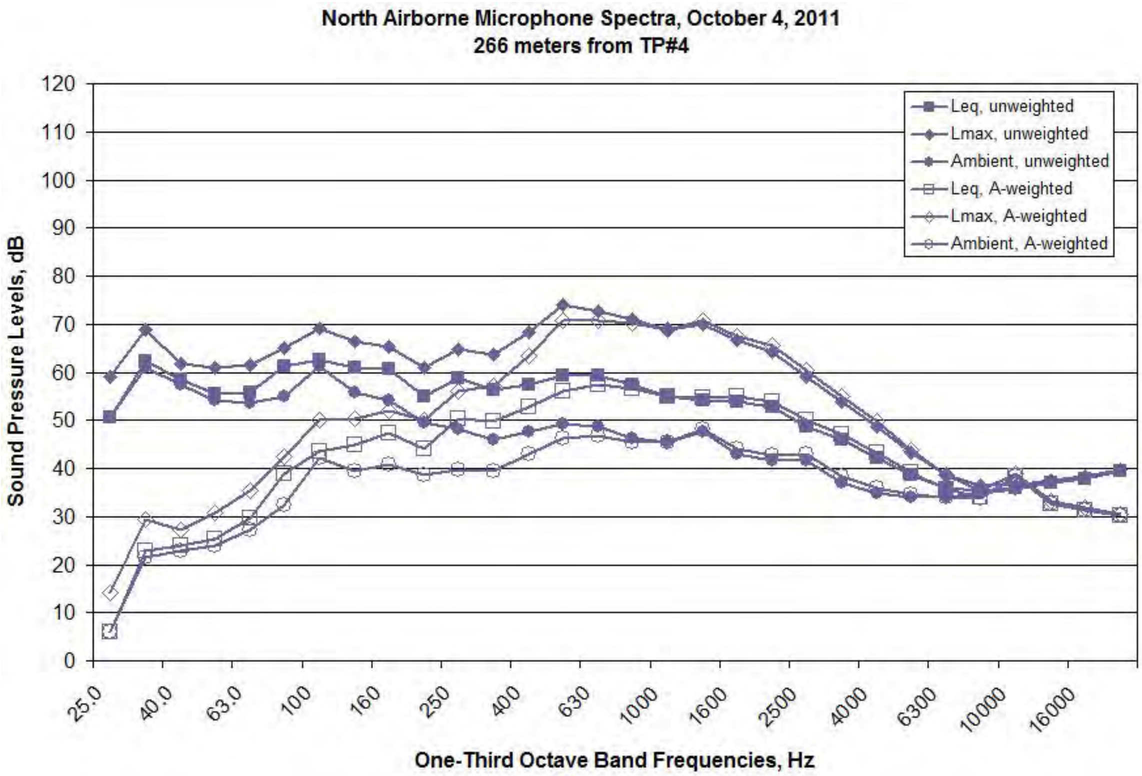

Figure C264. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#4, 10:45-11:07, on October 4, 2011

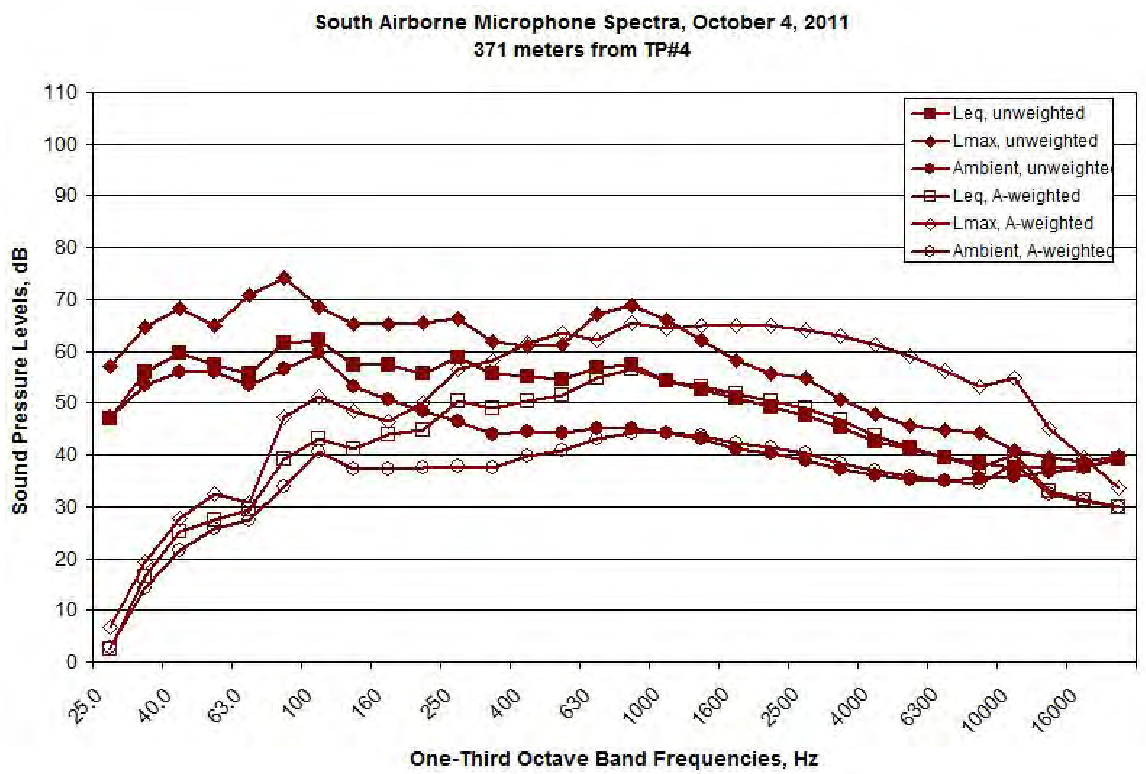

Figure C265. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#4, 10:45-11:07, on October 4, 2011

TTP#1

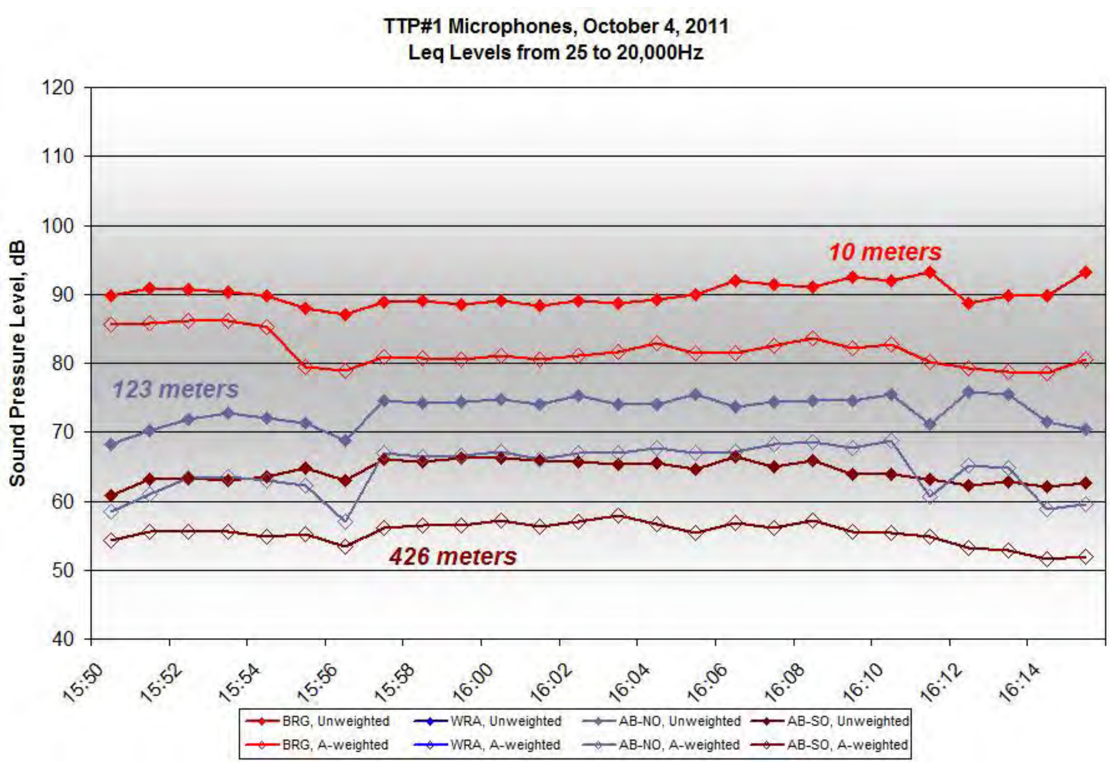

Figure C266. One-minute Unweighted and A-weighted Leq Level at TTP#1, 15:54-16:08, on October 4, 2011

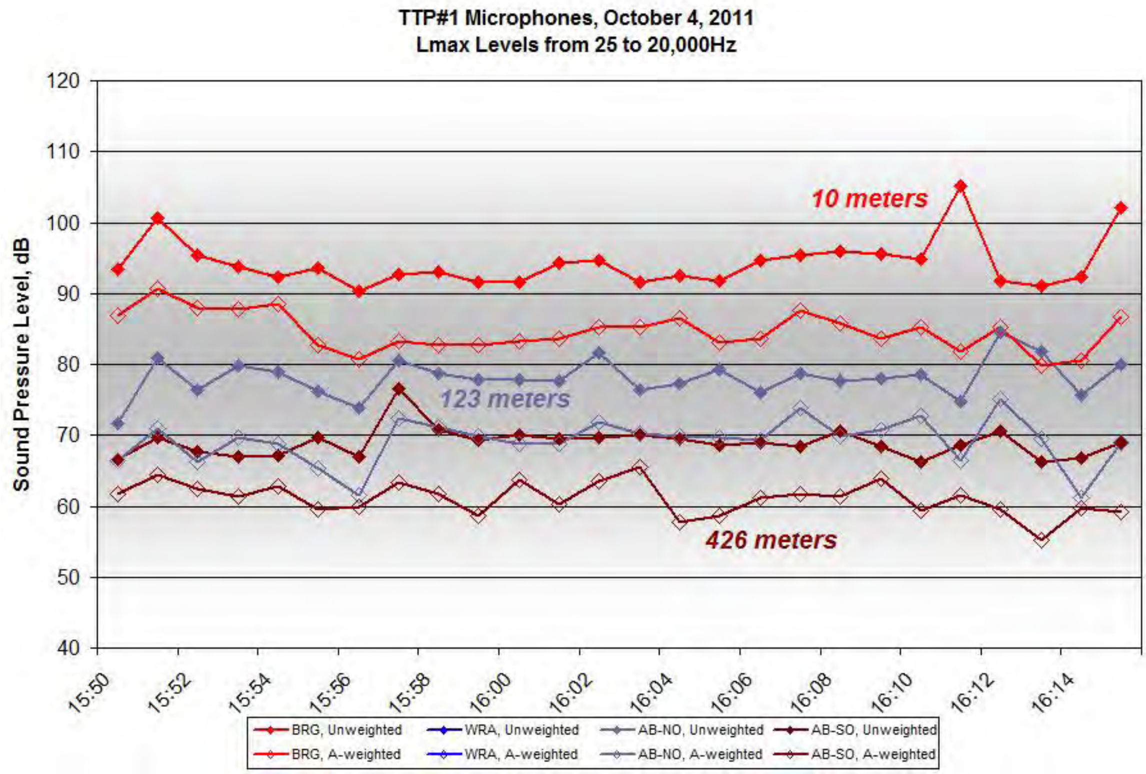

Figure C267. One-minute Unweighted and A-weighted Lmax Level at TTP#1, 15:54-16:08, on October 4, 2011

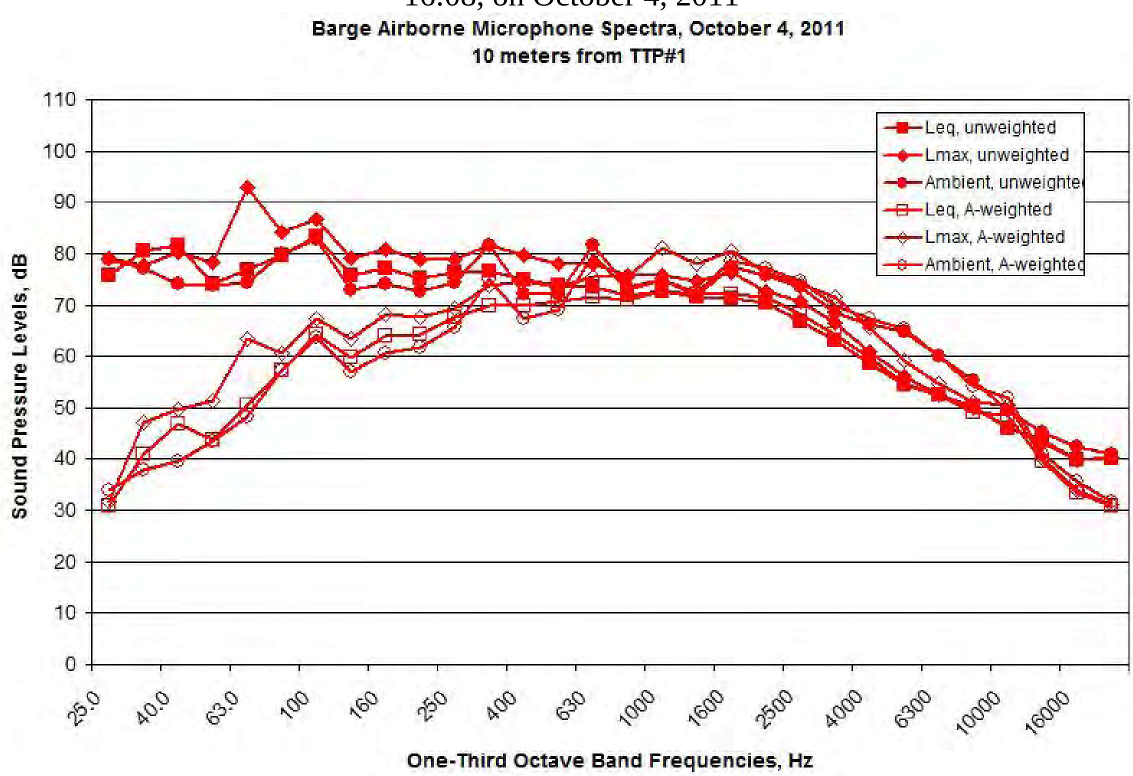

Figure C268. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#1, 15:54-16:08, on October 4, 2011

NO DATA AVAILABLE

Figure C269. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#1, 15:54-16:08, on October 4, 2011

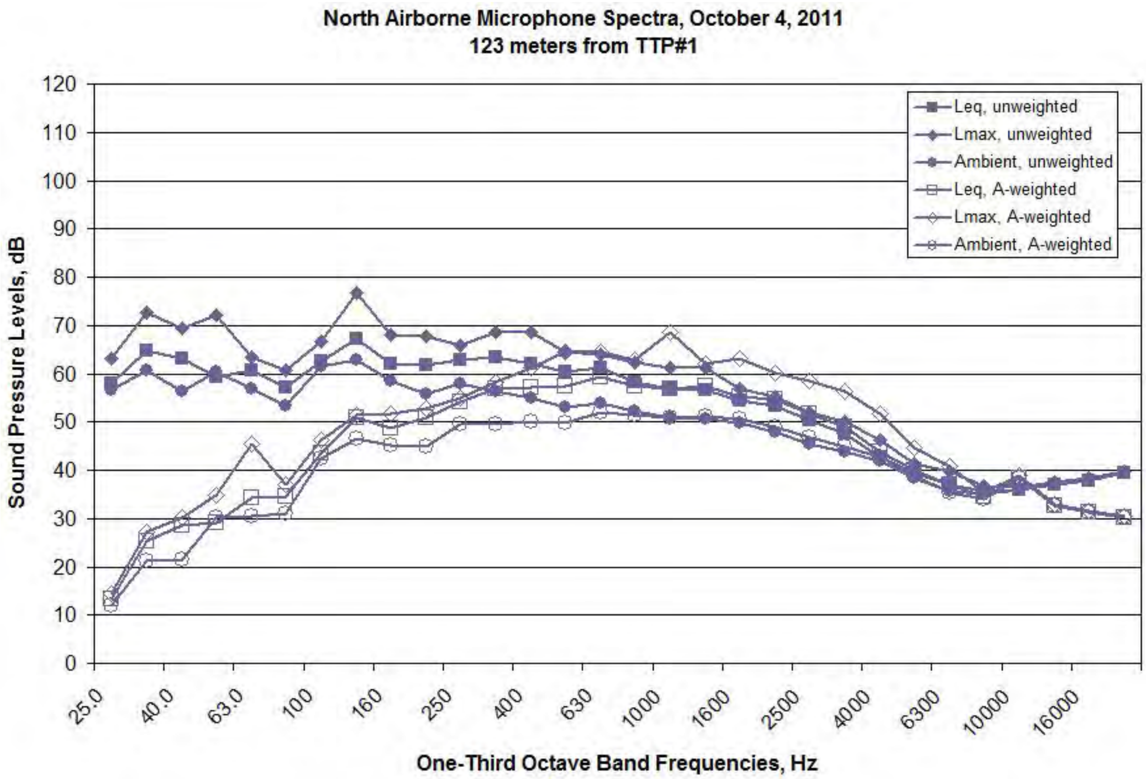

Figure C270. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#1, 15:54-16:08, on October 4, 2011

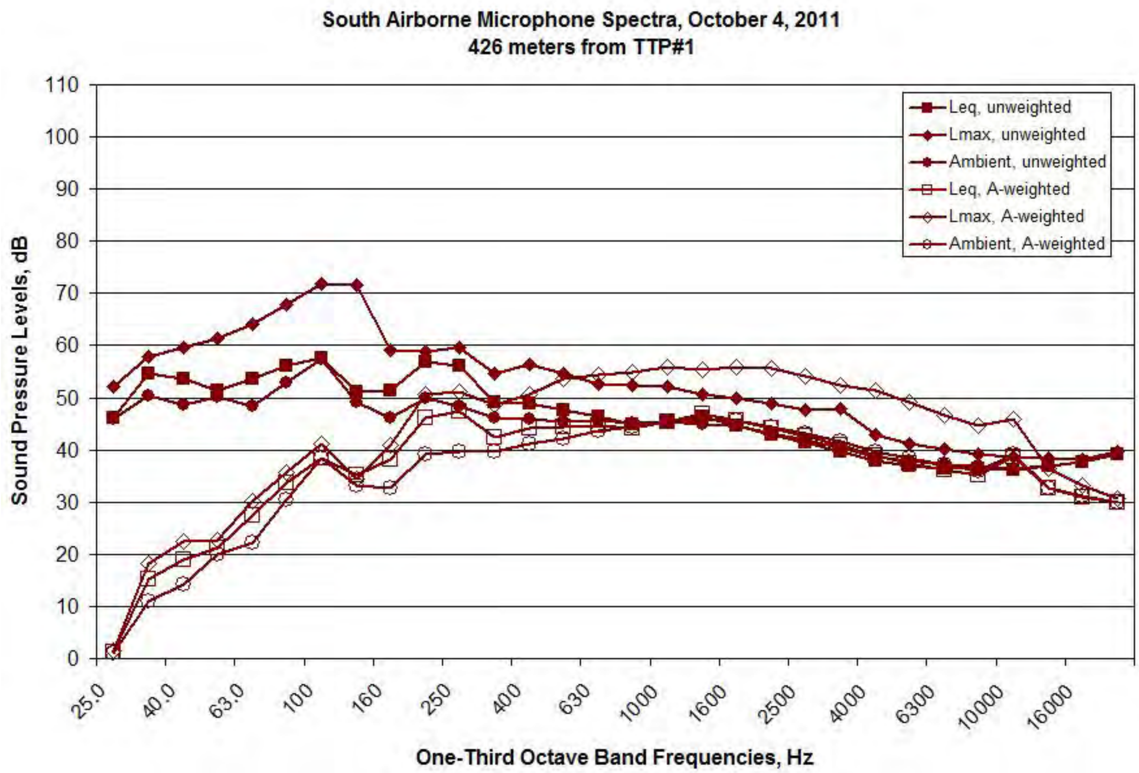

Figure C271. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#1, 15:54-16:08, on October 4, 2011

10/5/2011 – TP#1

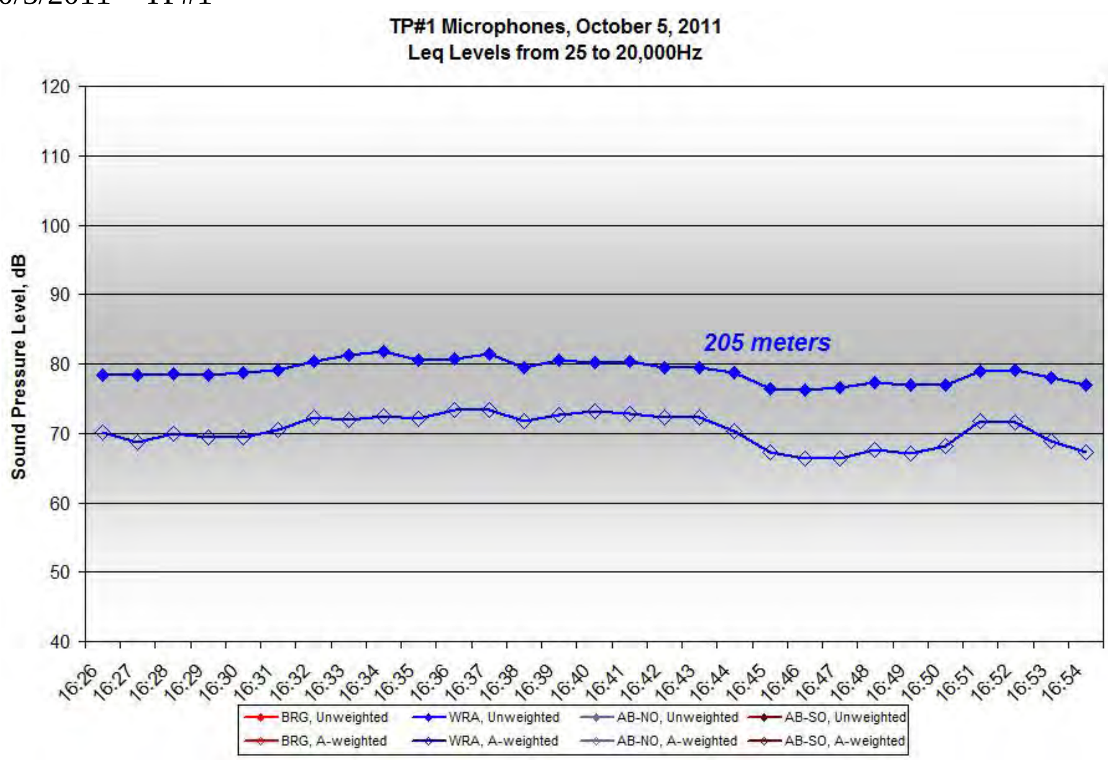

Figure C272. One-minute Unweighted and A-weighted Leq Level at TP#1, 16:28-16:52, on October 5, 2011

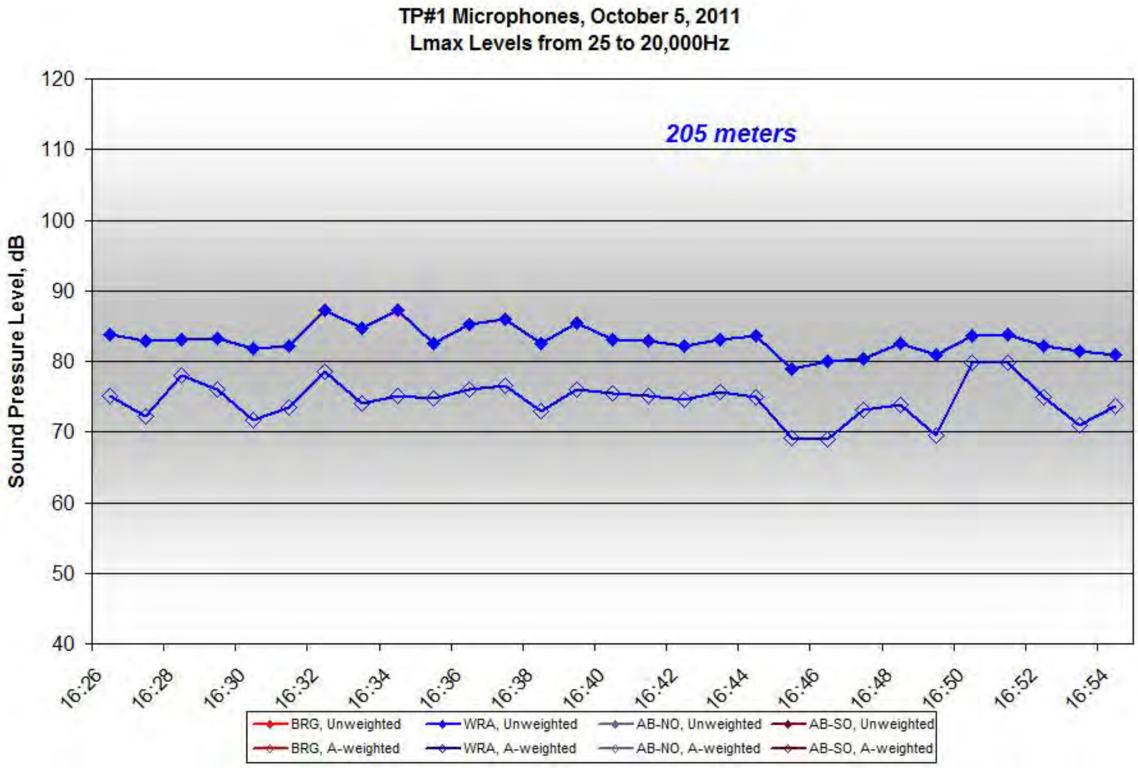

Figure C273. One-minute Unweighted and A-weighted Lmax Level at TP#1, 16:28-16:52, on October 5, 2011

NO DATA AVAILABLE

Figure C274. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#1, 16:28-16:52, on October 5, 2011

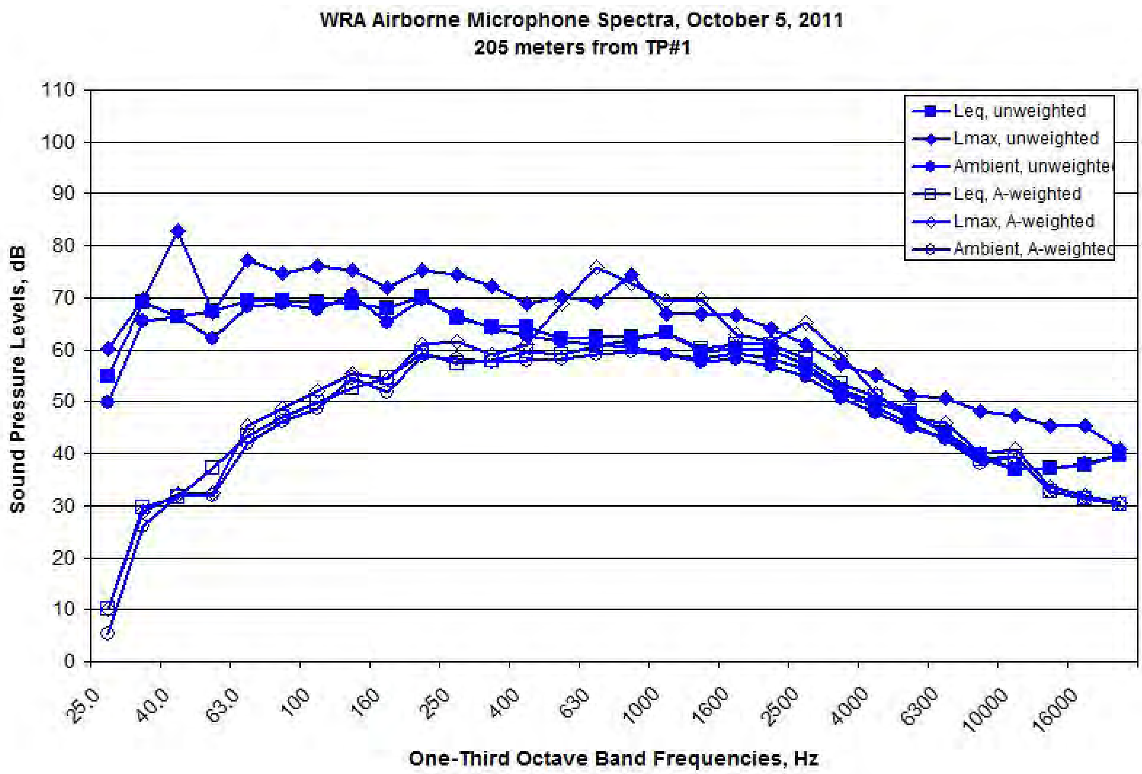

Figure C275. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#1, 16:28-16:52, on October 5, 2011

NO DATA AVAILABLE

Figure C276. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#1, 16:28-16:52, on October 5, 2011

NO DATA AVAILABLE

Figure C277. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#1, 16:28-16:52, on October 5, 2011

10/8/2011 – TP#1

NO DATA AVAILABLE

Figure C278. One-minute Unweighted and A-weighted Leq Level at TP#1, 15:04-15:17, on October 8, 2011

NO DATA AVAILABLE

Figure C279. One-minute Unweighted and A-weighted Lmax Level at TP#1, 15:04-15:17, on October 8, 2011

NO DATA AVAILABLE

Figure C280. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#1, 16:10-16:20, on October 8, 2011

NO DATA AVAILABLE

Figure C281. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#1, 16:10-16:20, on October 8, 2011

NO DATA AVAILABLE

Figure C282. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#1, 16:10-16:20, on October 8, 2011

NO DATA AVAILABLE

Figure C283. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#1, 16:10-16:20, on October 8, 2011

10/17/2011 – TP#3 MP#3

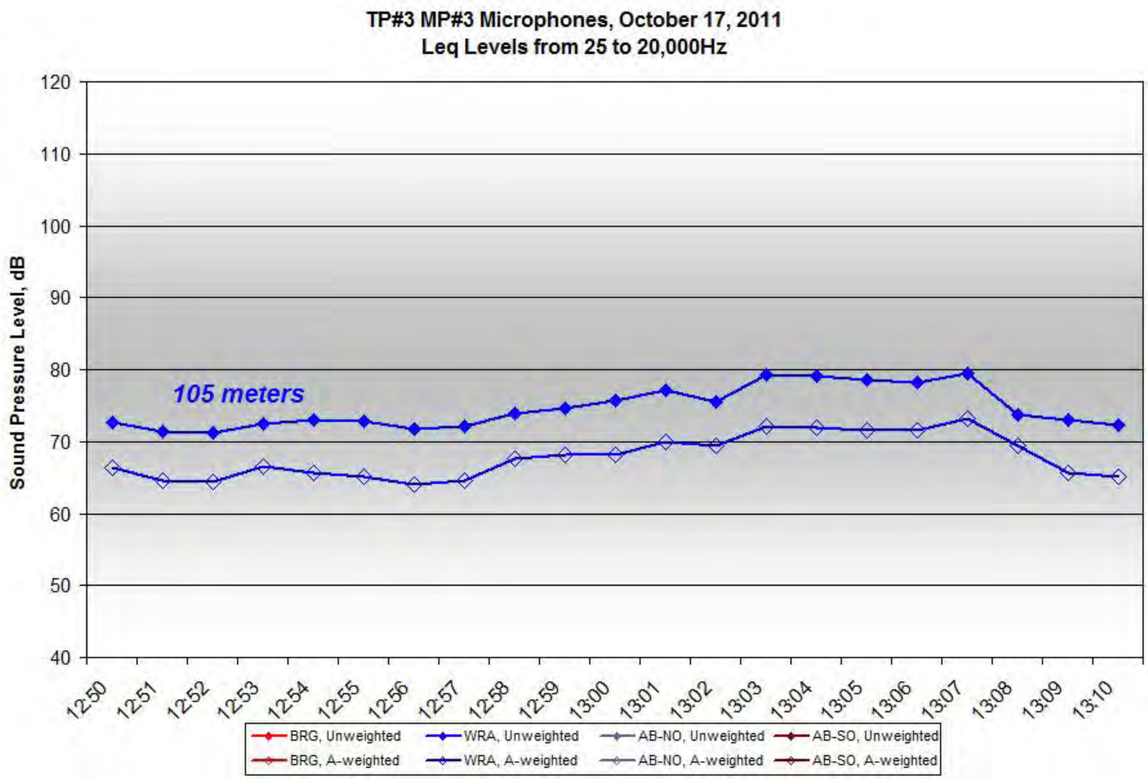

Figure C284. One-minute Unweighted and A-weighted Leq Level at TP#3 MP#3, 12:58-13:07, on October 17, 2011

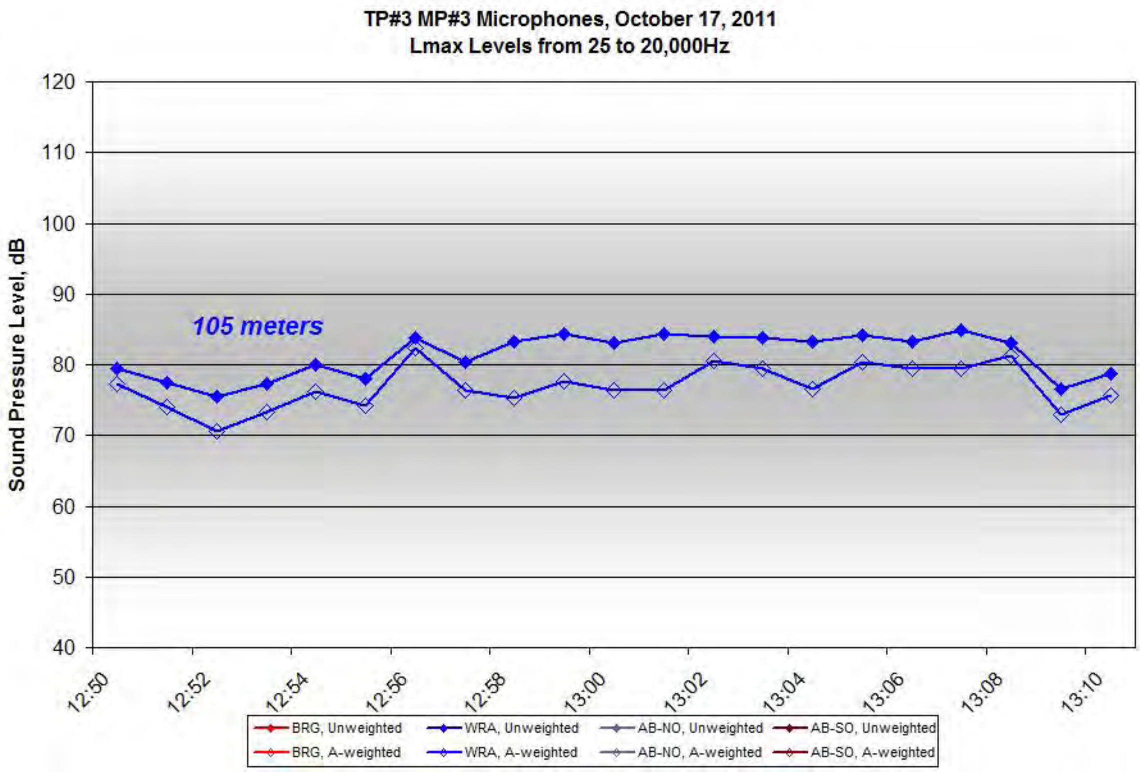

Figure C285. One-minute Unweighted and A-weighted Lmax Level at TP#3 MP#3, 12:58-13:07, on October 17, 2011

NO DATA AVAILABLE

Figure C286. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 MP#3, 12:58-13:07, on October 17, 2011

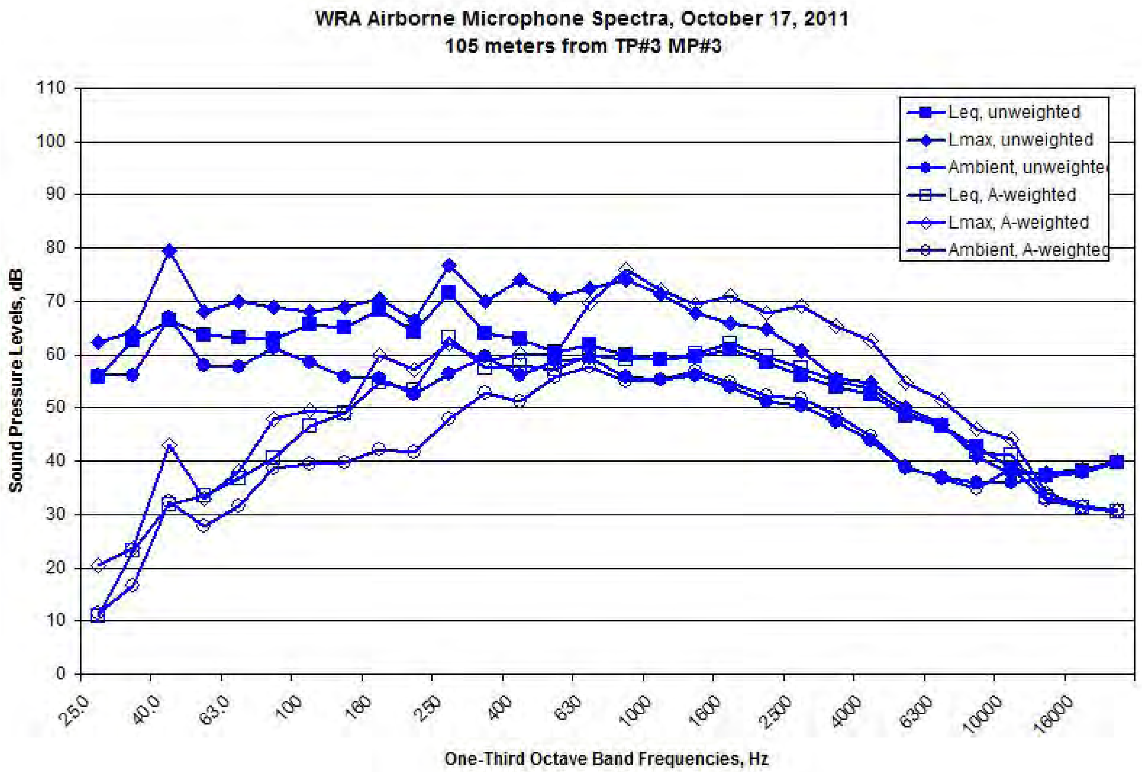

Figure C287. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 MP#3, 12:58-13:07, on October 17, 2011

NO DATA AVAILABLE

Figure C288. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 MP#3, 12:58-13:07, on October 17, 2011

NO DATA AVAILABLE

Figure C289. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 MP#3, 12:58-13:07, on October 17, 2011

TP#3 MP#2

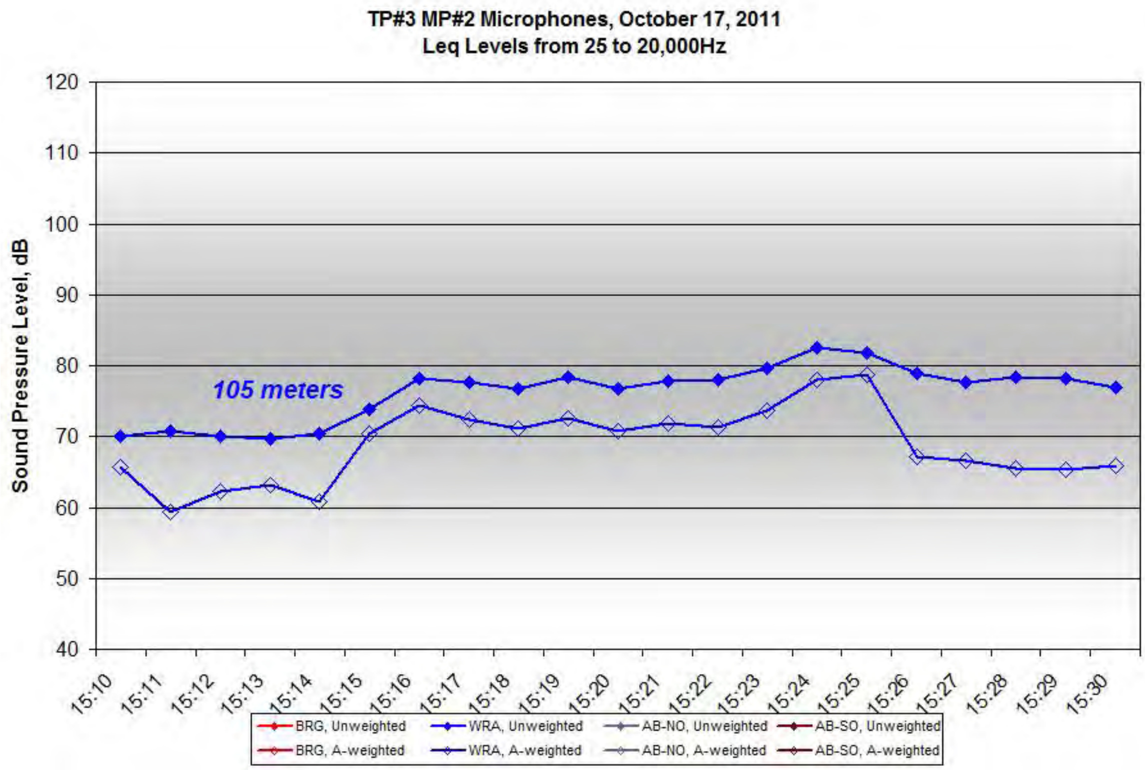

Figure C290. One-minute Unweighted and A-weighted Leq Level at TP#3 MP#2, 15:16-15:25, on October 17, 2011

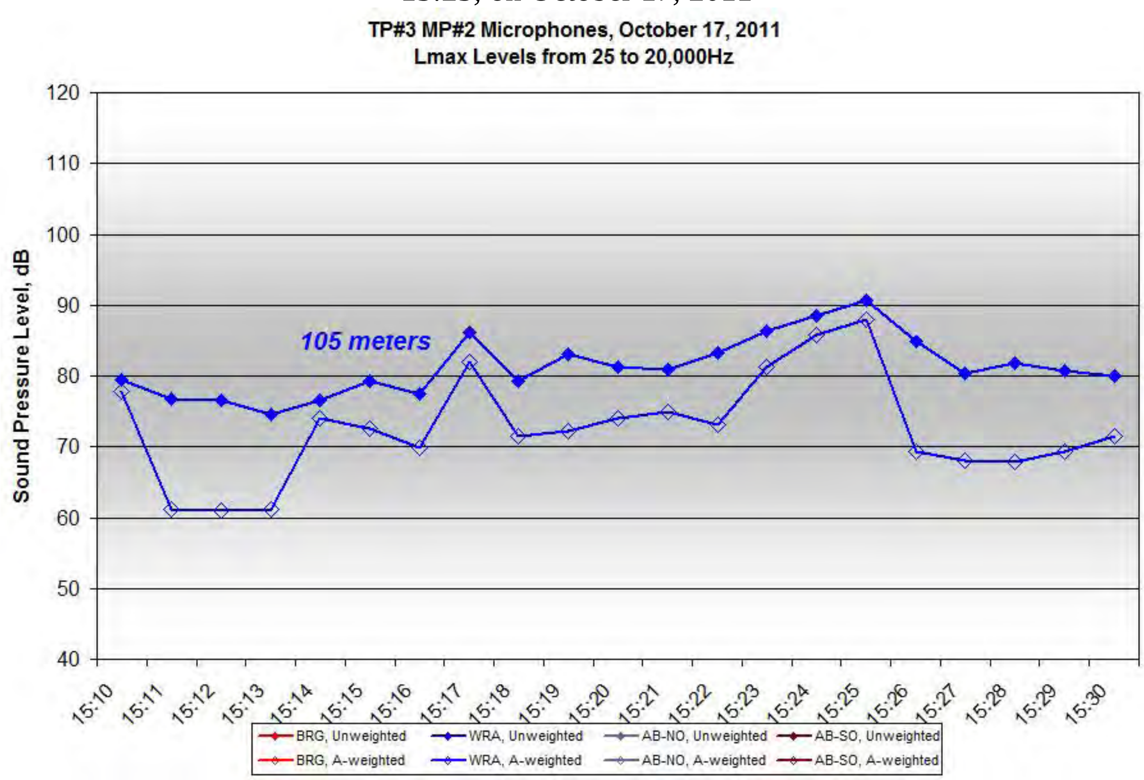

Figure C291. One-minute Unweighted and A-weighted Lmax Level at TP#3 MP#2, 15:16-15:25, on October 17, 2011

NO DATA AVAILABLE

Figure C292. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 MP#2, 15:16-15:25, on October 17, 2011

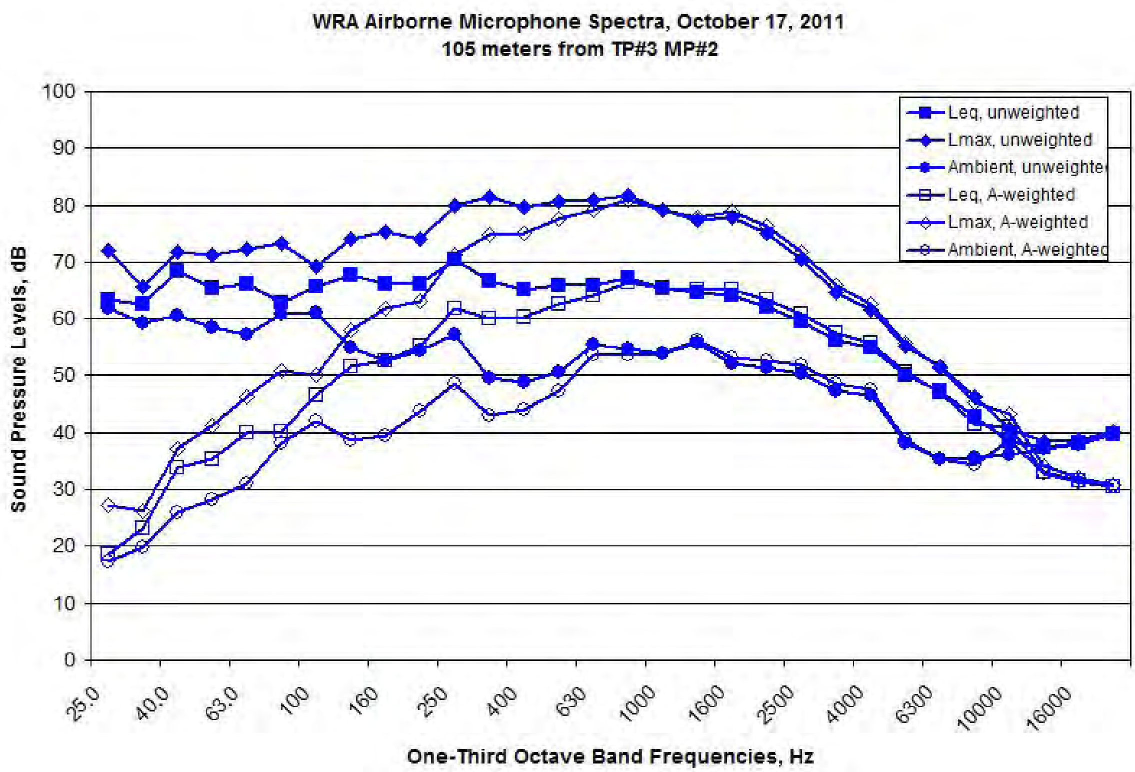

Figure C293. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 MP#2, 15:16-15:25, on October 17, 2011

NO DATA AVAILABLE

Figure C294. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 MP#2, 15:16-15:25, on October 17, 2011

NO DATA AVAILABLE

Figure C295. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 MP#2, 15:16-15:25, on October 17, 2011

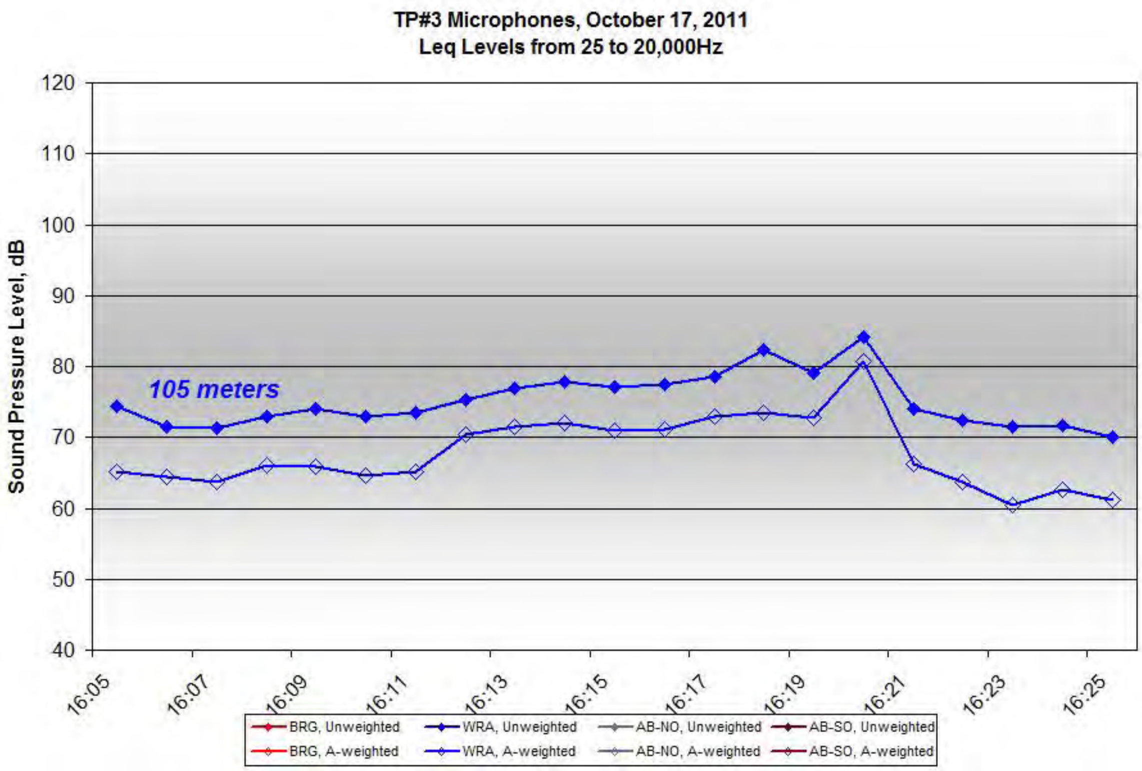

Figure C296. One-minute Unweighted and A-weighted Leq Level at TP#3, 16:13-16:20, on October 17, 2011

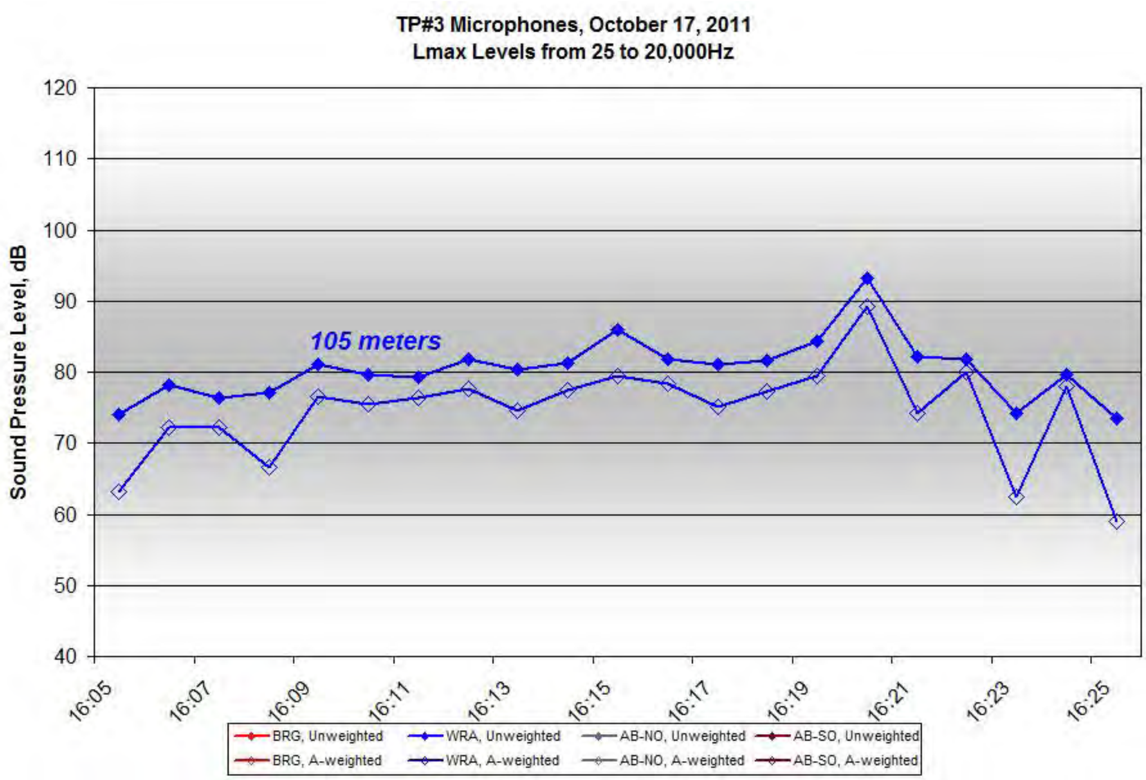

Figure C297. One-minute Unweighted and A-weighted Lmax Level at TP#3, 16:13-16:20, on October 17, 2011

NO DATA AVAILABLE

Figure C298. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3, 16:13-16:20, on October 17, 2011

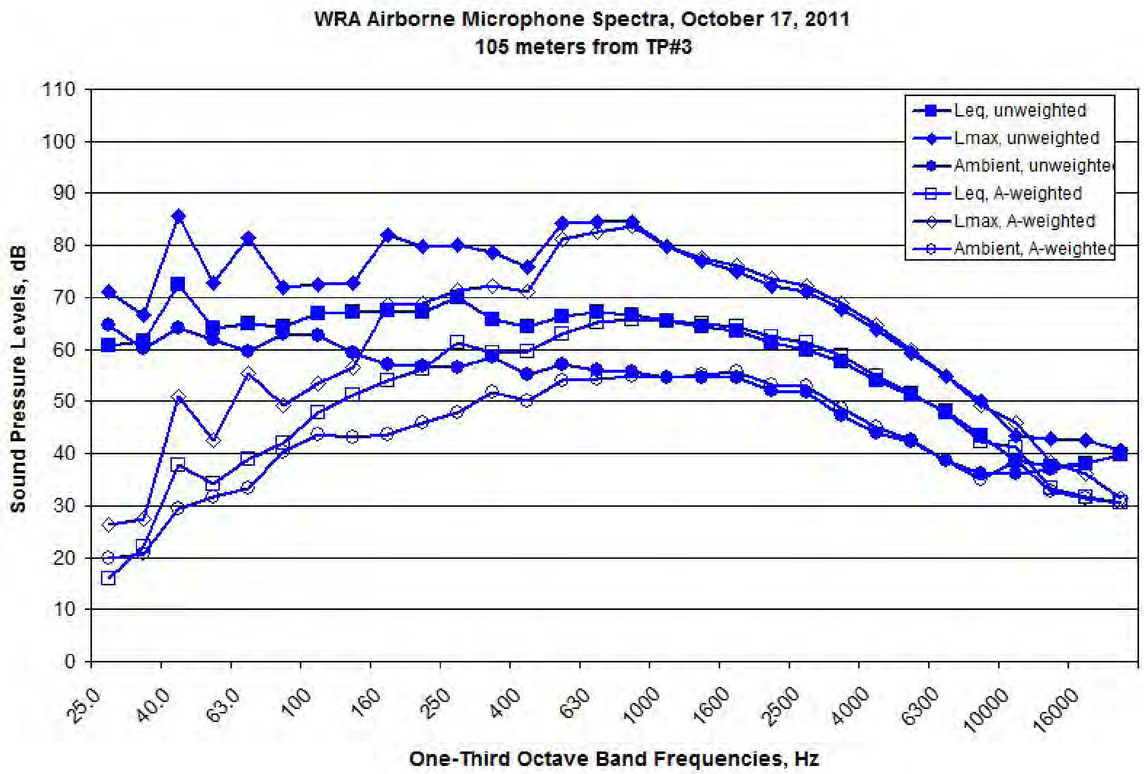

Figure C299. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3, 16:13-16:20, on October 17, 2011

NO DATA AVAILABLE

Figure C300. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3, 16:13-16:20, on October 17, 2011

NO DATA AVAILABLE

Figure C301. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3, 16:13-16:20, on October 17, 2011

10/18/2011 – TP#3 RP#3 (Vibratory Pile Driving Event)

NO DATA AVAILABLE

Figure C302. One-minute Unweighted and A-weighted Leq Level at TP#3 RP#3, 11:21-11:30, on October 18, 2011

NO DATA AVAILABLE

Figure C303. One-minute Unweighted and A-weighted Lmax Level at TP#3 RP#3, 11:21-11:30, on October 18, 2011

NO DATA AVAILABLE

Figure C304. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#3, 11:21-11:30, on October 18, 2011

NO DATA AVAILABLE

Figure C305. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#3, 11:21-11:30, on October 18, 2011

NO DATA AVAILABLE

Figure C306. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#3, 11:21-11:30, on October 18, 2011

NO DATA AVAILABLE

Figure C307. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#3, 11:21-11:30, on October 18, 2011

TP#3 RP#1

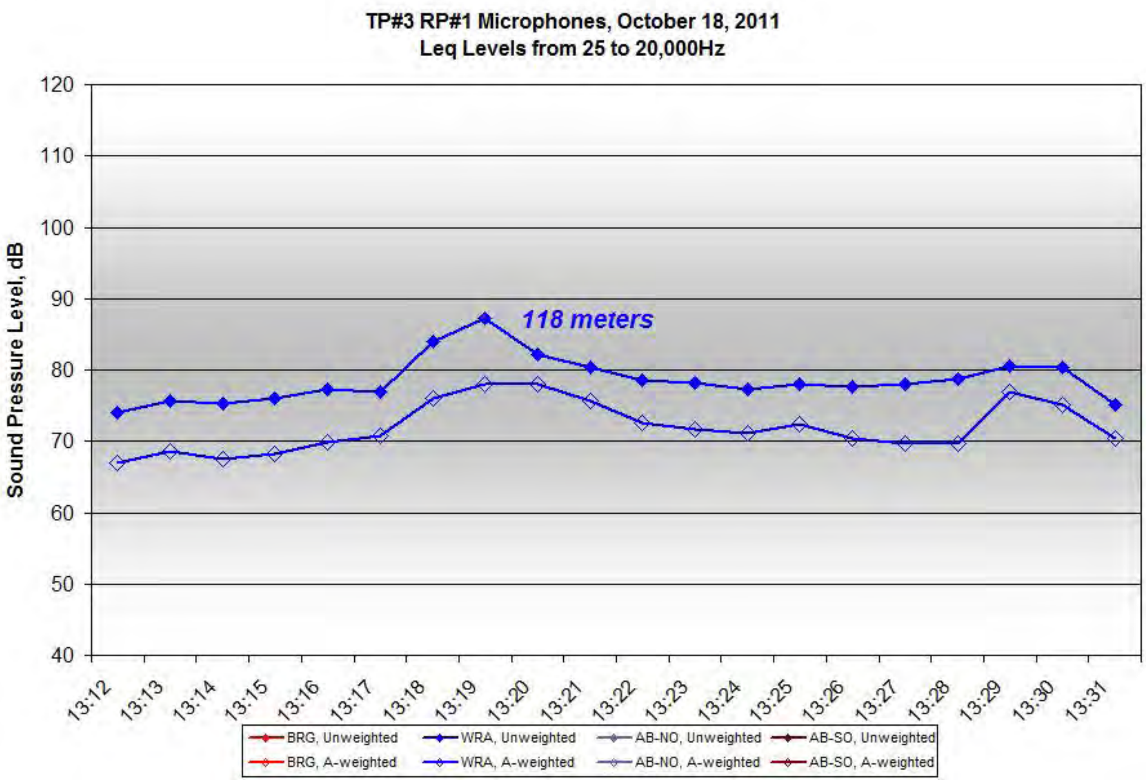

Figure C308. One-minute Unweighted and A-weighted Leq Level at TP#3 RP#1, 13:13-13:31, on October 18, 2011

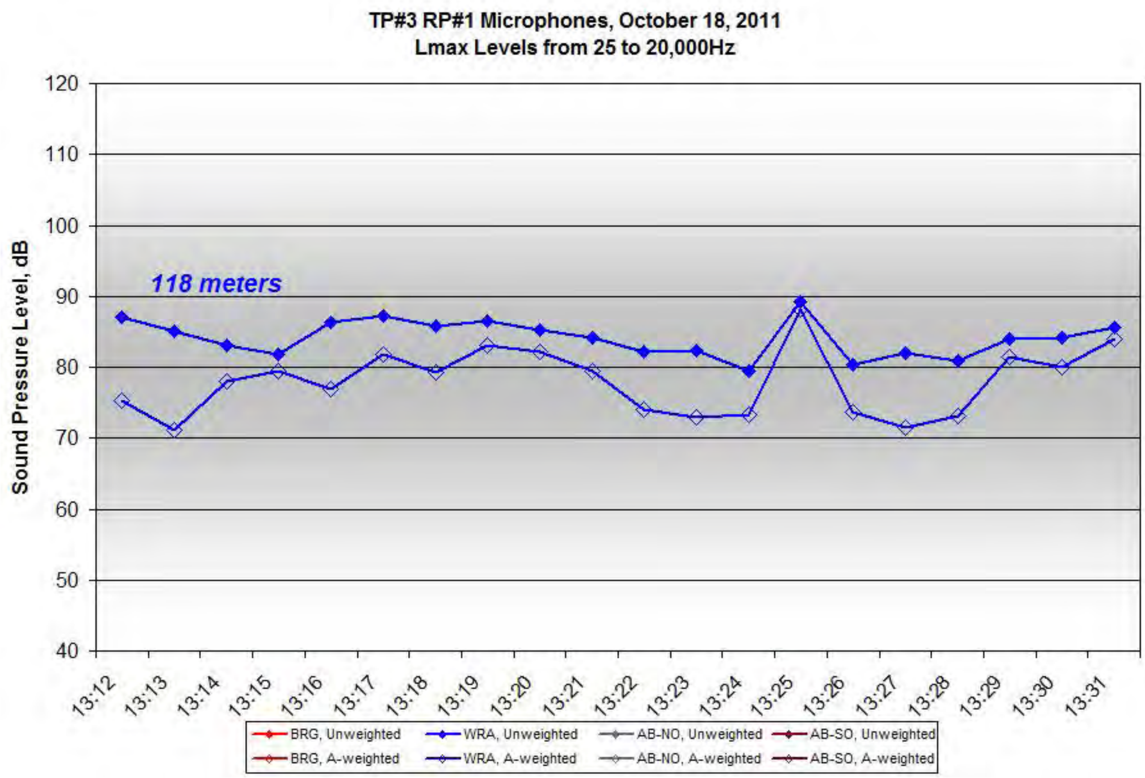

Figure C309. One-minute Unweighted and A-weighted Lmax Level at TP#3 RP#1, 13:13-13:31, on October 18, 2011

NO DATA AVAILABLE

Figure C310. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#1, 13:13-13:31, on October 18, 2011

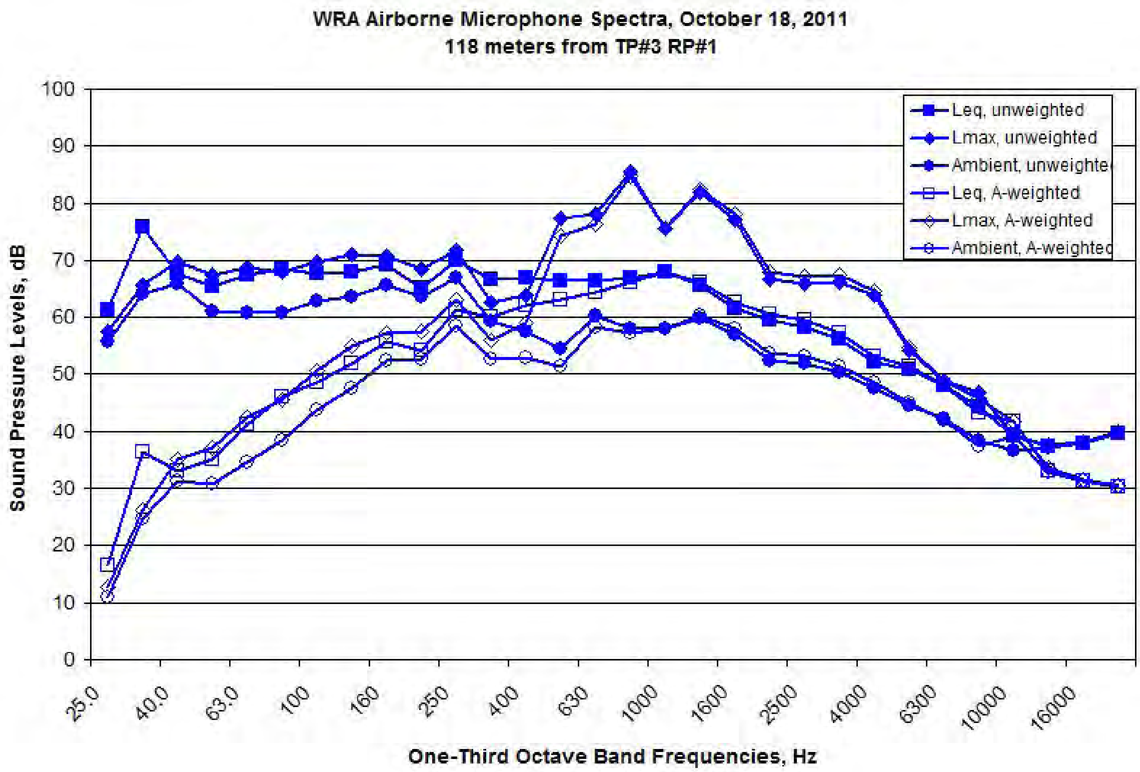

Figure C311. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#1, 13:13-13:31, on October 18, 2011

NO DATA AVAILABLE

Figure C312. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#1, 13:13-13:31, on October 18, 2011

NO DATA AVAILABLE

Figure C313. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#1, 13:13-13:31, on October 18, 2011

TP#3 RP#2

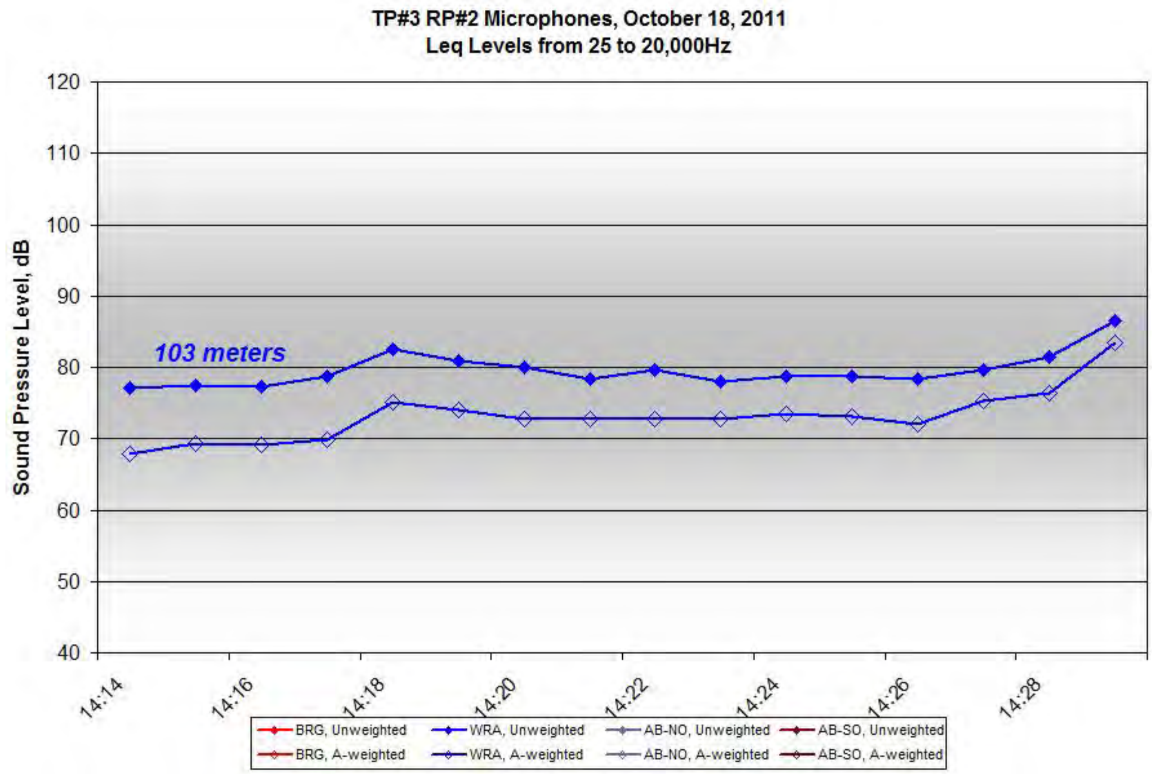

Figure C314. One-minute Unweighted and A-weighted Leq Level at TP#3 RP#2, 14:13-14:30, on October 18, 2011

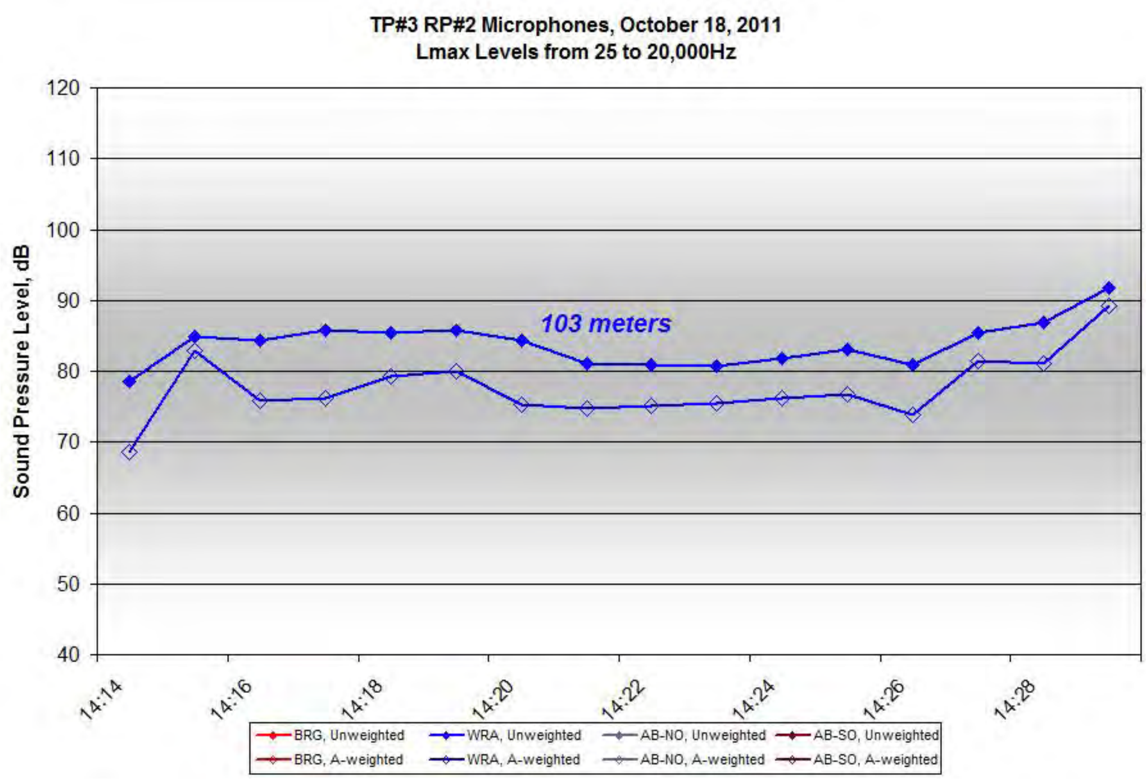

Figure C315. One-minute Unweighted and A-weighted Lmax Level at TP#3 RP#2, 14:13-14:30, on October 18, 2011

NO DATA AVAILABLE

Figure C316. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#2, 14:13-14:30, on October 18, 2011

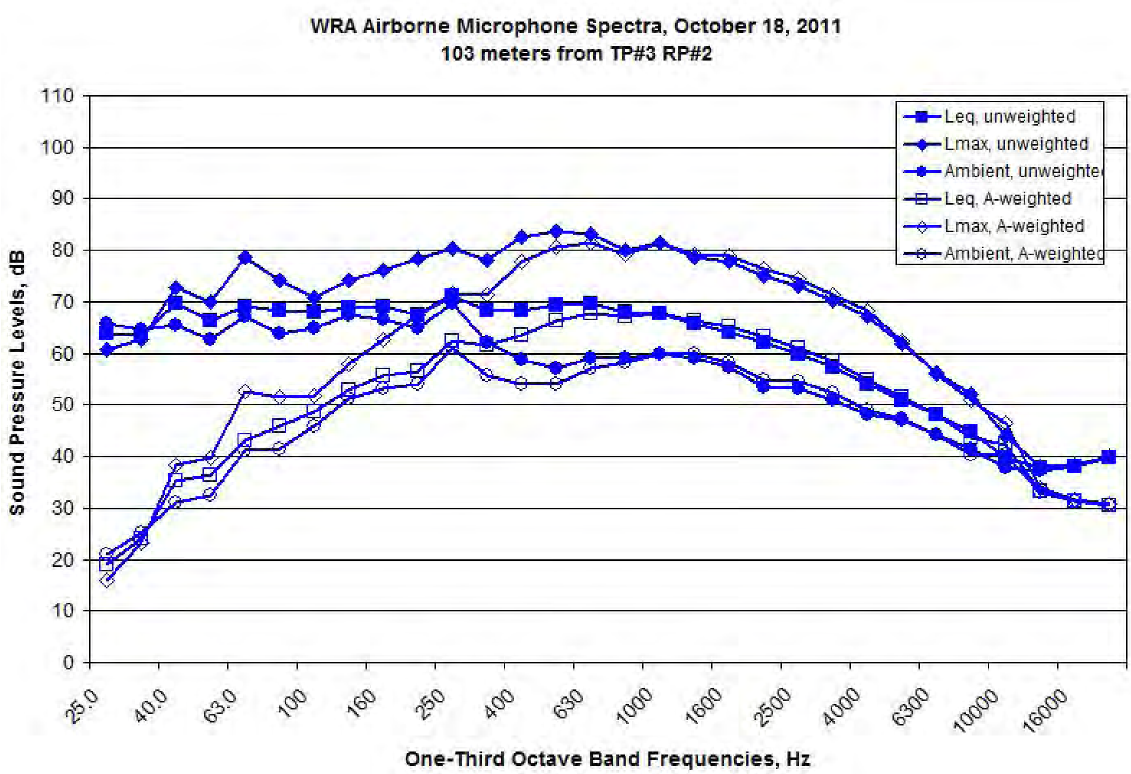

Figure C317. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#2, 14:13-14:30, on October 18, 2011

NO DATA AVAILABLE

Figure C318. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#2, 14:13-14:30, on October 18, 2011

NO DATA AVAILABLE

Figure C319. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#2, 14:13-14:30, on October 18, 2011

TP#3 MP#1

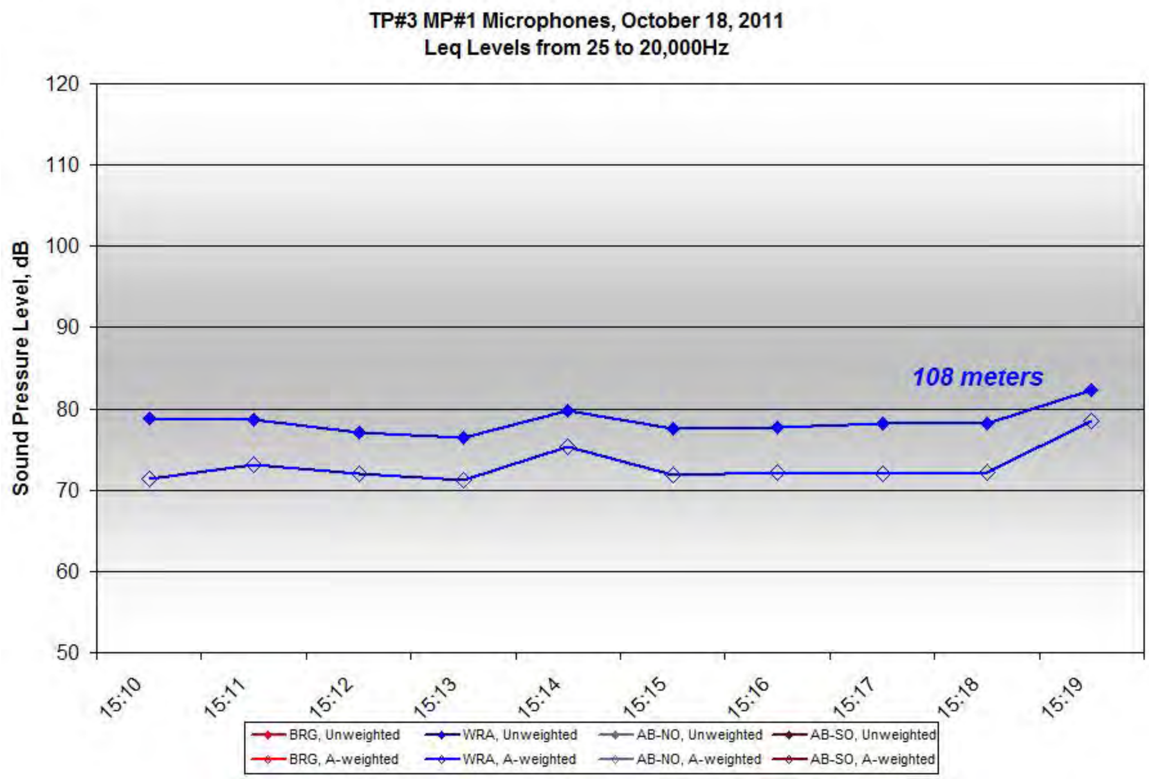

Figure C320. One-minute Unweighted and A-weighted Leq Level at TP#3 MP#1, 15:09-15:21, on October 18, 2011

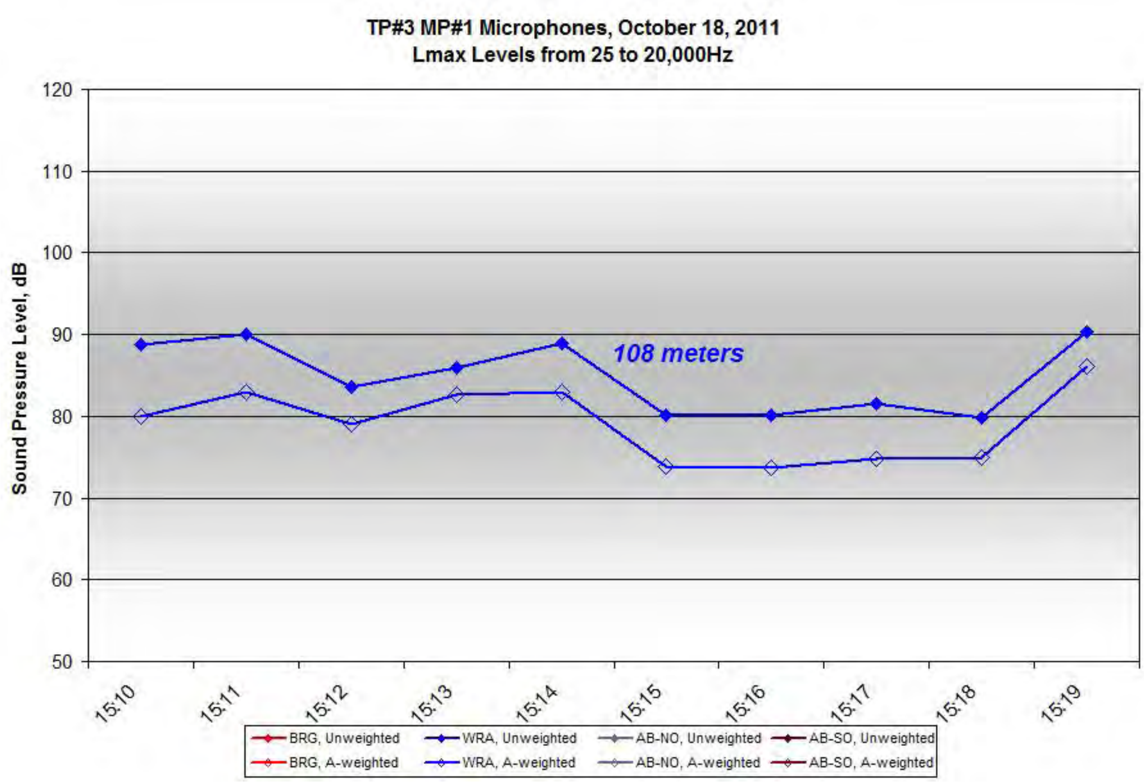

Figure C321. One-minute Unweighted and A-weighted Lmax Level at TP#3 MP#1, 15:09-15:21, on October 18, 2011

NO DATA AVAILABLE

Figure C322. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 MP#1, 15:09-15:21, on October 18, 2011

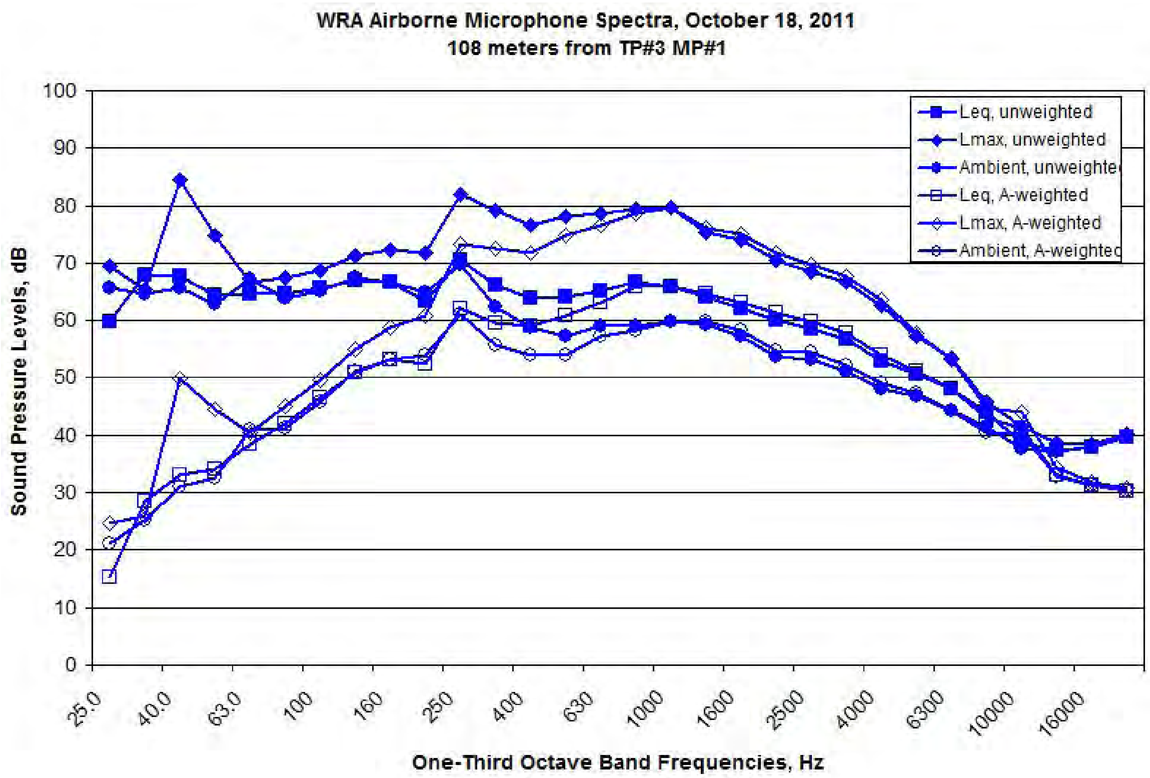

Figure C323. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 MP#1, 15:09-15:21, on October 18, 2011

NO DATA AVAILABLE

Figure C324. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 MP#1, 15:09-15:21, on October 18, 2011

NO DATA AVAILABLE

Figure C325. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 MP#1, 15:09-15:21, on October 18, 2011

10/19/2011 – TP#9 MP#2, 8:36-8:37

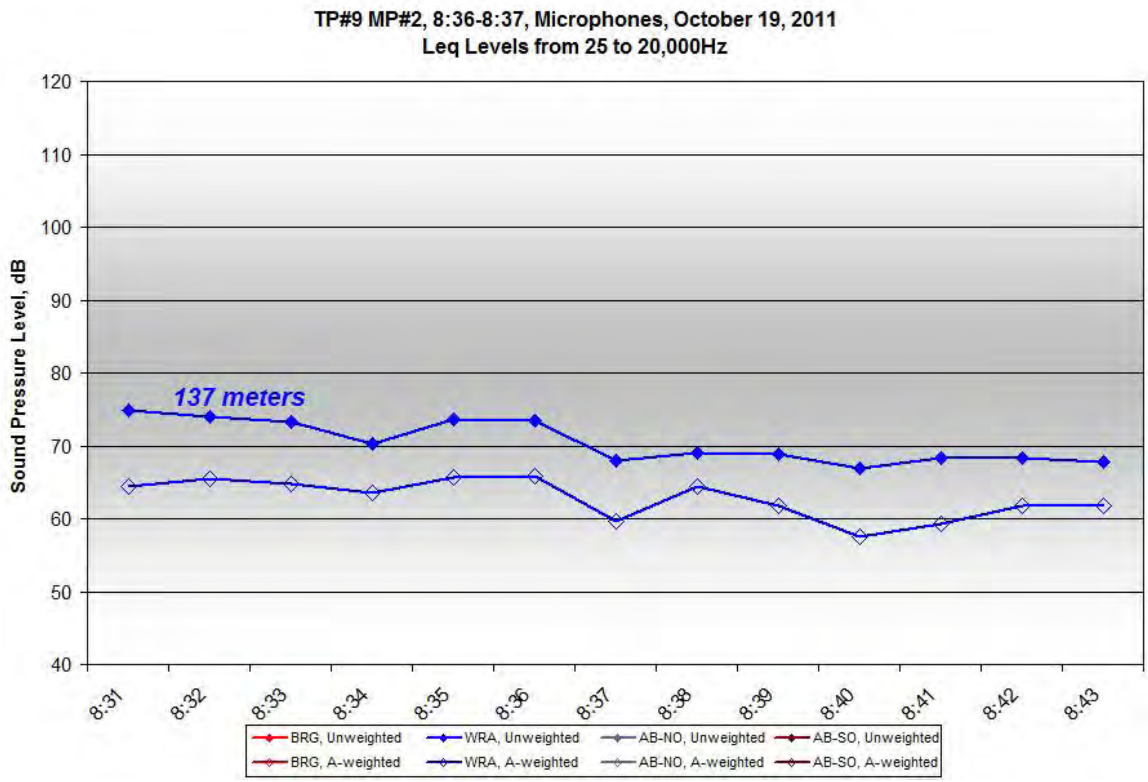

Figure C326. One-minute Unweighted and A-weighted Leq Level at TP#9 MP#2, 8:36-8:37, on October 19, 2011

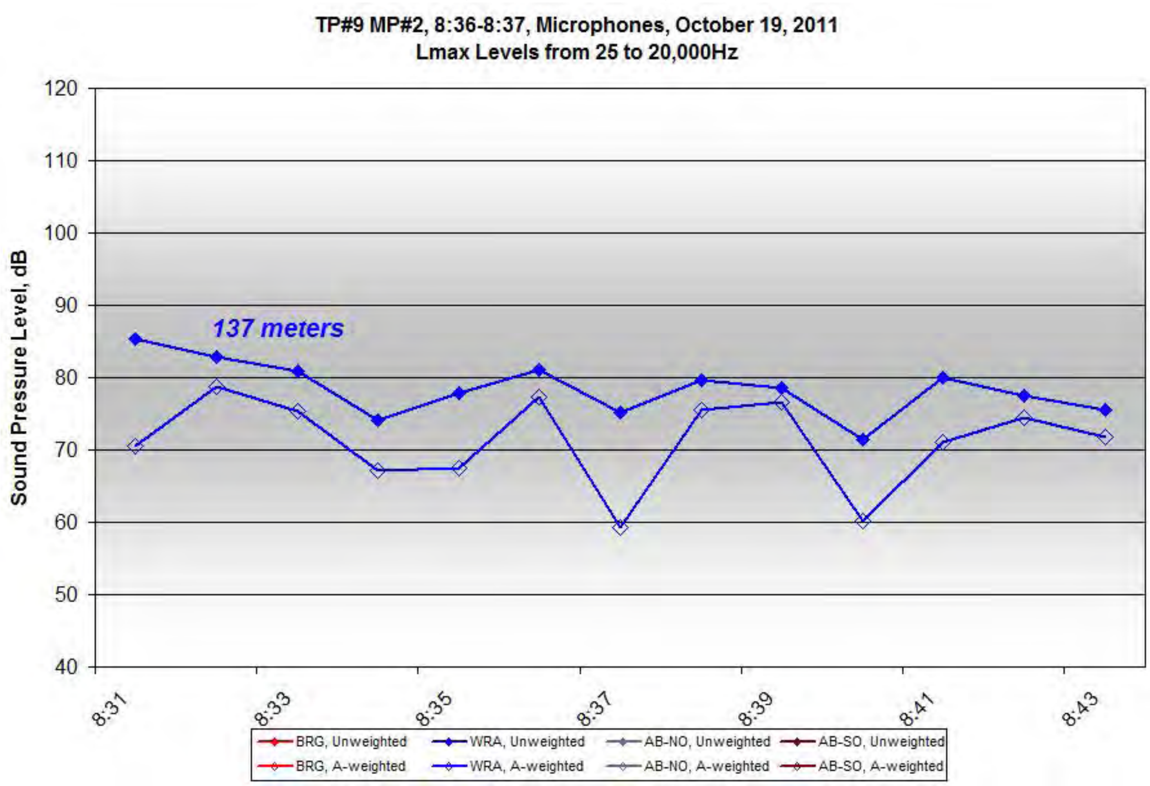

Figure C327. One-minute Unweighted and A-weighted Lmax Level at TP#9 MP#2, 8:36-8:37, on October 19, 2011

NO DATA AVAILABLE

Figure C328. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 MP#2, 8:36-8:37, on October 19, 2011

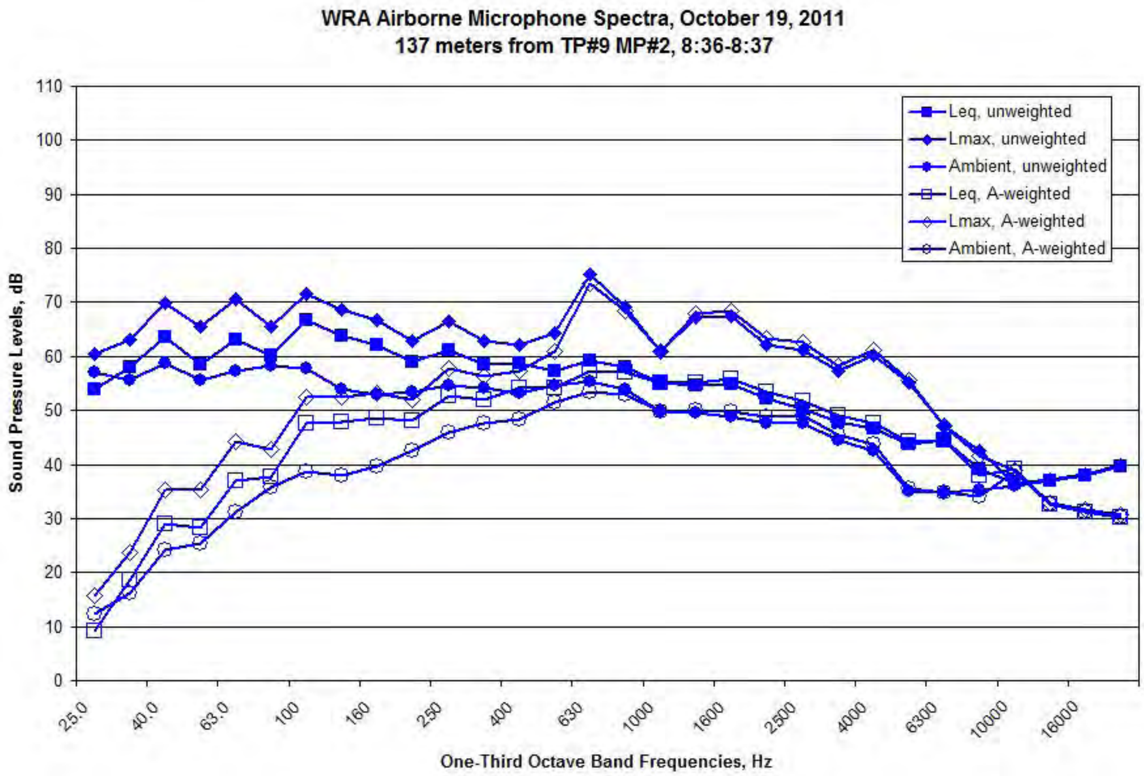

Figure C329. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 MP#2, 8:36-8:37, on October 19, 2011

NO DATA AVAILABLE

Figure C330. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 MP#2, 8:36-8:37, on October 19, 2011

NO DATA AVAILABLE

Figure C331. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 MP#2, 8:36-8:37, on October 19, 2011

TP#9 MP#2, 10:26-10:56

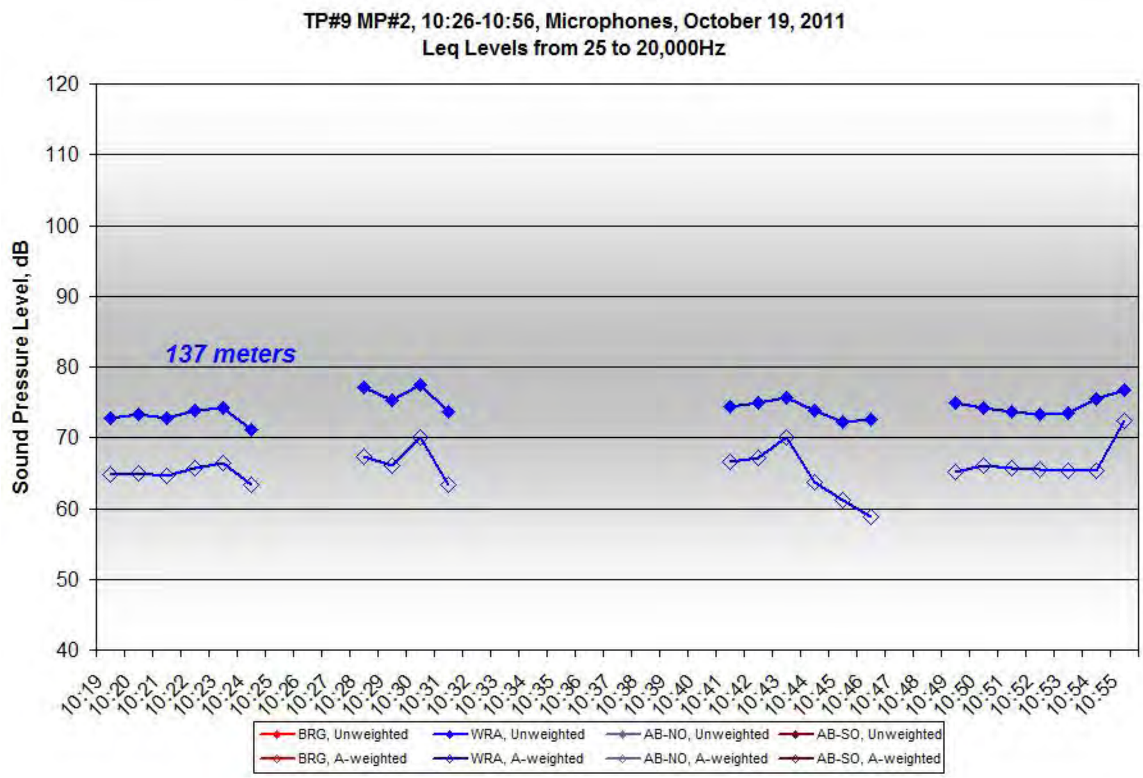

Figure C332. One-minute Unweighted and A-weighted Leq Level at TP#9 MP#2, 10:26-10:56, on October 19, 2011

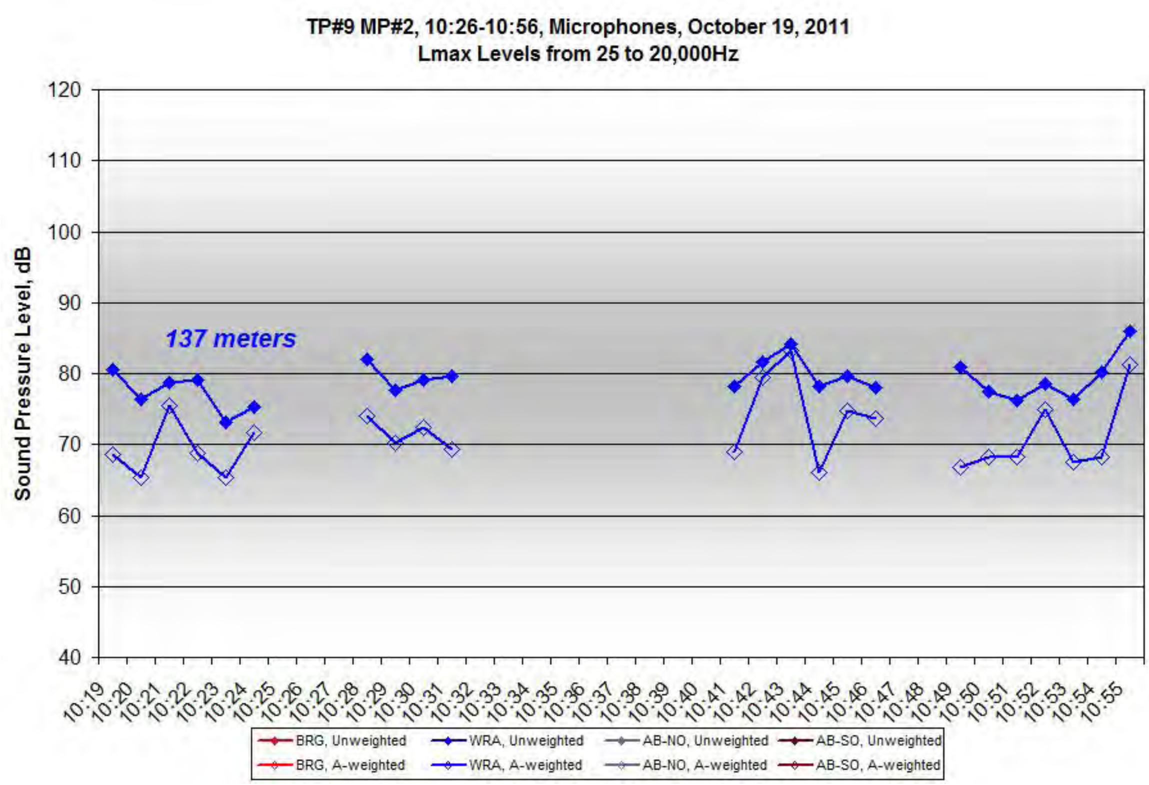

Figure C333. One-minute Unweighted and A-weighted Lmax Level at TP#9 MP#2, 10:26-10:56, on October 19, 2011

NO DATA AVAILABLE

Figure C334. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 MP#2, 10:26-10:56, on October 19, 2011

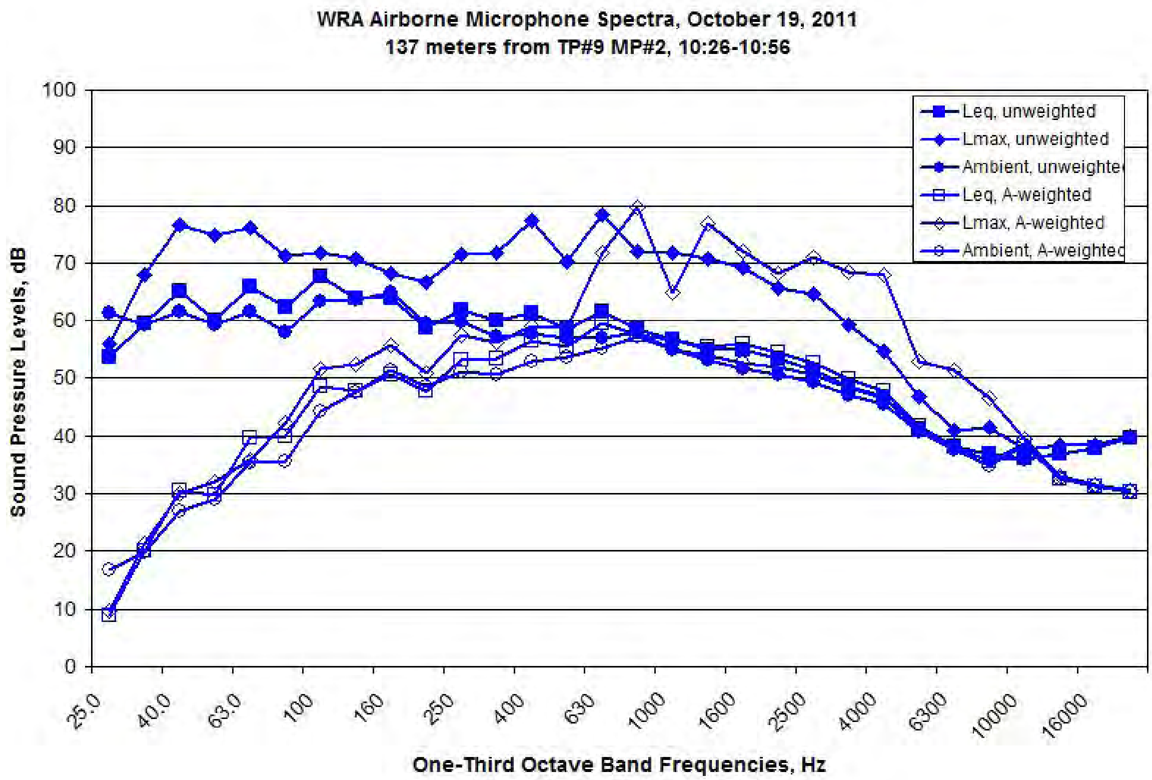

Figure C335. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 MP#2, 10:26-10:56, on October 19, 2011

NO DATA AVAILABLE

Figure C336. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 MP#2, 10:26-10:56, on October 19, 2011

NO DATA AVAILABLE

Figure C337. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 MP#2, 10:26-10:56, on October 19, 2011

TP#9 MP#3

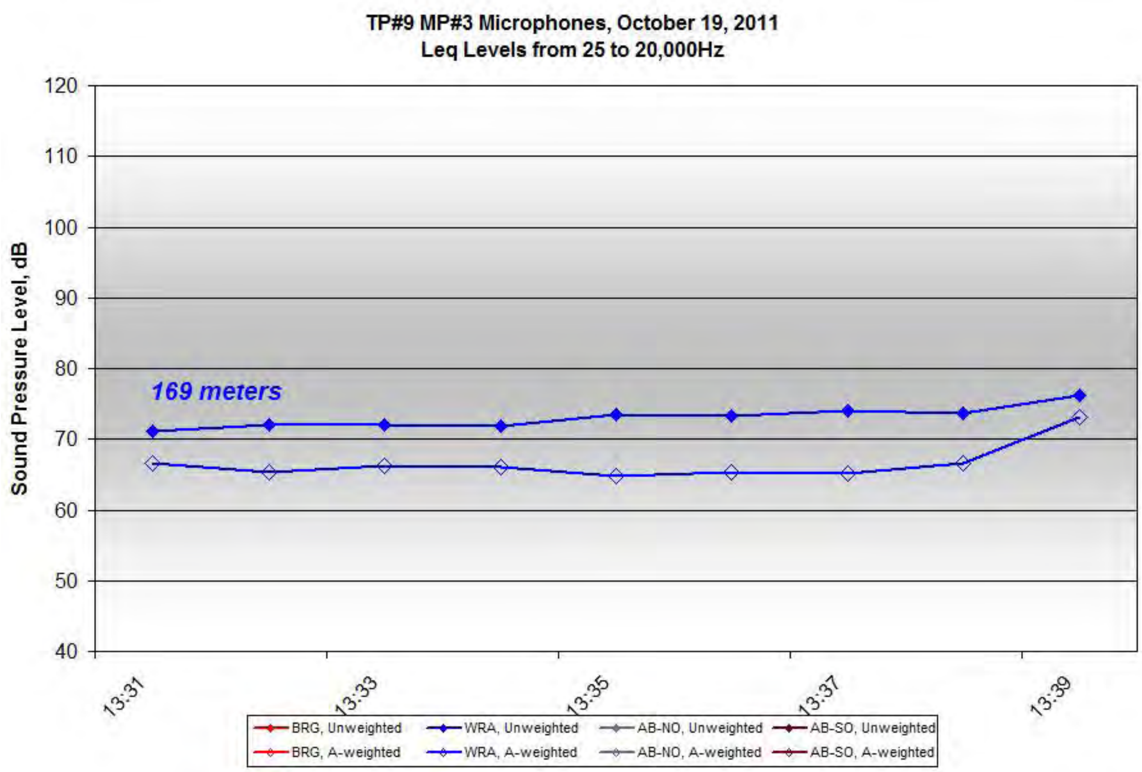

Figure C338. One-minute Unweighted and A-weighted Leq Level at TP#9 MP#3, 13:33-13:40, on October 19, 2011

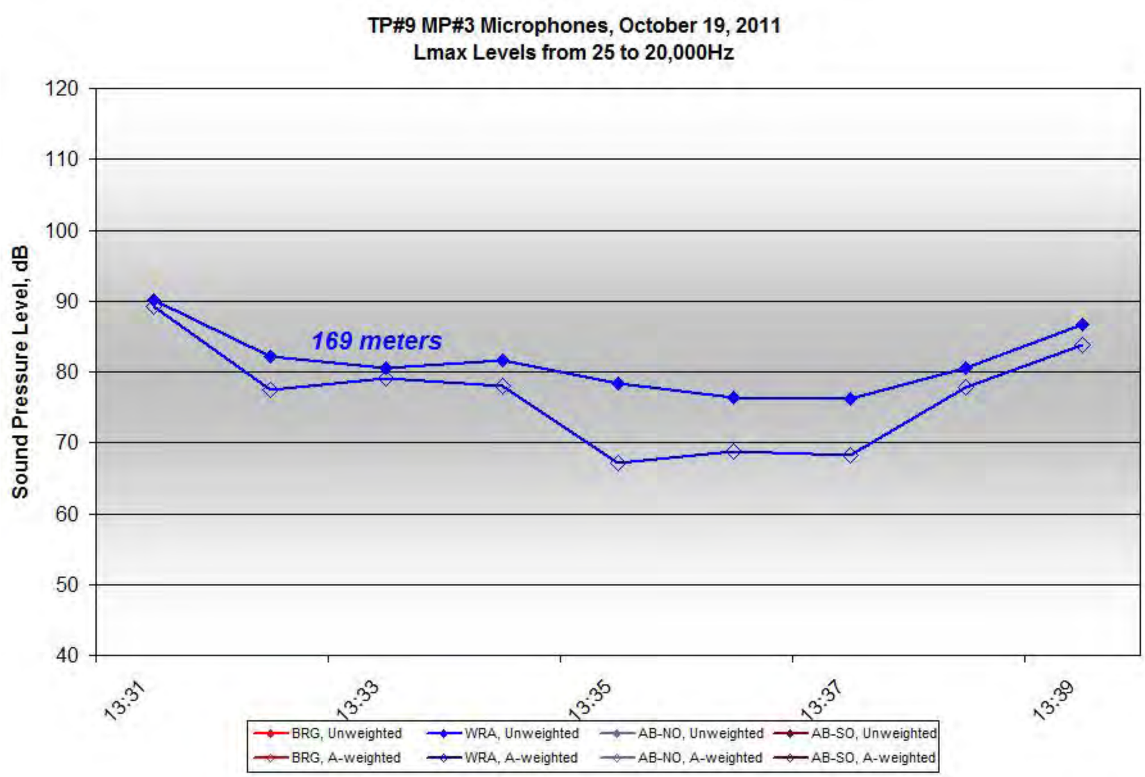

Figure C339. One-minute Unweighted and A-weighted Lmax Level at TP#9 MP#3, 13:33-13:40, on October 19, 2011

NO DATA AVAILABLE

Figure C340. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 MP#3, 13:33-13:40, on October 19, 2011

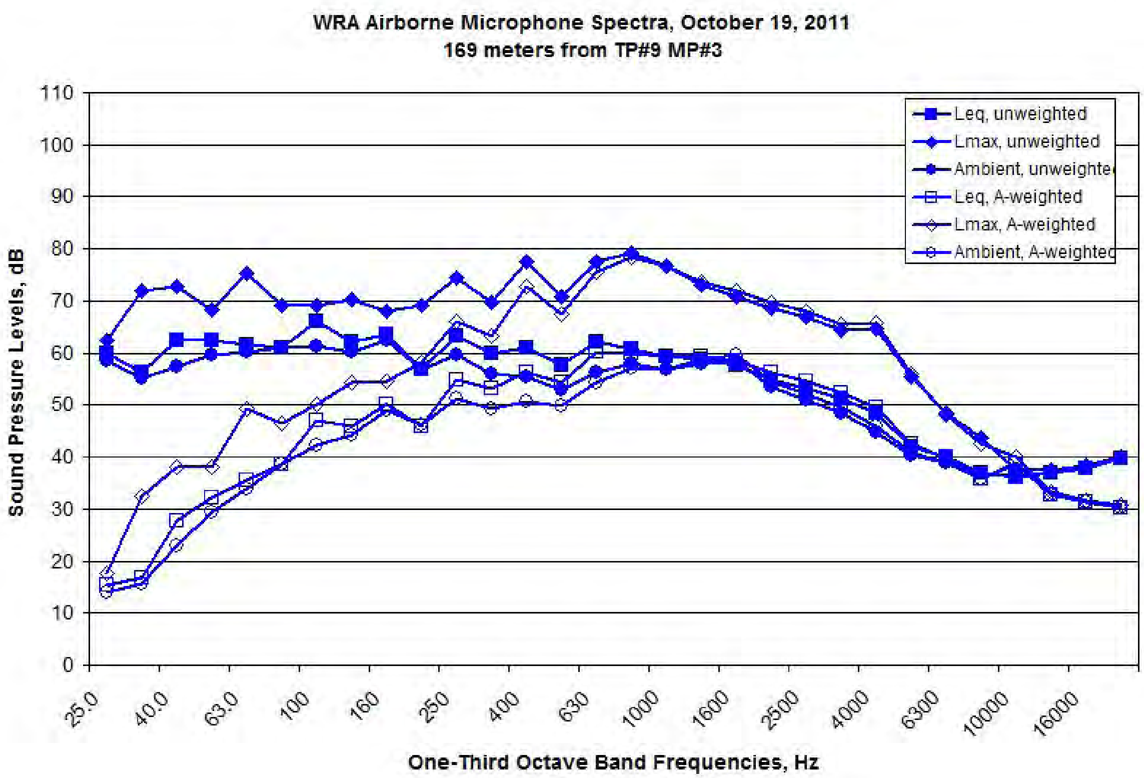

Figure C341. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 MP#3, 13:33-13:40, on October 19, 2011

NO DATA AVAILABLE

Figure C342. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 MP#3, 13:33-13:40, on October 19, 2011

NO DATA AVAILABLE

Figure C343. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 MP#3, 13:33-13:40, on October 19, 2011

TP#9 MP#1

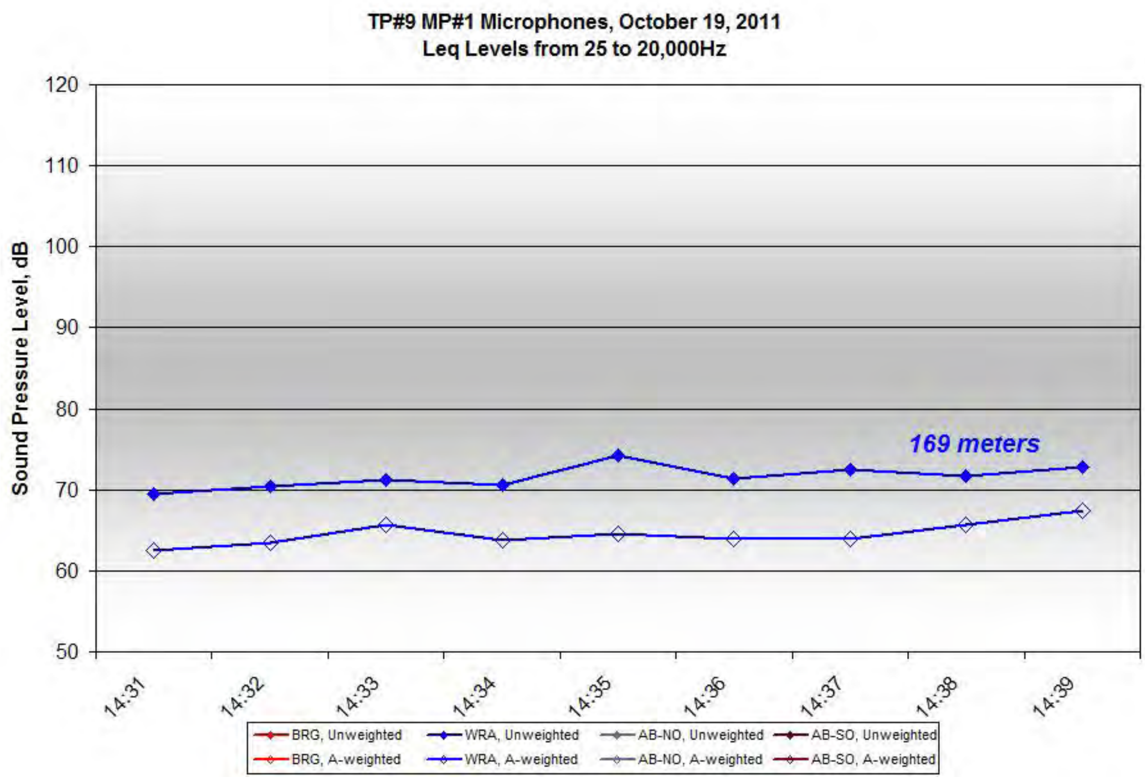

Figure C344. One-minute Unweighted and A-weighted Leq Level at TP#9 MP#1, 14:34-14:40, on October 19, 2011

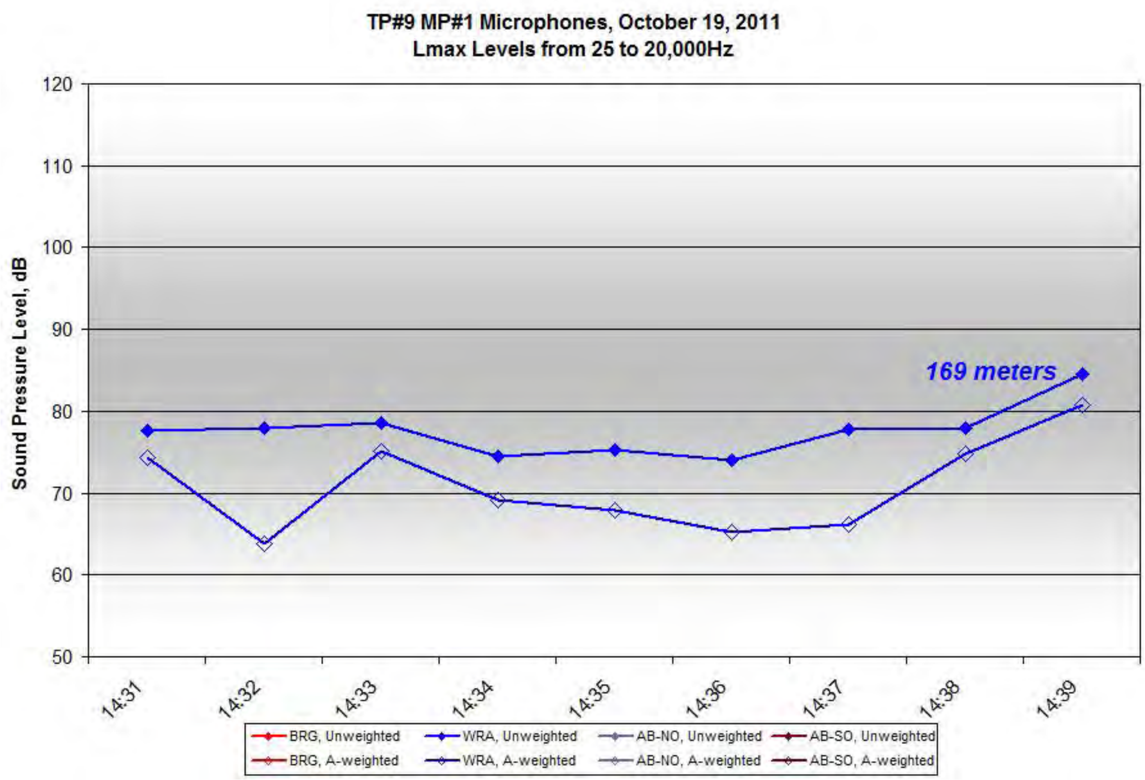

Figure C345. One-minute Unweighted and A-weighted Lmax Level at TP#9 MP#1, 14:34-14:40, on October 19, 2011

NO DATA AVAILABLE

Figure C346. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 MP#1, 14:34-14:40, on October 19, 2011

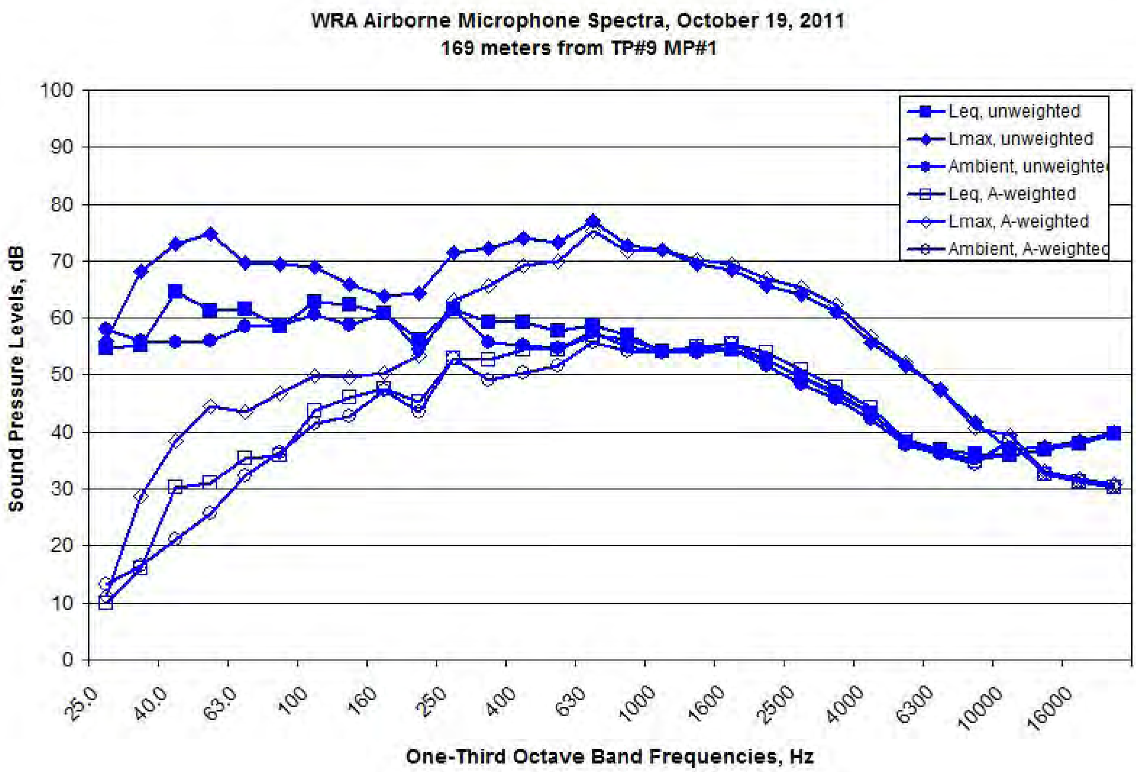

Figure C347. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 MP#1, 14:34-14:40, on October 19, 2011

NO DATA AVAILABLE

Figure C348. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 MP#1, 14:34-14:40, on October 19, 2011

NO DATA AVAILABLE

Figure C349. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 MP#1, 14:34-14:40, on October 19, 2011

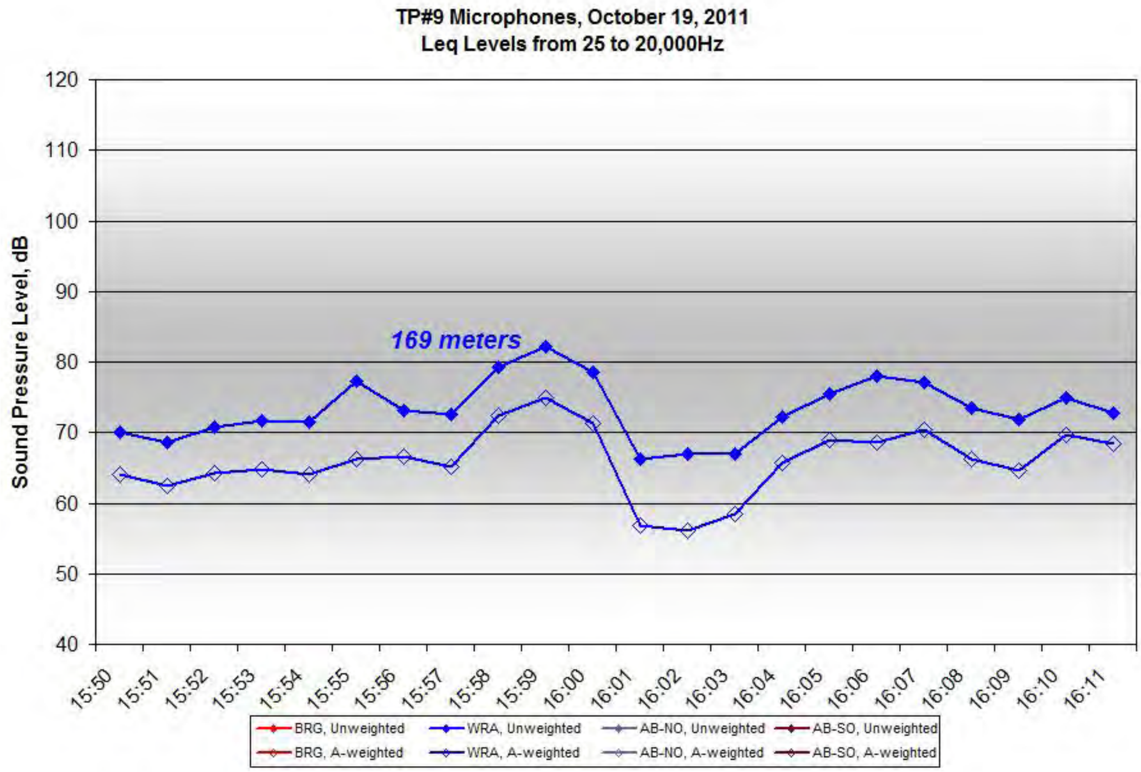

Figure C350. One-minute Unweighted and A-weighted Leq Level at TP#9, 15:55-16:12, on October 19, 2011

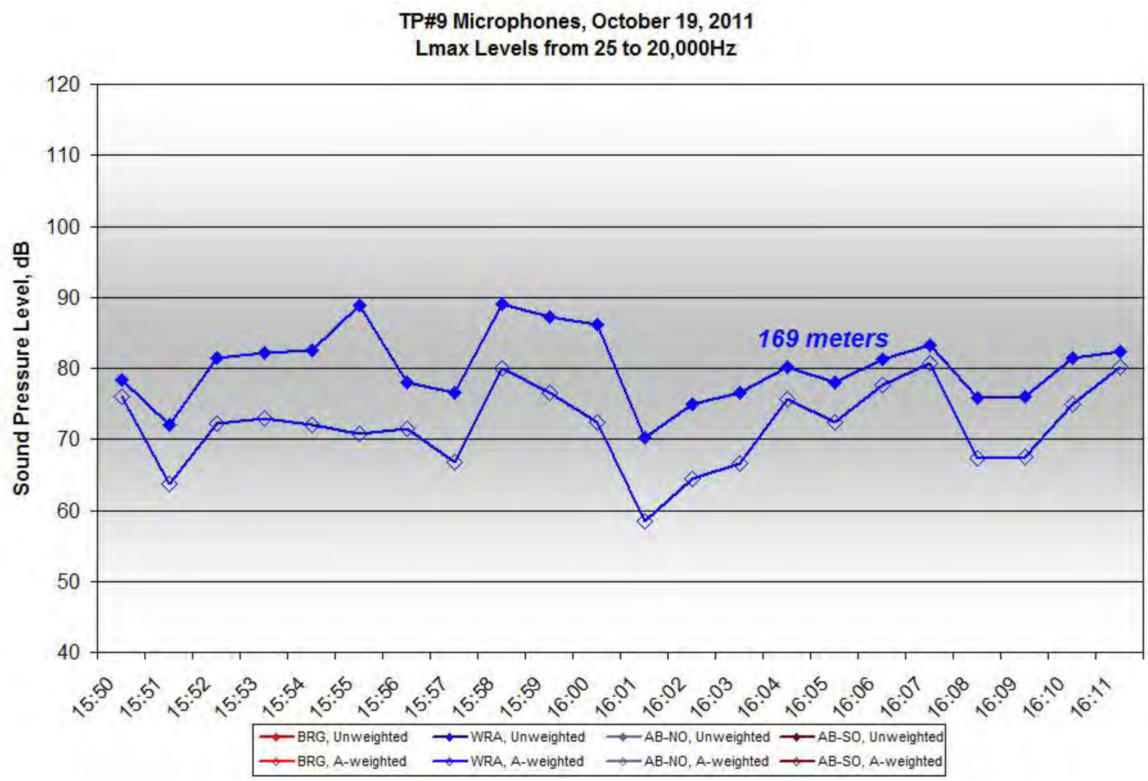

Figure C351. One-minute Unweighted and A-weighted Lmax Level at TP#9, 15:55-16:12, on October 19, 2011

NO DATA AVAILABLE

Figure C352. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9, 15:55-16:12, on October 19, 2011

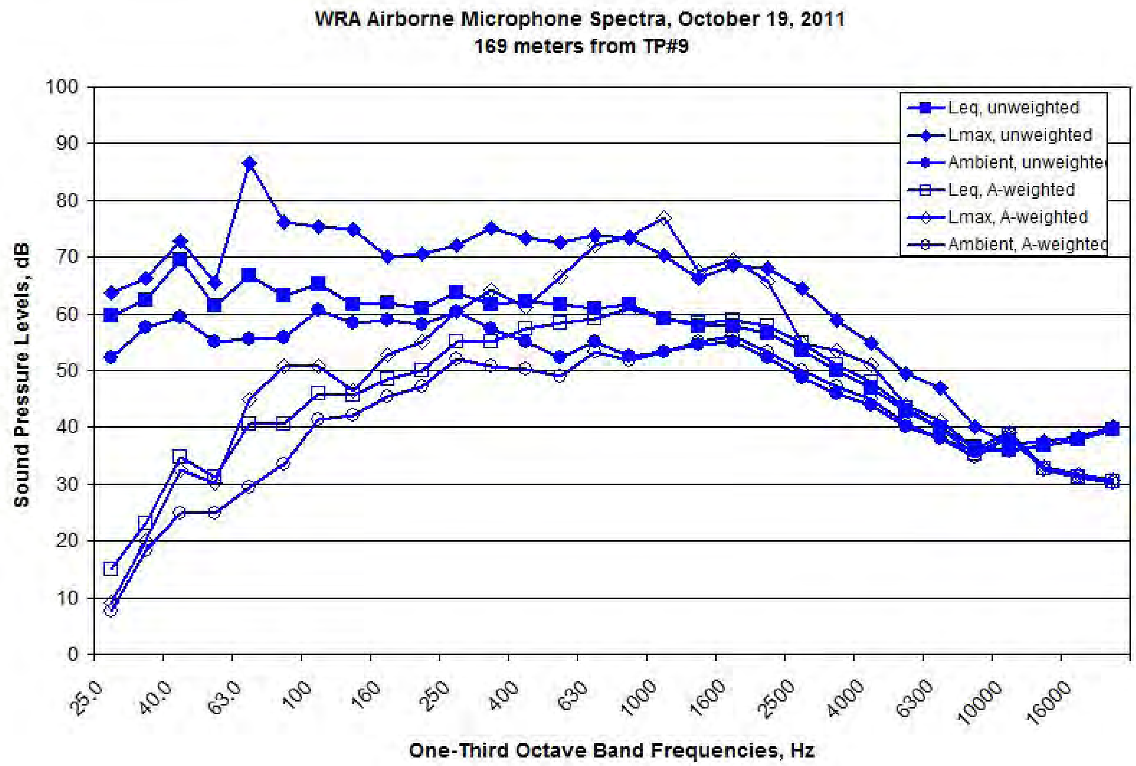

Figure C353. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9, 15:55-16:12, on October 19, 2011

NO DATA AVAILABLE

Figure C354. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9, 15:55-16:12, on October 19, 2011

NO DATA AVAILABLE

Figure C355. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9, 15:55-16:12, on October 19, 2011

10/20/2011 – TP#9 RP#3

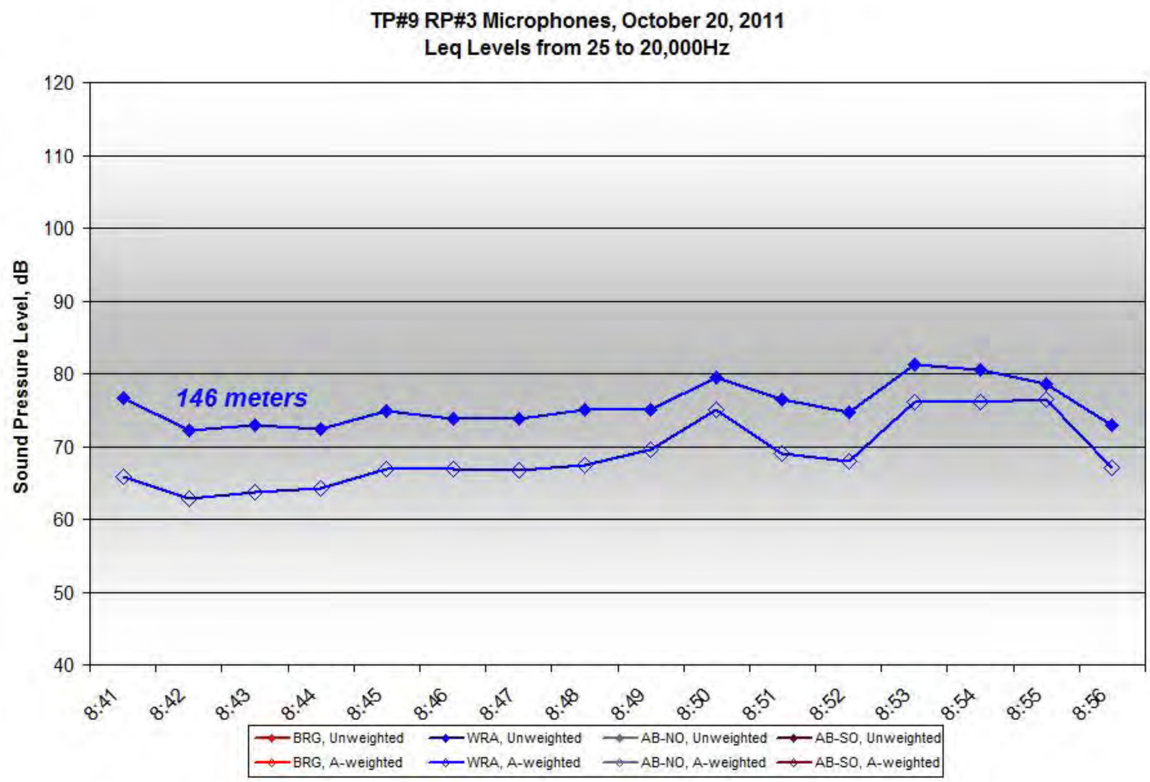

Figure C356. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#3, 8:40-8:56, on October 20, 2011

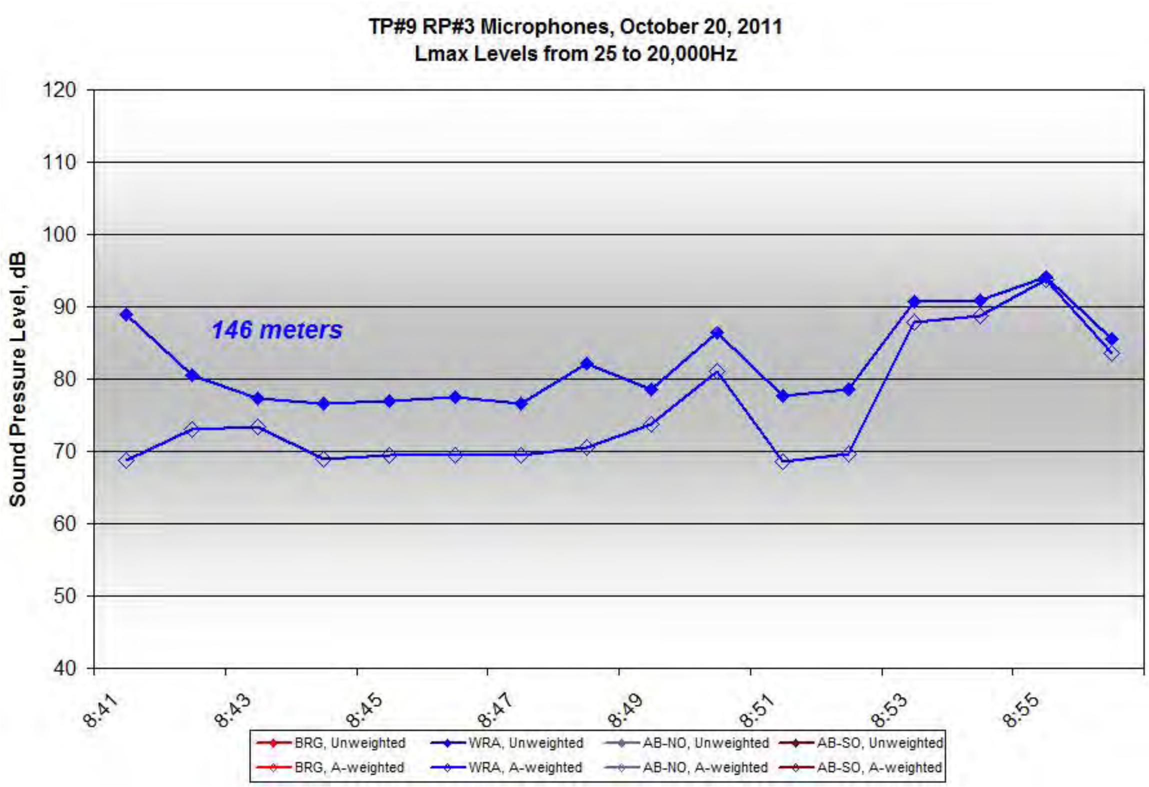

Figure C357. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#3, 8:40-8:56, on October 20, 2011

NO DATA AVAILABLE

Figure C358. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#3, 8:40-8:56, on October 20, 2011

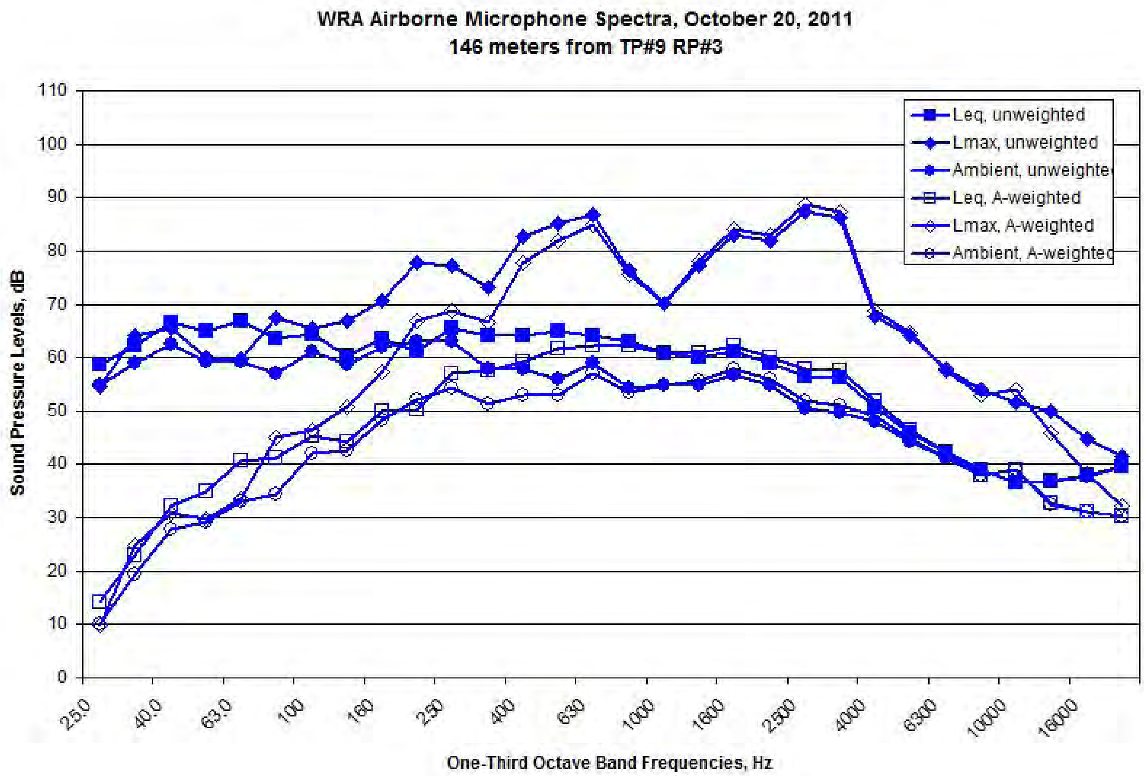

Figure C359. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#3, 8:40-8:56, on October 20, 2011

NO DATA AVAILABLE

Figure C360. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#3, 8:40-8:56, on October 20, 2011

NO DATA AVAILABLE

Figure C361. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#3, 8:40-8:56, on October 20, 2011

TP#9 RP#1

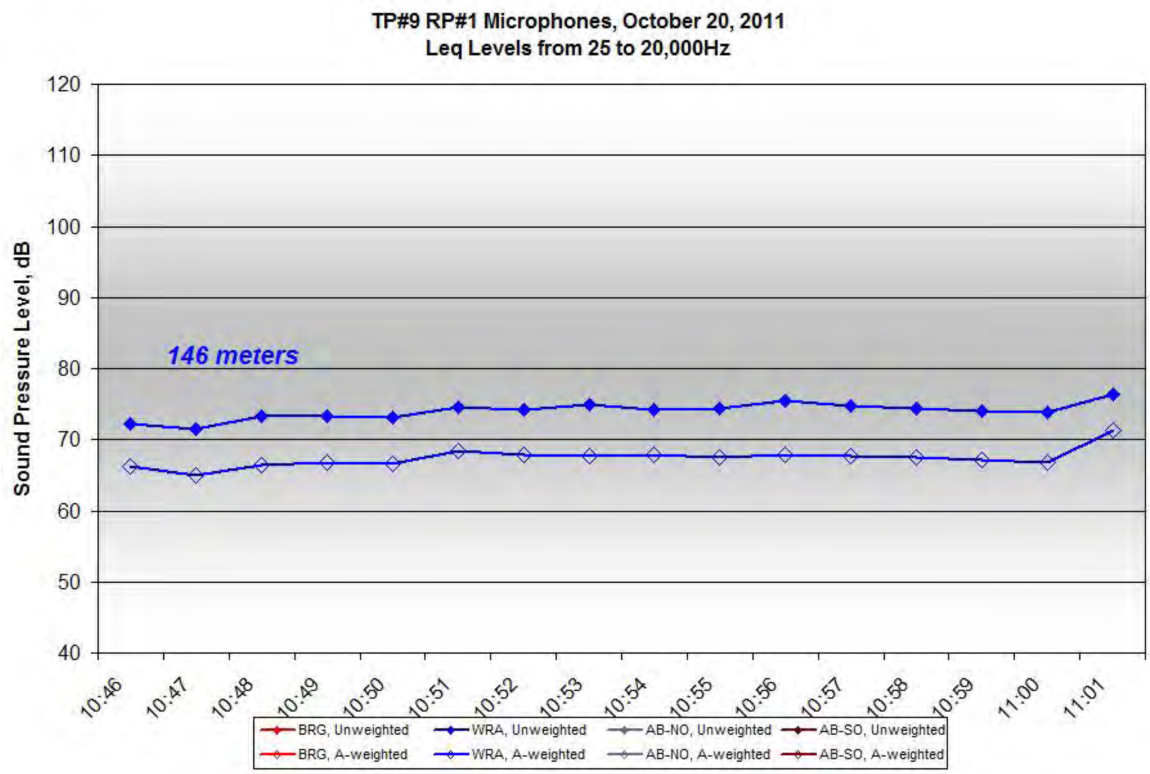

Figure C362. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#1, 10:51-11:02, on October 20, 2011

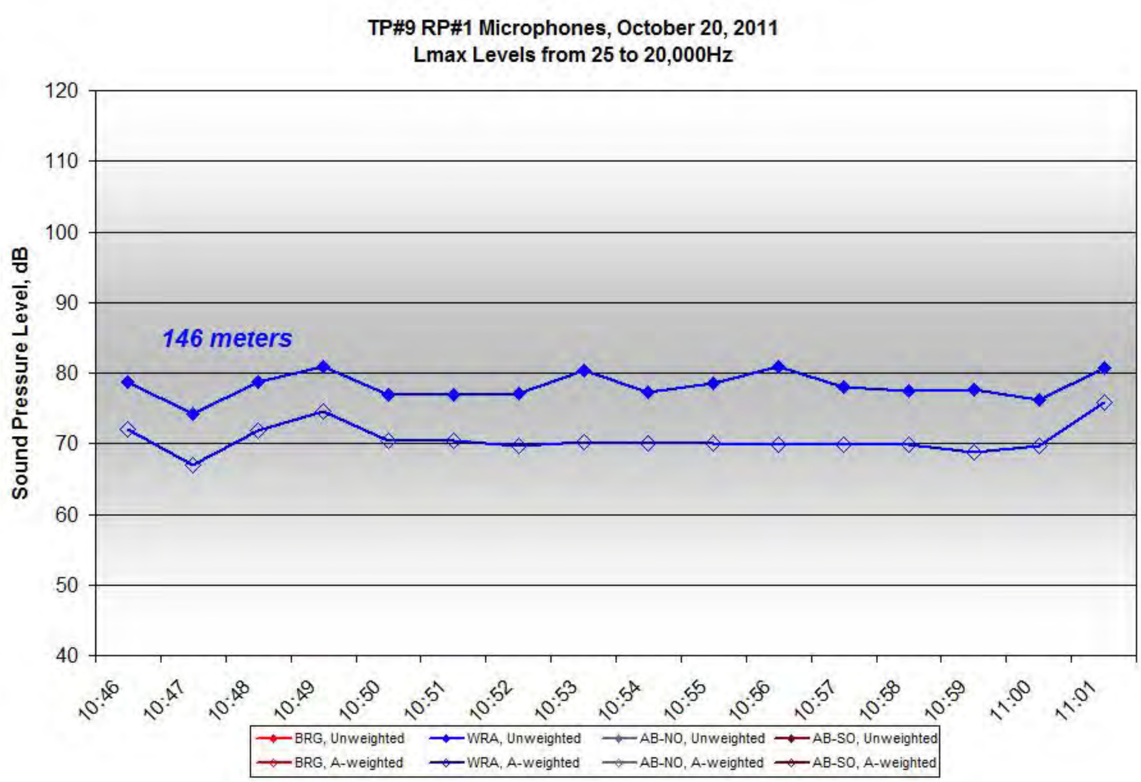

Figure C363. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#1, 10:51-11:02, on October 20, 2011

NO DATA AVAILABLE

Figure C364. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#1, 10:51-11:02, on October 20, 2011

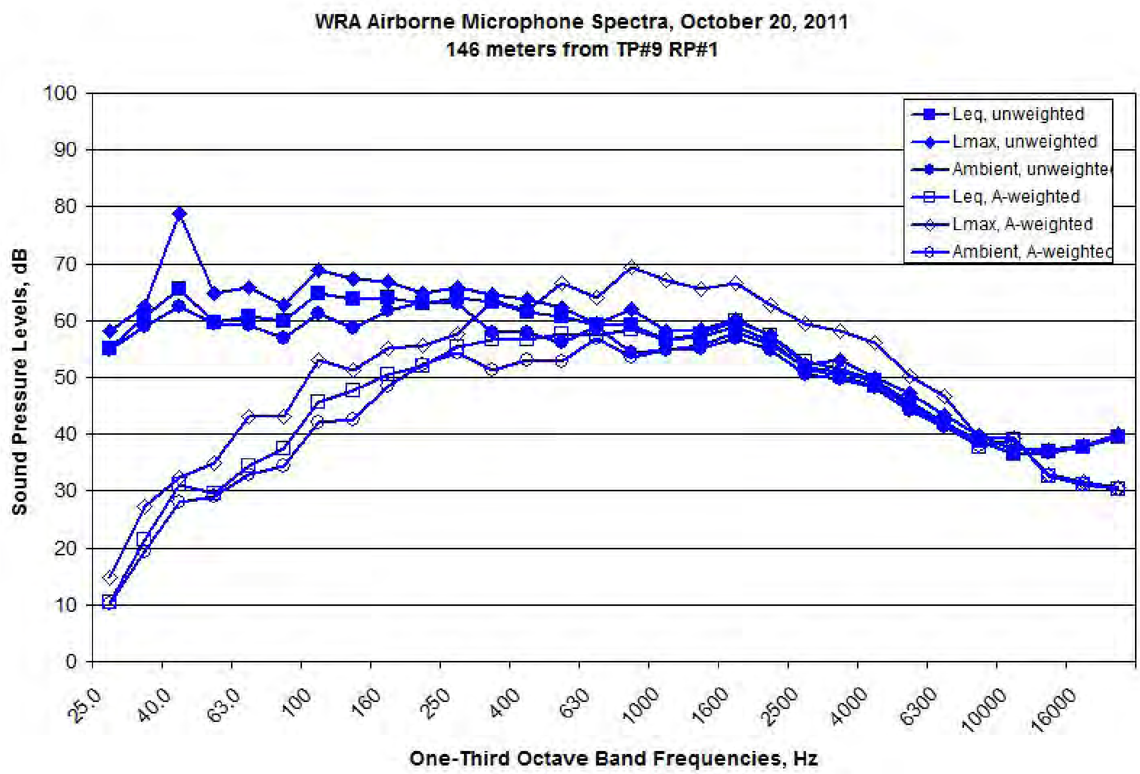

Figure C365. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#1, 10:51-11:02, on October 20, 2011

NO DATA AVAILABLE

Figure C366. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#1, 10:51-11:02, on October 20, 2011

NO DATA AVAILABLE

Figure C367. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#1, 10:51-11:02, on October 20, 2011

TP#9 RP#2

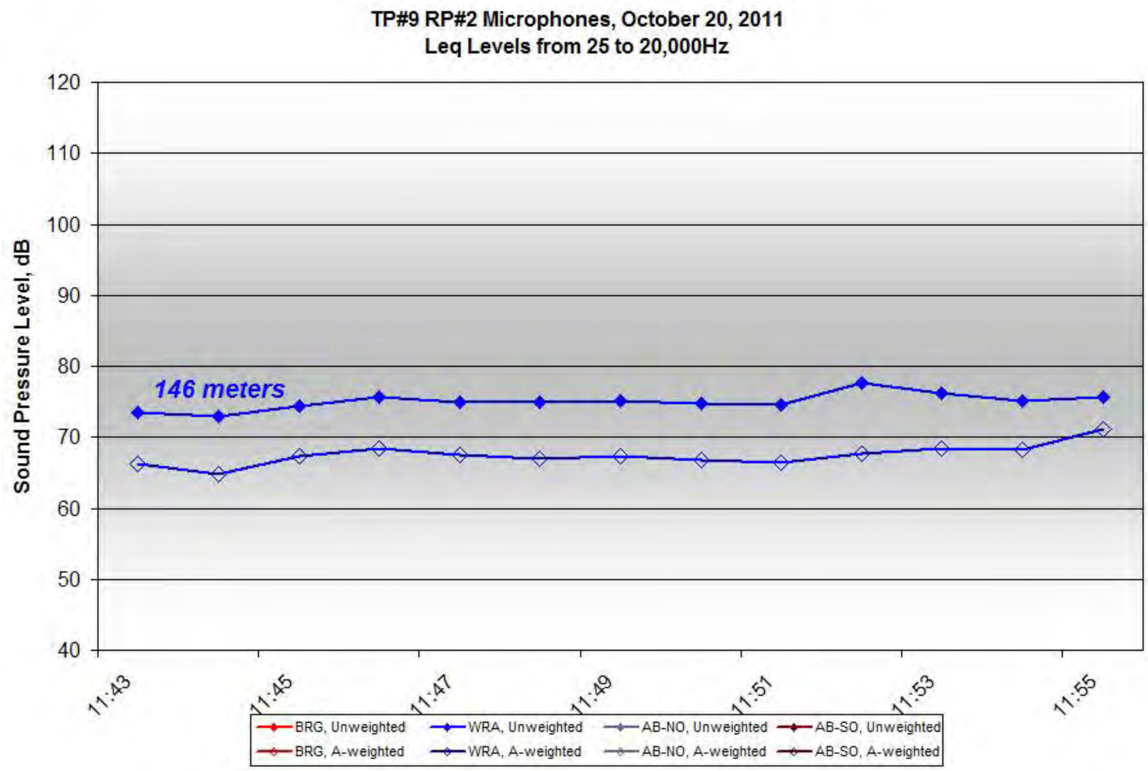

Figure C368. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#2, 11:46-11:55, on October 20, 2011

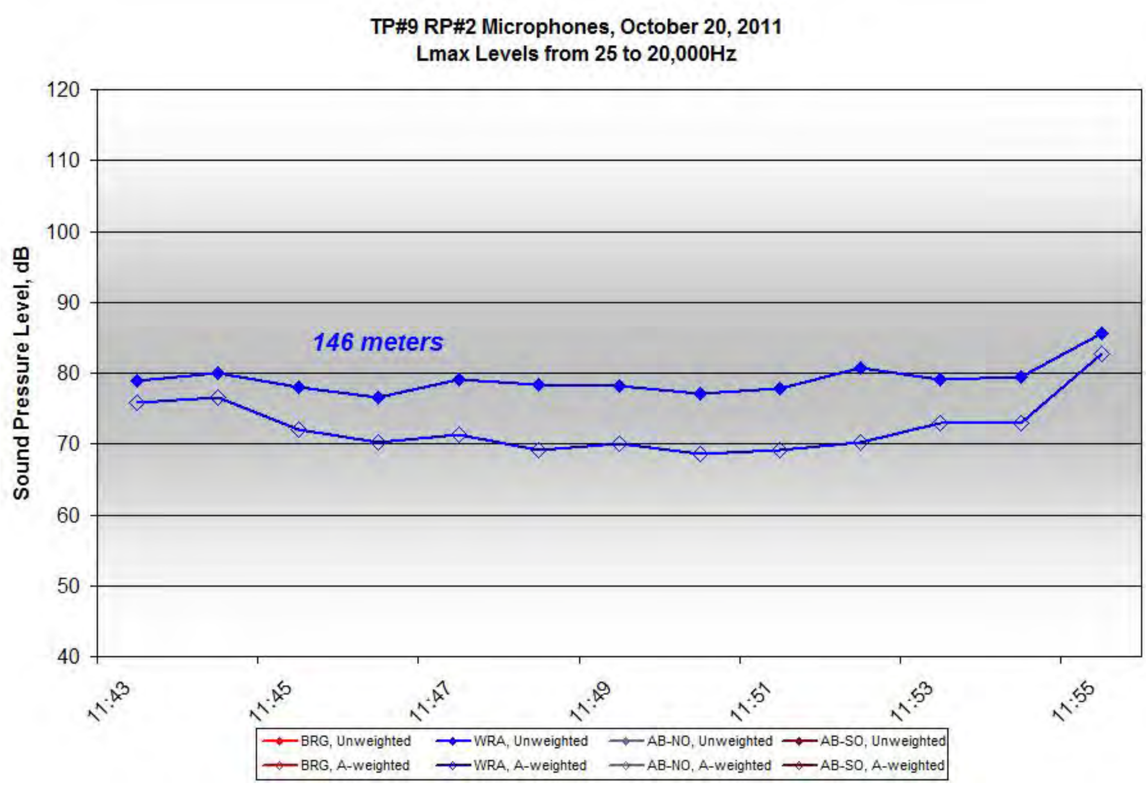

Figure C369. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#2, 11:46-11:55, on October 20, 2011

NO DATA AVAILABLE

Figure C370. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#2, 11:46-11:55, on October 20, 2011

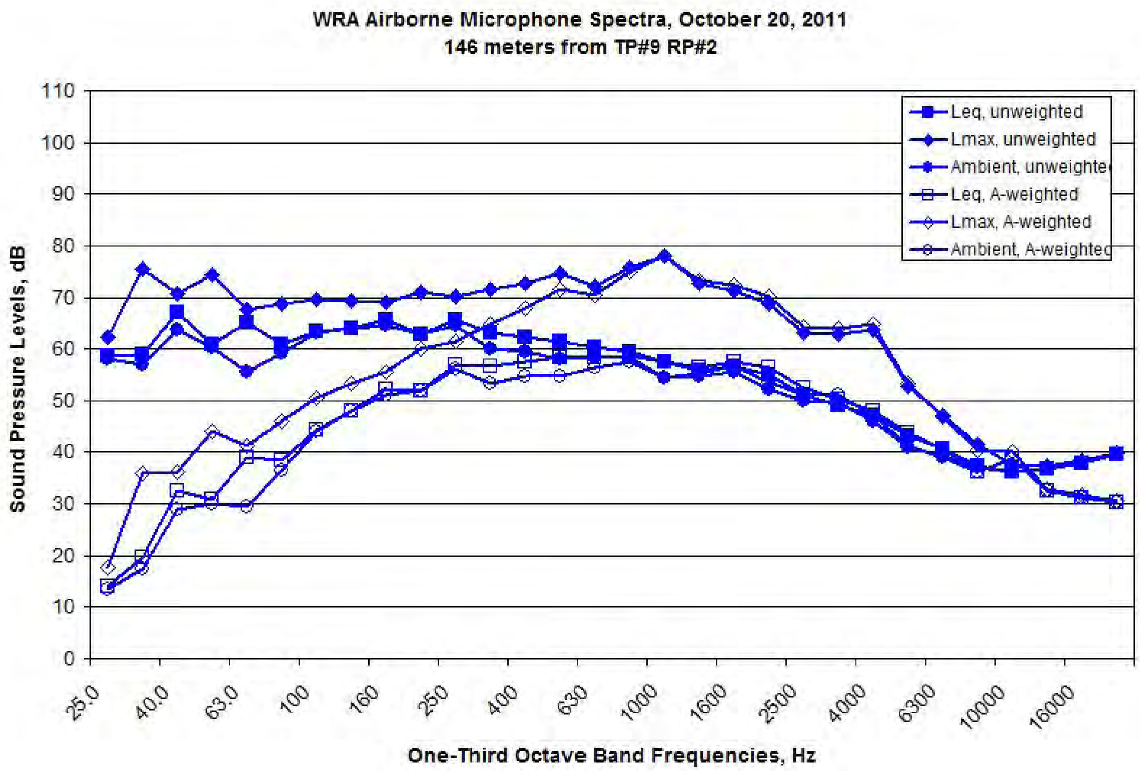

Figure C371. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#2, 11:46-11:55, on October 20, 2011

NO DATA AVAILABLE

Figure C372. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#2, 11:46-11:55, on October 20, 2011

NO DATA AVAILABLE

Figure C373. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#2, 11:46-11:55, on October 20, 2011

TTP#4, 13:33-13:40

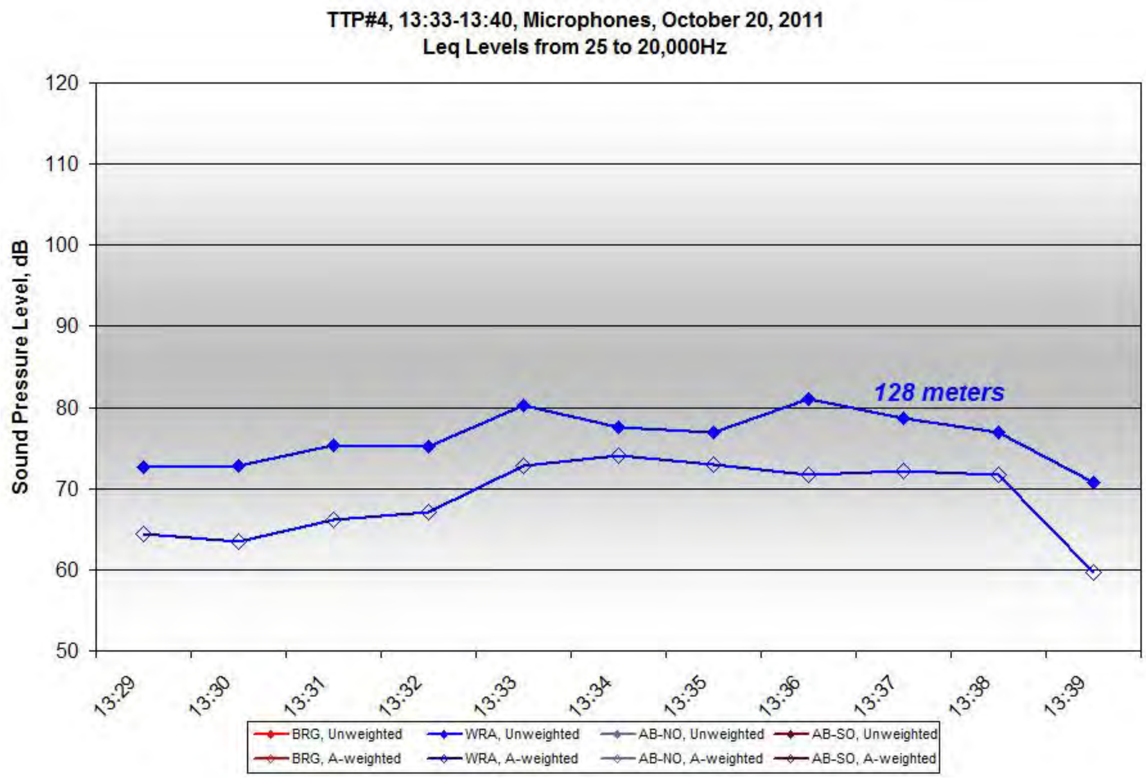

Figure C374. One-minute Unweighted and A-weighted Leq Level at TTP#4, 13:33-13:40, on October 20, 2011

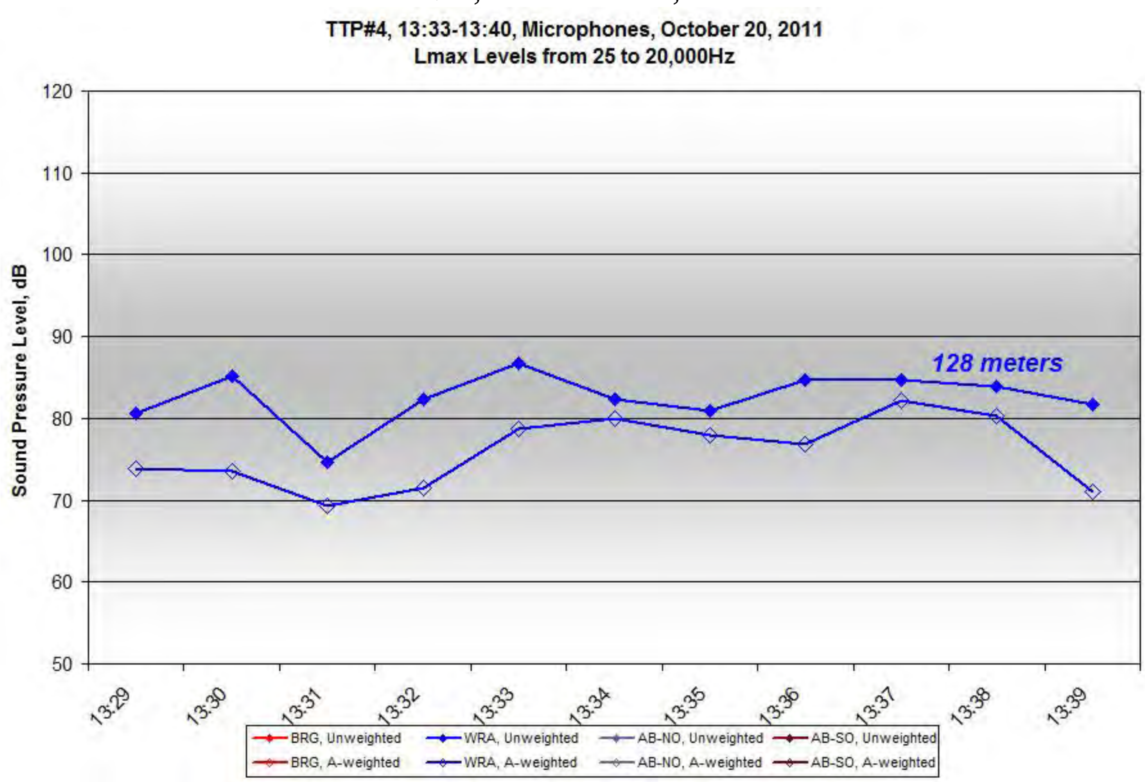

Figure C375. One-minute Unweighted and A-weighted Lmax Level at TTP#4, 13:33-13:40, on October 20, 2011

NO DATA AVAILABLE

Figure C376. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#4, 13:33-13:40, on October 20, 2011

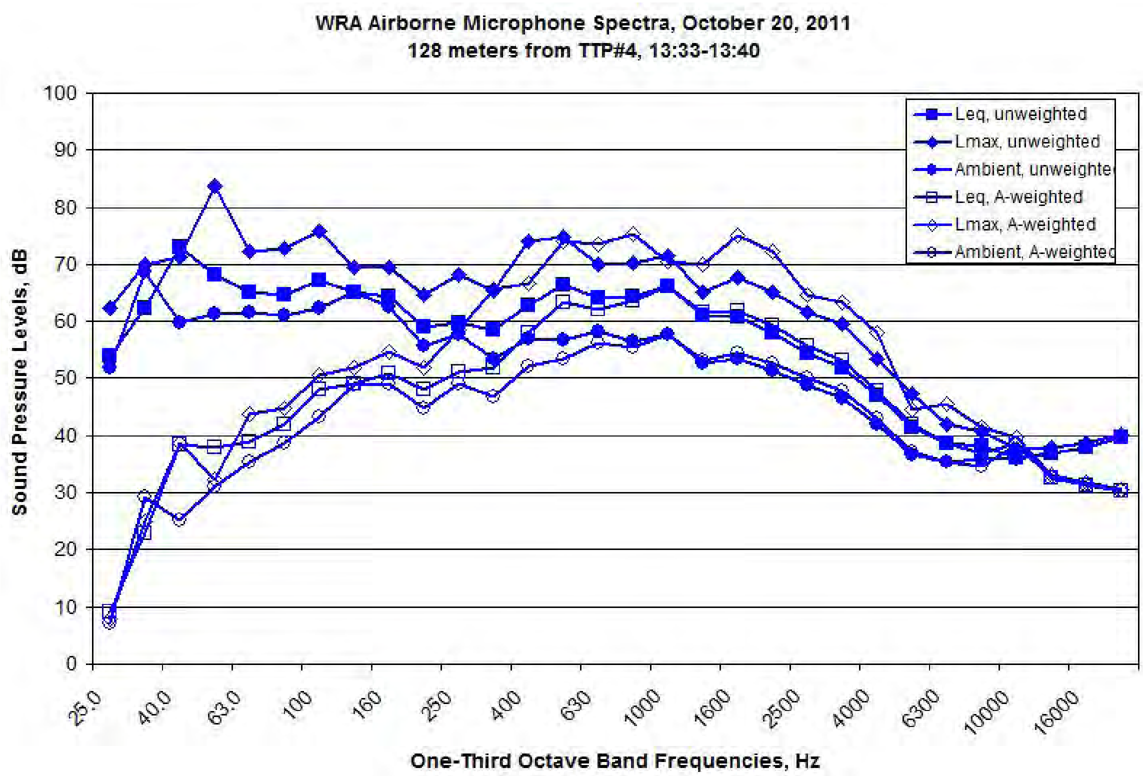

Figure C377. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#4, 13:33-13:40, on October 20, 2011

NO DATA AVAILABLE

Figure C378. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#4, 13:33-13:40, on October 20, 2011

NO DATA AVAILABLE

Figure C379. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#4, 13:33-13:40, on October 20, 2011

TTP#4, 14:03-14:13

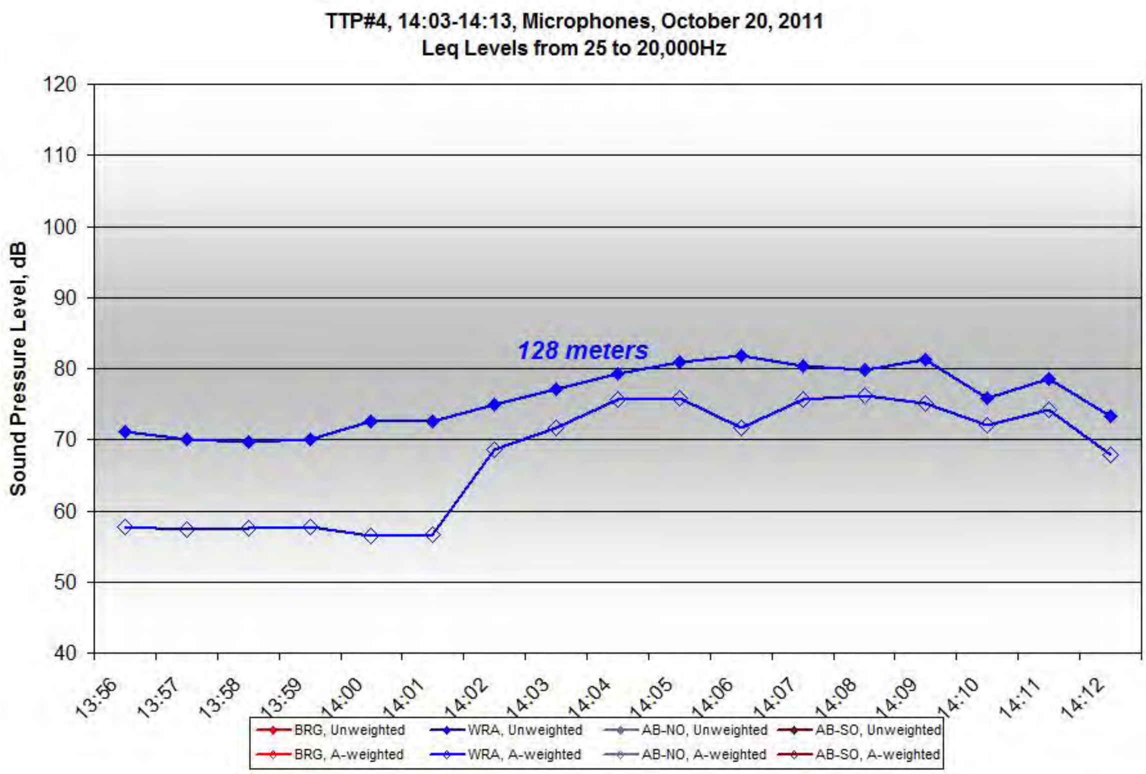

Figure C380. One-minute Unweighted and A-weighted Leq Level at TTP#4, 14:03-14:13, on October 20, 2011

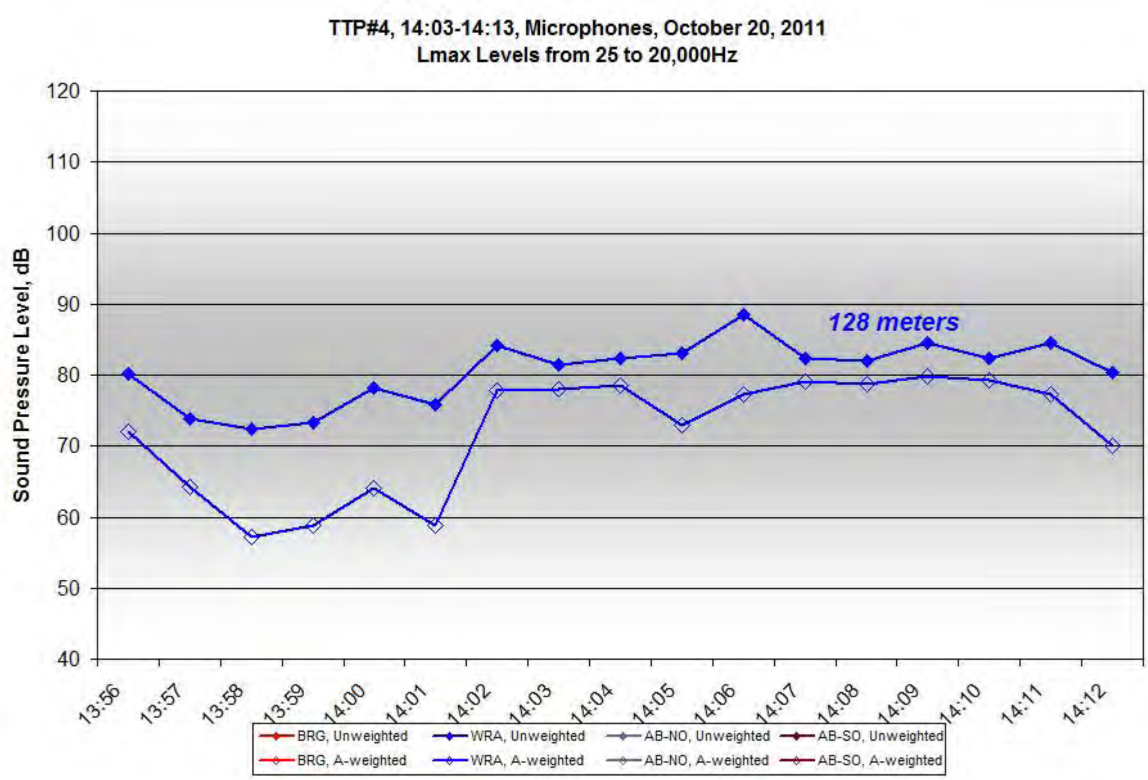

Figure C381. One-minute Unweighted and A-weighted Lmax Level at TTP#4, 14:03-14:13, on October 20, 2011

NO DATA AVAILABLE

Figure C382. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#4, 14:03-14:13, on October 20, 2011

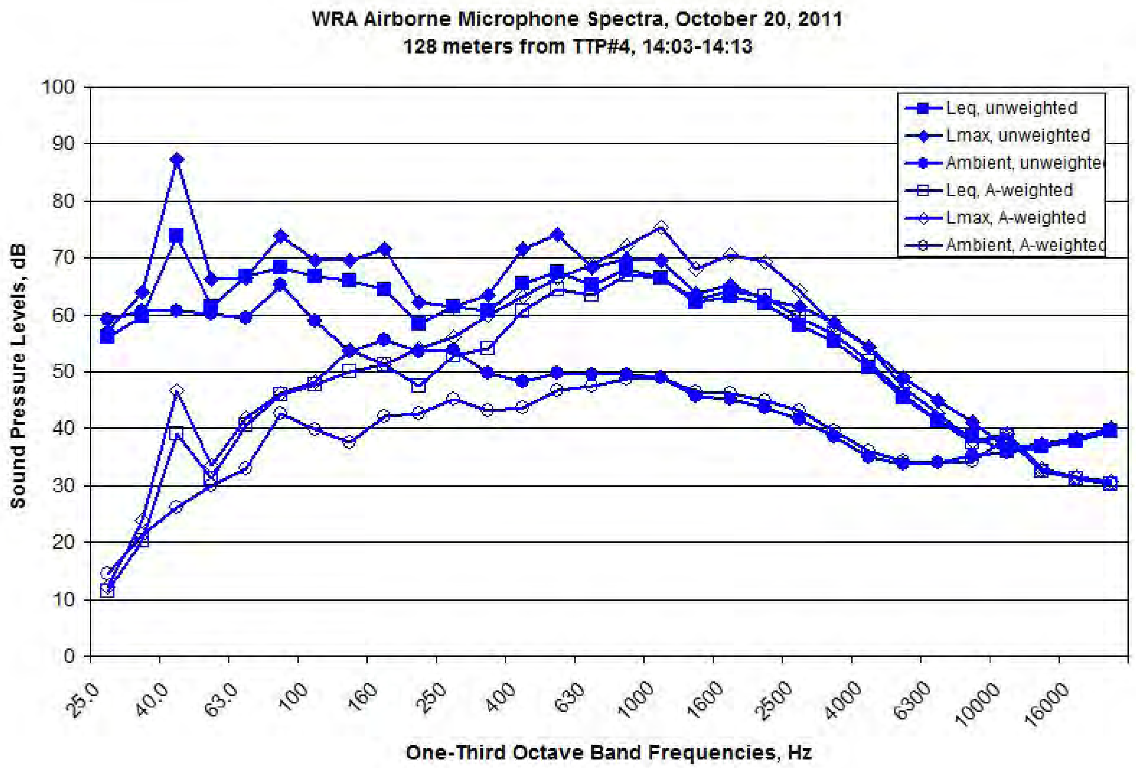

Figure C383. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#4, 14:03-14:13, on October 20, 2011

NO DATA AVAILABLE

Figure C384. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#4, 14:03-14:13, on October 20, 2011

NO DATA AVAILABLE

Figure C385. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#4, 14:03-14:13, on October 20, 2011

TTP#3

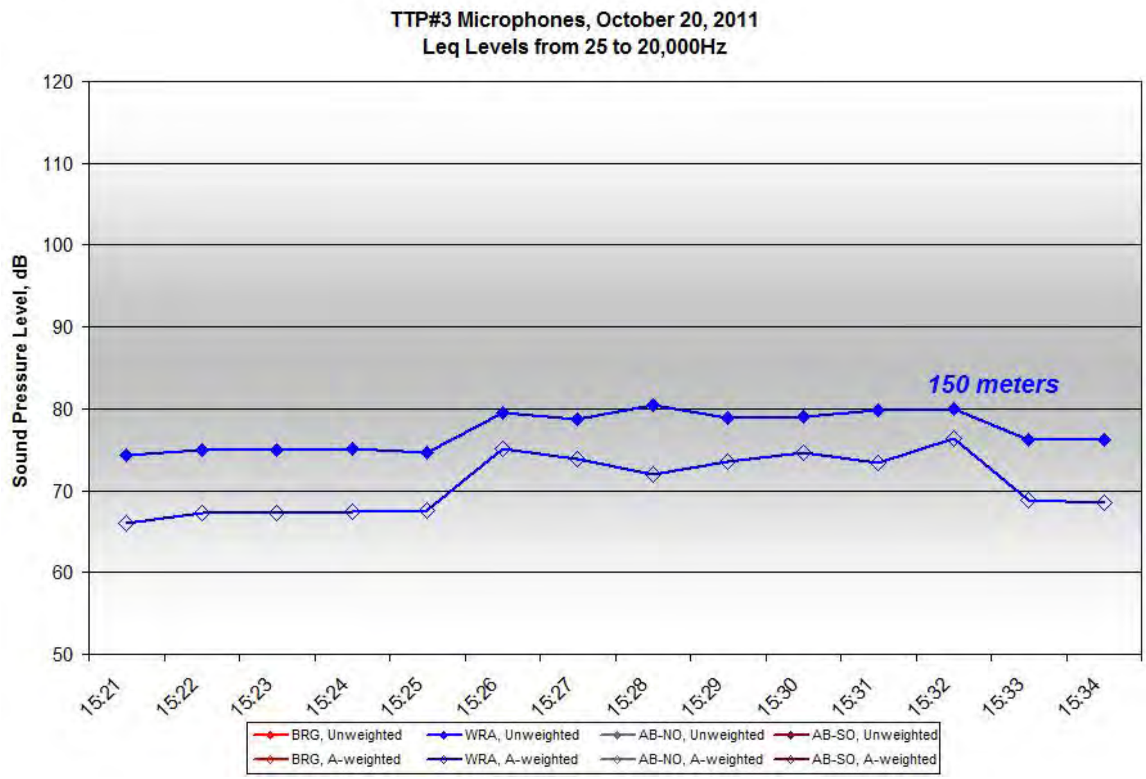

Figure C386. One-minute Unweighted and A-weighted Leq Level at TTP#4, 14:03-14:13, on October 20, 2011

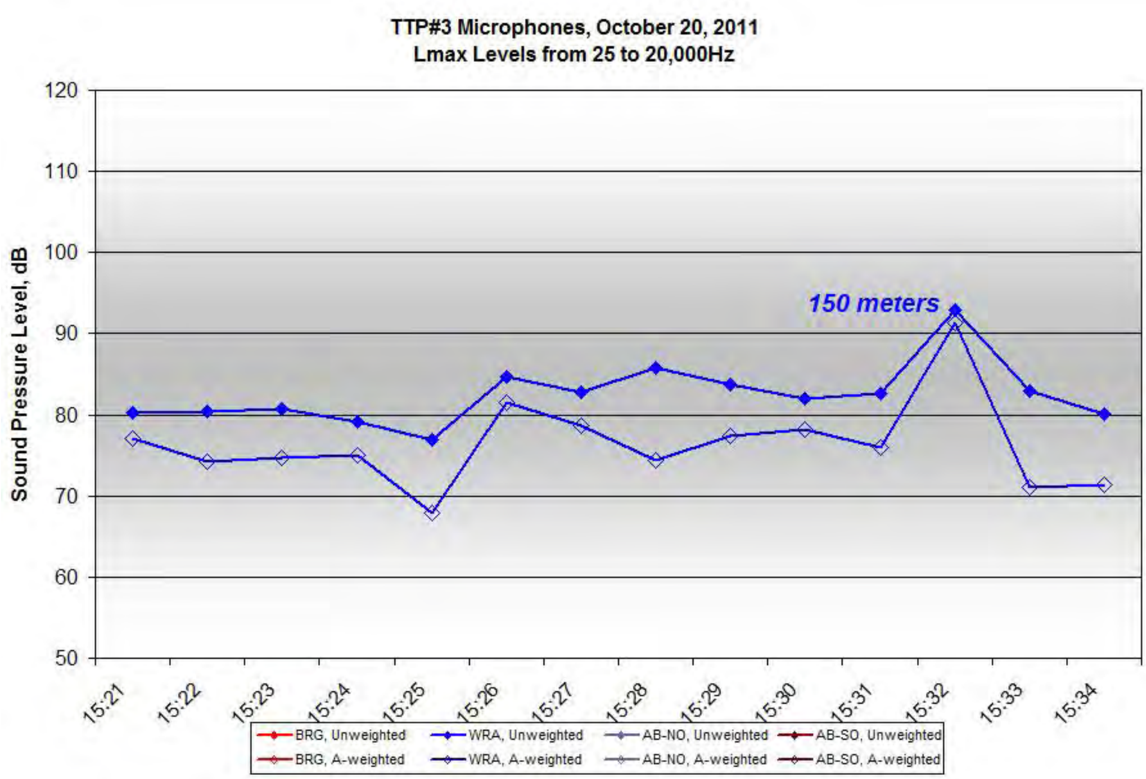

Figure C387. One-minute Unweighted and A-weighted Lmax Level at TTP#3, on October 20, 2011

NO DATA AVAILABLE

Figure C388. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#3, on October 20, 2011

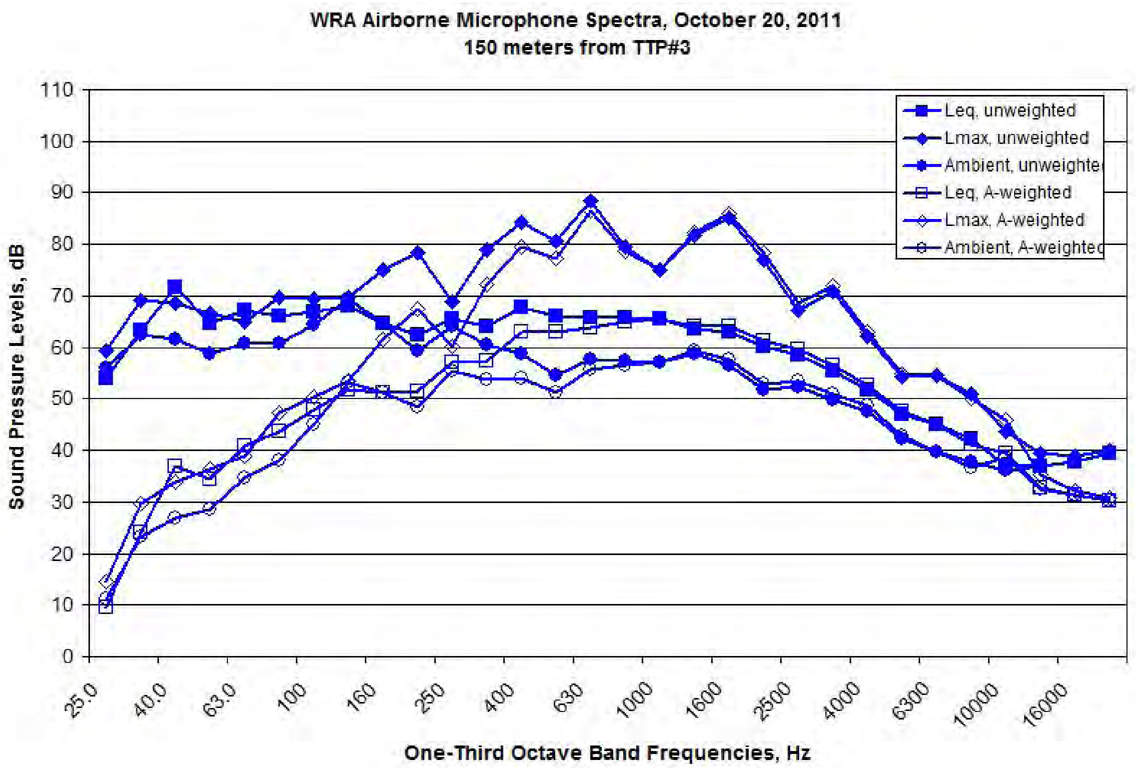

Figure C389. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#3, on October 20, 2011

NO DATA AVAILABLE

Figure C390. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#3, on October 20, 2011

NO DATA AVAILABLE

Figure C391. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#3, on October 20, 2011

C.2. AIRBORNE RESULTS DURING IMPACT PILE DRIVING

9/1/2011 – TTP#1 (Bubble Curtain On and Off)

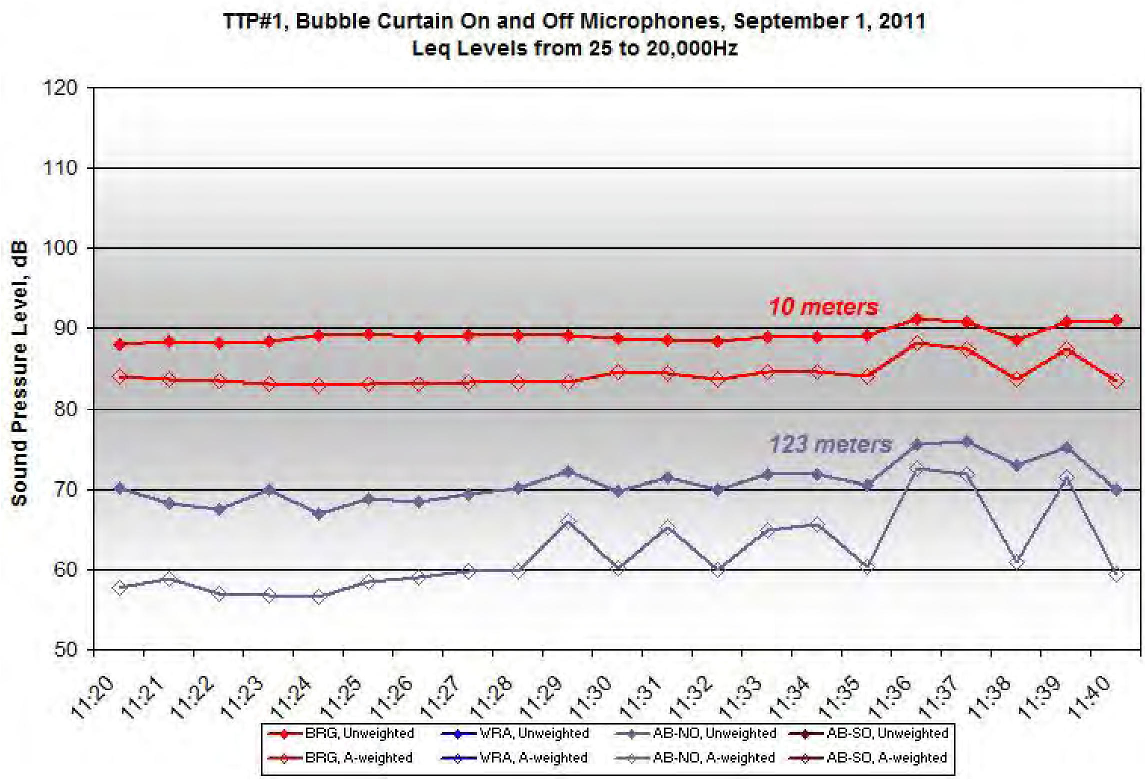

Figure C392. One-minute Unweighted and A-weighted Leq Level at TTP#1, 11:30-11:37, on September 1, 2011

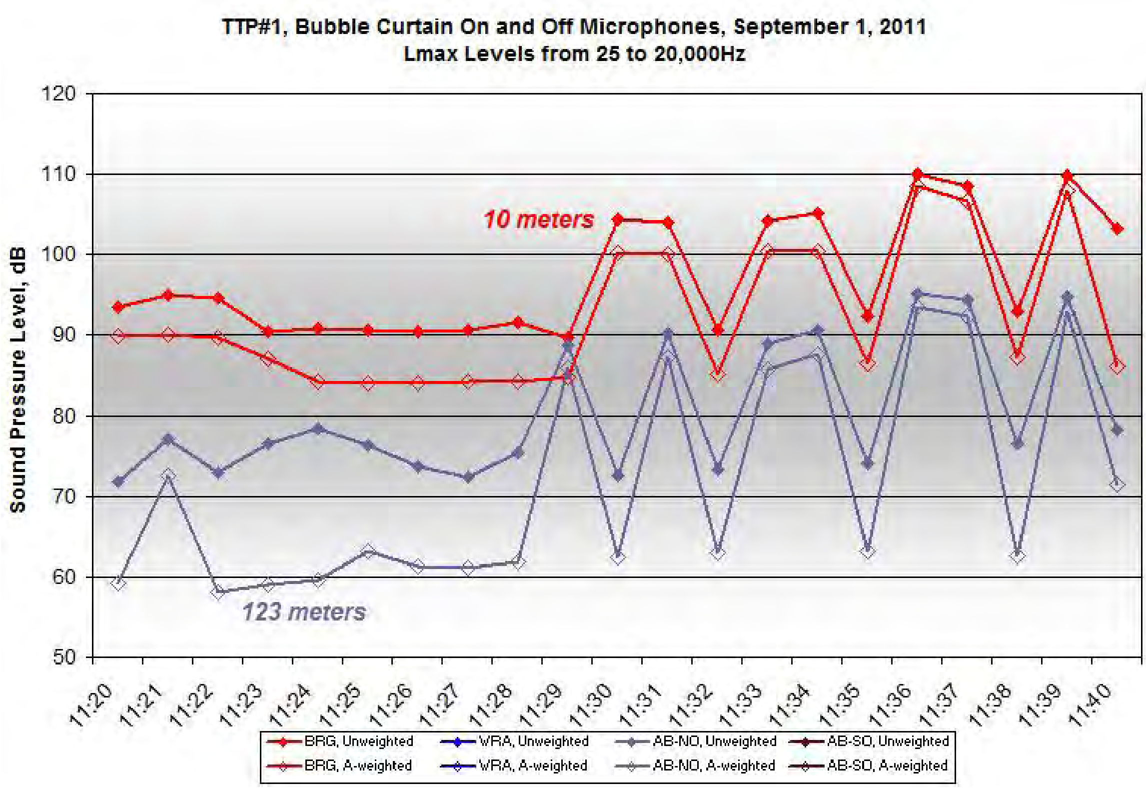

Figure C393. One-minute Unweighted and A-weighted Lmax Level at TTP#1, 11:30-11:37, on September 1, 2011

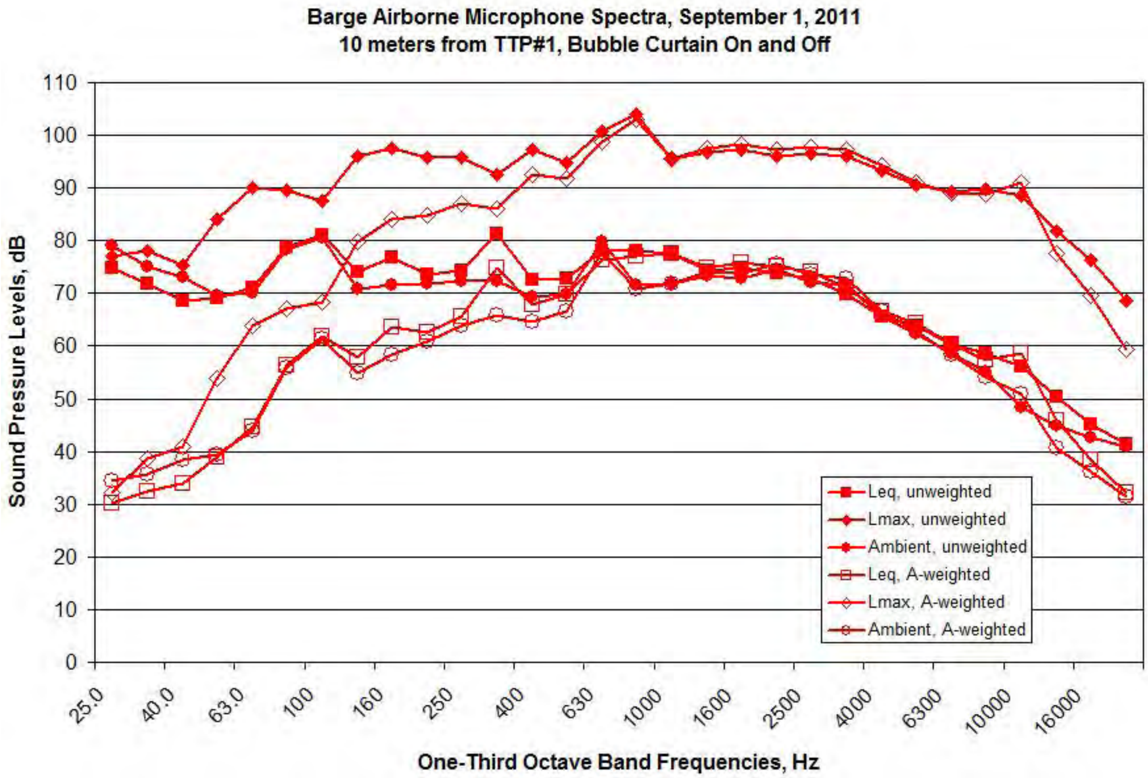

Figure C394. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#1, 11:30-11:34, on September 1, 2011

NO DATA AVAILABLE

Figure C395. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#1, 11:30-11:34, on September 1, 2011

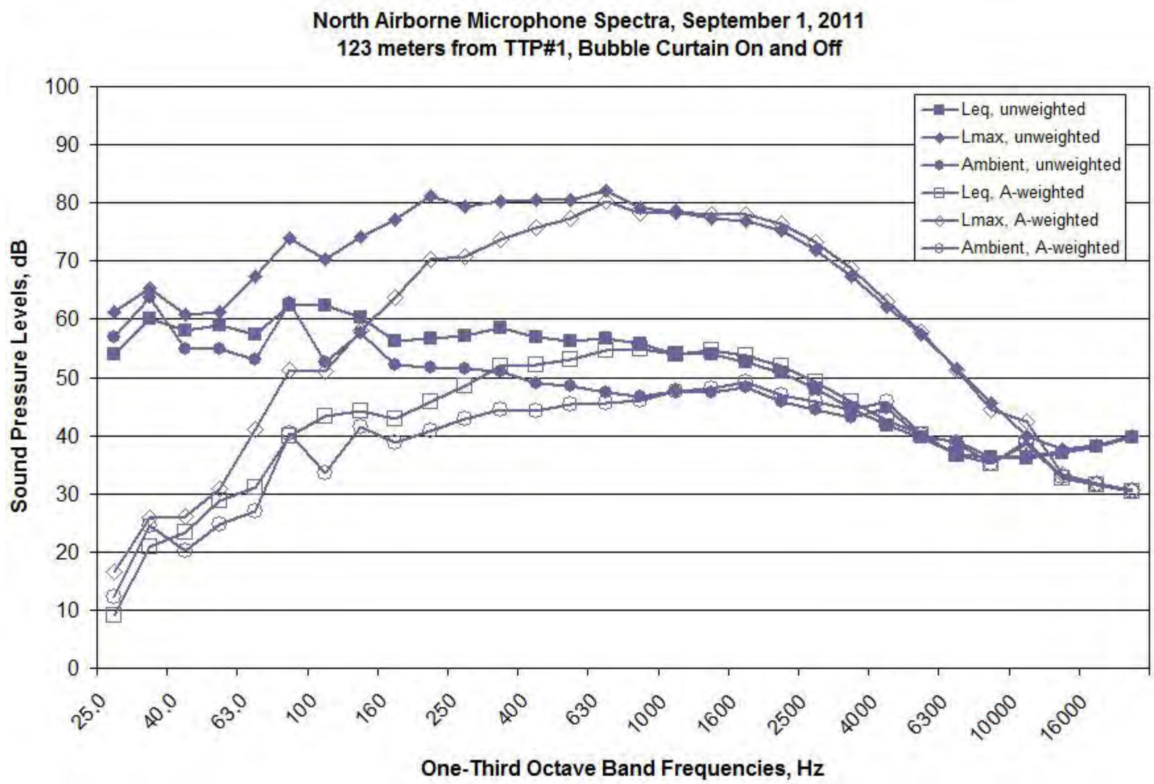

Figure C396. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#1, 11:30-11:34, on September 1, 2011

NO DATA AVAILABLE

Figure C397. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#1, 11:30-11:34, on September 1, 2011

TTP#2 (Bubble Curtain On and Off)

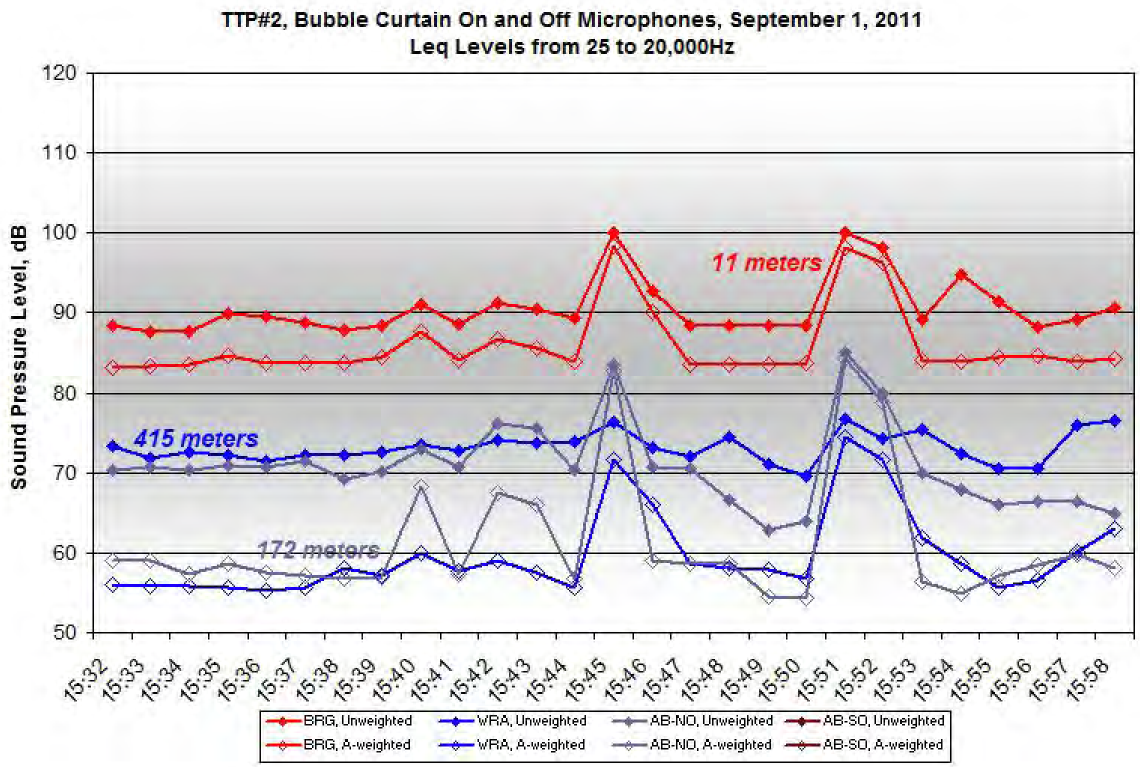

Figure C398. One-minute Unweighted and A-weighted Leq Level at TTP#2, 15:40-15:52, on September 1, 2011

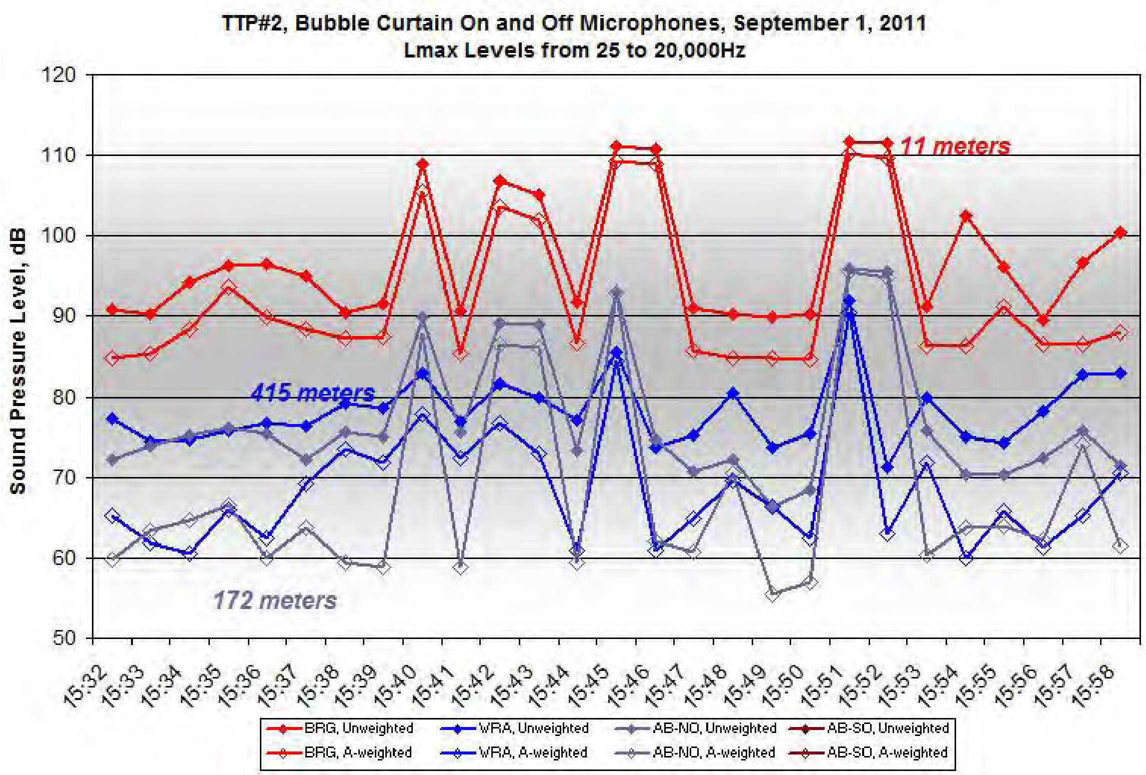

Figure C399. One-minute Unweighted and A-weighted Lmax Level at TTP#2, 15:40-15:52, on September 1, 2011

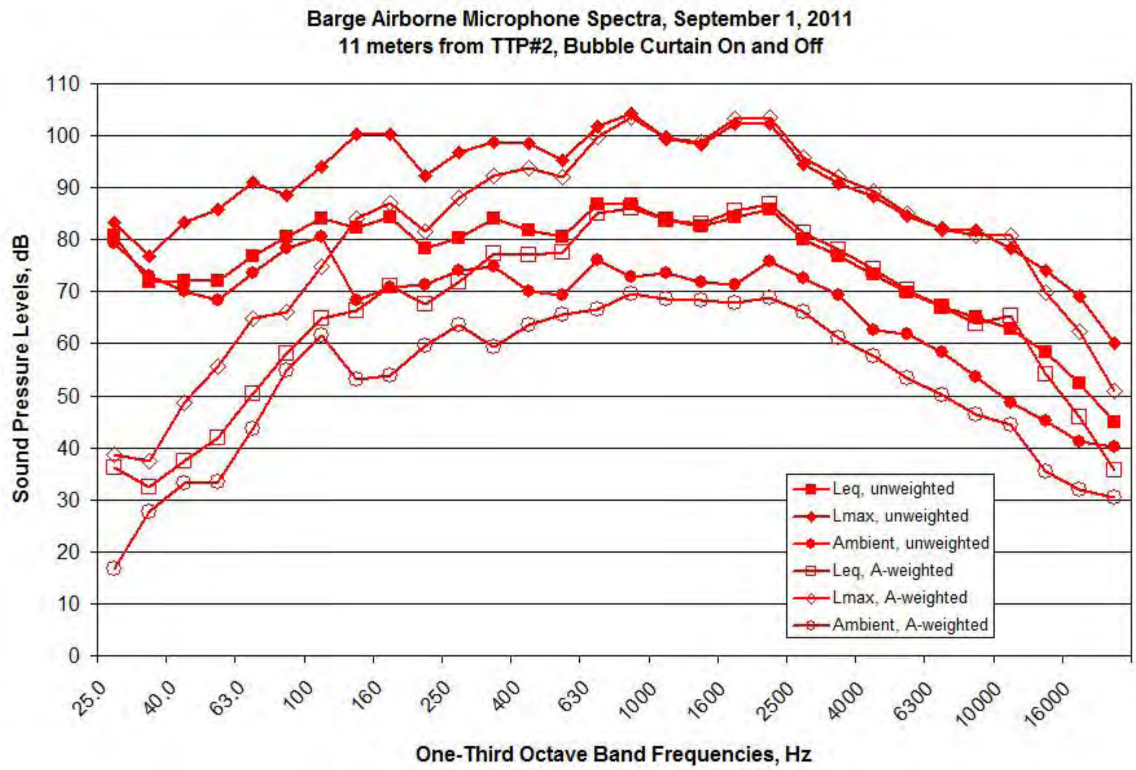

Figure C400. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#2, 15:40-15:46, on September 1, 2011

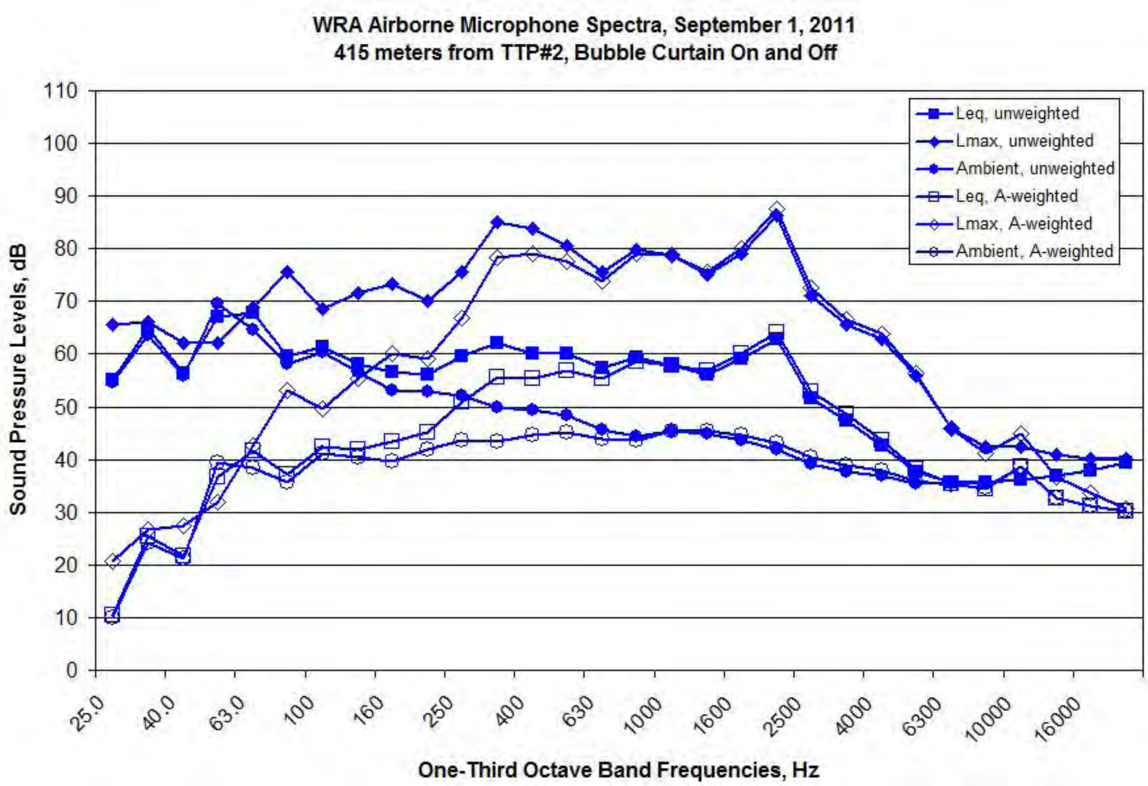

Figure C401. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#2, 15:40-15:46, on September 1, 2011

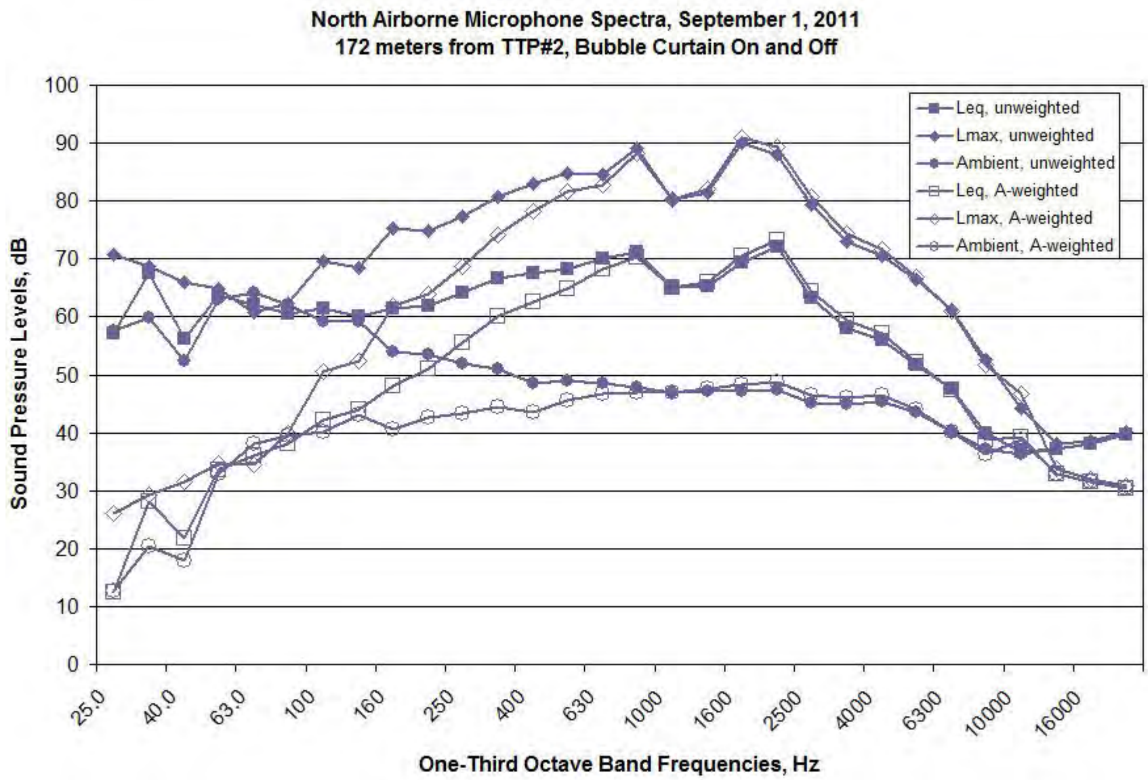

Figure C402. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#2, 15:40-15:46, on September 1, 2011

NO DATA AVAILABLE

Figure C403. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#2, 15:40-15:46, on September 1, 2011

9/10/2011 – TP#7 (Bubble Curtain On and Off)

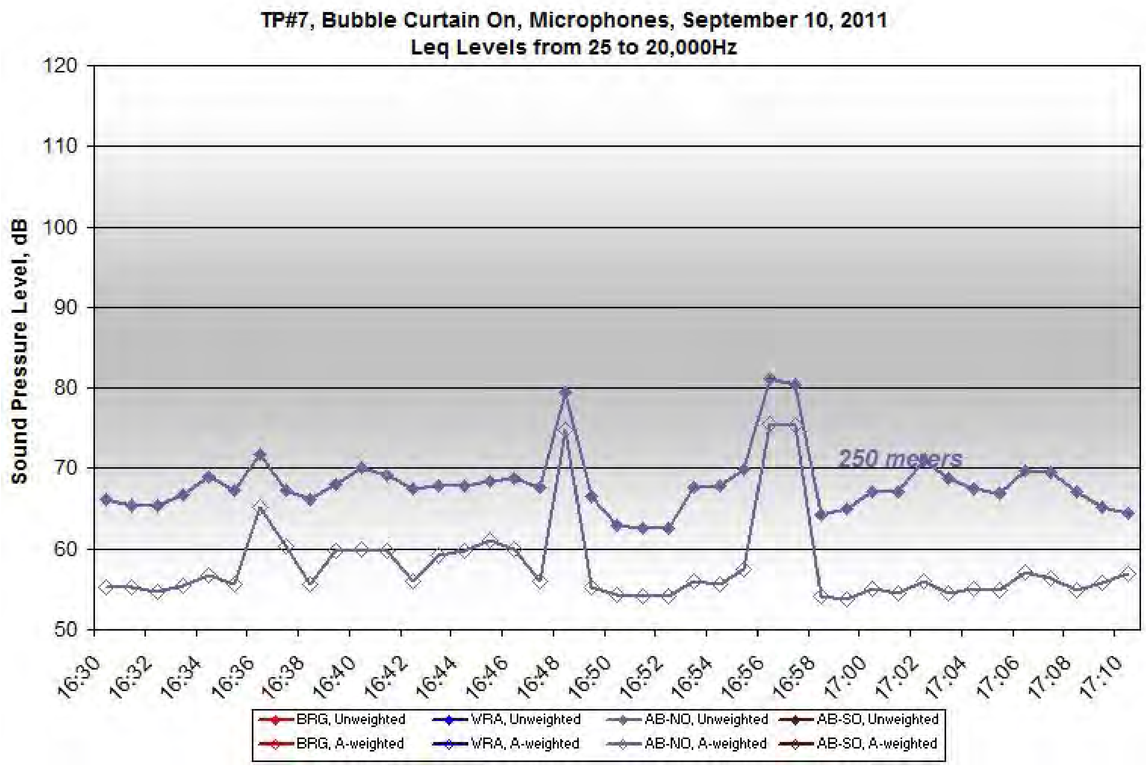

Figure C404. One-minute Unweighted and A-weighted Leq Level at TP#7, 16:37-16:57, on September 10, 2011

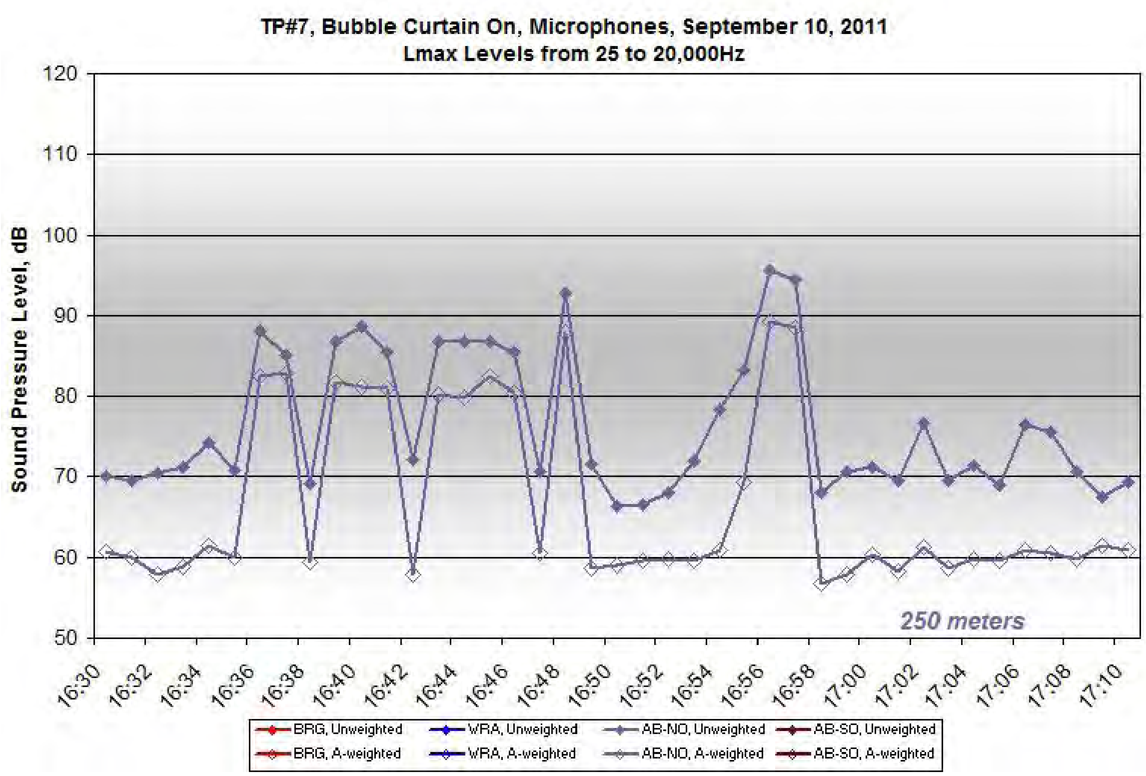

Figure C405. One-minute Unweighted and A-weighted Lmax Level at TP#7, 16:37-16:57, on September 10, 2011

NO DATA AVAILABLE

Figure C406. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#7, 16:37-16:48, on September 10, 2011

NO DATA AVAILABLE

Figure C407. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#7, 16:56-16:57, on September 10, 2011

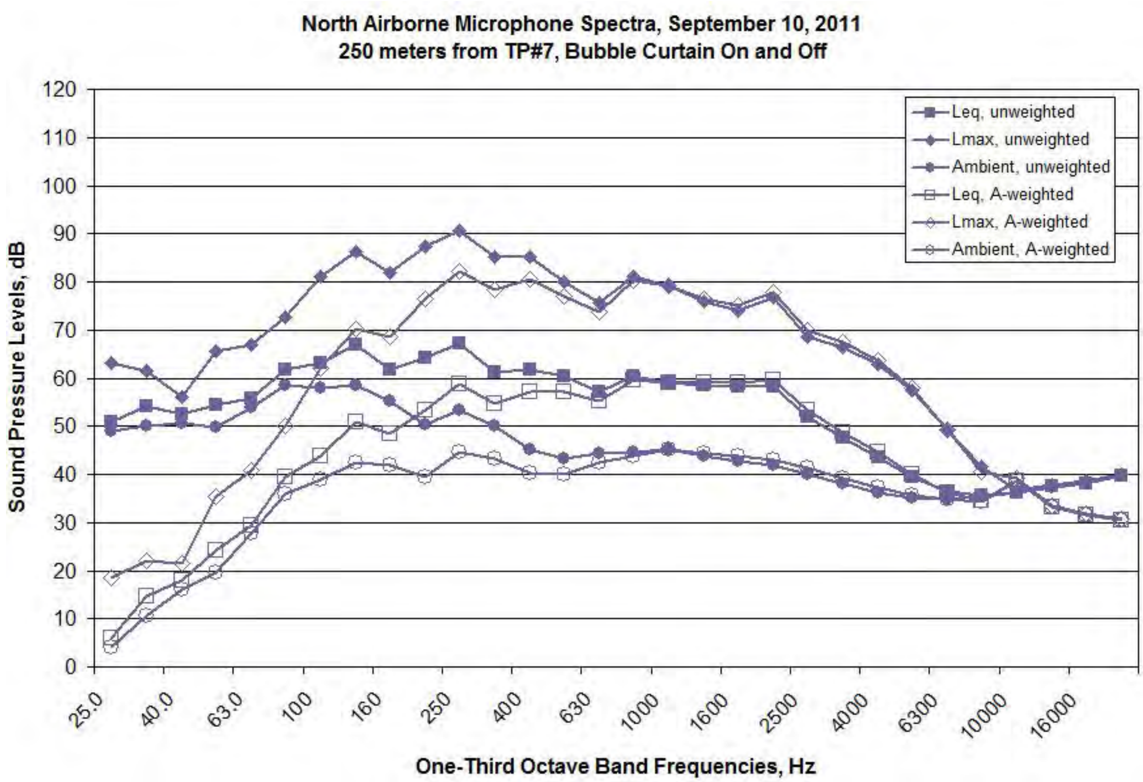

Figure C408. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#7, 16:37-16:48, on September 10, 2011

NO DATA AVAILABLE

Figure C409. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#7, 16:56-16:57, on September 10, 2011

9/15/2011 – TP#3 RP#3 (Bubble Curtain On and Off)

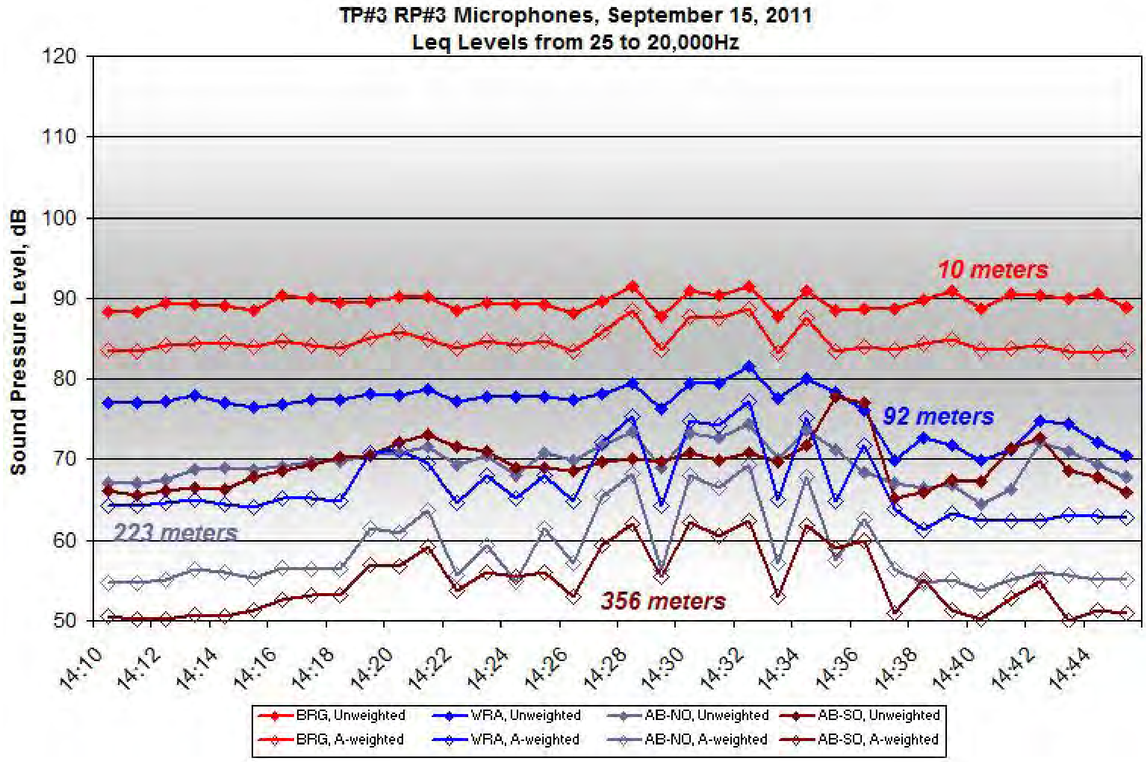

Figure C410. One-minute Unweighted and A-weighted Leq Level at TP#3 RP#3, 14:18-14:34, on September 15, 2011

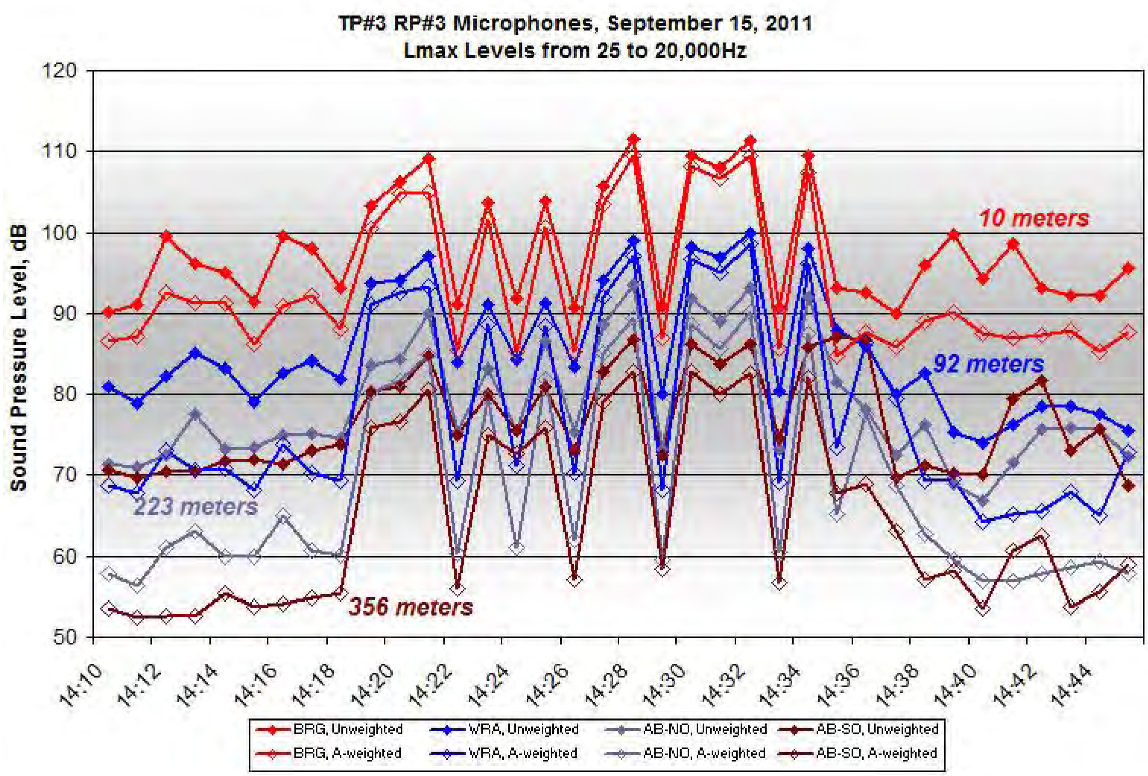

Figure C411. One-minute Unweighted and A-weighted Lmax Level at TP#3 RP#3, 14:18-14:34, on September 15, 2011

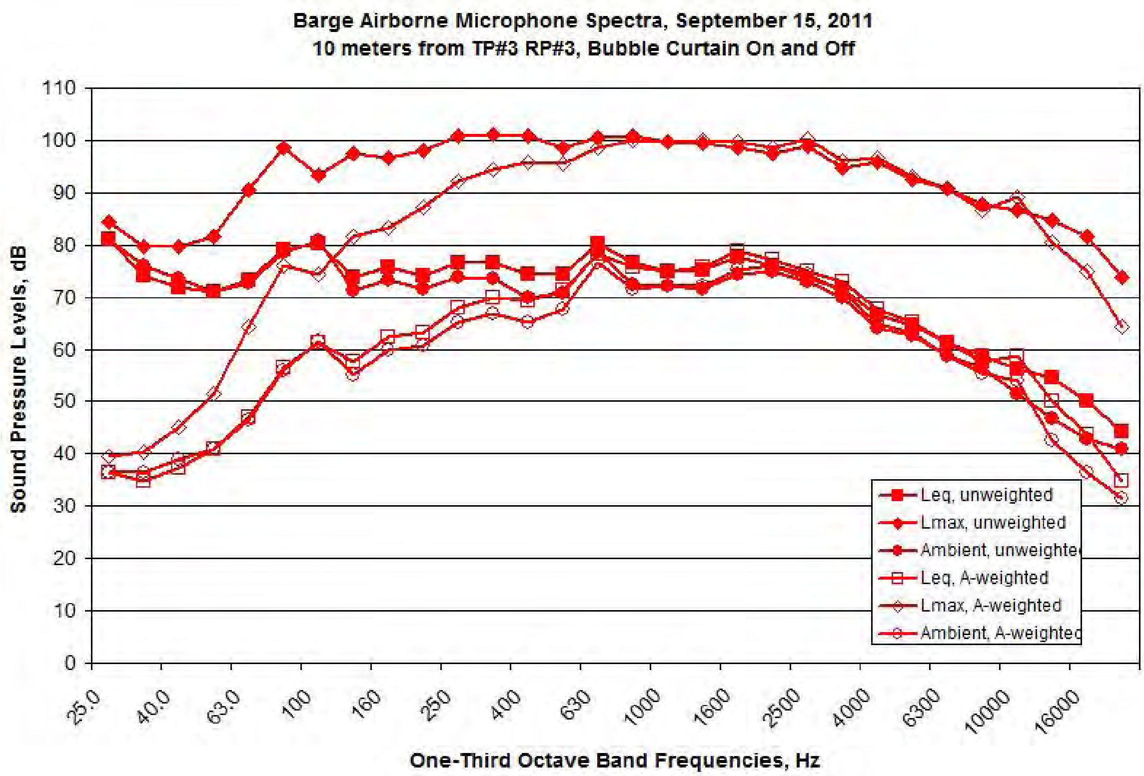

Figure C412. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#3, 14:18-14:25, on September 15, 2011

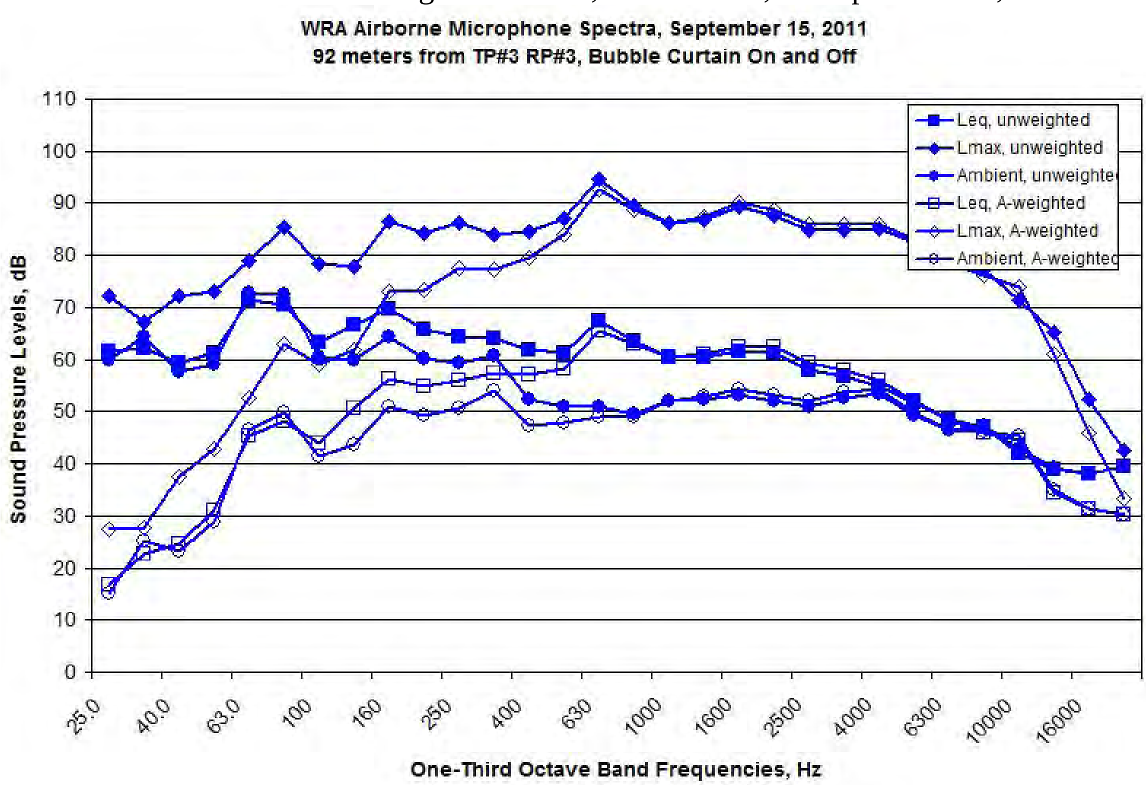

Figure C413. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#3, 14: 27-14:34, on September 15, 2011

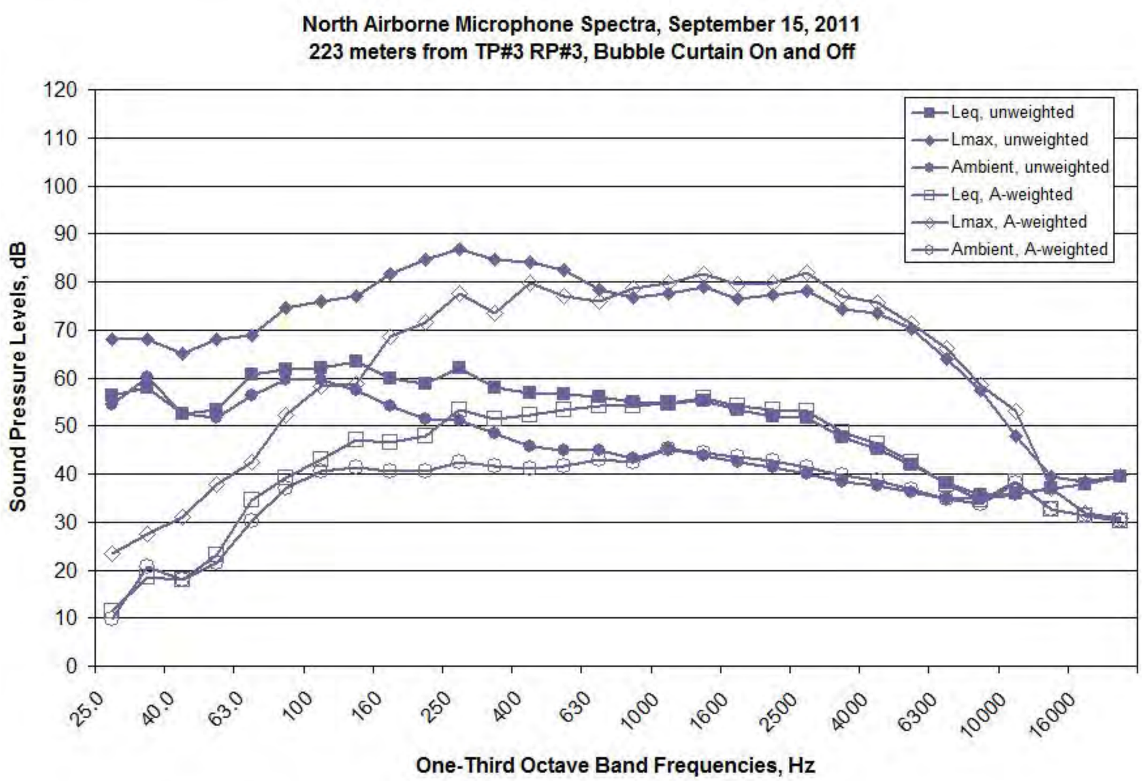

Figure C414. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#3, 14:18-14: 25, on September 15, 2011

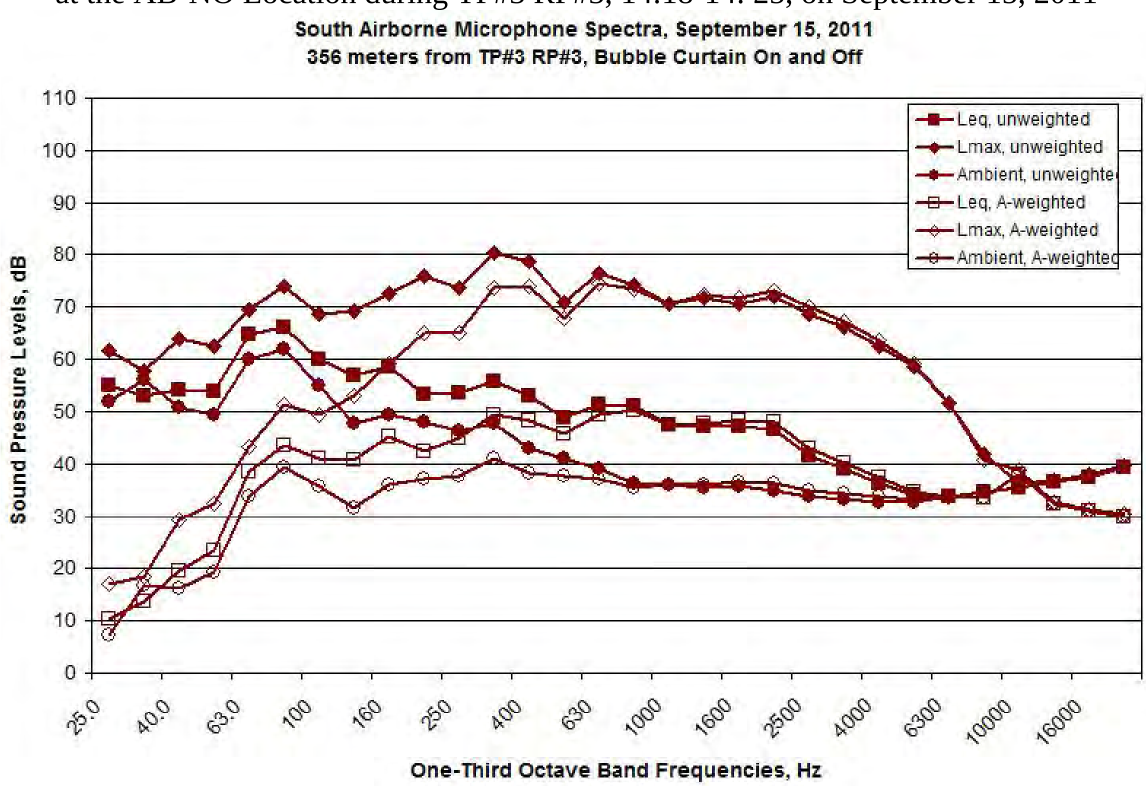

Figure C415. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#3, 14: 27-14:34, on September 15, 2011

9/16/2011 – TP#3 RP#2 (Bubble Curtain On Only)

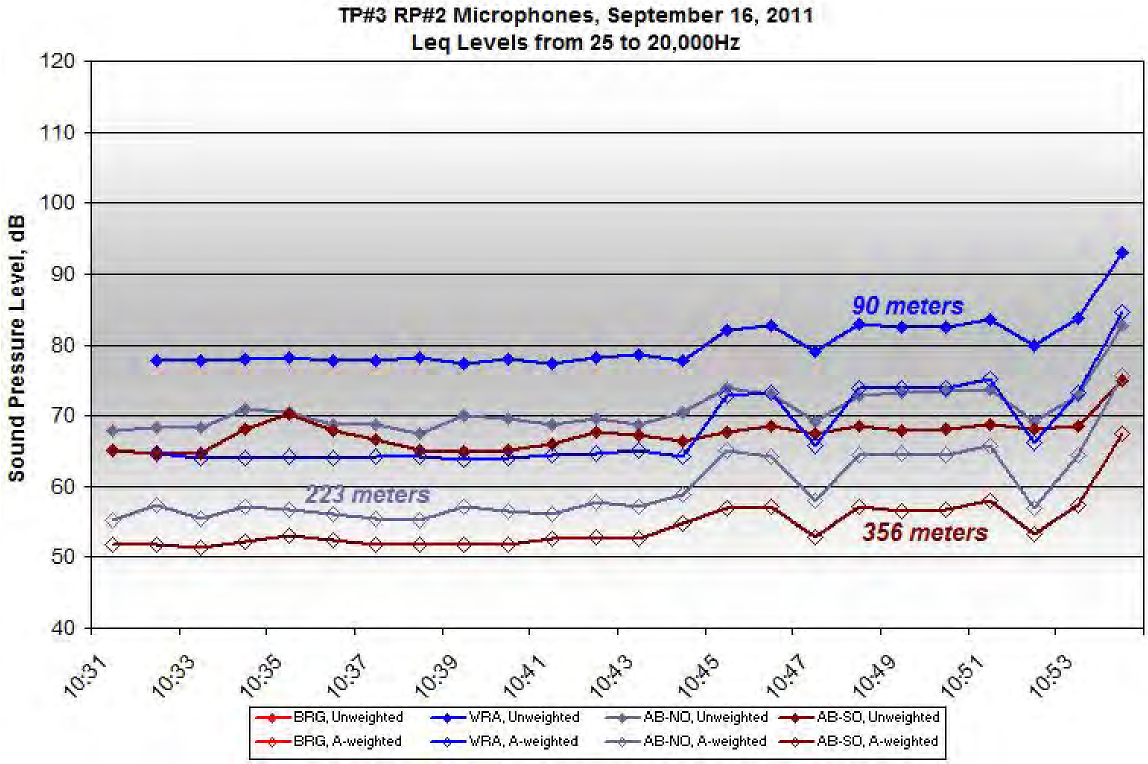

Figure C416. One-minute Unweighted and A-weighted Leq Level at TP#3 RP#2, 10:44-10:53, on September 16, 2011

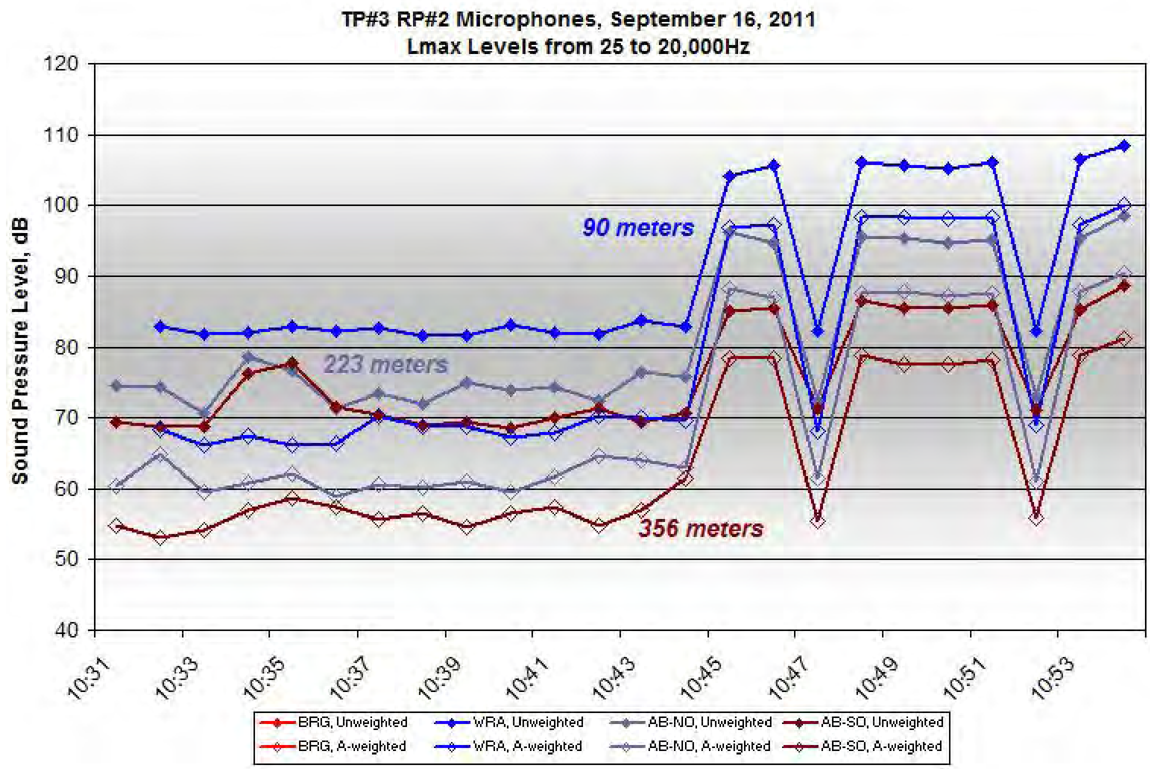

Figure C417. One-minute Unweighted and A-weighted Lmax Level at TP#3 RP#2, 10:44-10:53, on September 16, 2011

NO DATA AVAILABLE

Figure C418. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#2, 10:44-10:53, on September 16, 2011

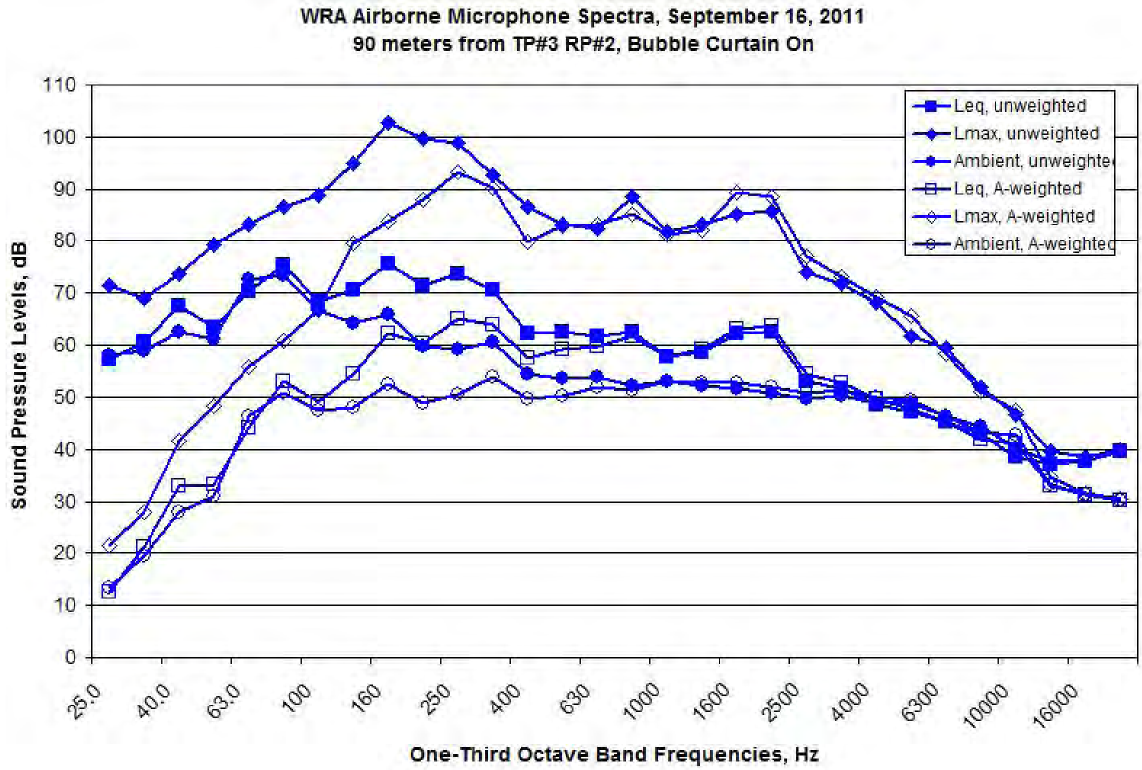

Figure C419. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#2, 10:44-10:53, on September 16, 2011

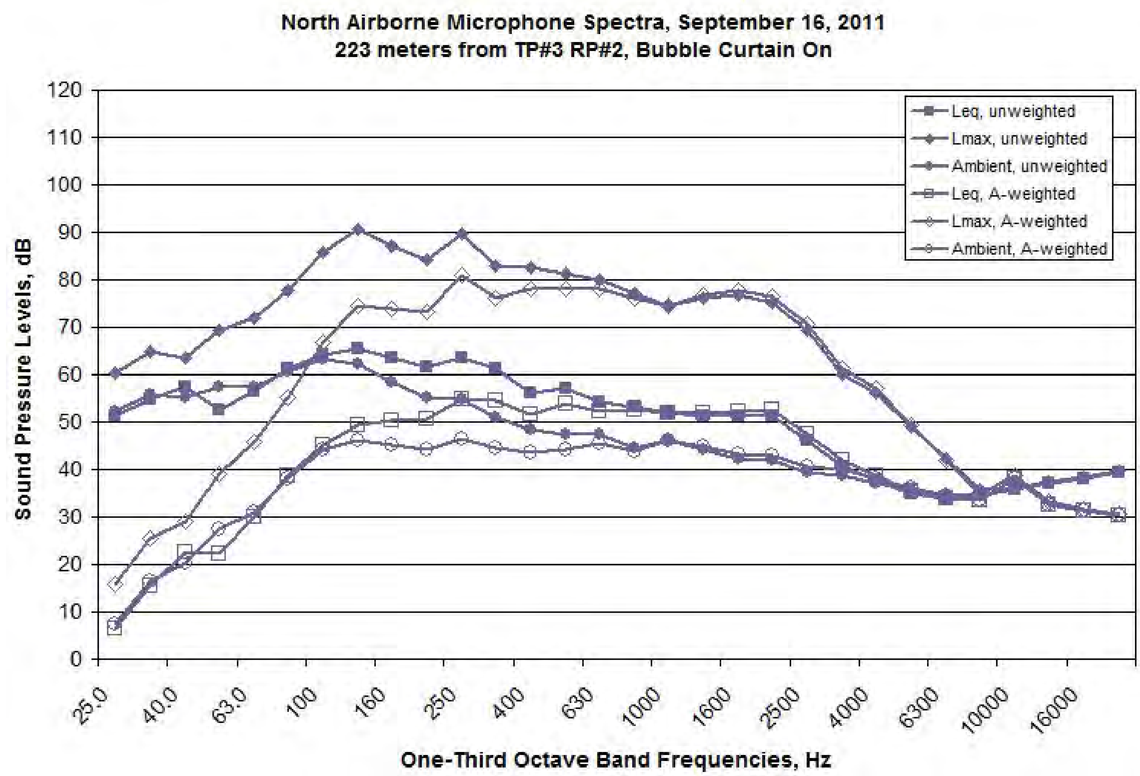

Figure C420. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#2, 10:44-10:53, on September 16, 2011

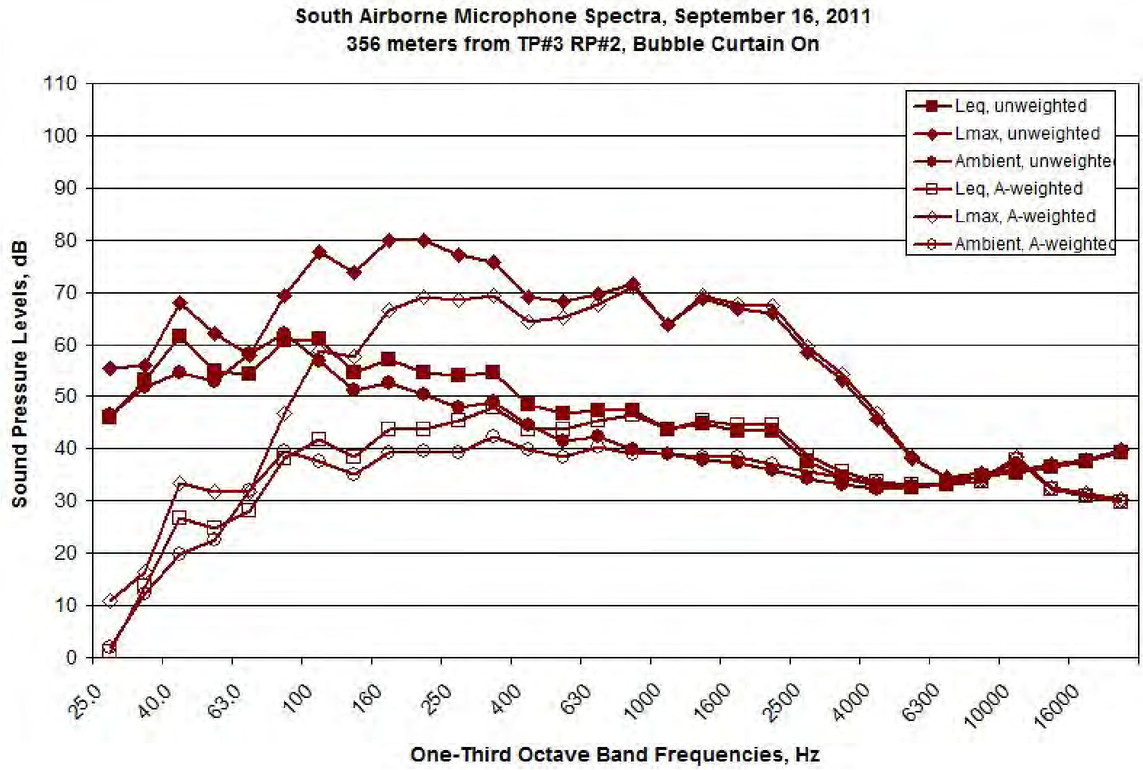

Figure C421. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#2, 10:44-10:53, on September 16, 2011

TP#3 RP#1 (Bubble Curtain On Only)

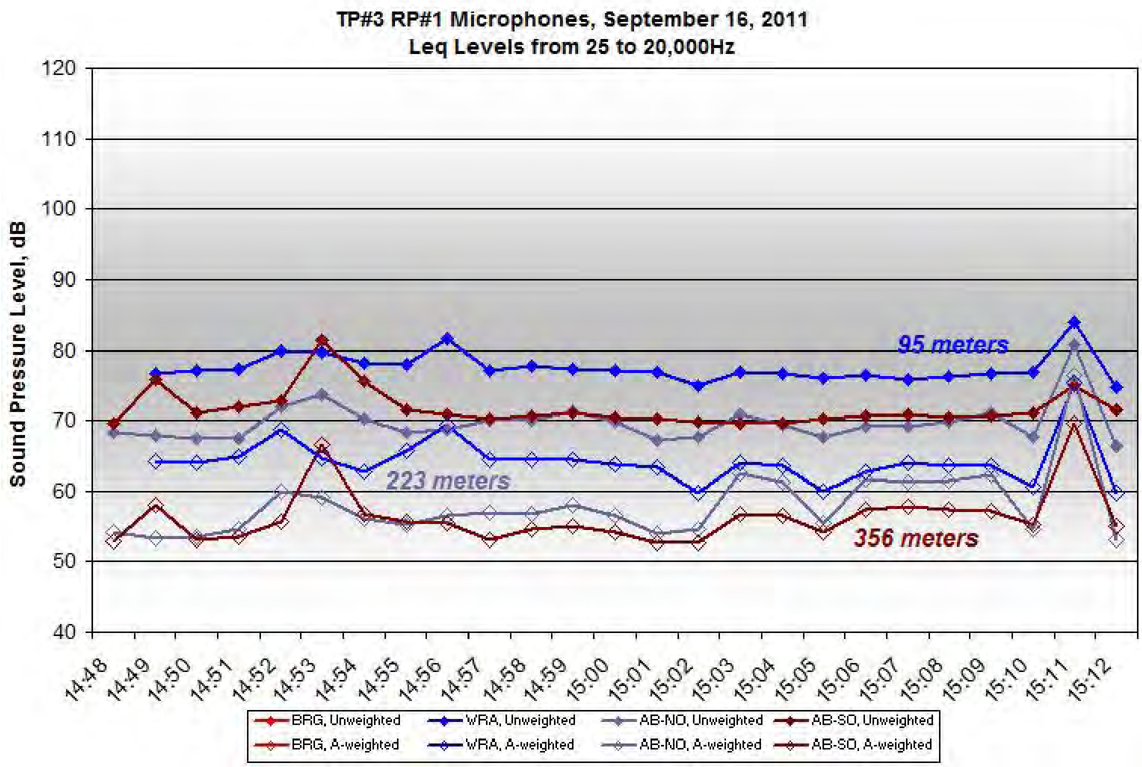

Figure C422. One-minute Unweighted and A-weighted Leq Level at TP#3 RP#1, 15:02-15:11, on September 16, 2011

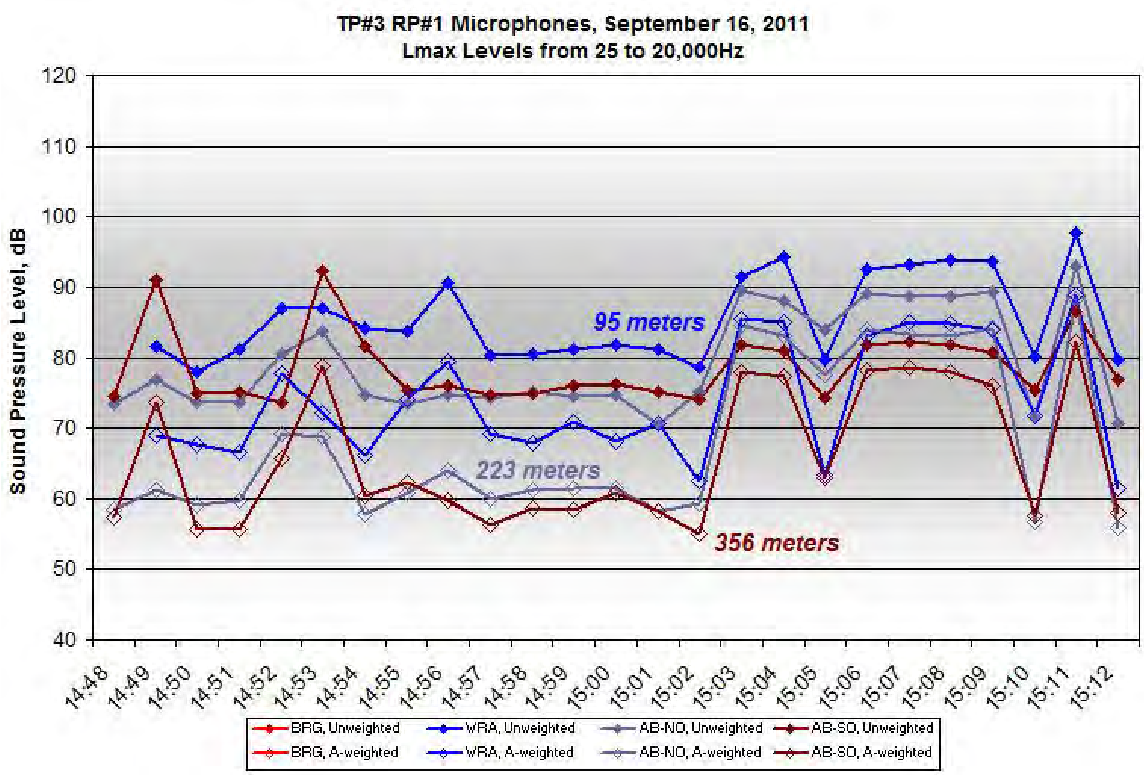

Figure C423. One-minute Unweighted and A-weighted Lmax Level at TP#3 RP#1, 15:02-15:11, on September 16, 2011

NO DATA AVAILABLE

Figure C424. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3 RP#1, 15:02-15:11, on September 16, 2011

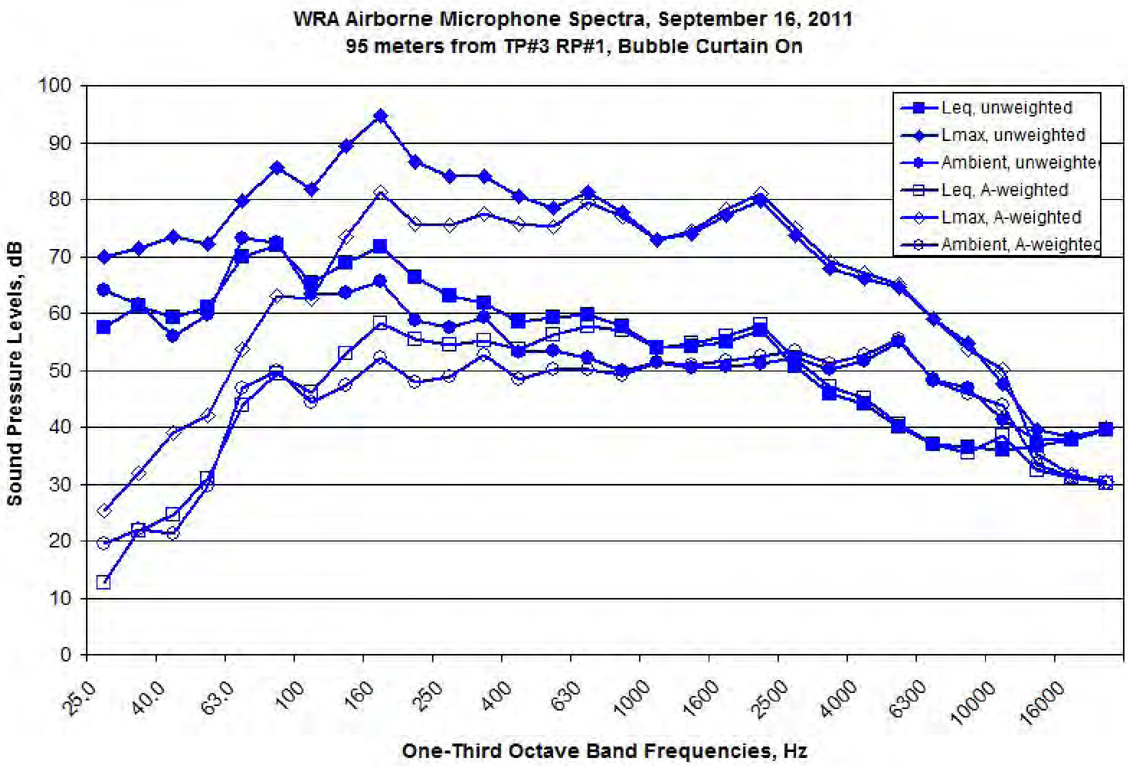

Figure C425. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3 RP#1, 15:02-15:11, on September 16, 2011

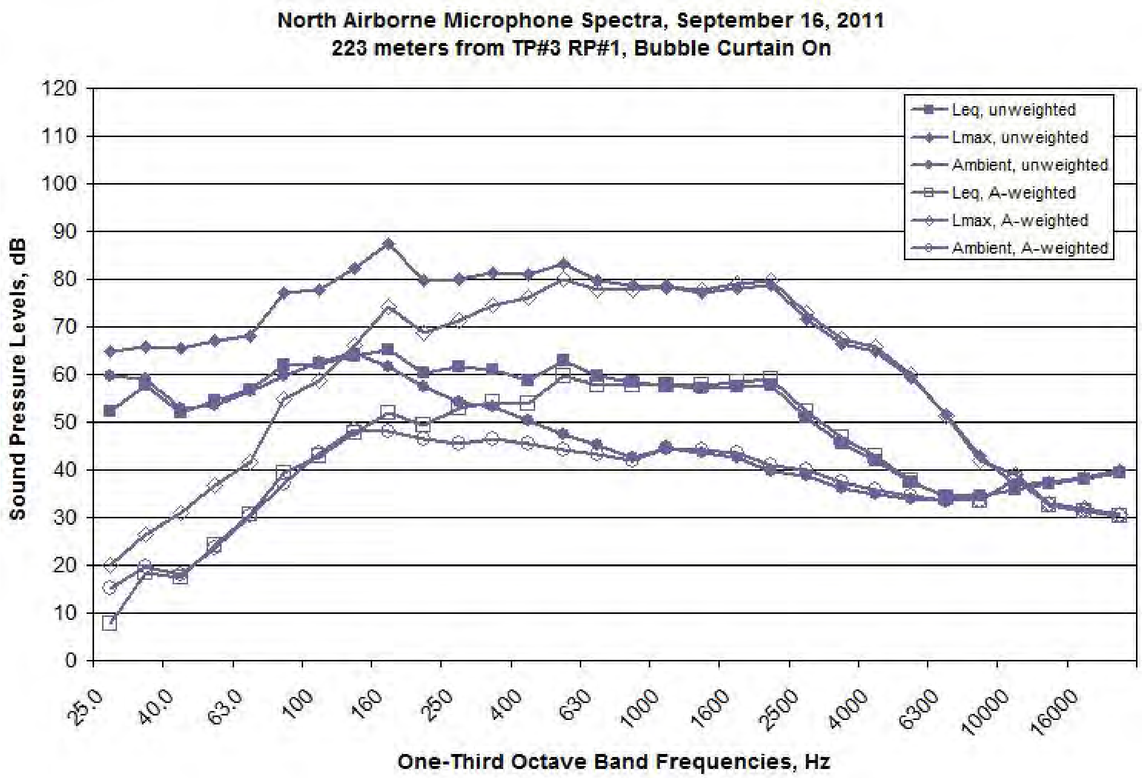

Figure C426. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3 RP#1, 15:02-15:11, on September 16, 2011

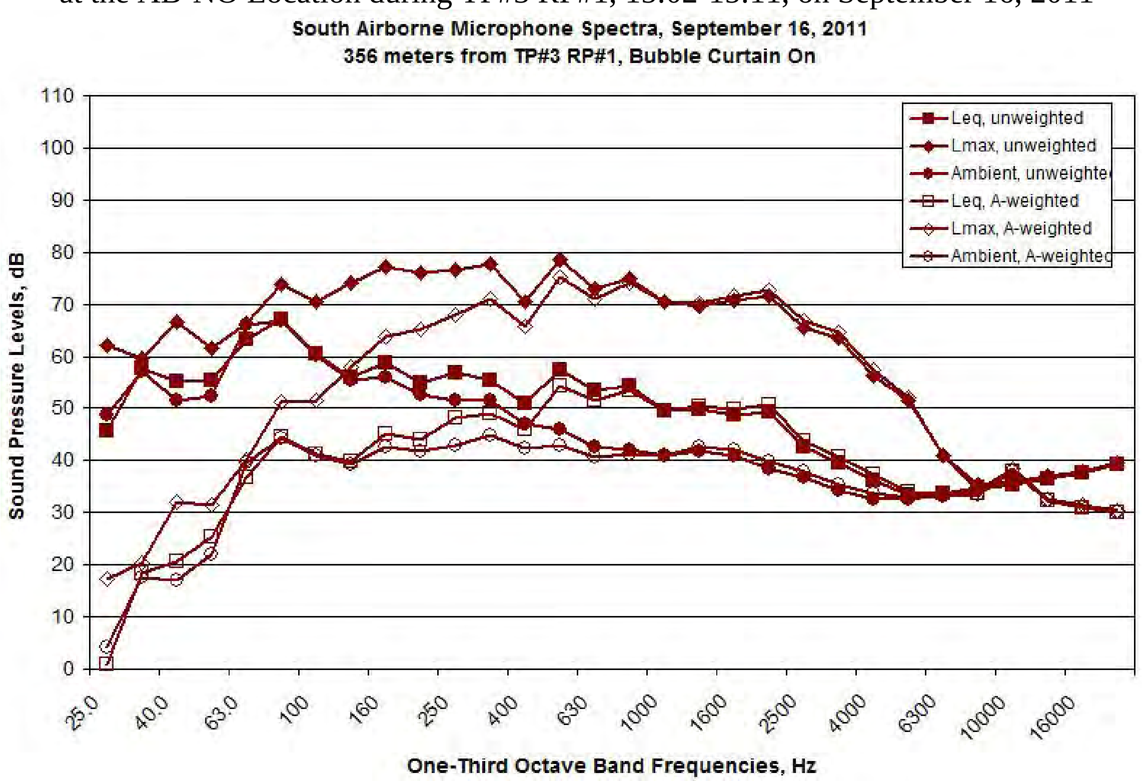

Figure C427. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3 RP#1, 15:02-15:11, on September 16, 2011

TP#3 (Bubble Curtain Off Only)

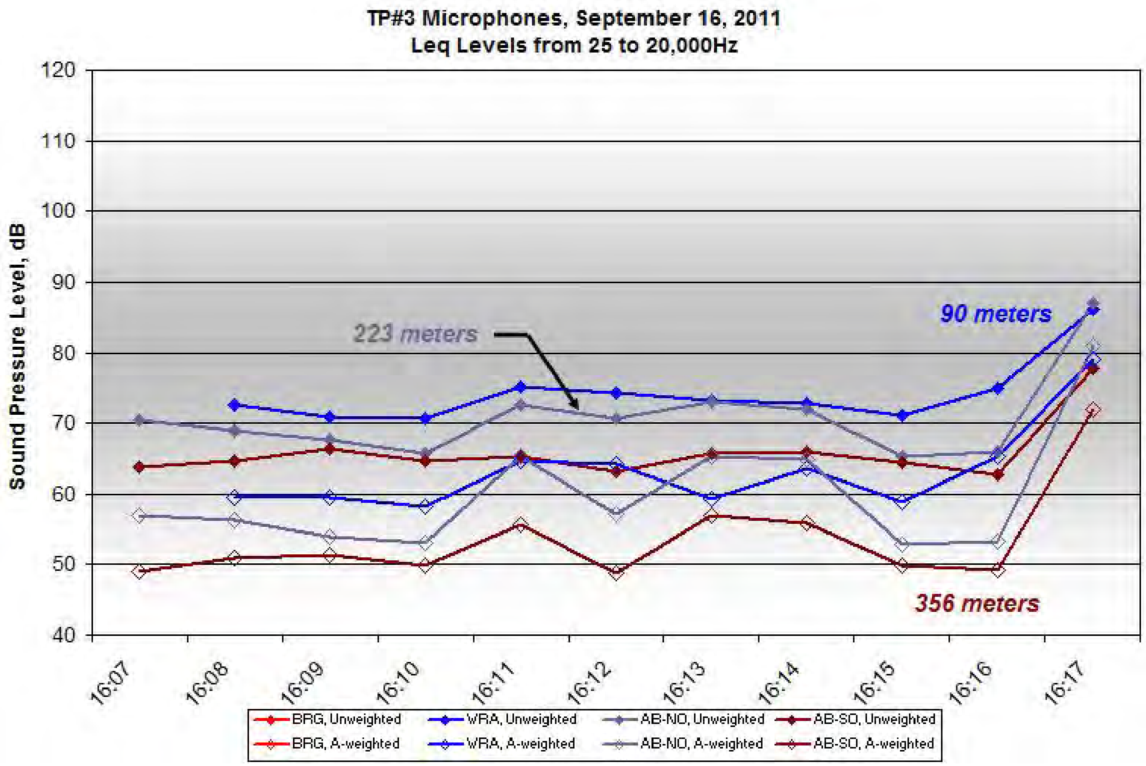

Figure C428. One-minute Unweighted and A-weighted Leq Level at TP#3, 16:10-16:16, on September 16, 2011

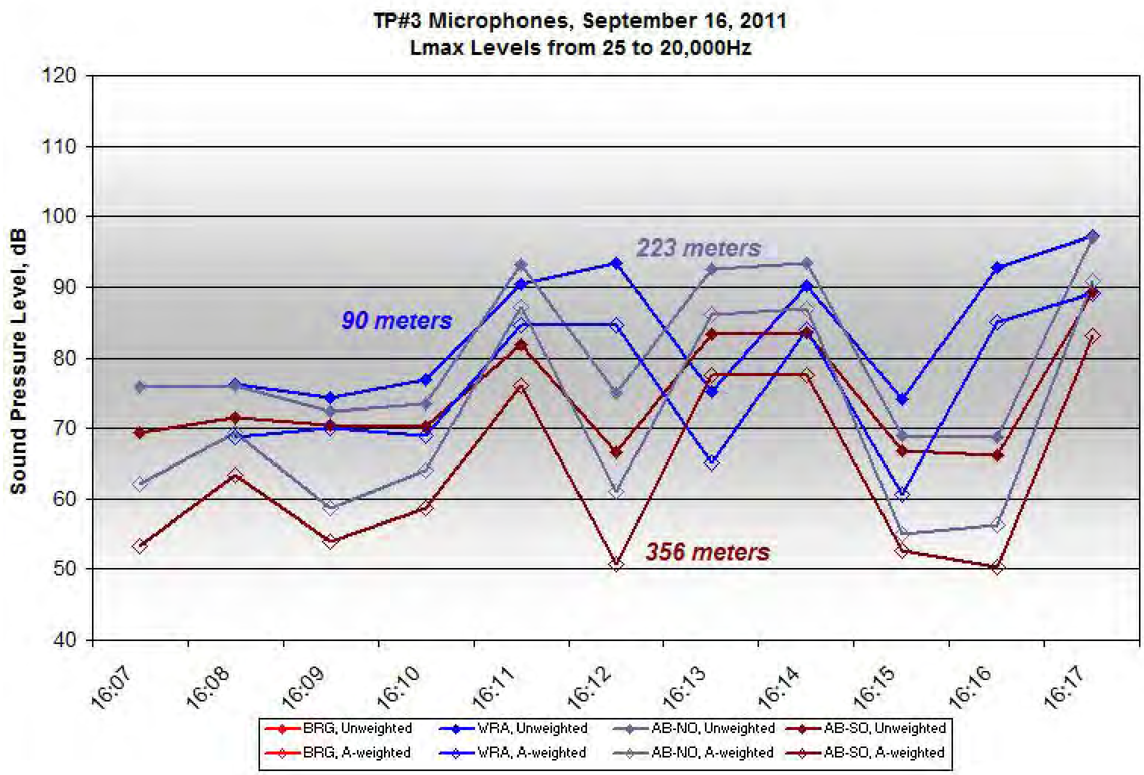

Figure C429. One-minute Unweighted and A-weighted Lmax Level at TP#3, 16:10-16:16, on September 16, 2011

NO DATA AVAILABLE

Figure C430. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#3, 16:10-16:16, on September 16, 2011

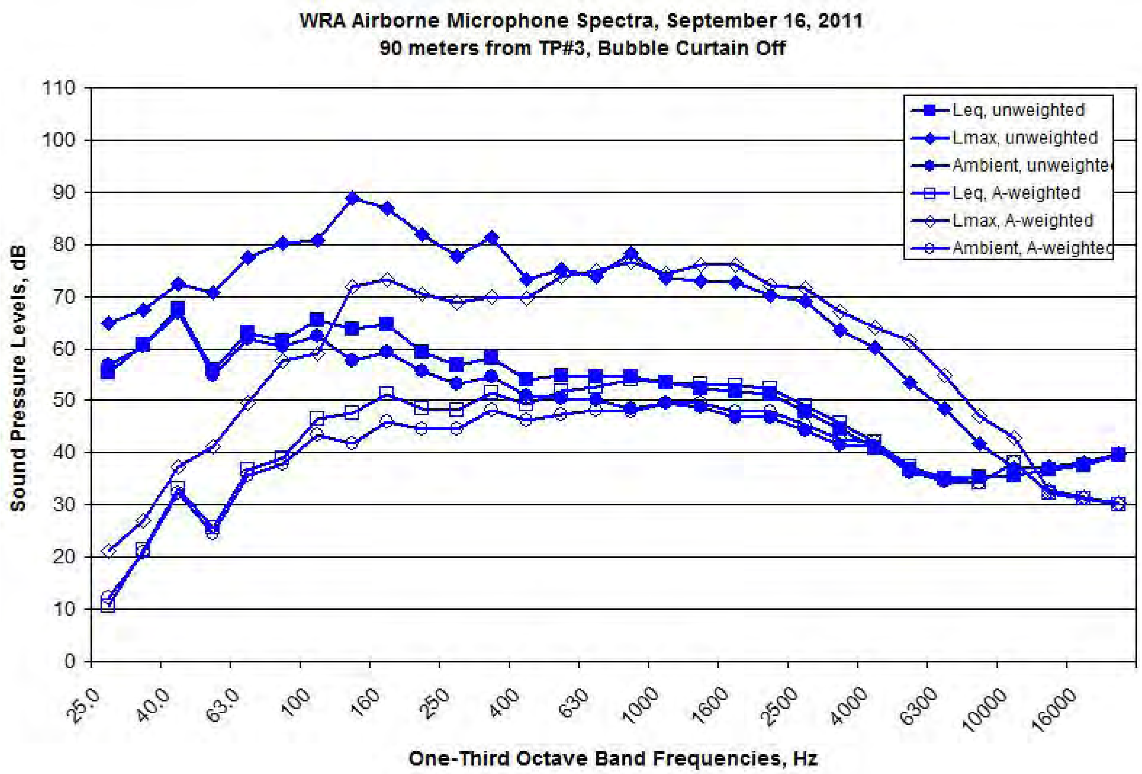

Figure C431. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#3, 16:10-16:16, on September 16, 2011

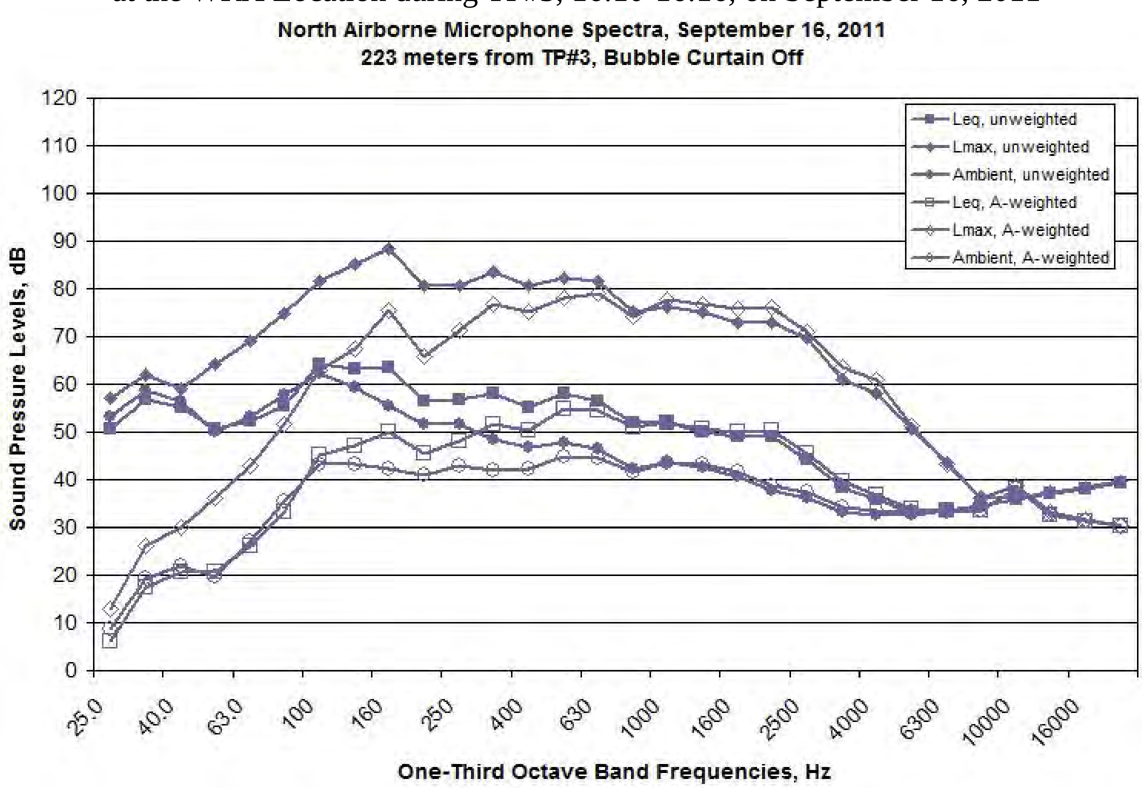

Figure C432. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#3, 16:10-16:16, on September 16, 2011

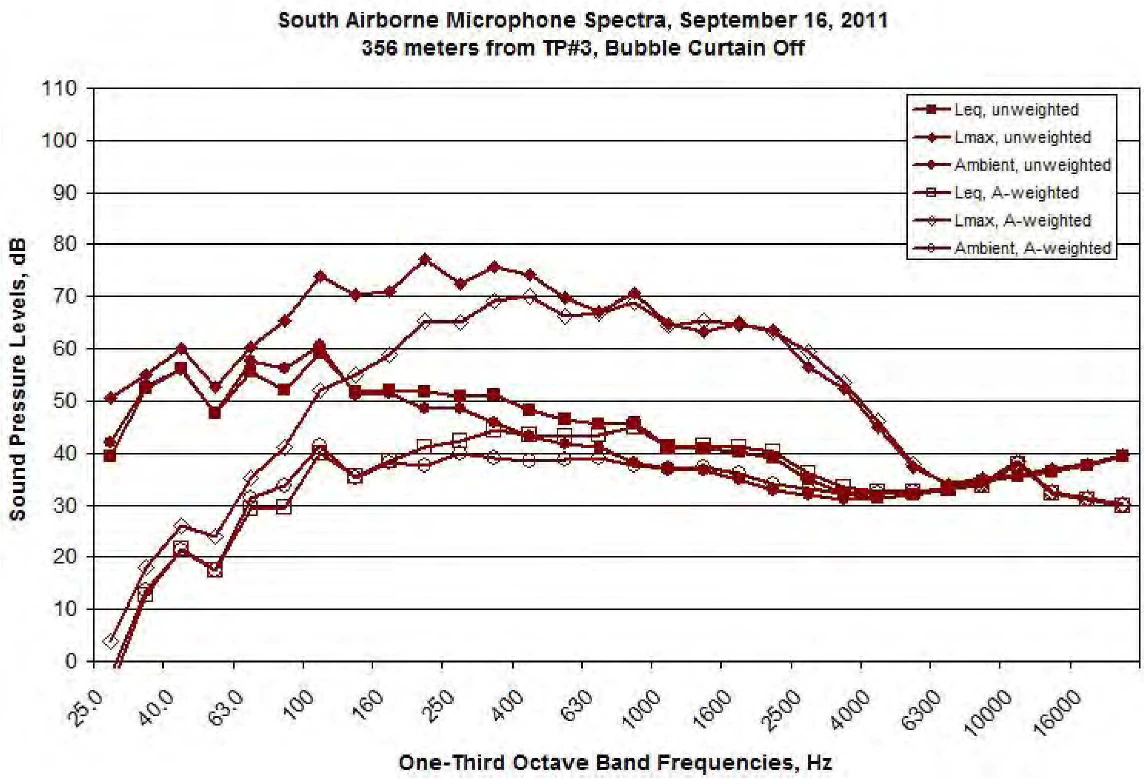

Figure C433. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#3, 16:10-16:16, on September 16, 2011

9/17/2011 – TP#2 (Bubble Curtain On Only)

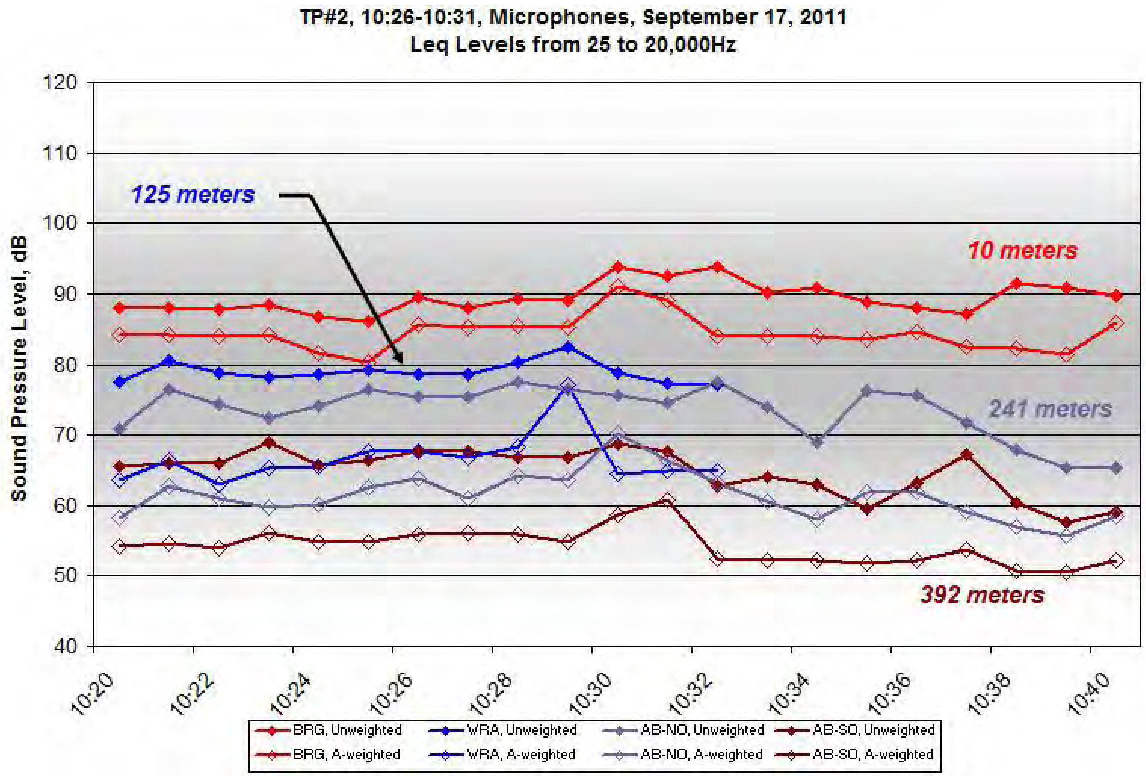

Figure C434. One-minute Unweighted and A-weighted Leq Level at TP#2, 10:26-10:31, on September 17, 2011

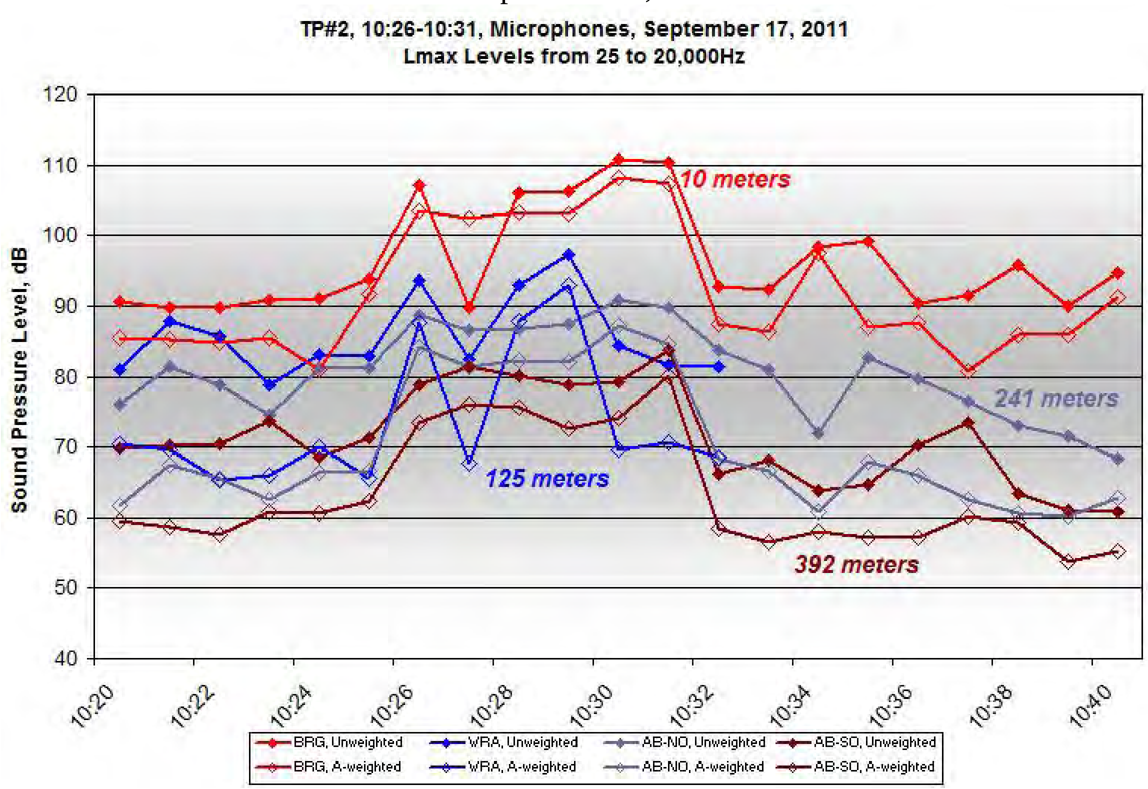

Figure C435. One-minute Unweighted and A-weighted Lmax Level at TP#2, 10:26-10:31, on September 17, 2011

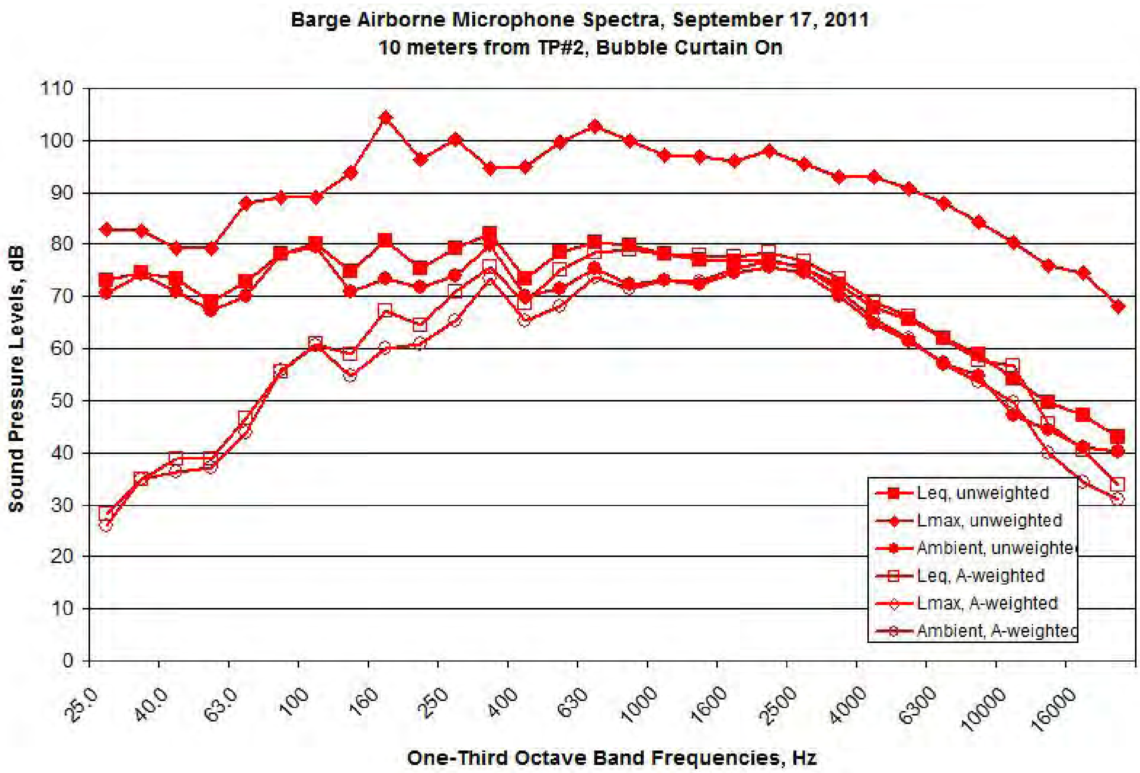

Figure C436. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#2, 10:26-10:31, on September 17, 2011

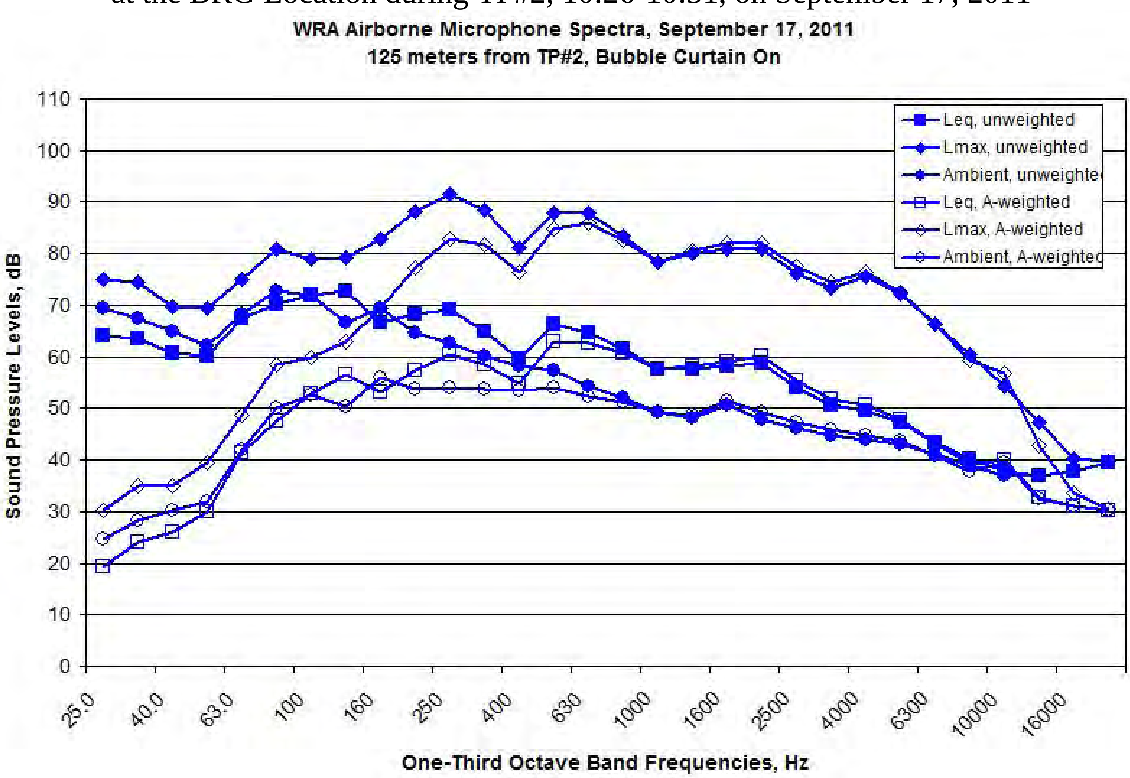

Figure C437. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#2, 10:26-10:31, on September 17, 2011

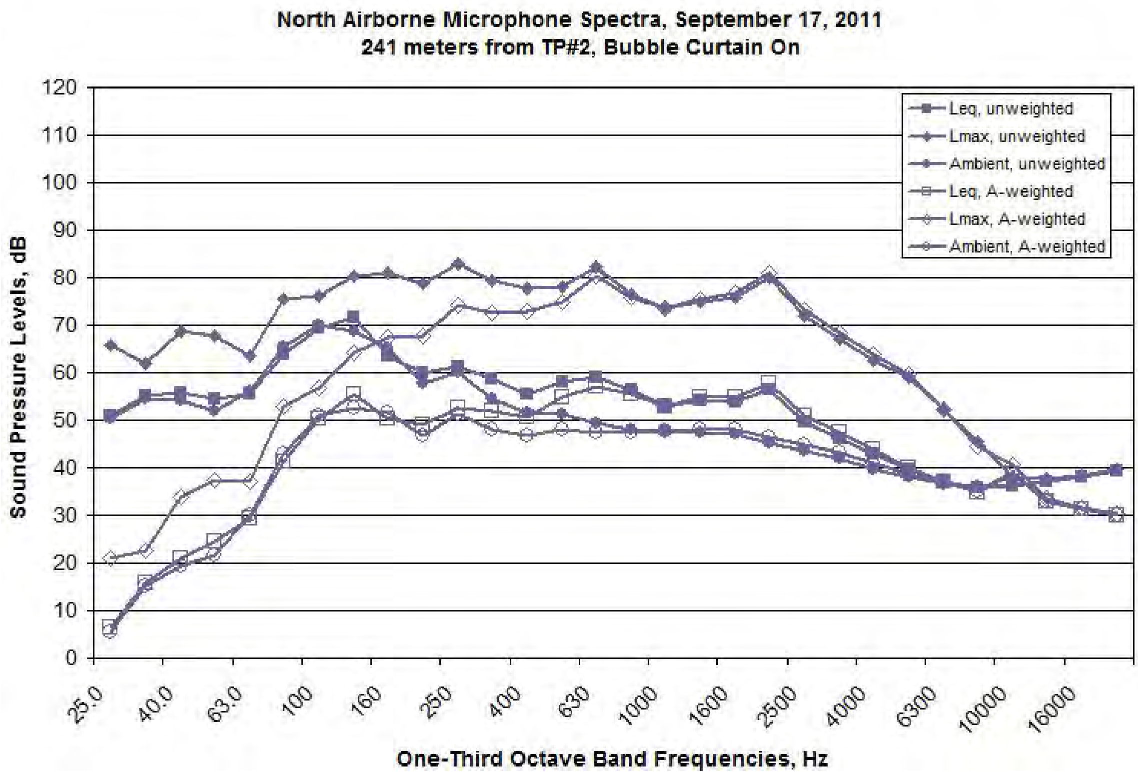

Figure C438. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#2, 10:26-10:31, on September 17, 2011

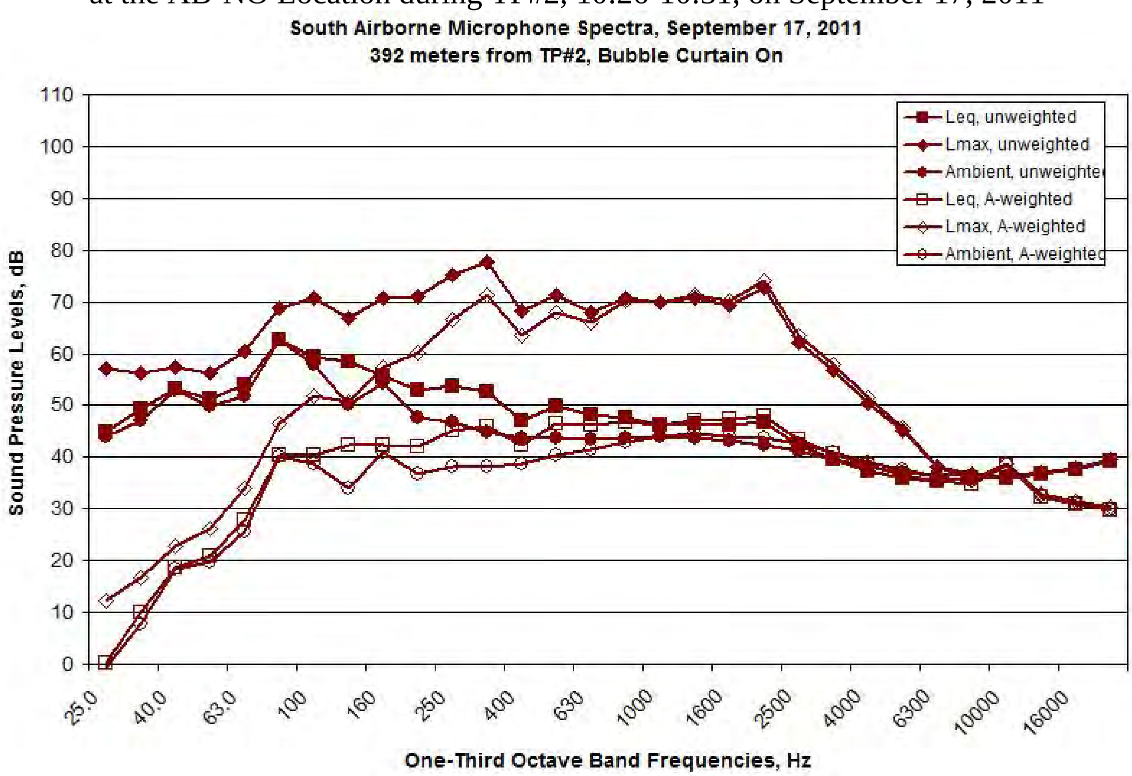

Figure C439. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#2, 10:26-10:31, on September 17, 2011

9/21/2011 – TTP#3 (Bubble Curtain On Only)

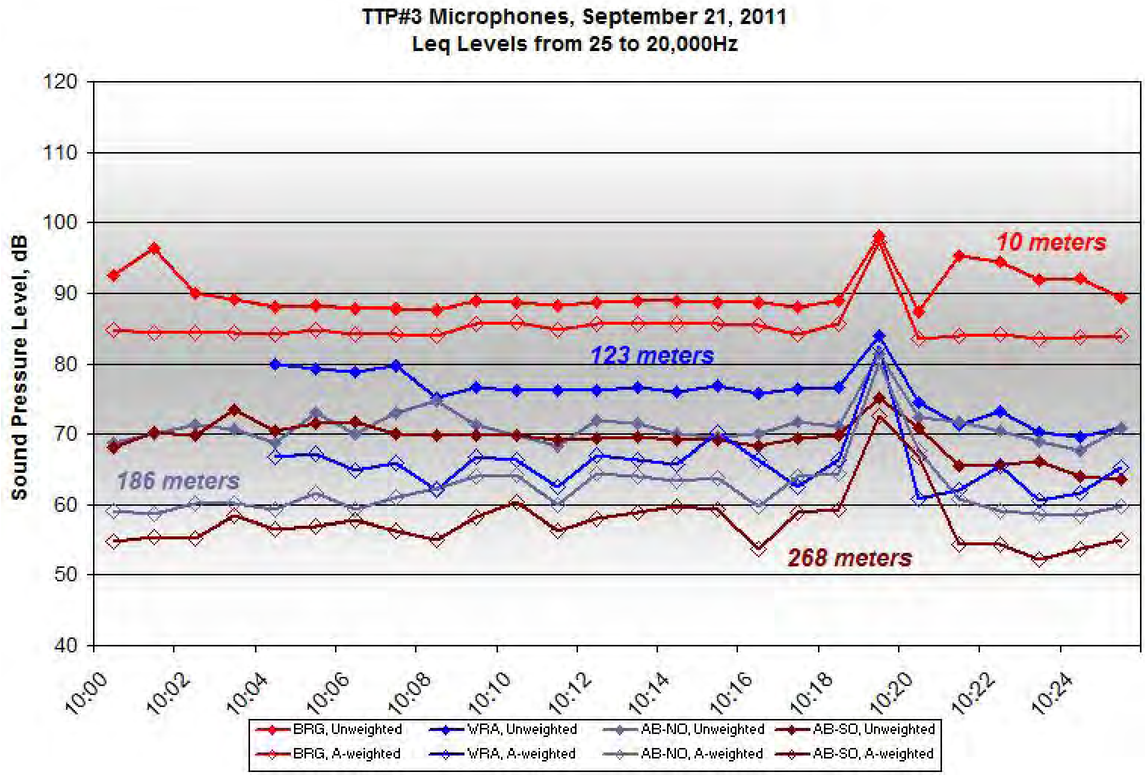

Figure C440. One-minute Unweighted and A-weighted Leq Level at TTP#3, 10:09-10:20, on September 21, 2011

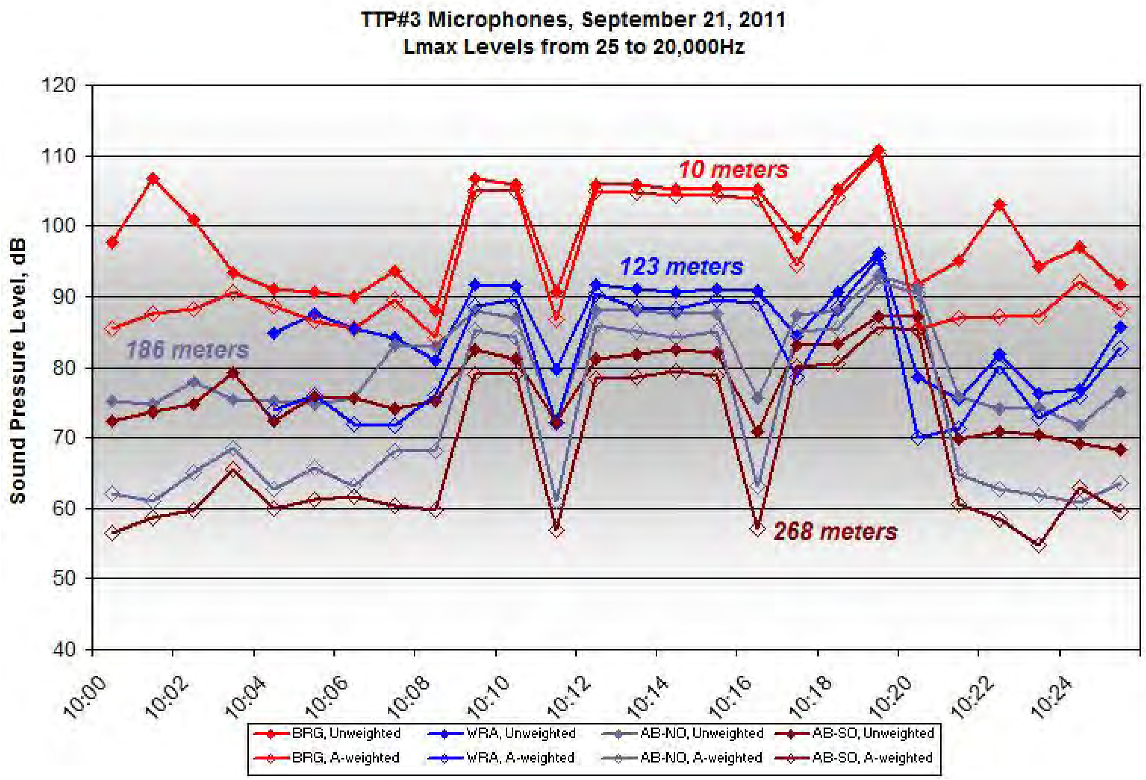

Figure C441. One-minute Unweighted and A-weighted Lmax Level at TTP#3, 10:09-10:20, on September 21, 2011

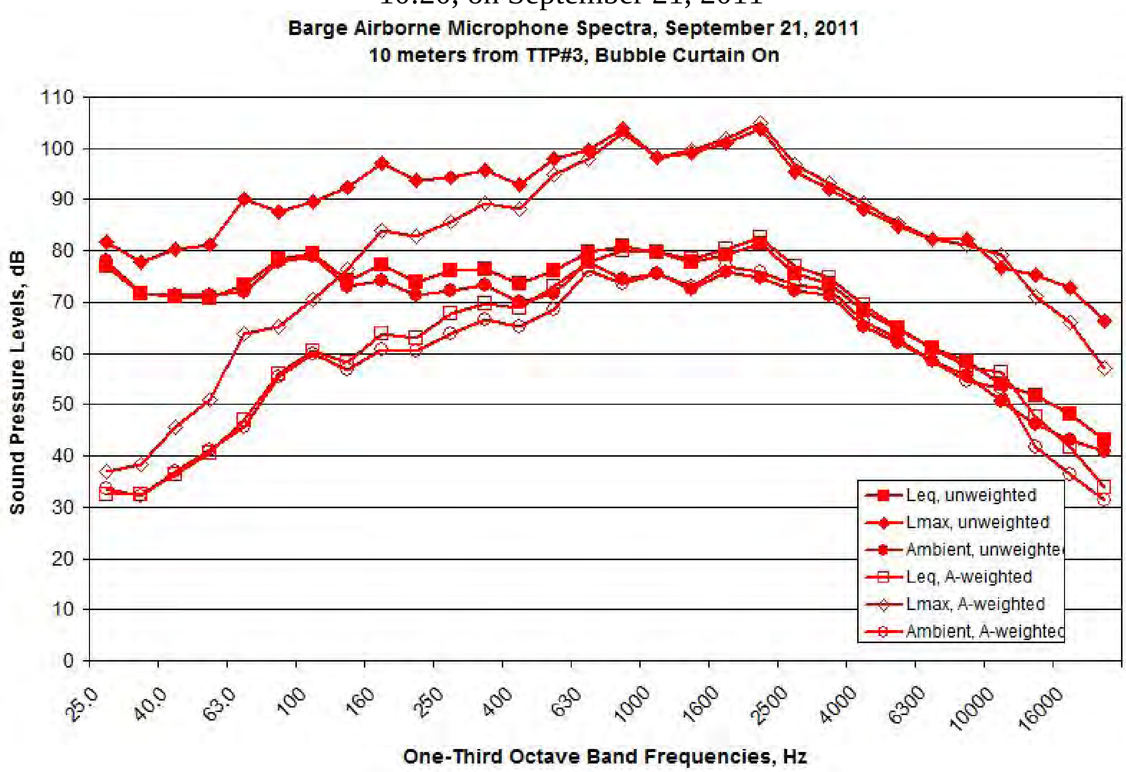

Figure C442. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#3, 10:09-10:20, on September 21, 2011

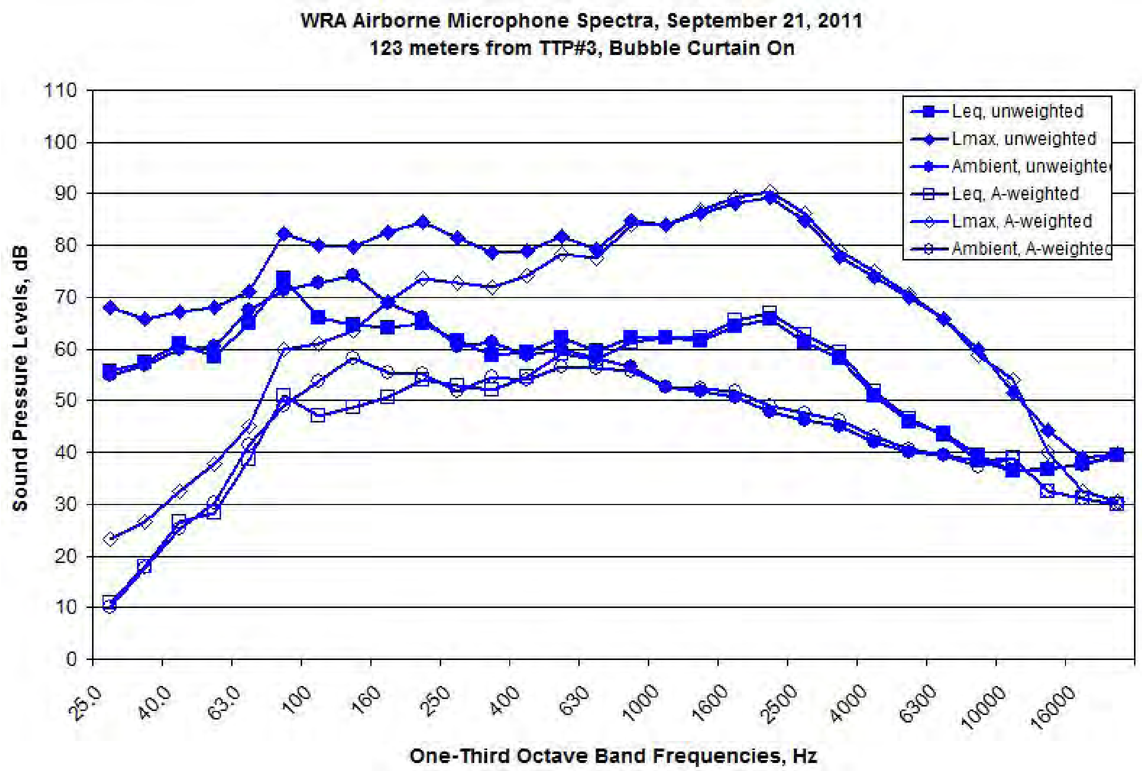

Figure C443. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#3, 10:09-10:20, on September 21, 2011

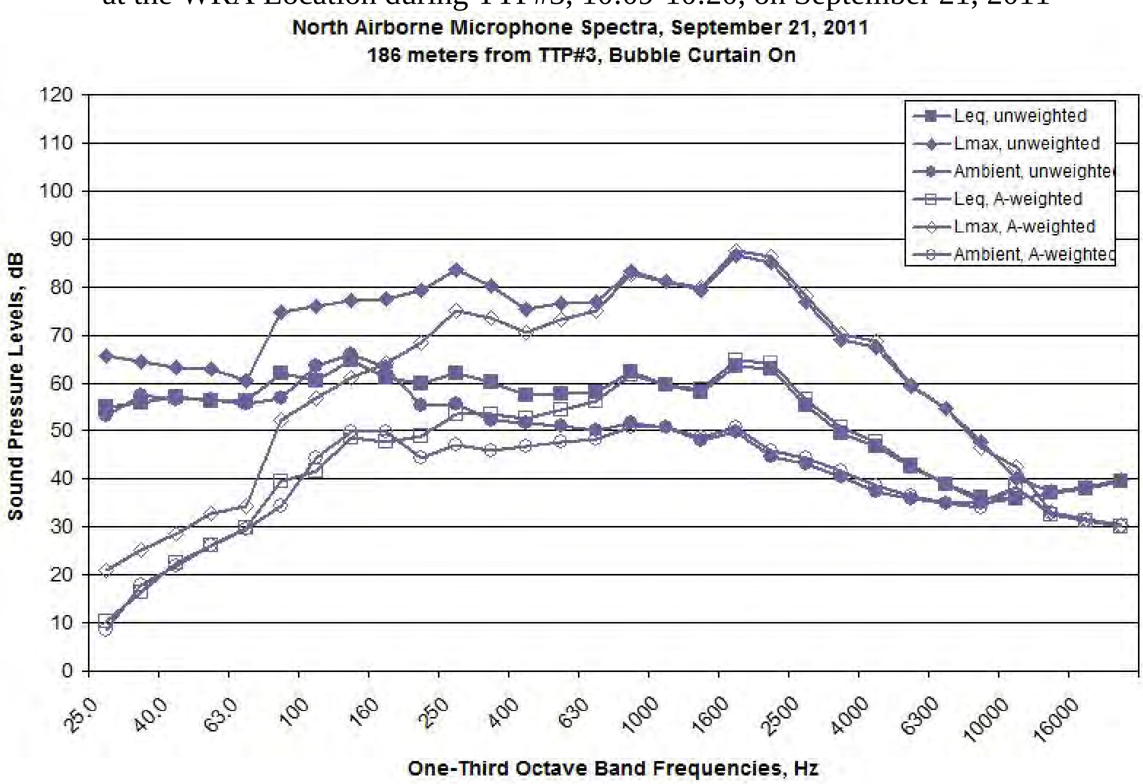

Figure C444. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#3, 10:09-10:20, on September 21, 2011

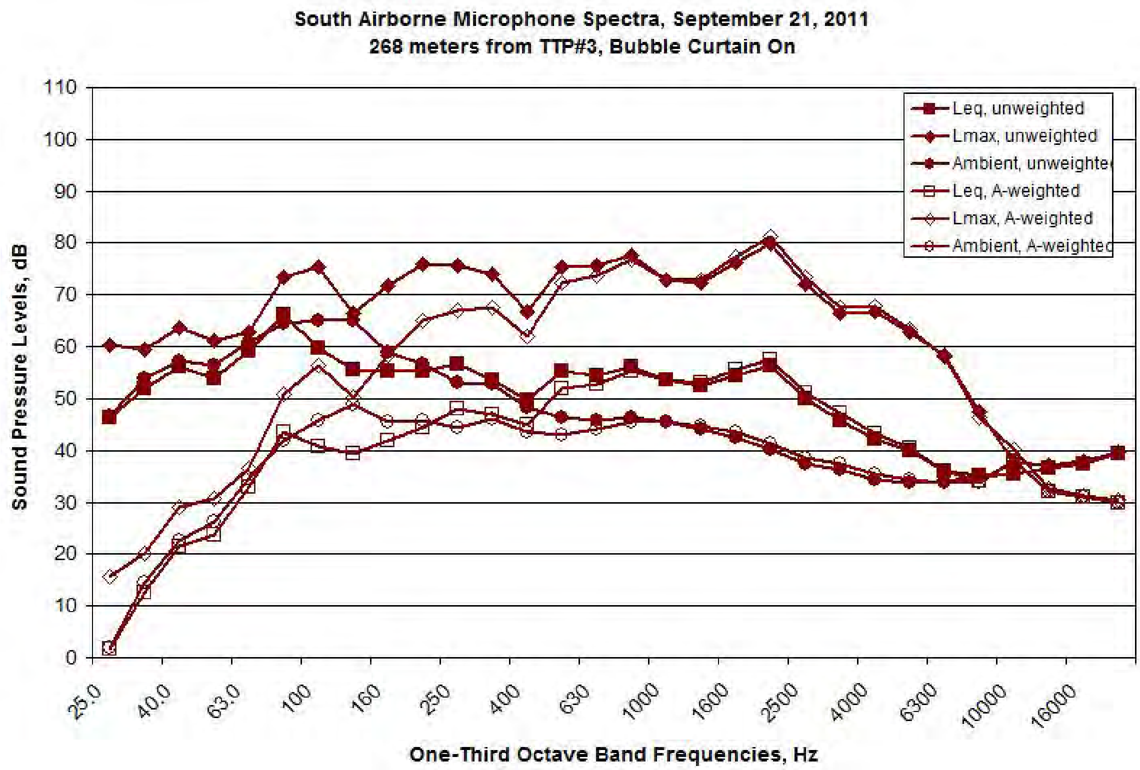

Figure C445. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#3, 10:09-10:20, on September 21, 2011

9/24/2011 – TP#10 (Bubble Curtain On Only)

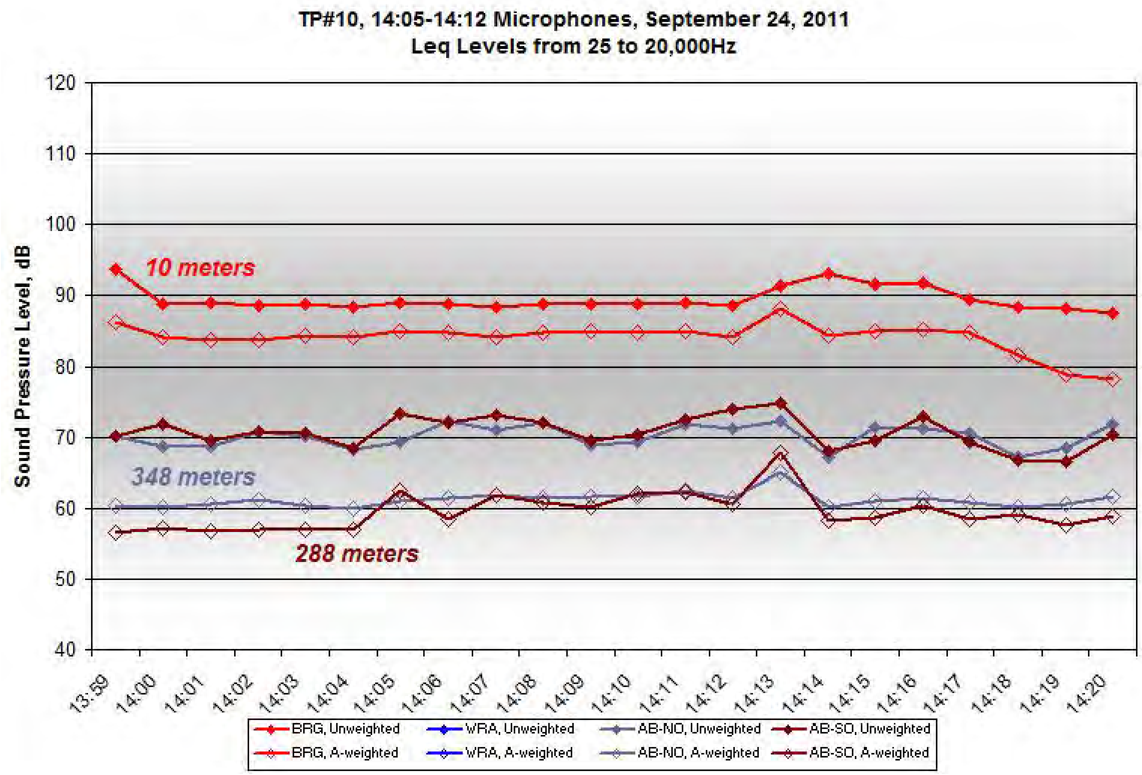

Figure C446. One-minute Unweighted and A-weighted Leq Level at TP#10, 14:05-14:12, on September 24, 2011

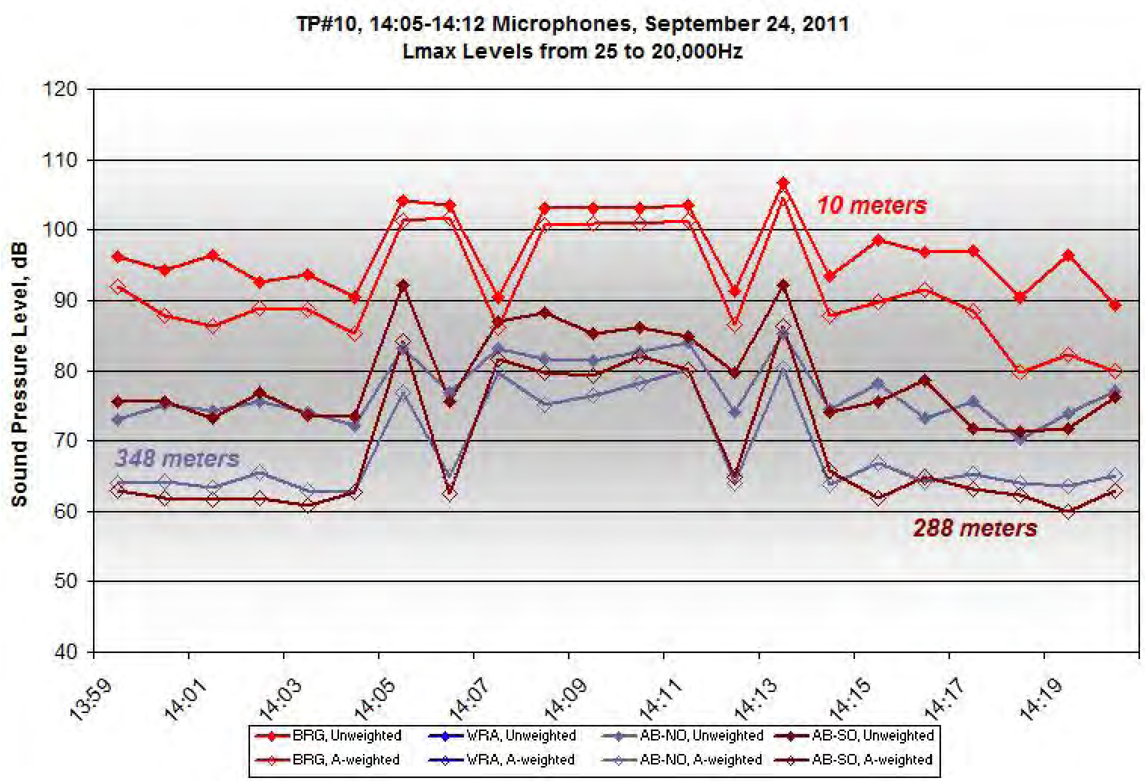

Figure C447. One-minute Unweighted and A-weighted Lmax Level at TP#10, 14:05-14:12, on September 24, 2011

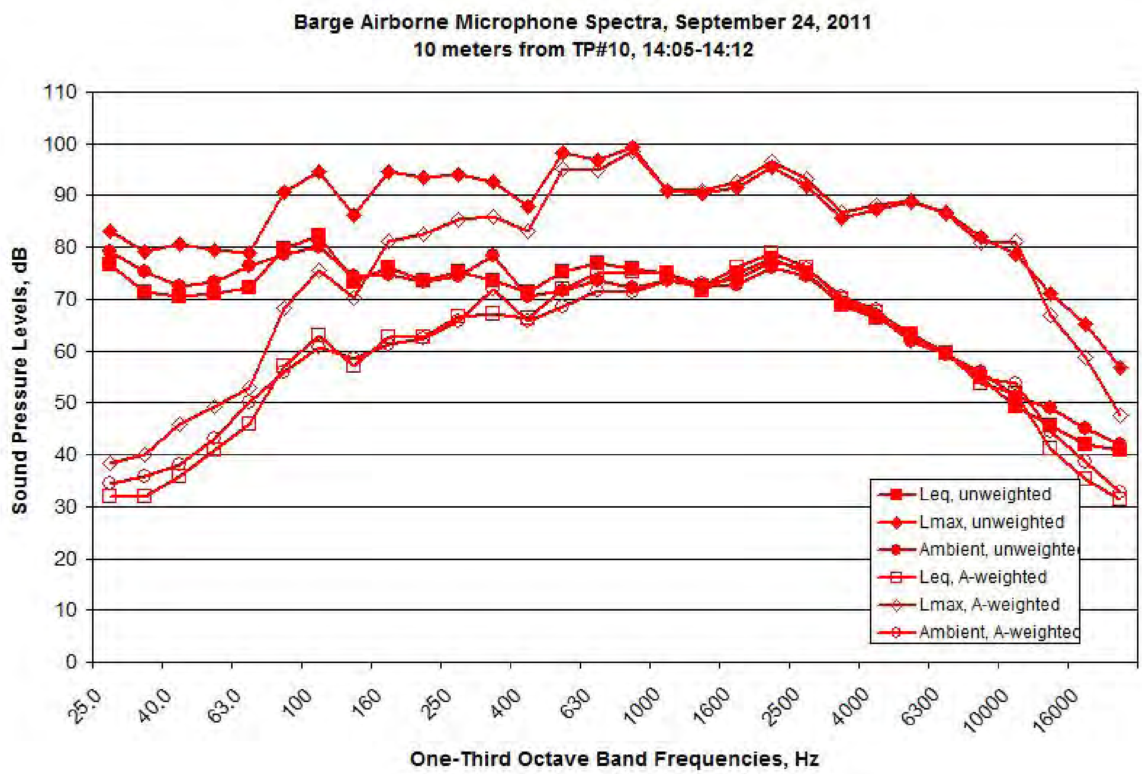

Figure C448. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#10, 14:05-14:12, on September 24, 2011

NO DATA AVAILABLE

Figure C449. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#10, 14:05-14:12, on September 24, 2011

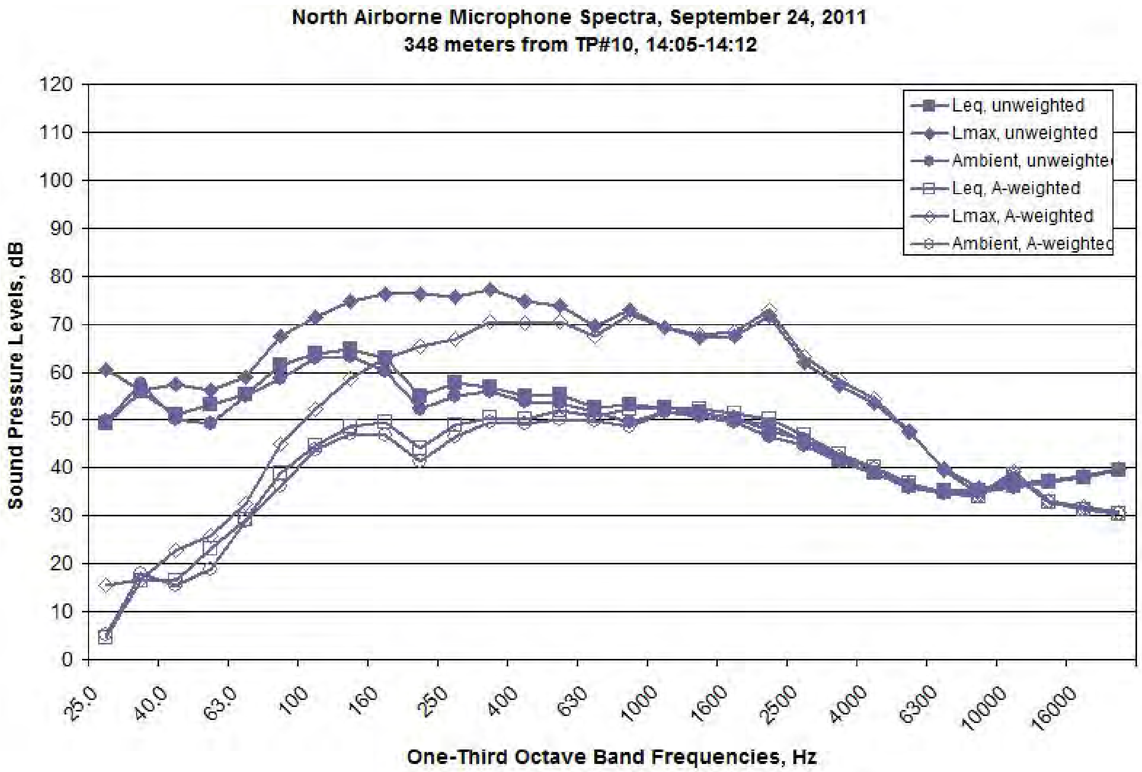

Figure C450. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#10, 14:05-14:12, on September 24, 2011

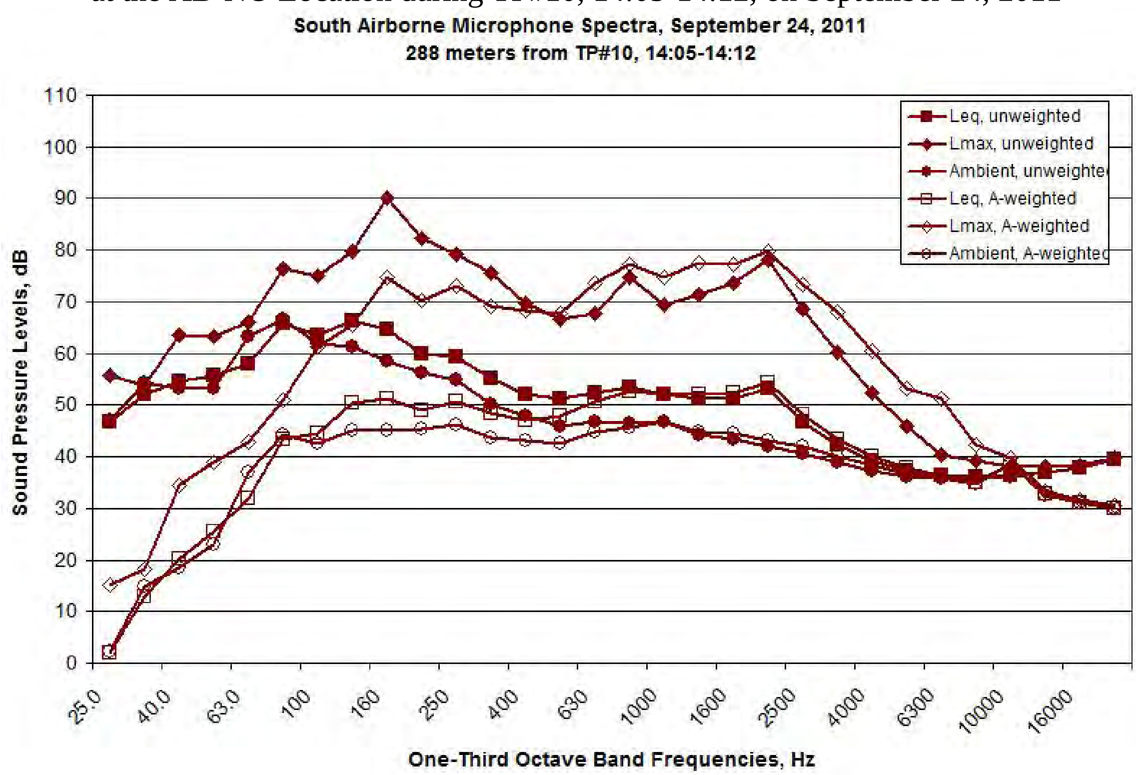

Figure C451. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#10, 14:05-14:12, on September 24, 2011

9/26/2011 – TP#8 (Bubble Curtain On Only)

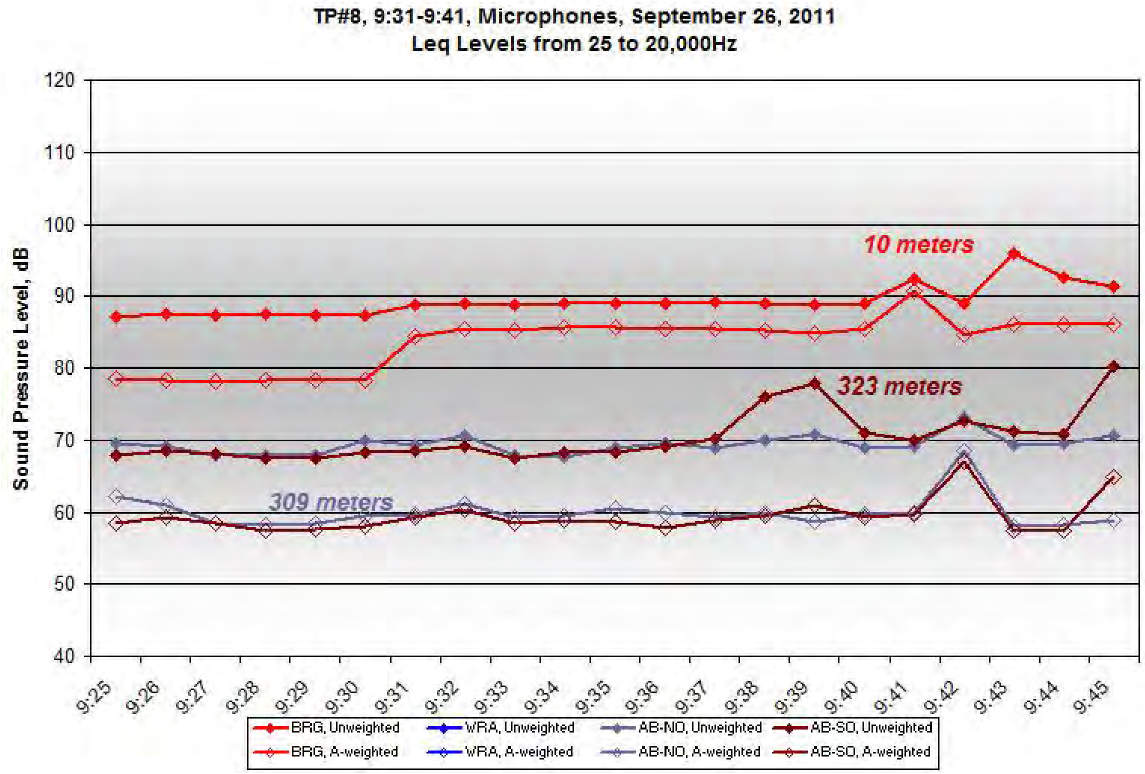

Figure C452. One-minute Unweighted and A-weighted Leq Level at TP#8, 9:31-9:41, on September 26, 2011

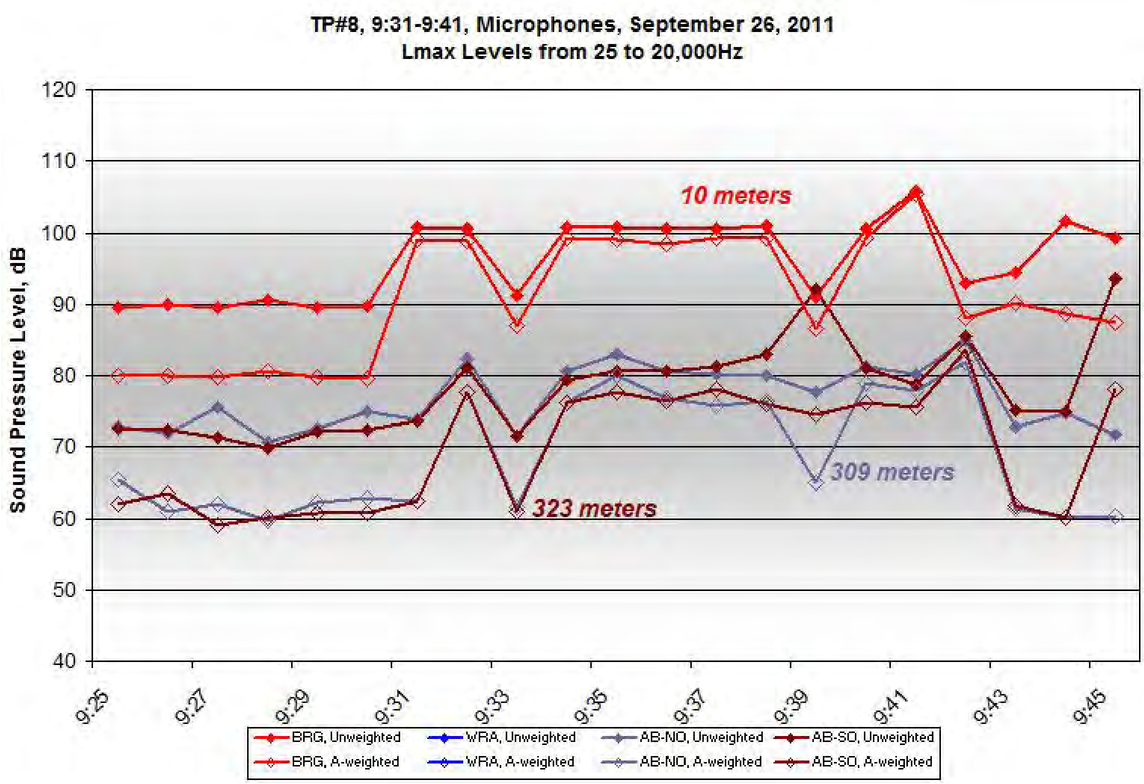

Figure C453. One-minute Unweighted and A-weighted Lmax Level at TP#8, 9:31-9:41, on September 26, 2011

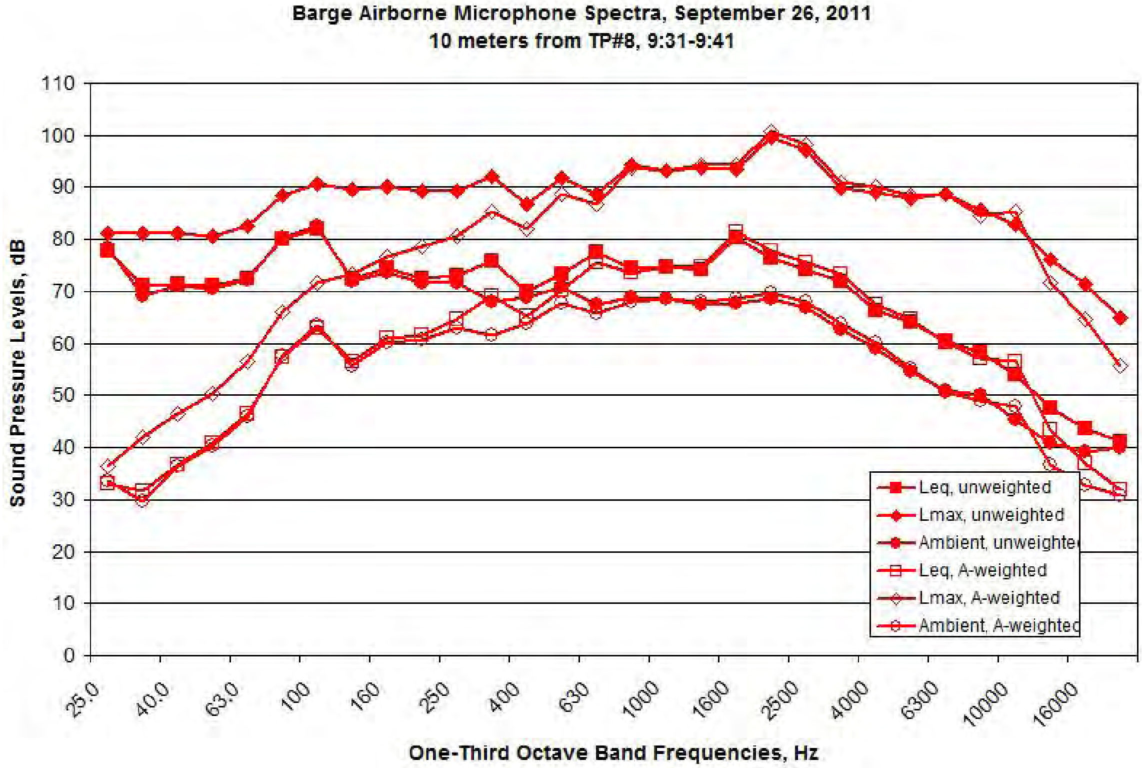

Figure C454. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#8, 9:31-9:41, on September 26, 2011

NO DATA AVAILABLE

Figure C455. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#8, 9:31-9:41, on September 26, 2011

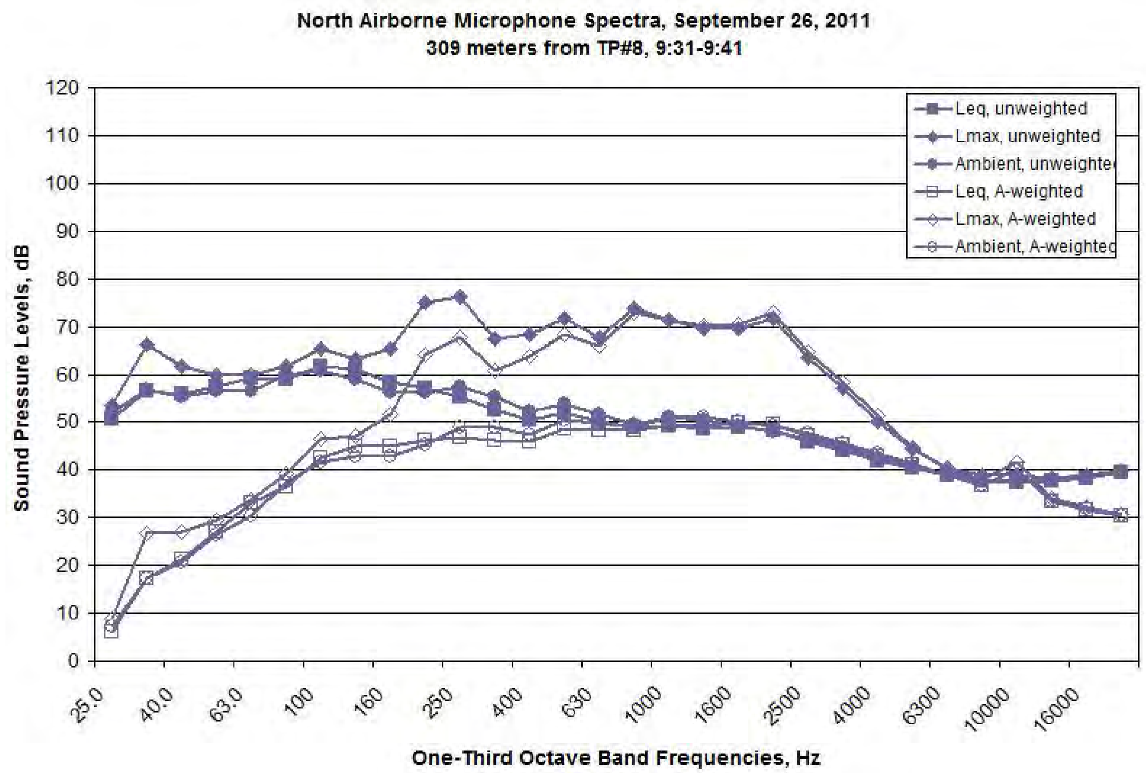

Figure C456. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#8, 9:31-9:41, on September 26, 2011

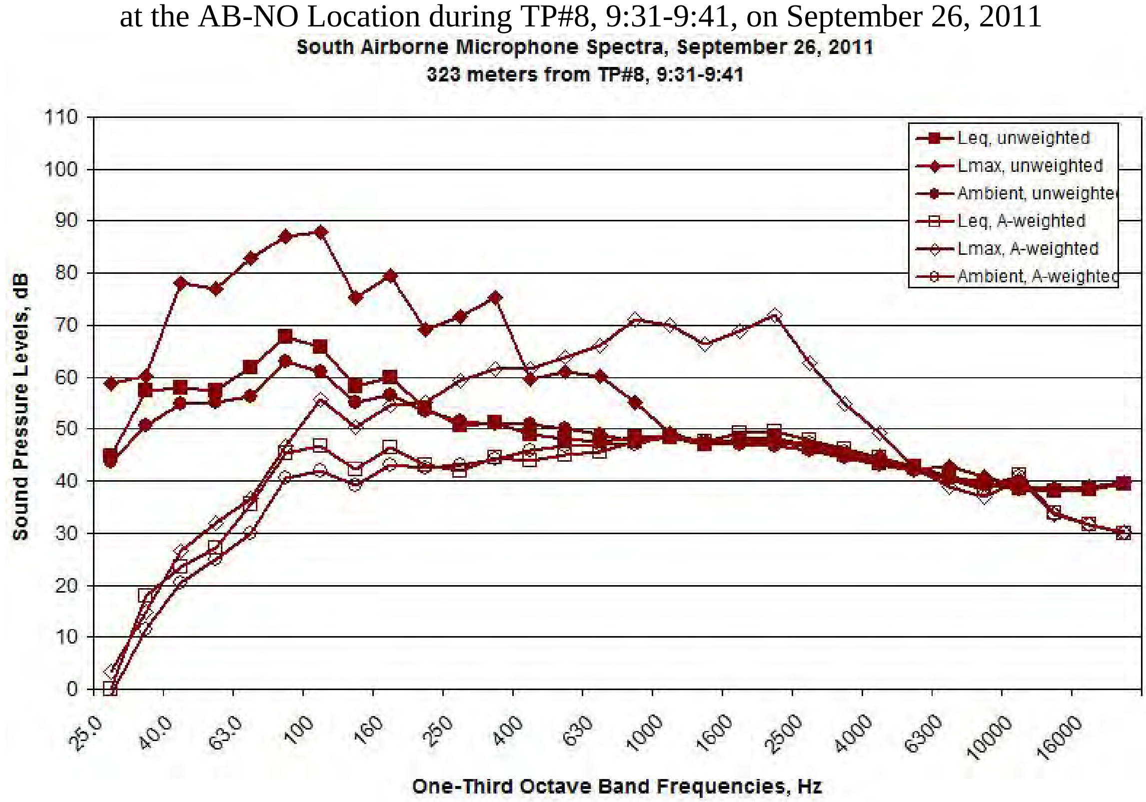

Figure C457. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#8, 9:31-9:41, on September 26, 2011

9/29/2011 – TP#12 (Bubble Curtain On Only)

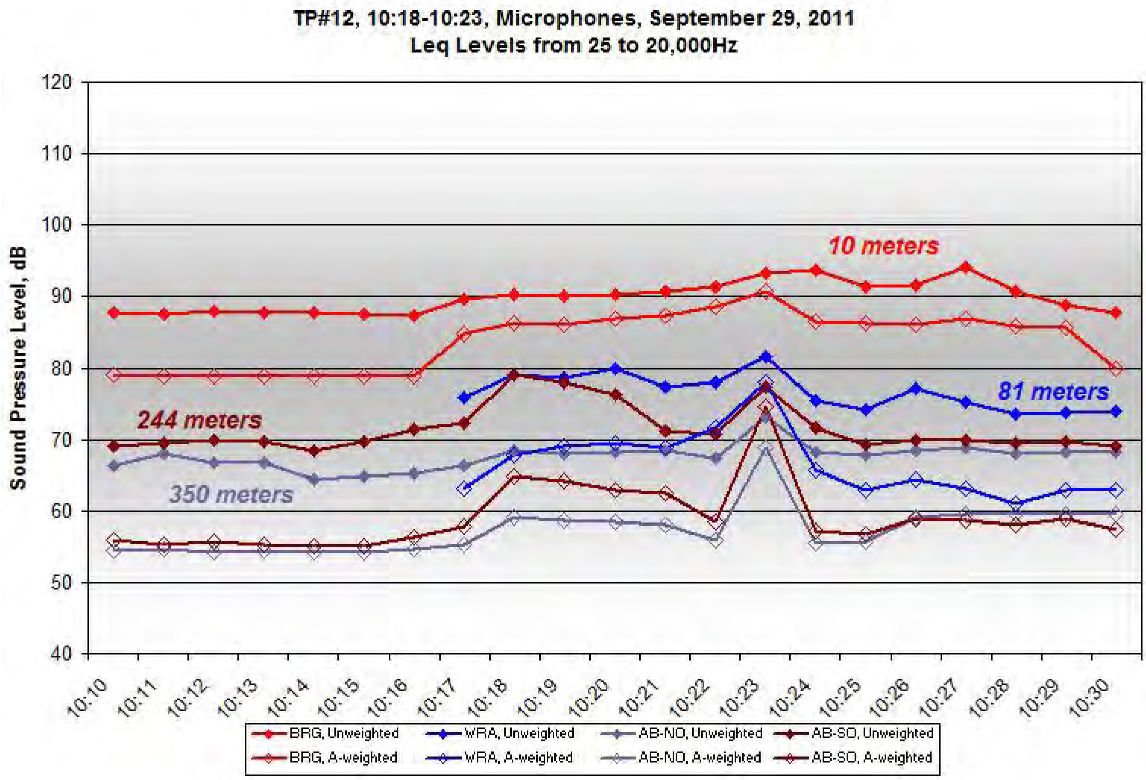

Figure C458. One-minute Unweighted and A-weighted Leq Level at TP#12, 10:18-10:23, on September 29, 2011

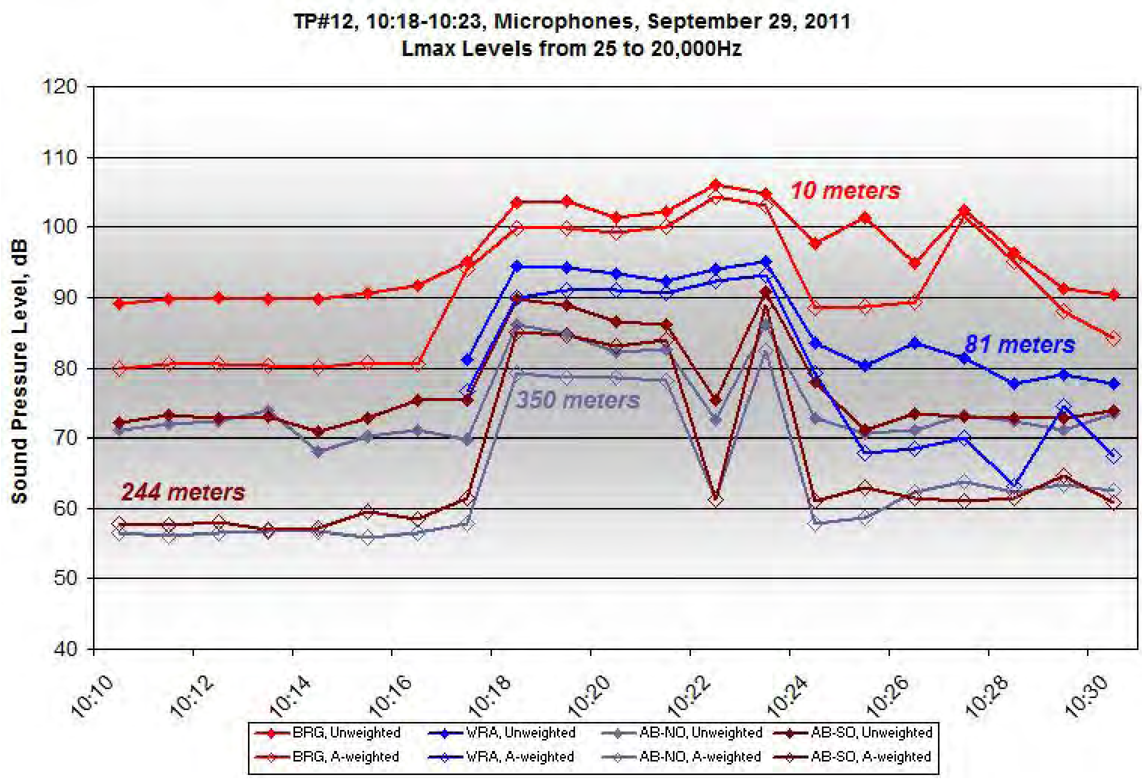

Figure C459. One-minute Unweighted and A-weighted Lmax Level at TP#12, 10:18-10:23, on September 29, 2011

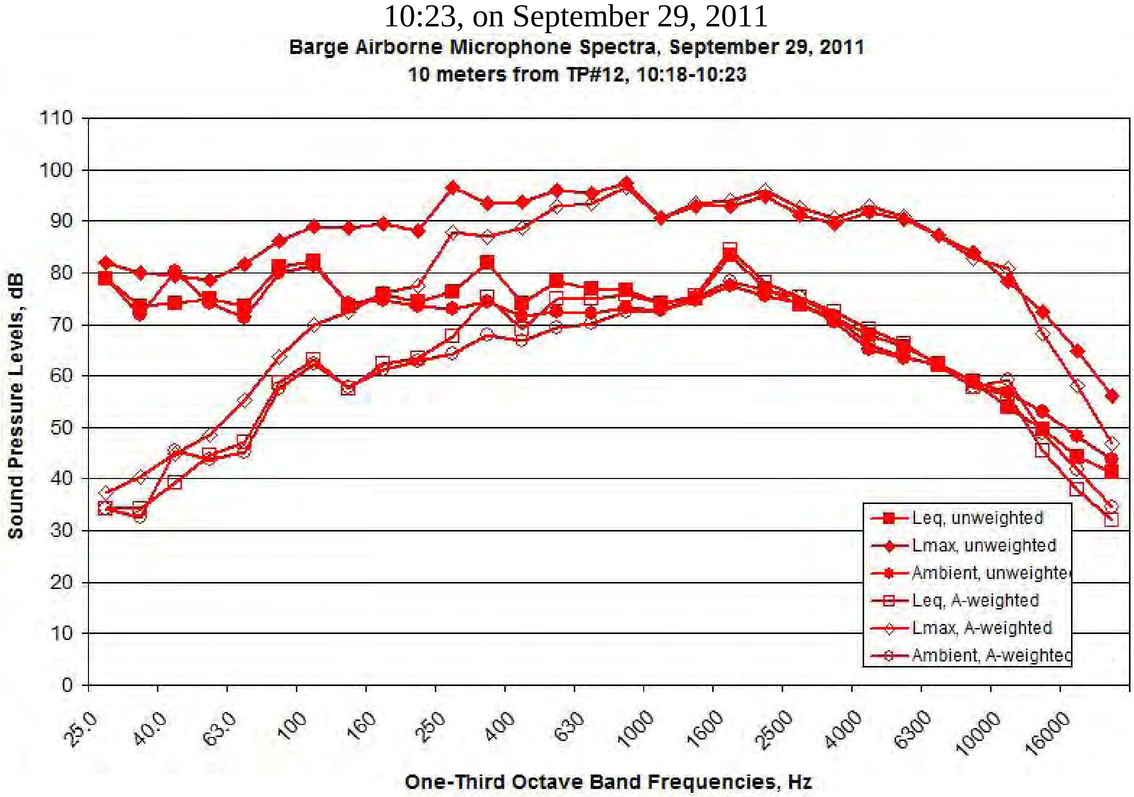

Figure C460. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#12, 10:18-10:23, on September 29, 2011

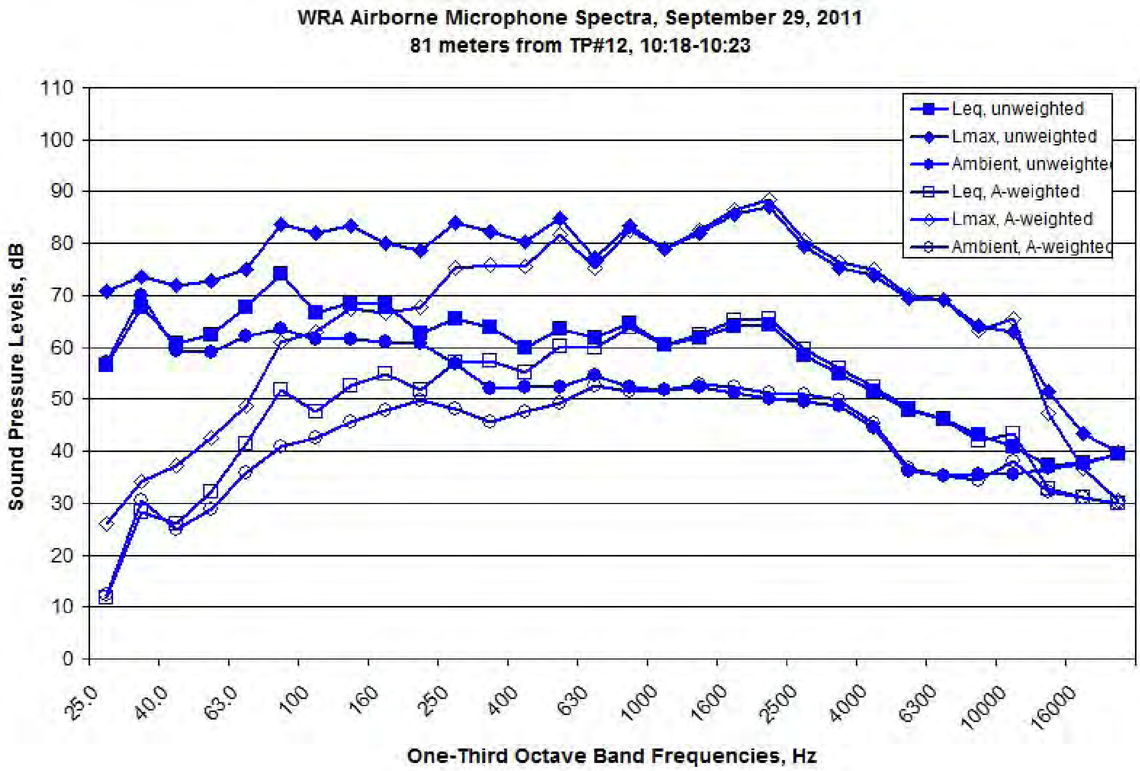

Figure C461. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#12, 10:18-10:23, on September 29, 2011

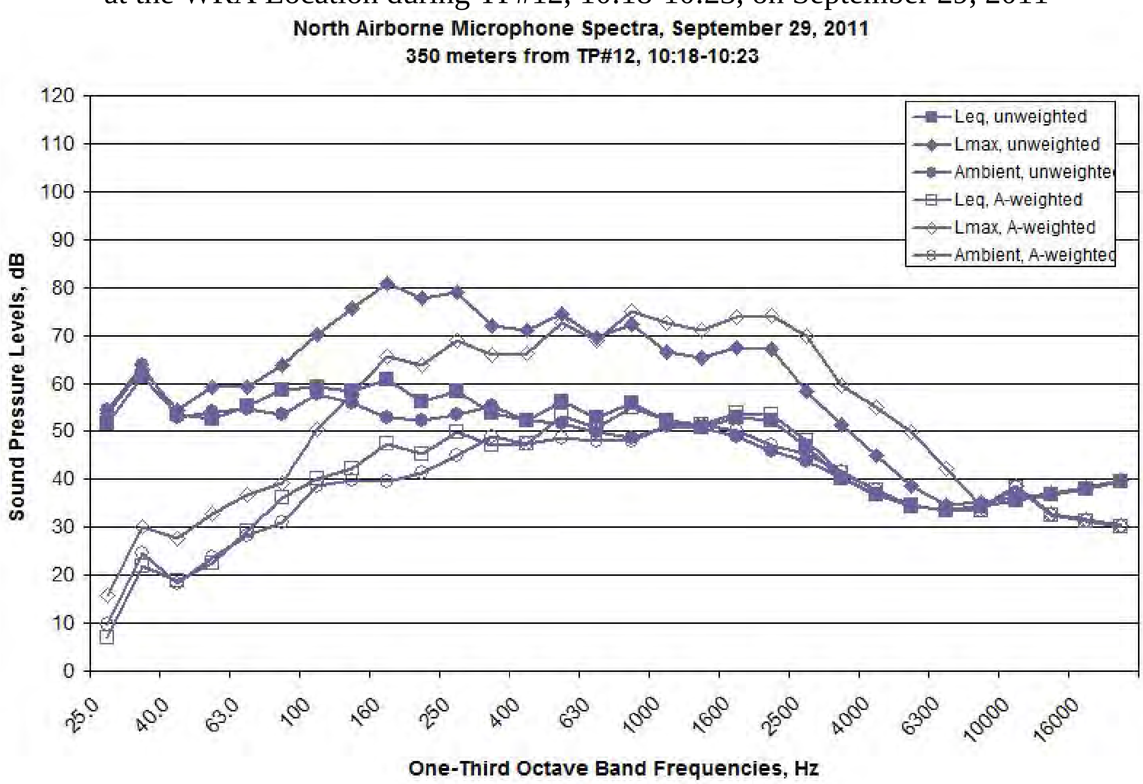

Figure C462. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#12, 10:18-10:23, on September 29, 2011

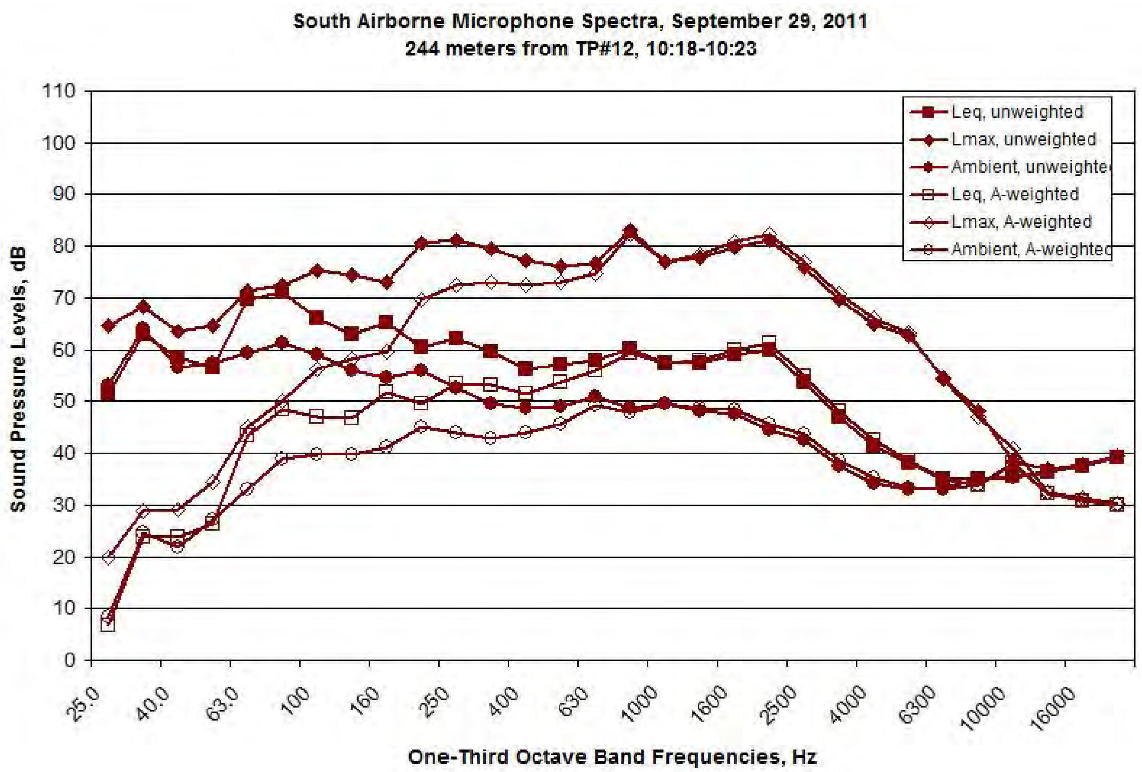

Figure C463. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#12, 10:18-10:23, on September 29, 2011

TP#11 (Bubble Curtain On and Off)

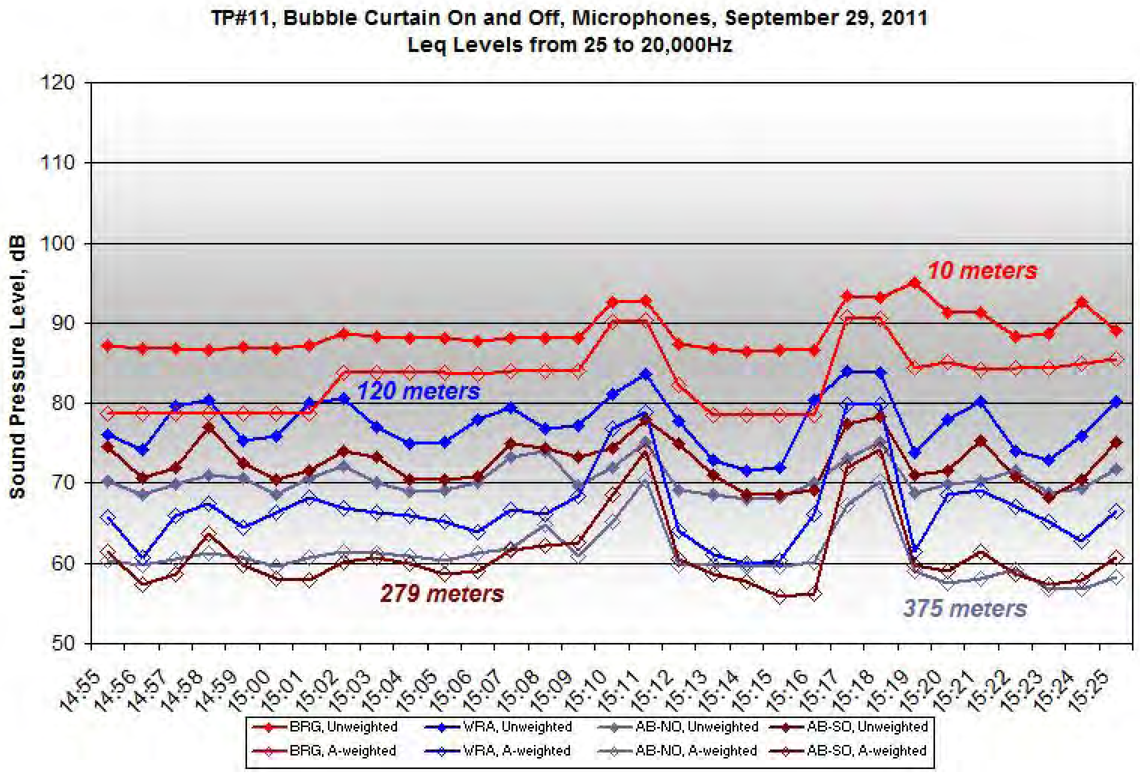

Figure C464. One-minute Unweighted and A-weighted Leq Level at TP#11, 15:03-15:18, on September 29, 2011

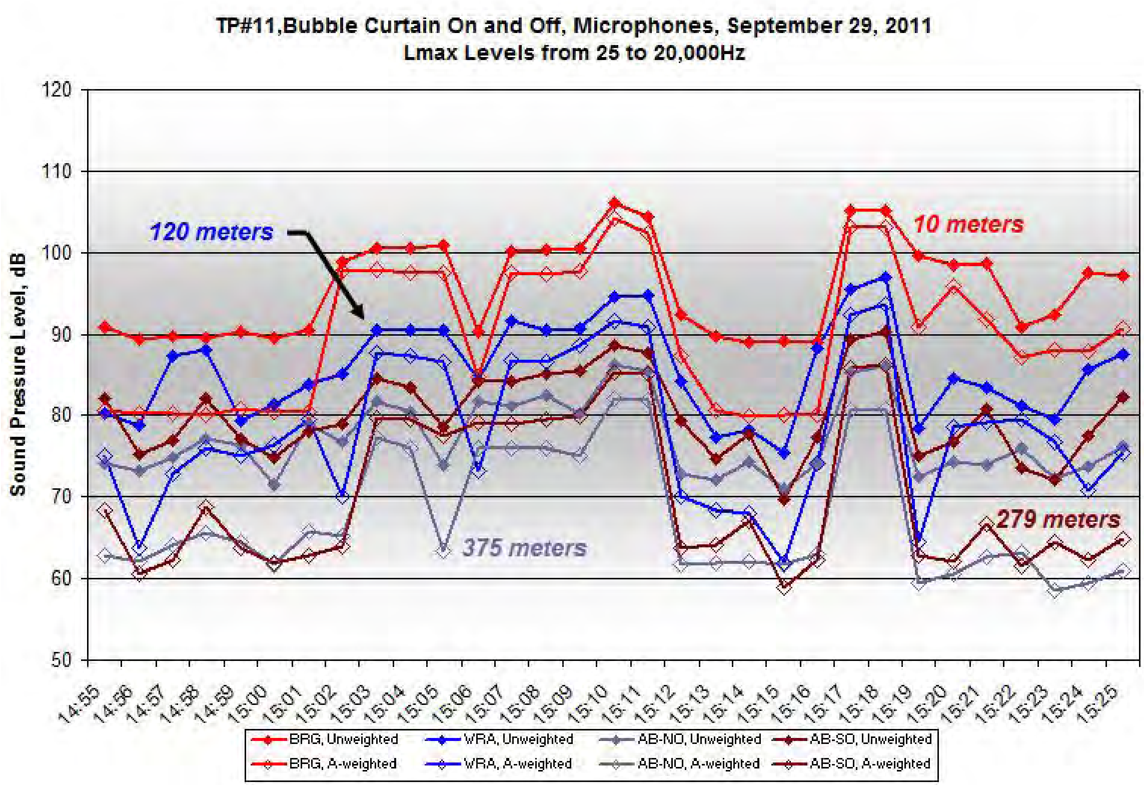

Figure C465. One-minute Unweighted and A-weighted Lmax Level at TP#11, 15:03-15:18, on September 29, 2011

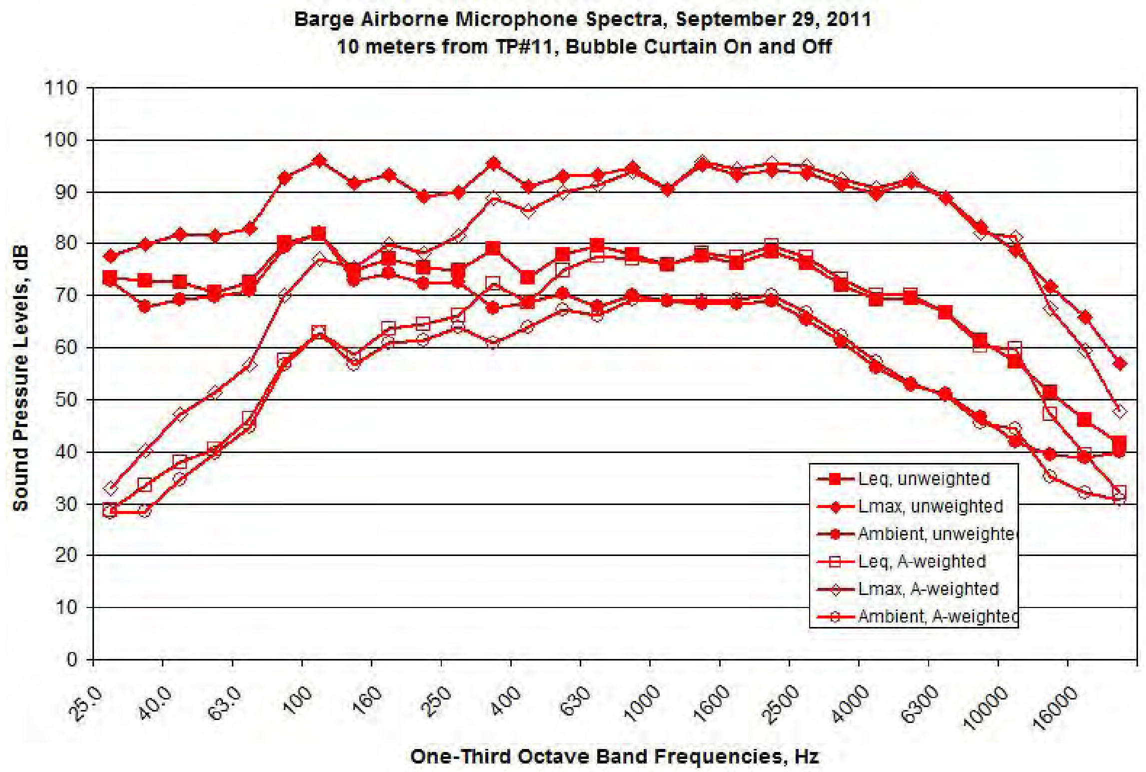

Figure C466. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#11, 15:03-15:11, on September 29, 2011

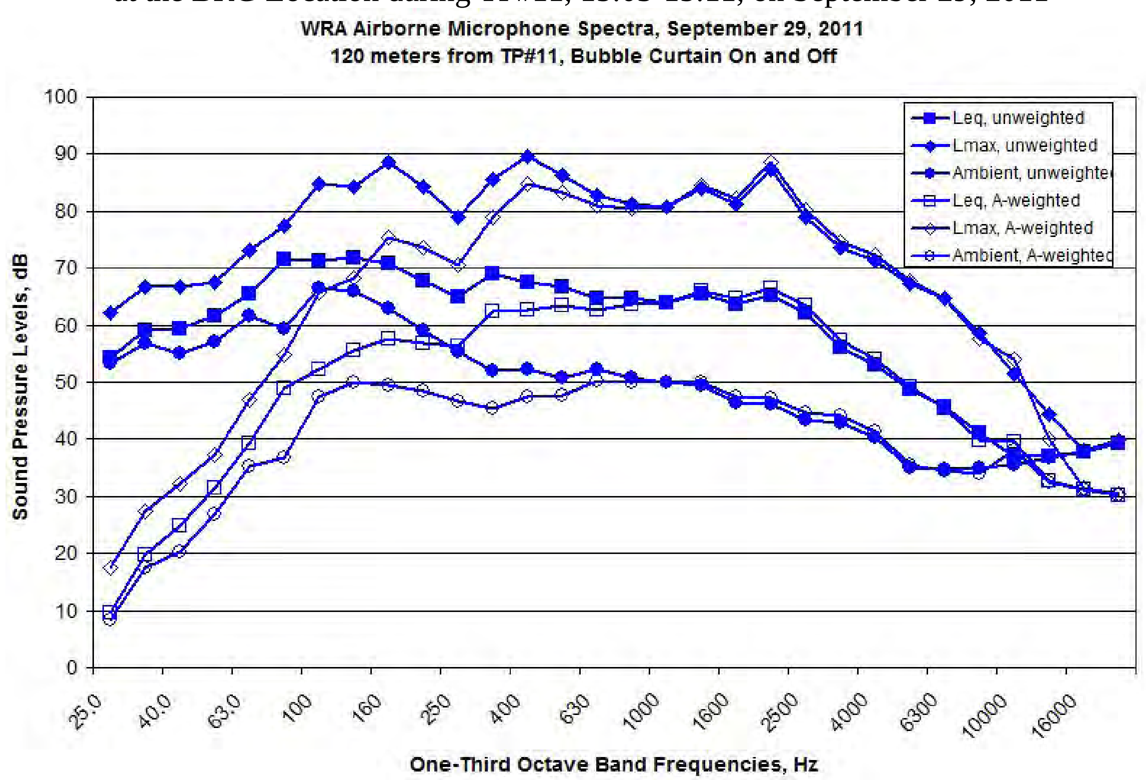

Figure C467. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#11, 15:17-15:18, on September 29, 2011

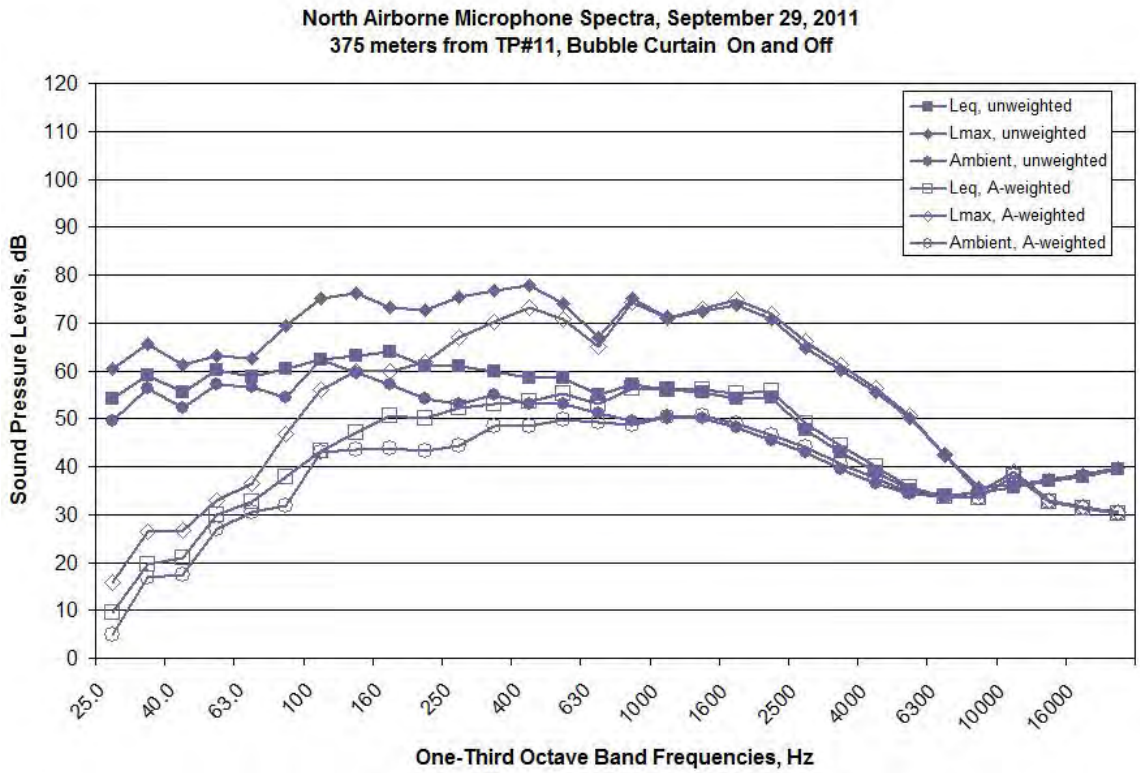

Figure C468. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#11, 15:03-15:11, on September 29, 2011

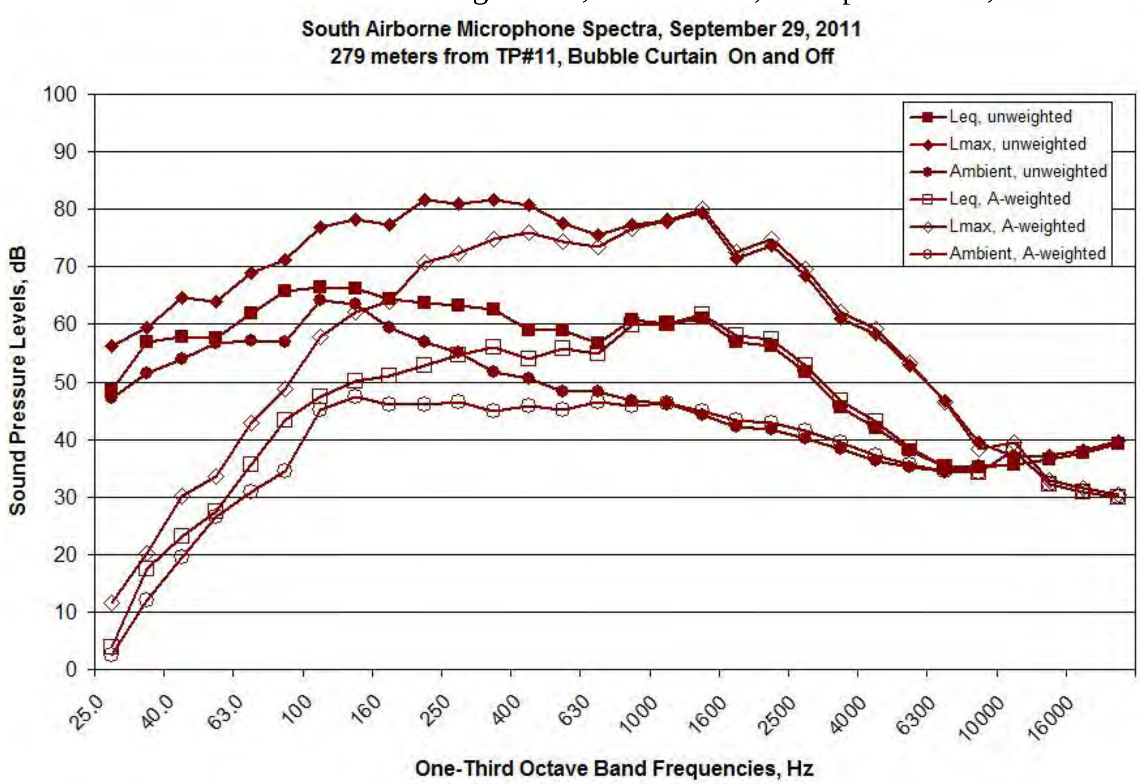

Figure C469. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#11, 15:17-15:18, on September 29, 2011

9/30/2011 – TP#13 (Bubble Curtain On Only)

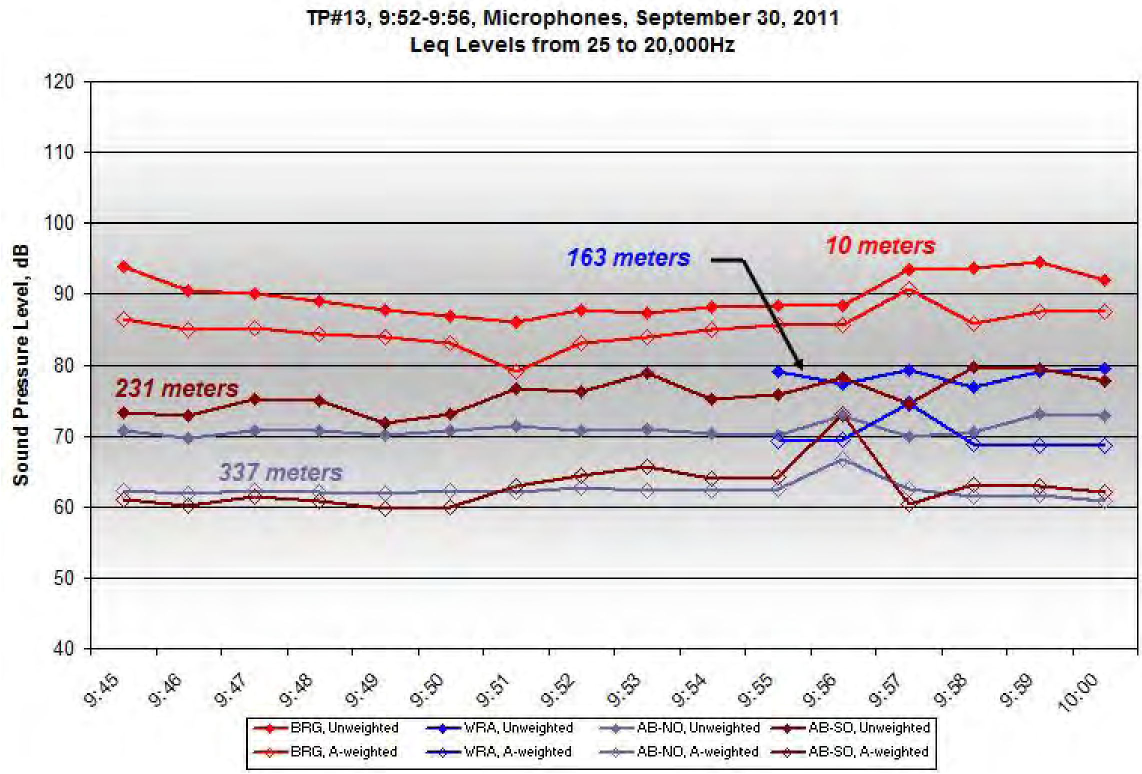

Figure C470. One-minute Unweighted and A-weighted Leq Level at TP#13, 9:52-9:56, on September 30, 2011

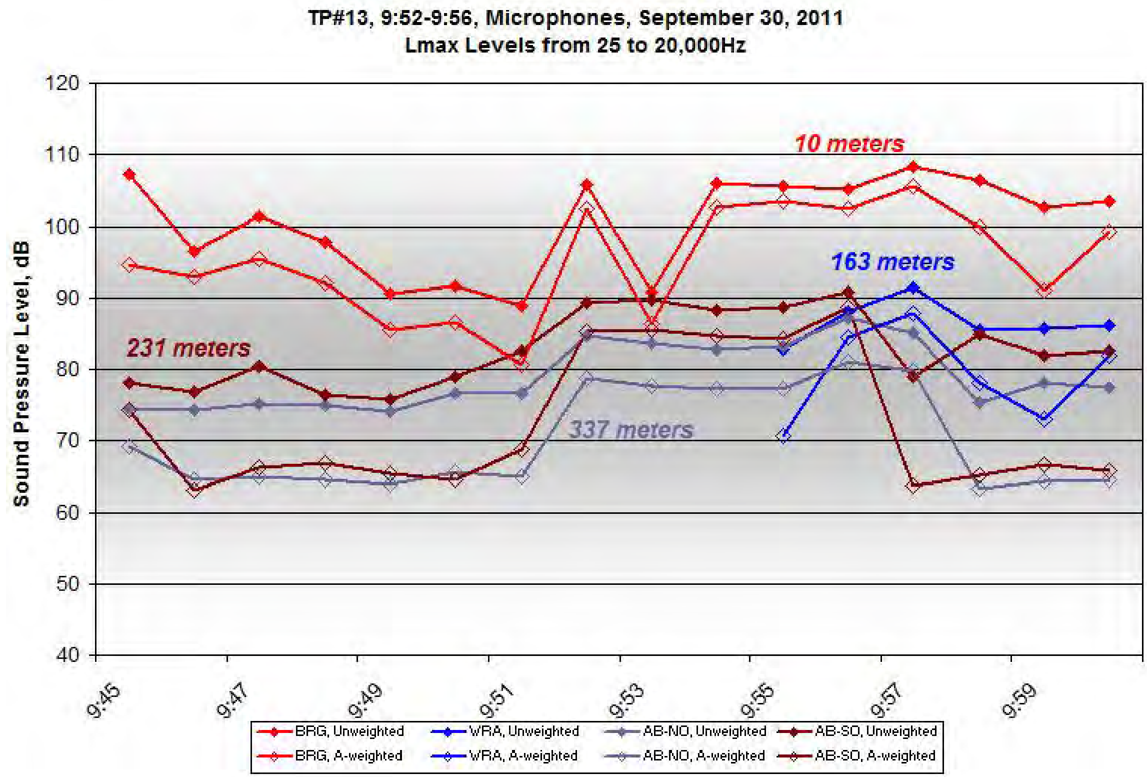

Figure C471. One-minute Unweighted and A-weighted Lmax Level at TP#13, 9:52-9:56, on September 30, 2011

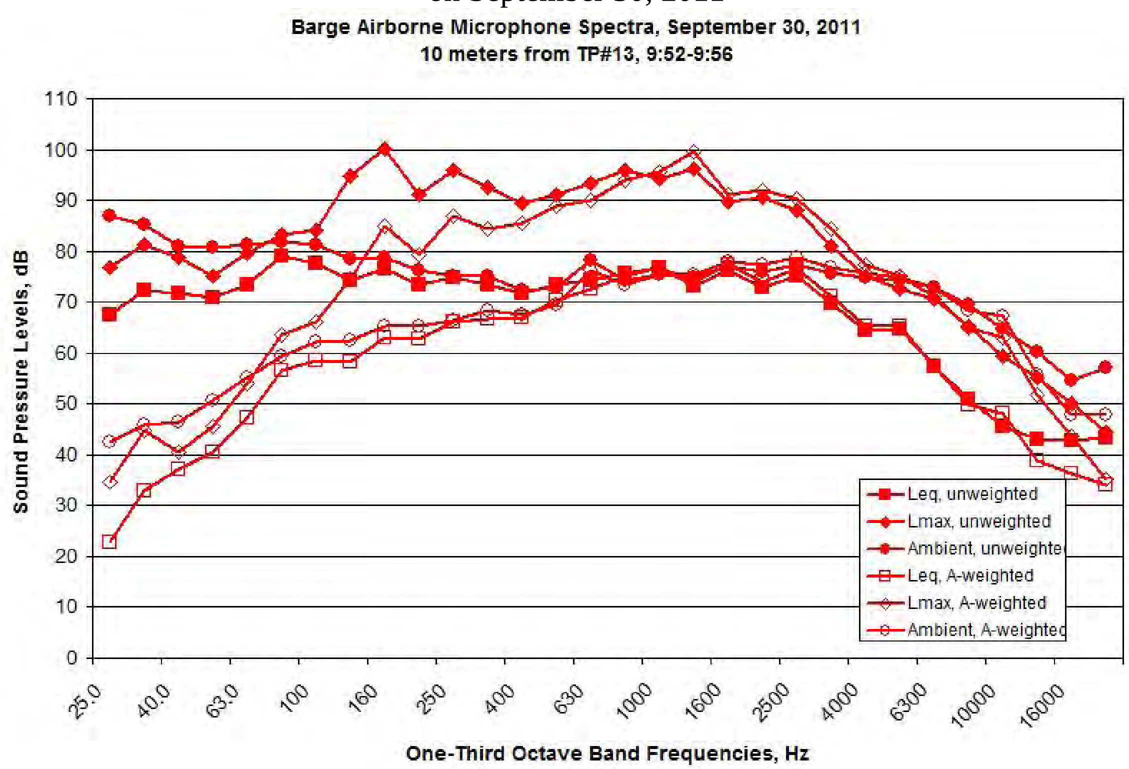

Figure C472. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#13, 9:52-9:56, on September 30, 2011

Figure C473. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#13, 9:52-9:56, on September 30, 2011

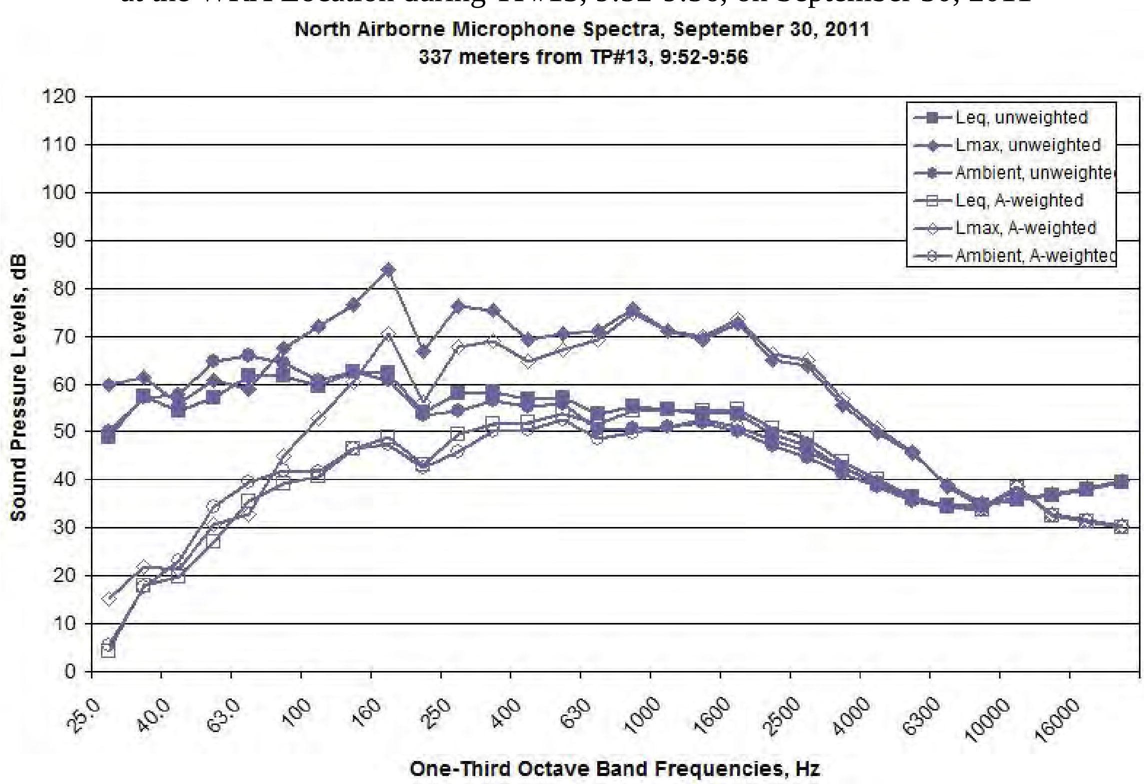

Figure C474. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#13, 9:52-9:56, on September 30, 2011

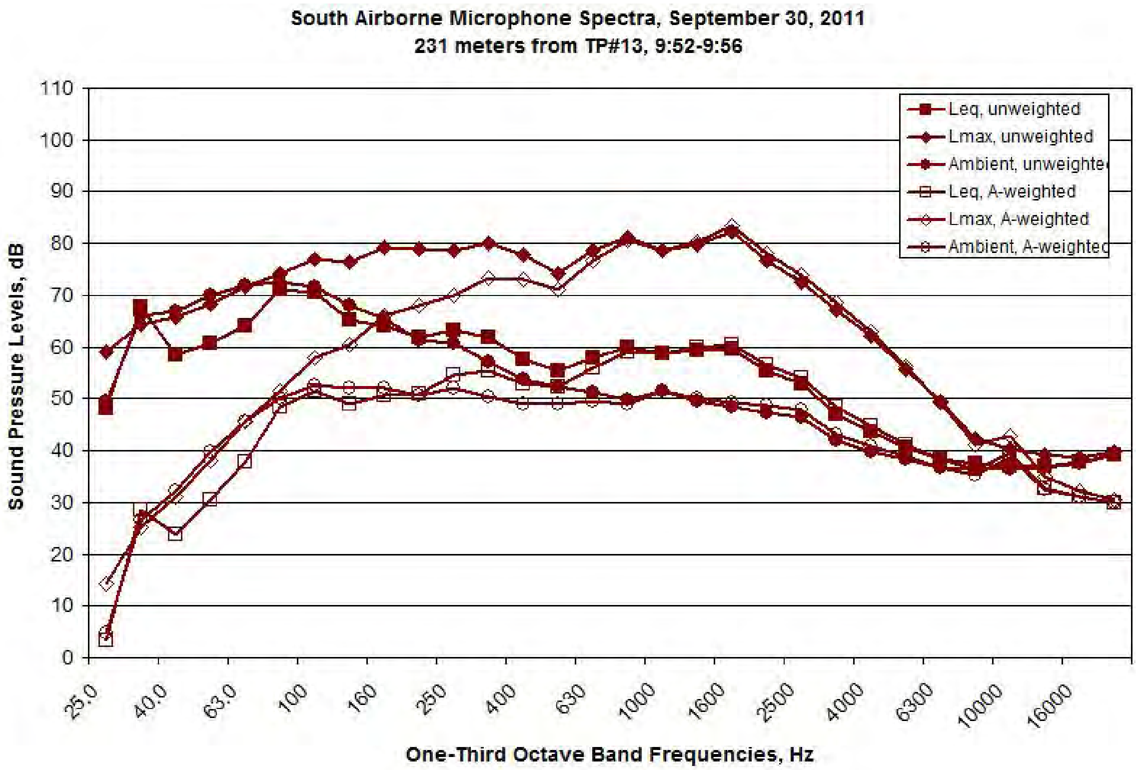

Figure C475. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#13, 9:52-9:56, on September 30, 2011

TP#5 (Bubble Curtain On and Off)

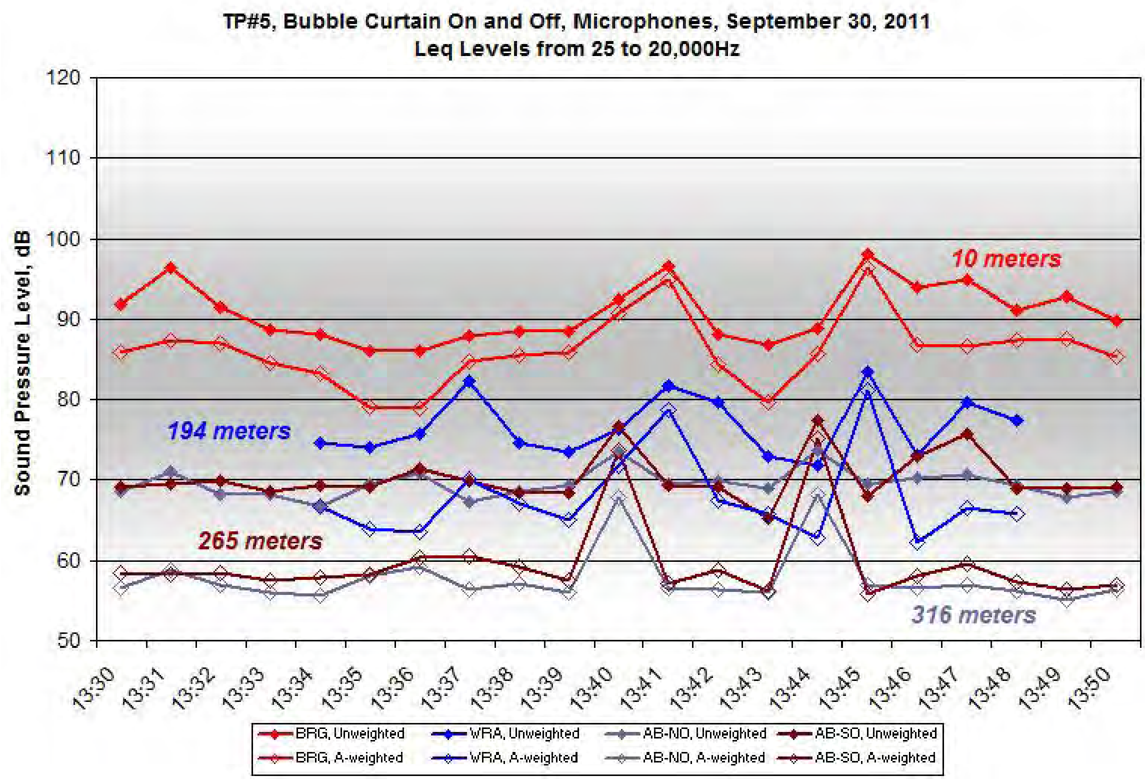

Figure C476. One-minute Unweighted and A-weighted Leq Level at TP#5, 13:36-13:44, on September 30, 2011

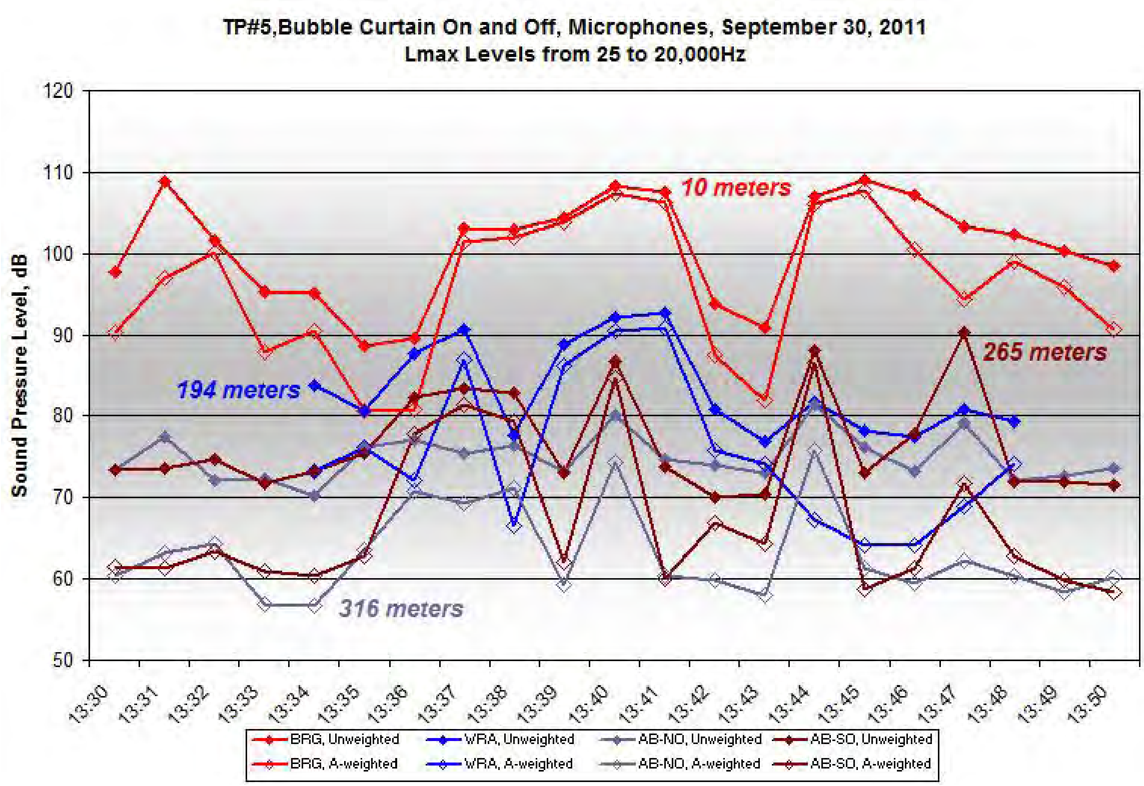

Figure C477. One-minute Unweighted and A-weighted Lmax Level at TP#5, 13:36-13:44, on September 30, 2011

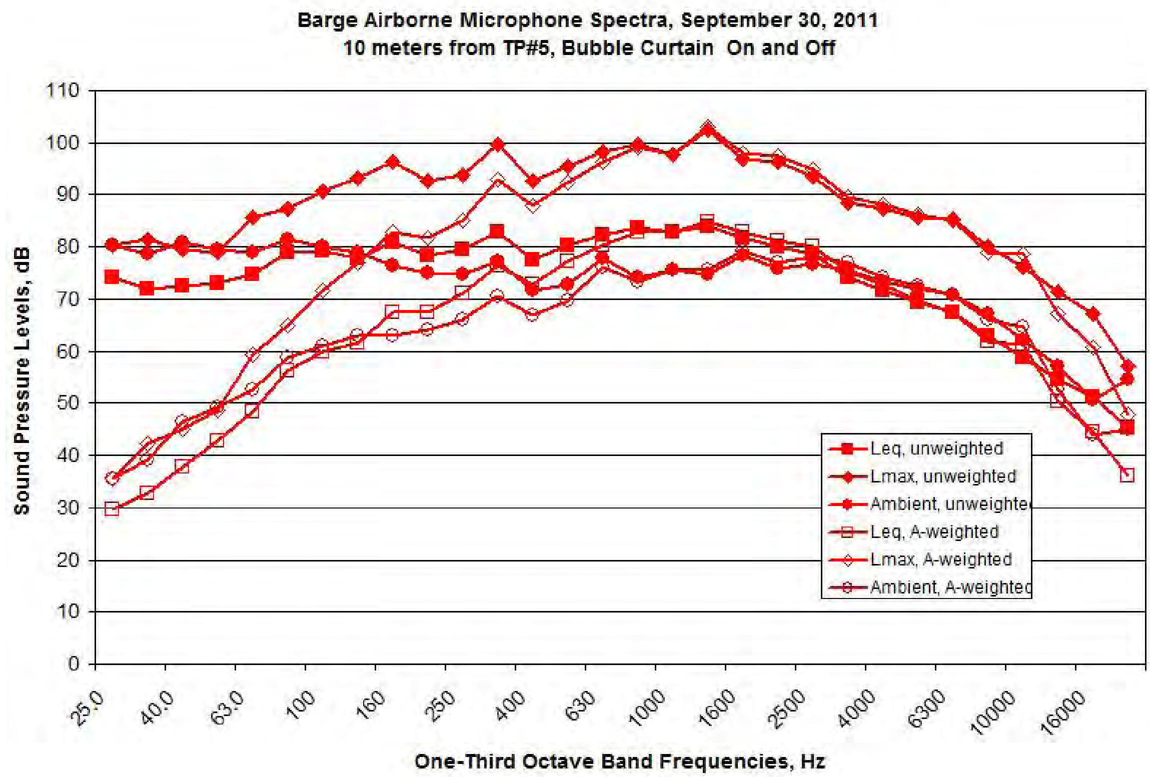

Figure C478. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#5, 13:36-13:40, on September 30, 2011

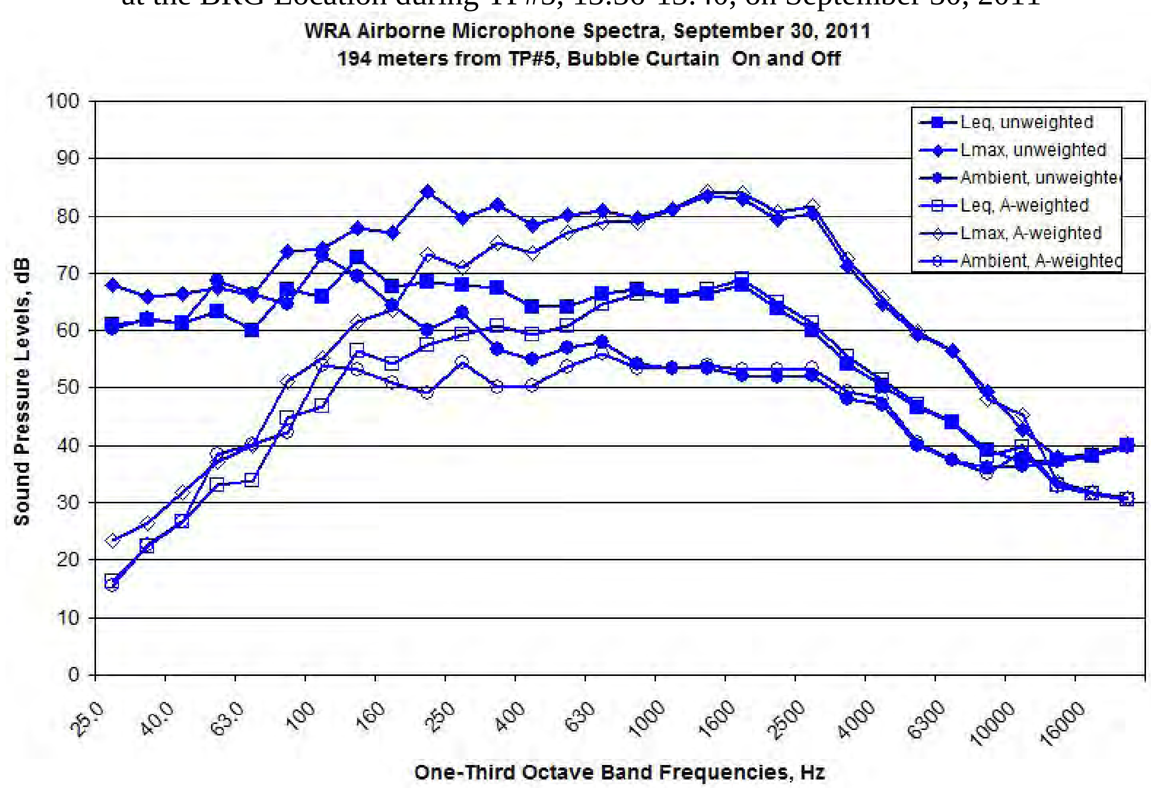

Figure C479. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#5, 13:43-13:44, on September 30, 2011

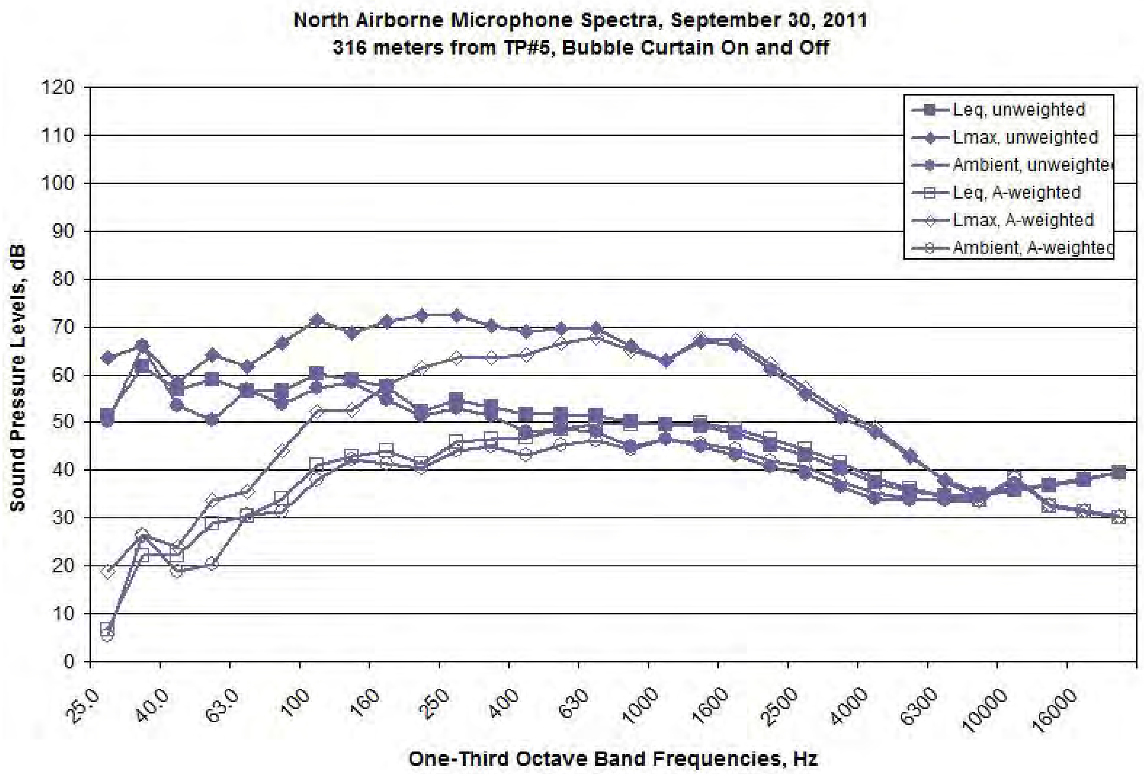

Figure C480. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#5, 13:36-13:40, on September 30, 2011

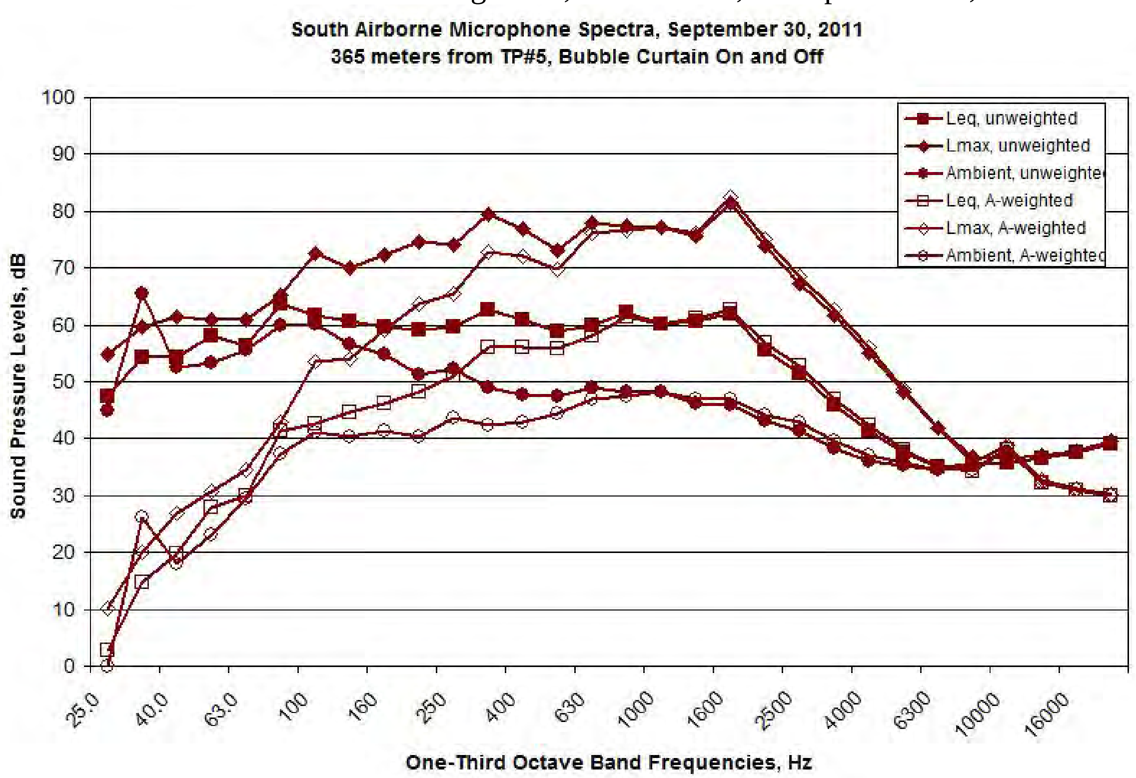

Figure C481. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#5, 13:43-13:44, on September 30, 2011

10/1/2011 – TP#9 RP#3 (Bubble Curtain On Only)

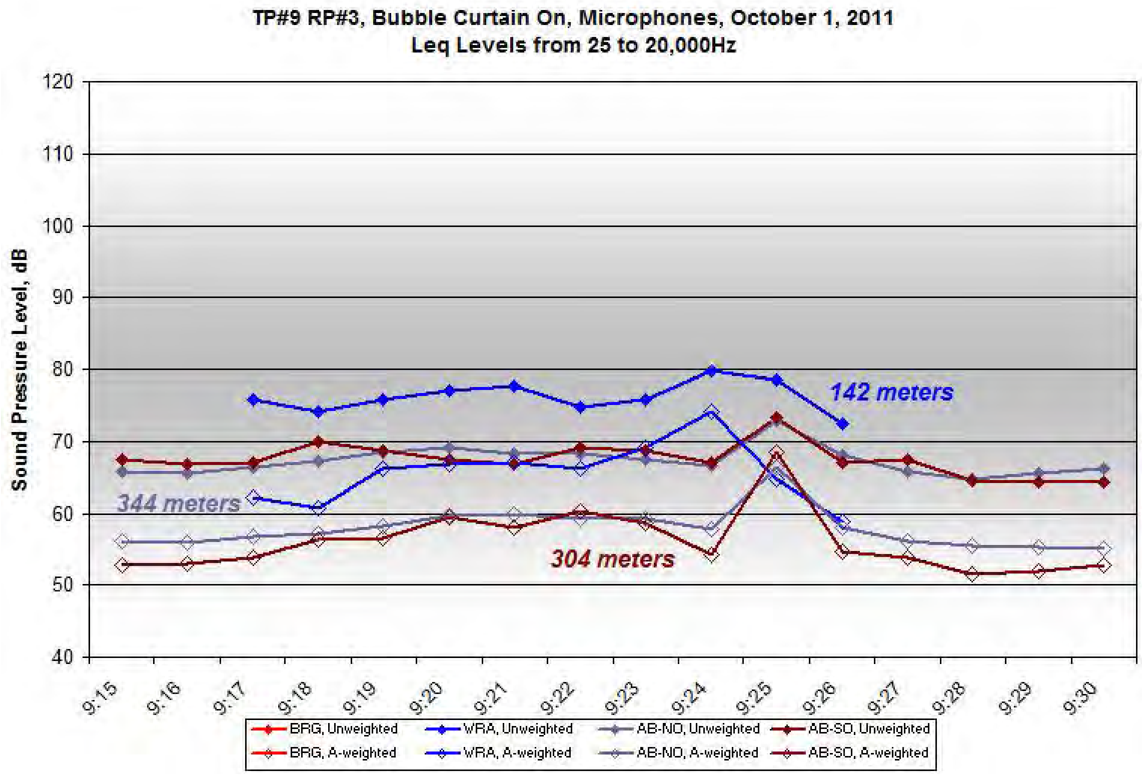

Figure C482. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#3, 9:19-9:24, on October 1, 2011

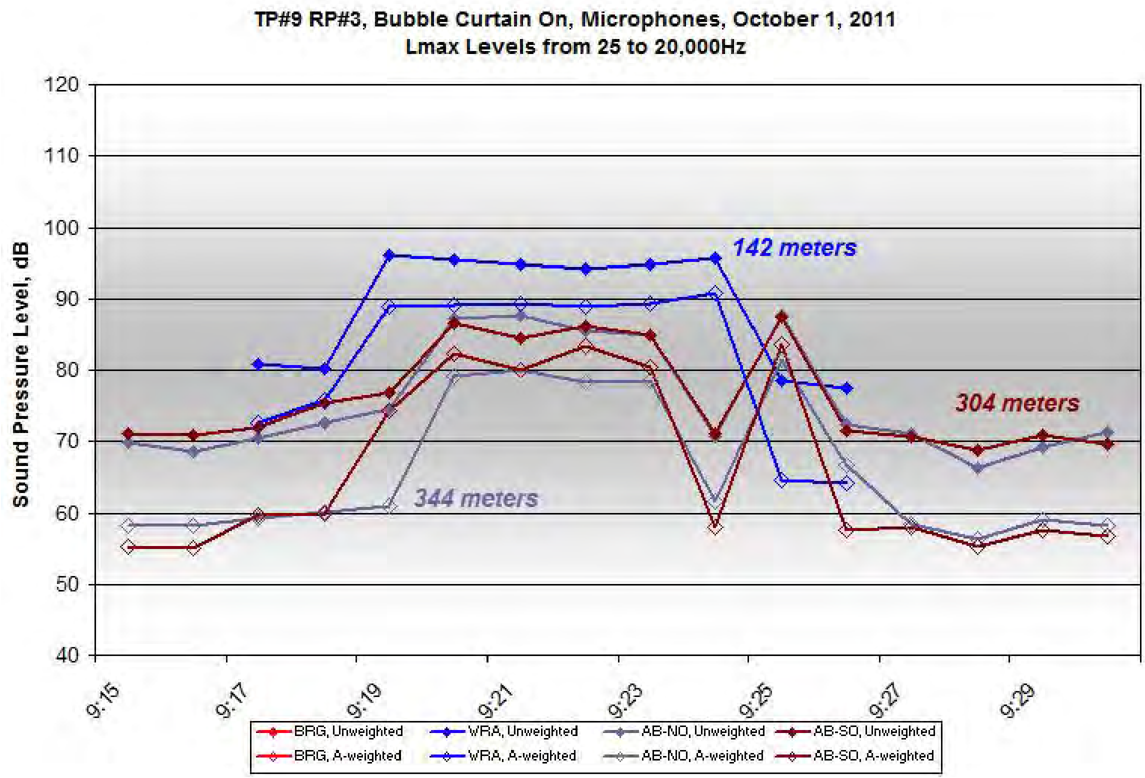

Figure C483. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#3, 9:19-9:24, on October 1, 2011

NO DATA AVAILABLE

Figure C484. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#3, 9:19-9:24, on October 1, 2011

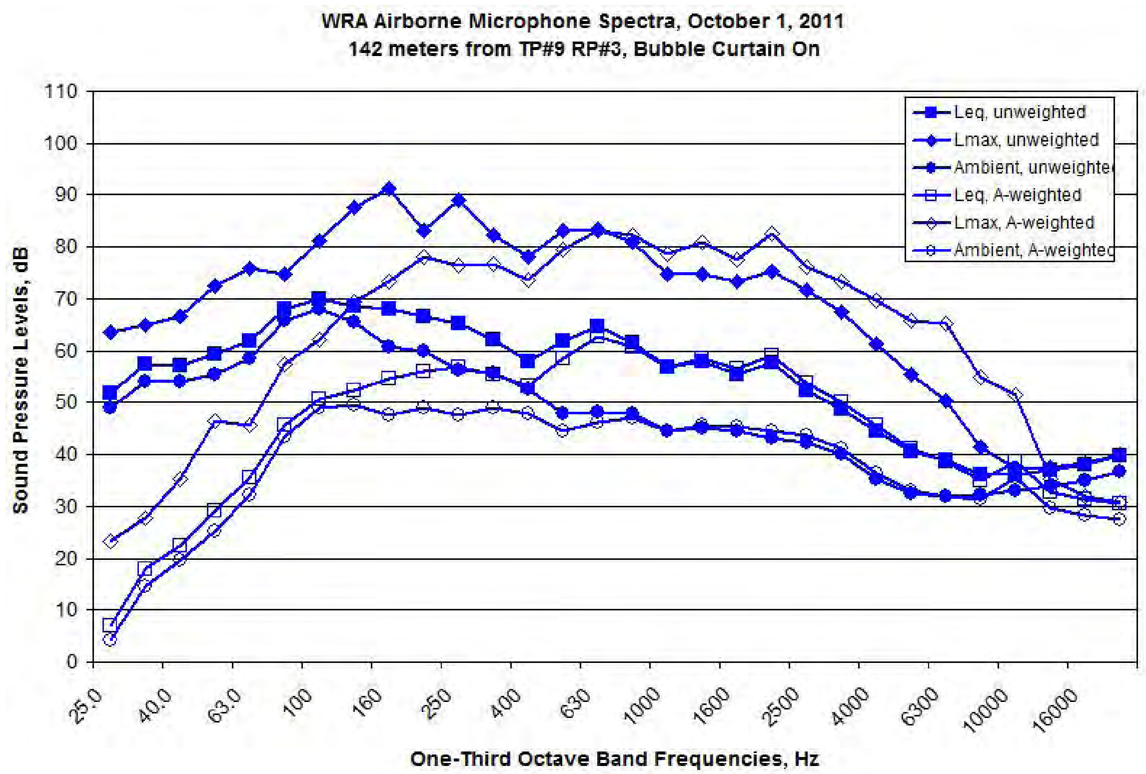

Figure C485. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#3, 9:19-9:24, on October 1, 2011

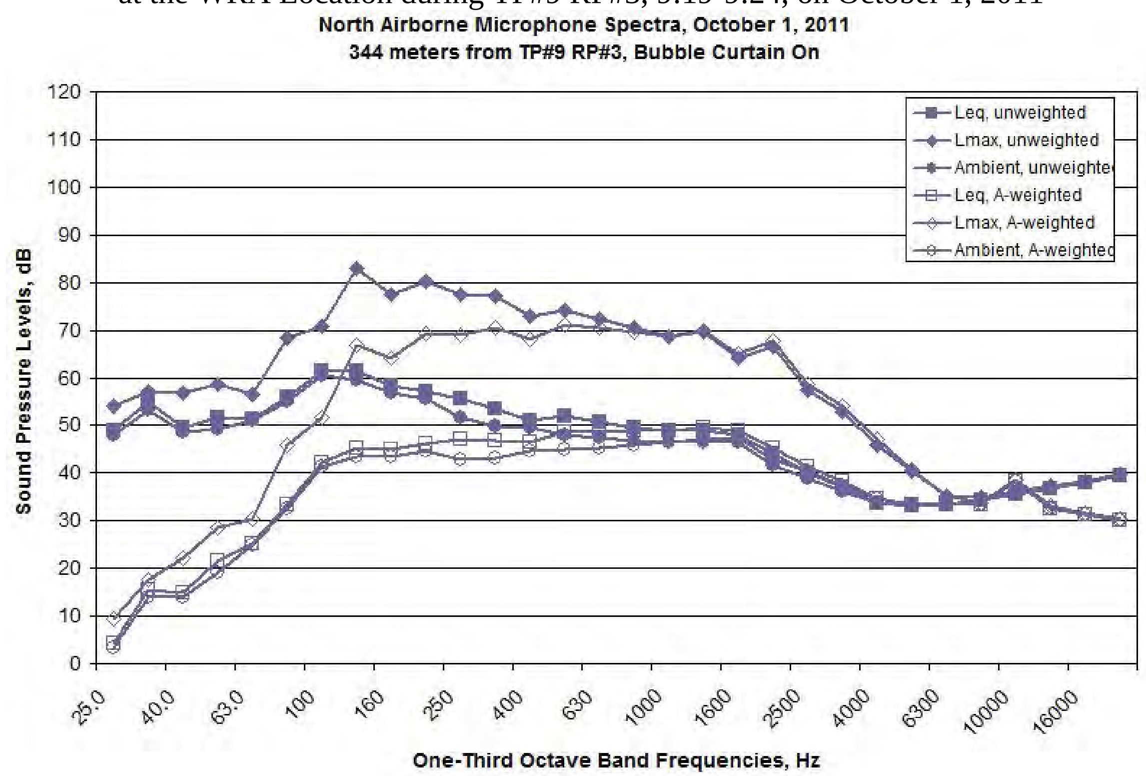

Figure C486. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#3, 9:19-9:24, on October 1, 2011

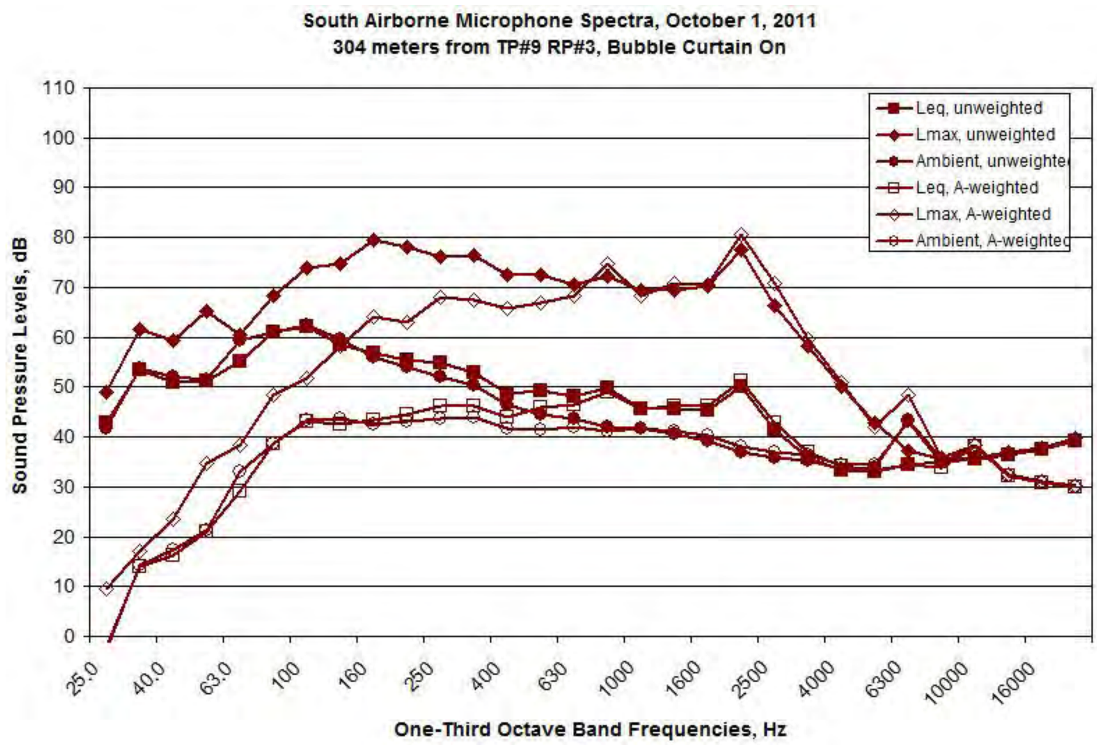

Figure C487. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#3, 9:19-9:24, on October 1, 2011

TP#9 RP#2 (Bubble Curtain On Only)

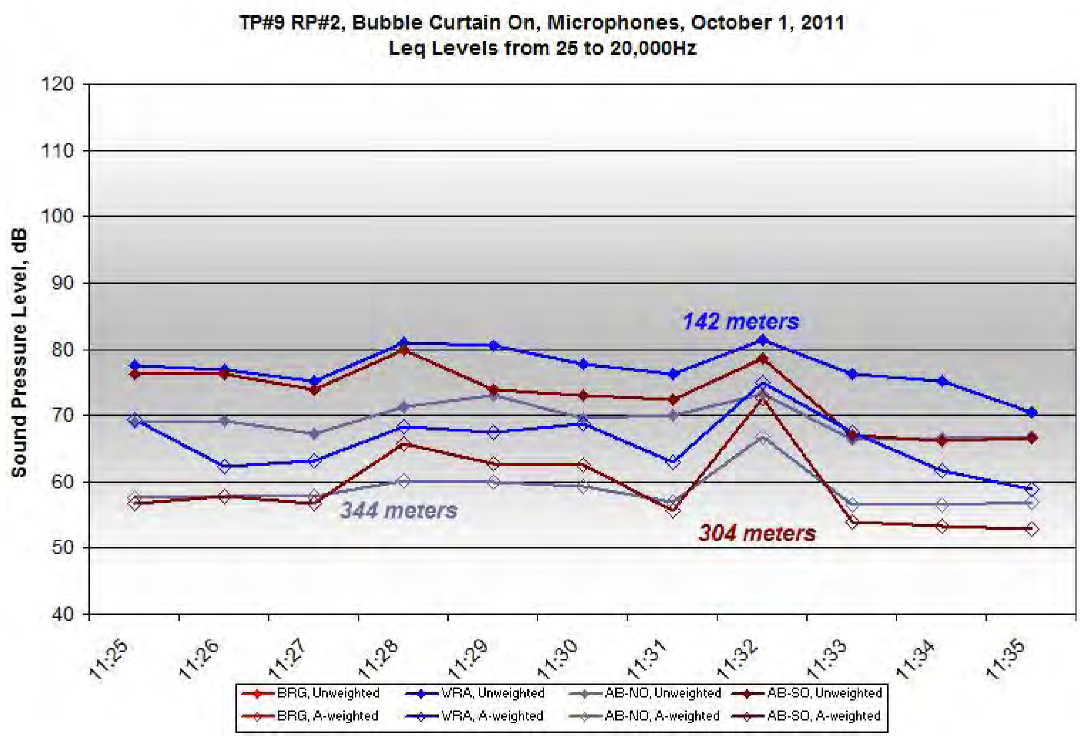

Figure C488. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#2, 11:27-11:31, on October 1, 2011

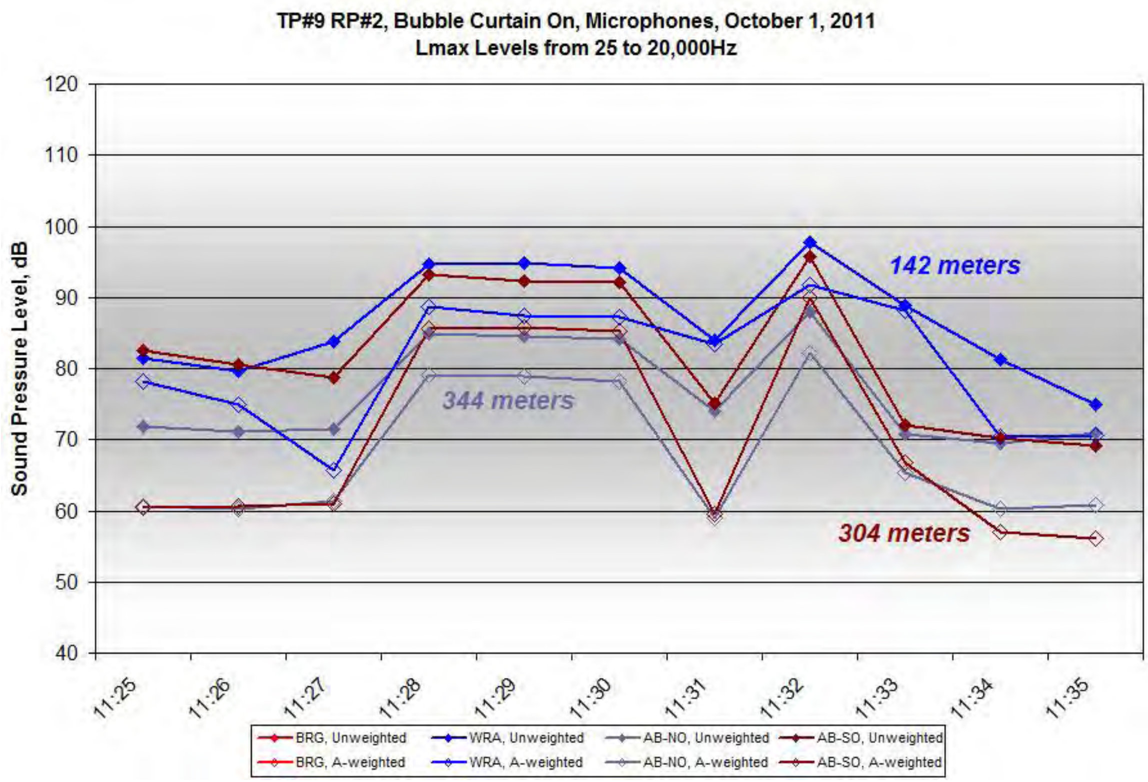

Figure C489. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#2, 11:27-11:31, on October 1, 2011

NO DATA AVAILABLE

Figure C490. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#2, 11:27-11:31, on October 1, 2011

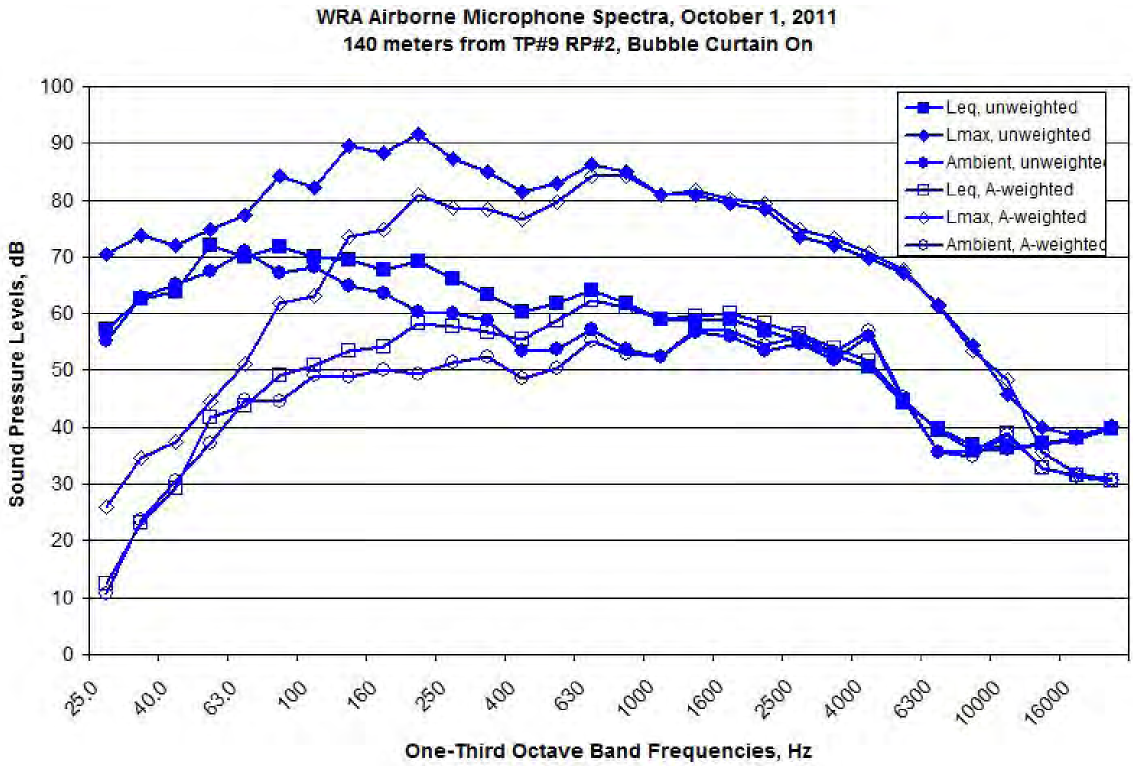

Figure C491. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#2, 11:27-11:31, on October 1, 2011

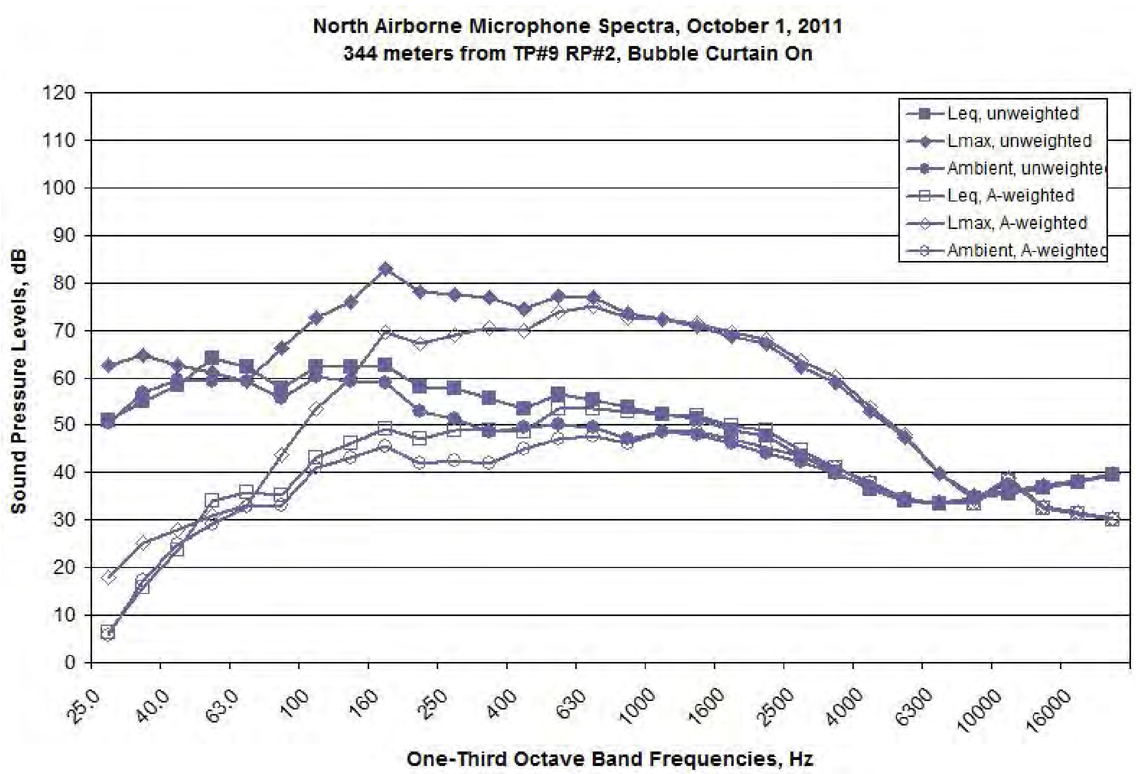

Figure C492. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#2, 11:27-11:31, on October 1, 2011

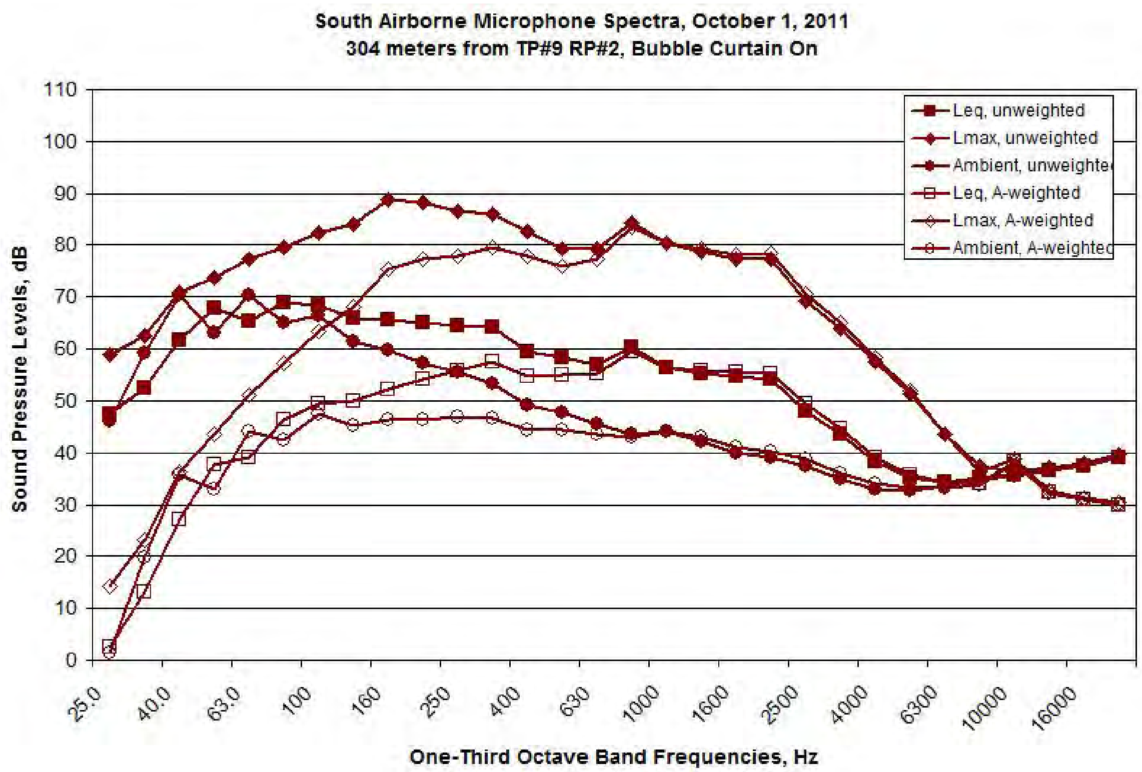

Figure C493. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#2, 11:27-11:31, on October 1, 2011

TP#9 RP#1 (Bubble Curtain On Only)

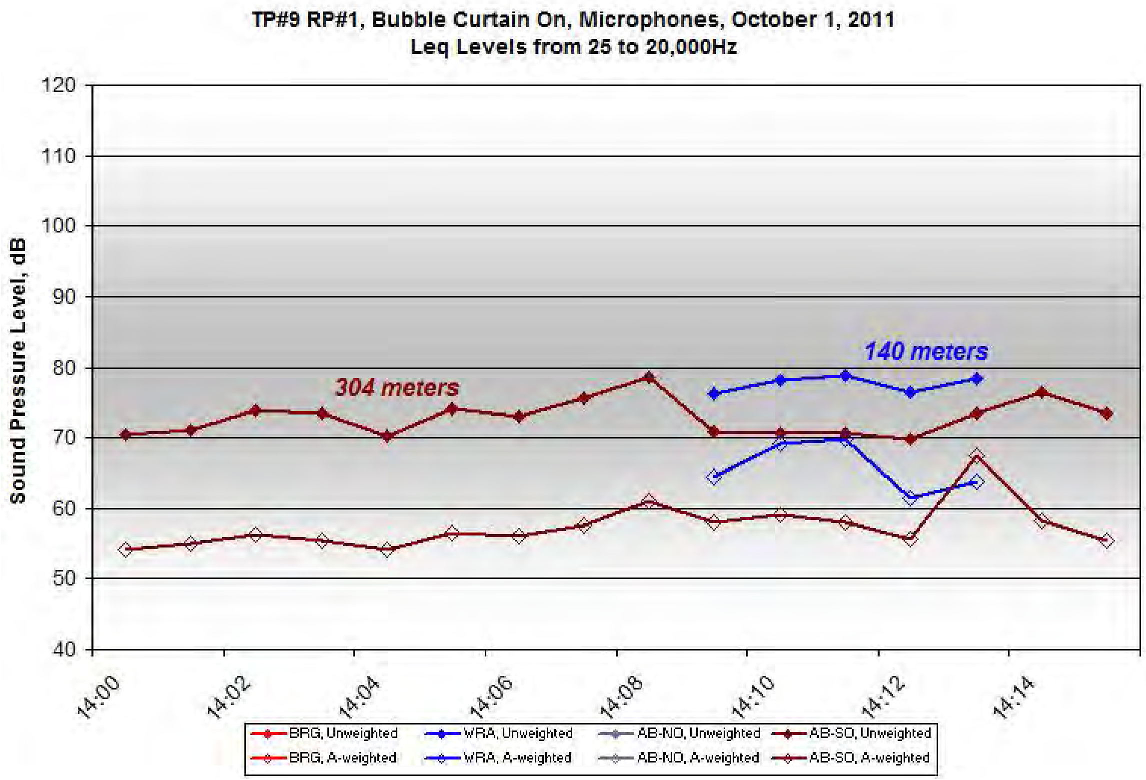

Figure C494. One-minute Unweighted and A-weighted Leq Level at TP#9 RP#1, 14:07-14:12, on October 1, 2011

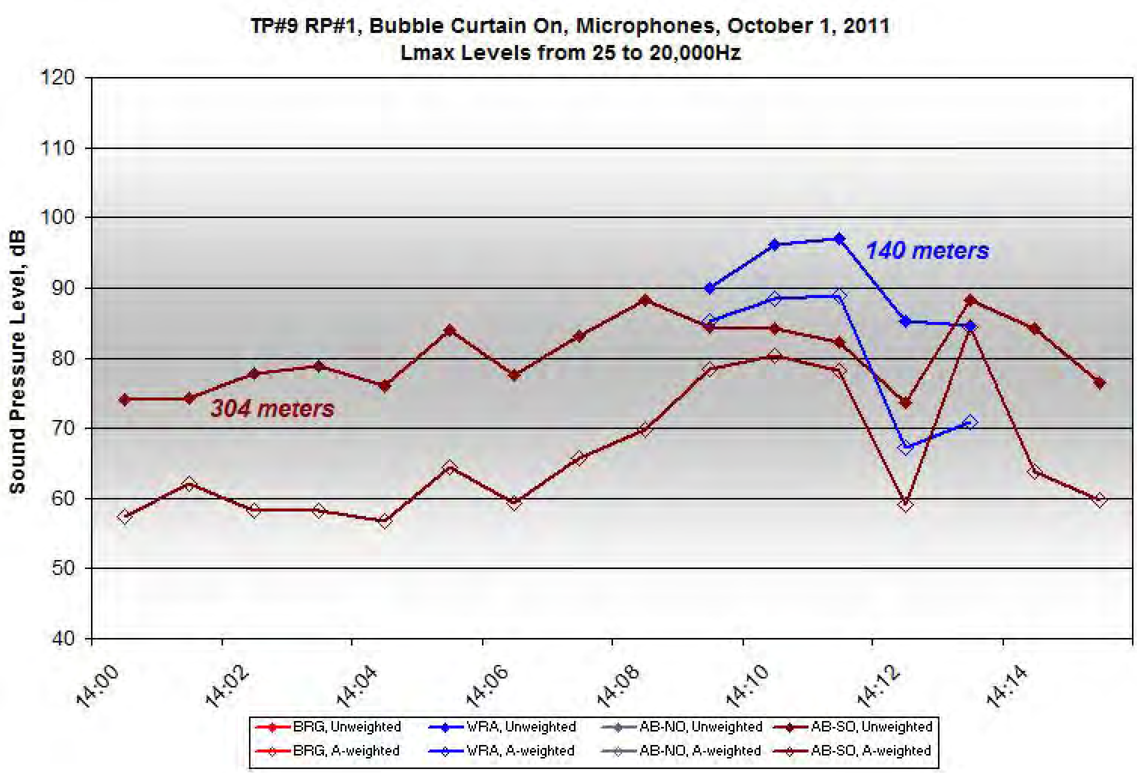

Figure C495. One-minute Unweighted and A-weighted Lmax Level at TP#9 RP#1, 14:07-14:12, on October 1, 2011

NO DATA AVAILABLE

Figure C496. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9 RP#1, 14:07-14:12, on October 1, 2011

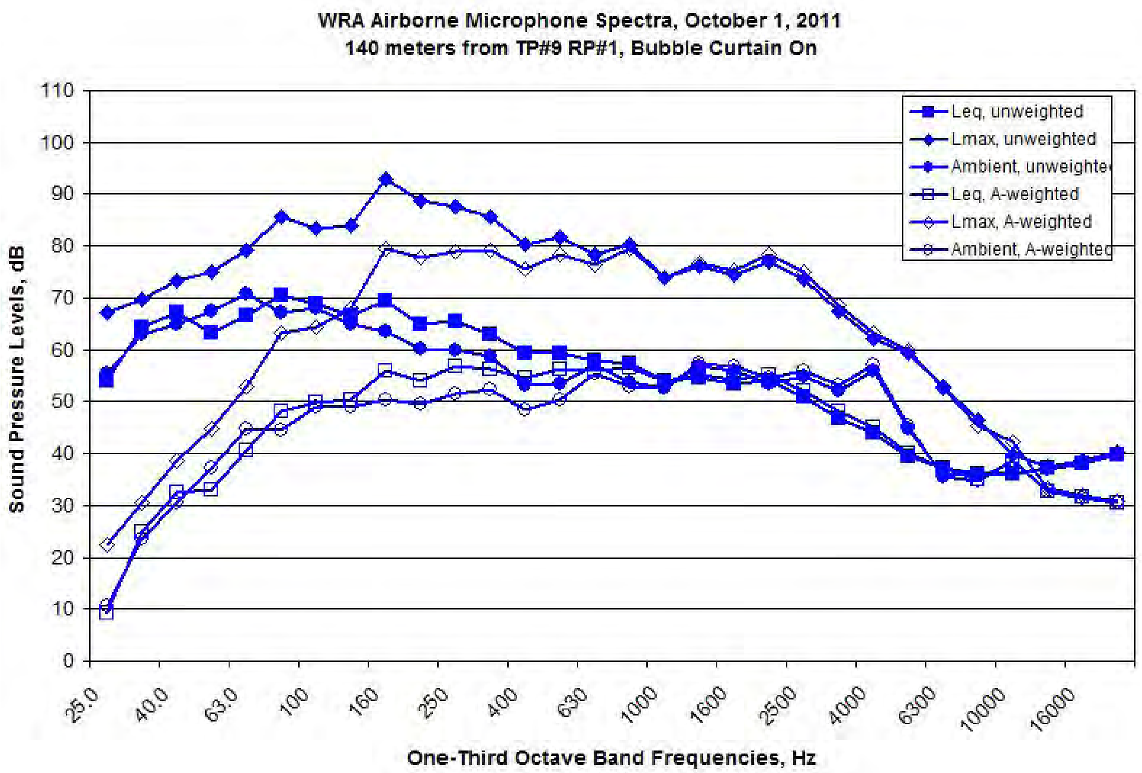

Figure C497. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9 RP#1, 14:07-14:12, on October 1, 2011

NO DATA AVAILABLE

Figure C498. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9 RP#1, 14:07-14:12, on October 1, 2011

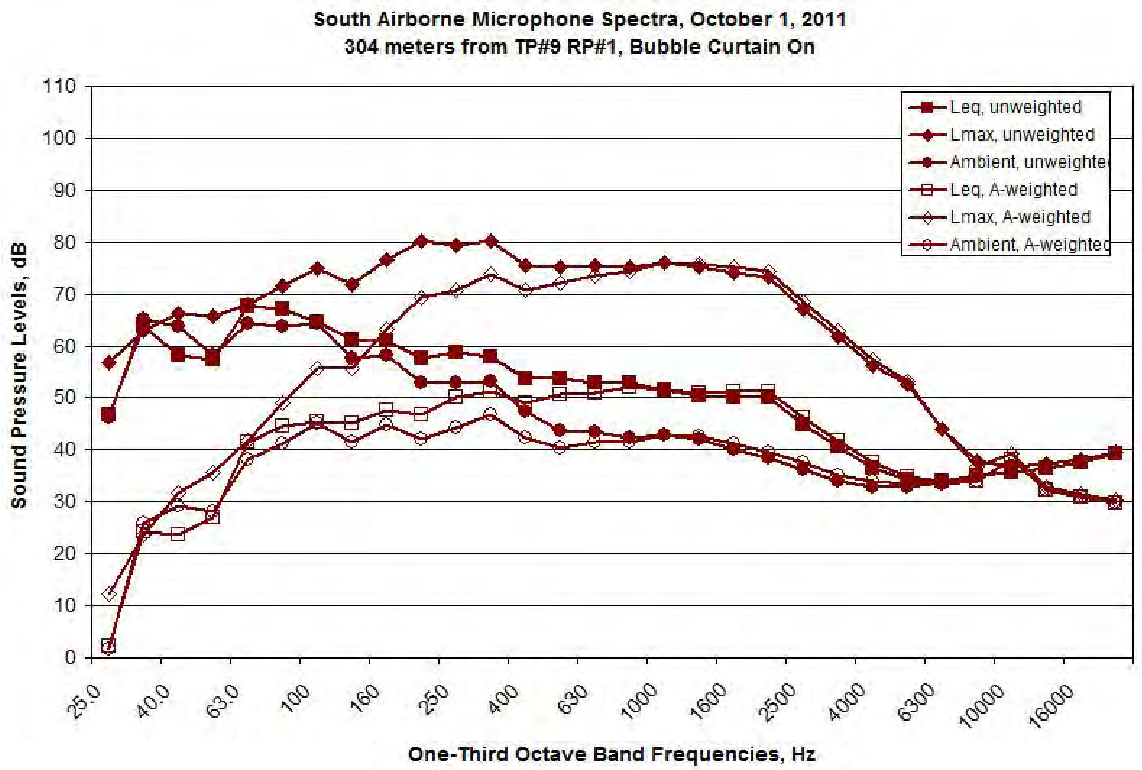

Figure C499. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9 RP#1, 14:07-14:12, on October 1, 2011

TP#9 (Bubble Curtain On Only)

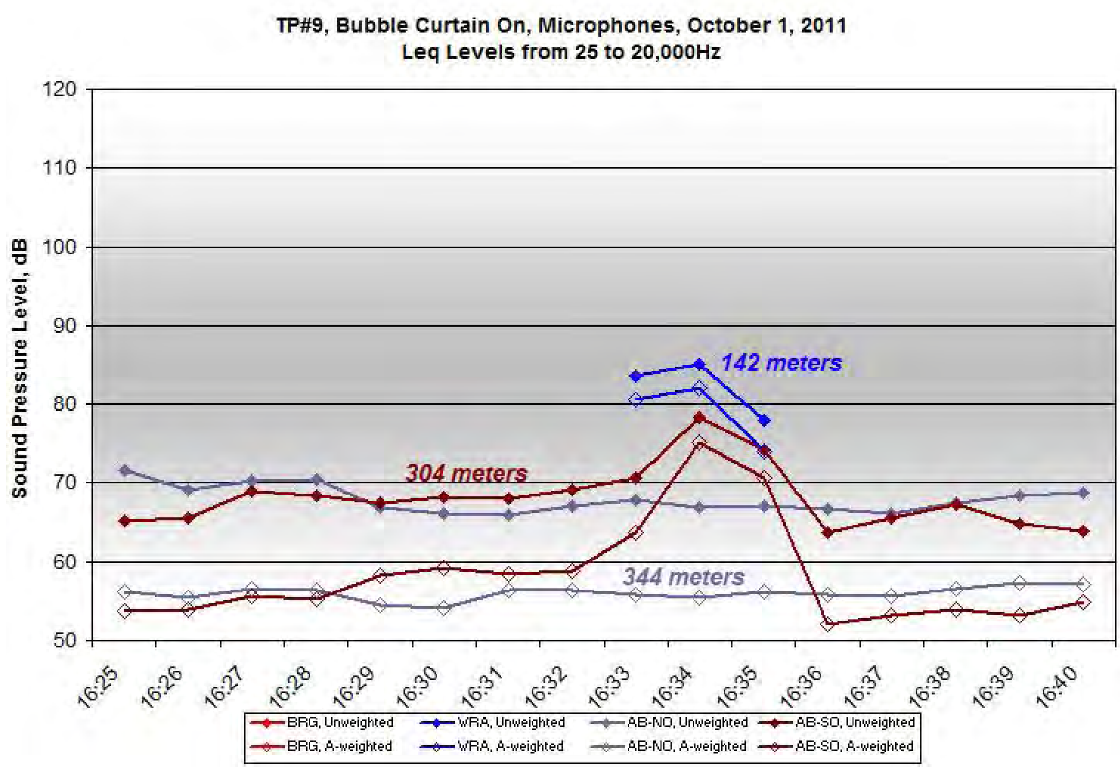

Figure C500. One-minute Unweighted and A-weighted Leq Level at TP#9, 16:29-16:34, on October 1, 2011

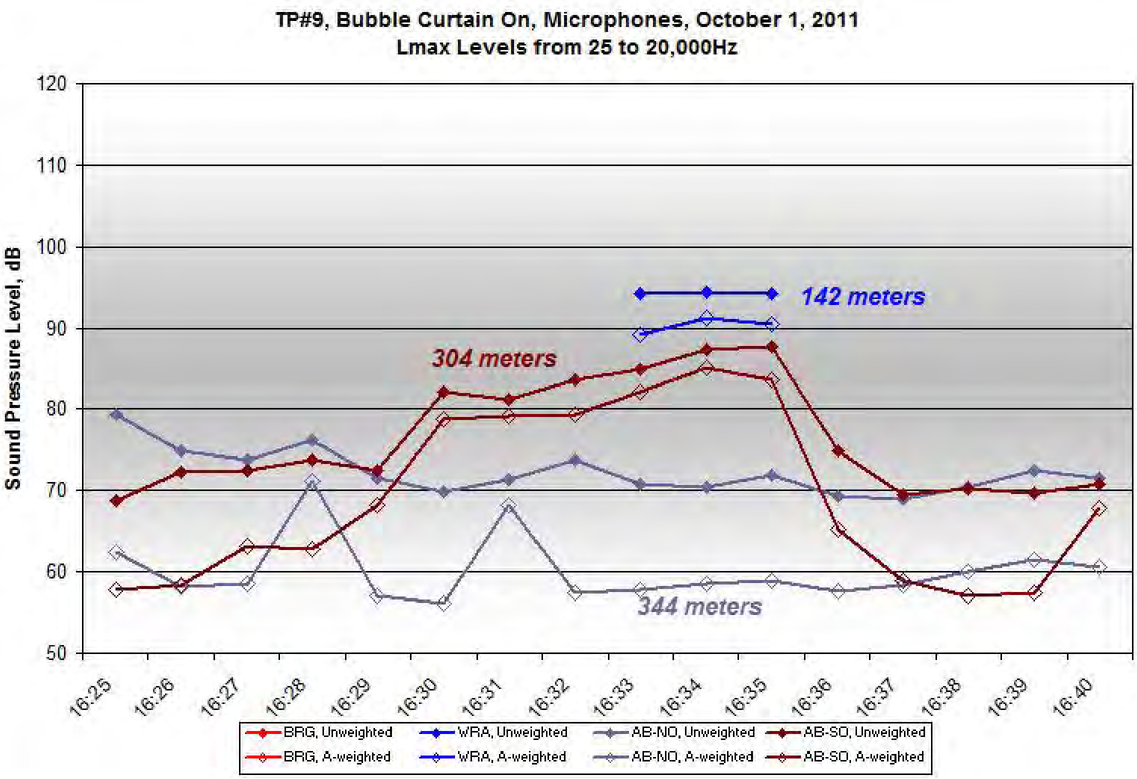

Figure C501. One-minute Unweighted and A-weighted Lmax Level at TP#9, 16:29-16:34, on October 1, 2011

NO DATA AVAILABLE

Figure C502. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#9, 16:29-16:34, on October 1, 2011

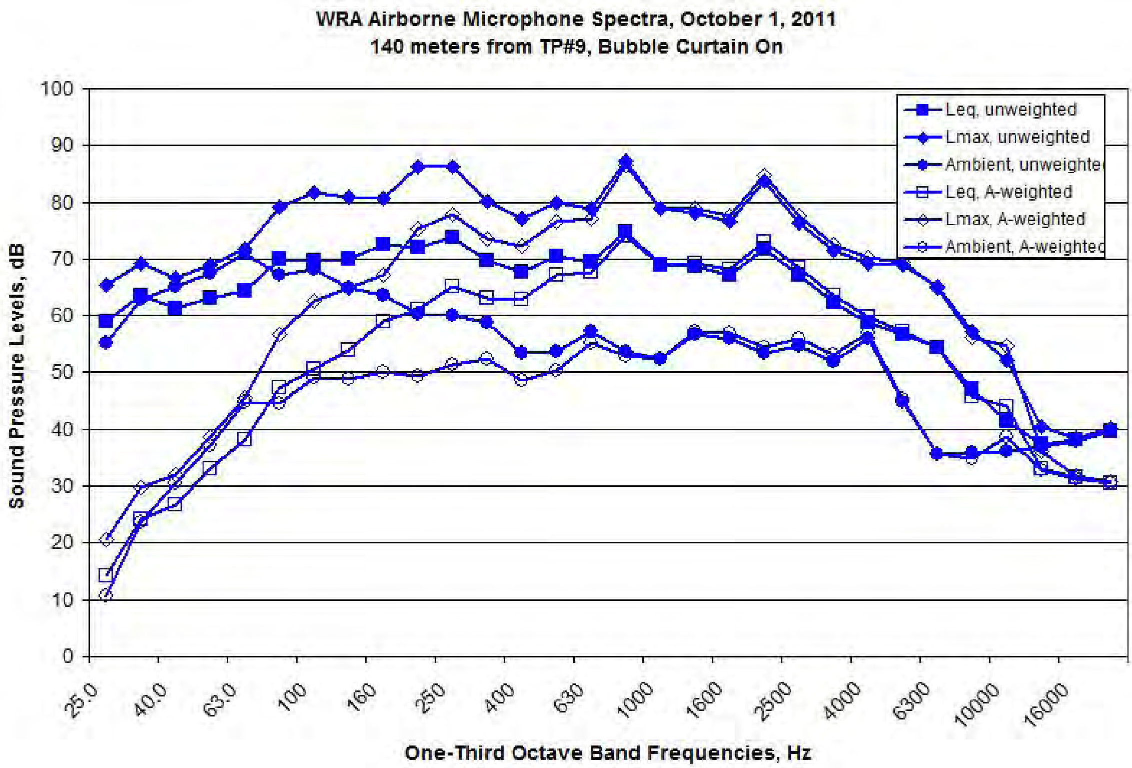

Figure C503. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#9, 16:29-16:34, on October 1, 2011

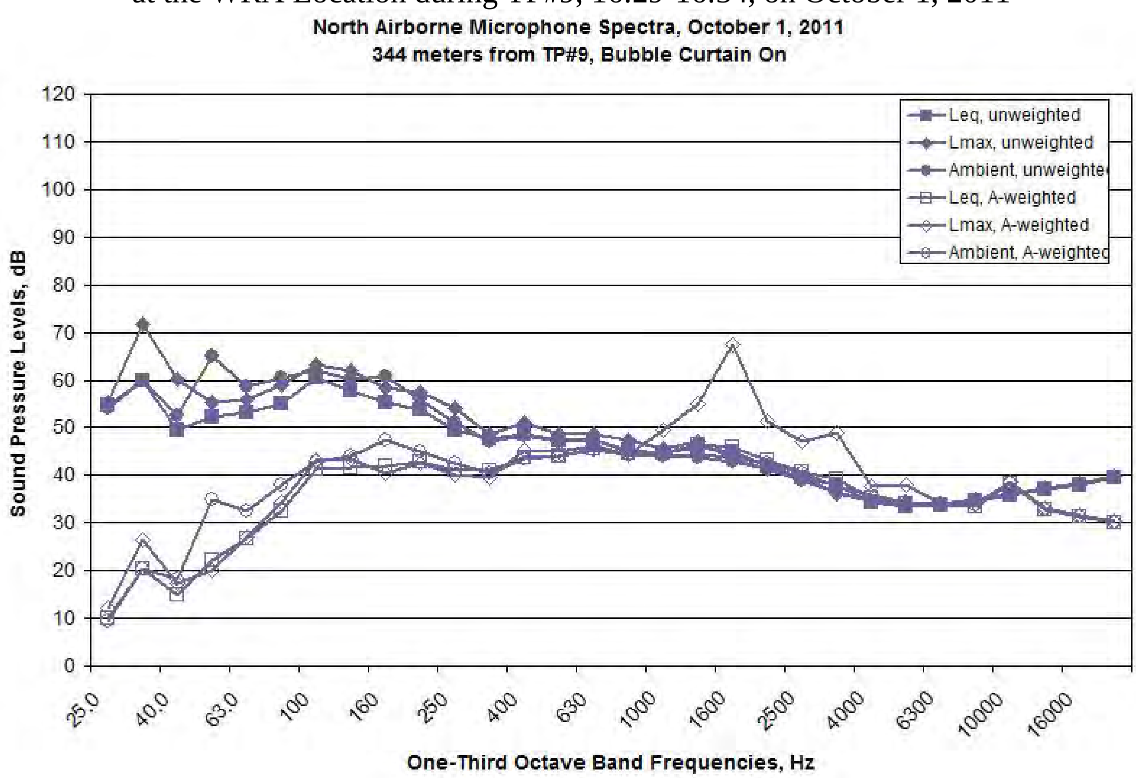

Figure C504. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#9, 16:29-16:34, on October 1, 2011

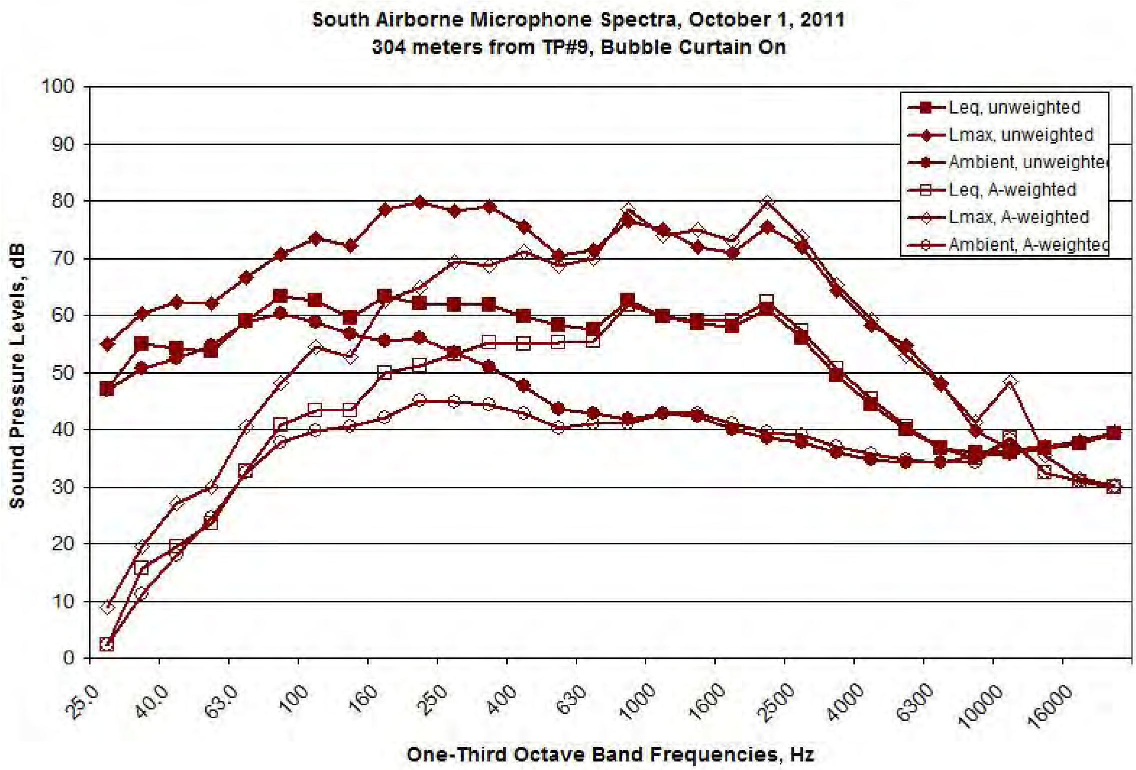

Figure C505. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#9, 16:29-16:34, on October 1, 2011

10/3/2011 – TP#6 (Bubble Curtain On Only)

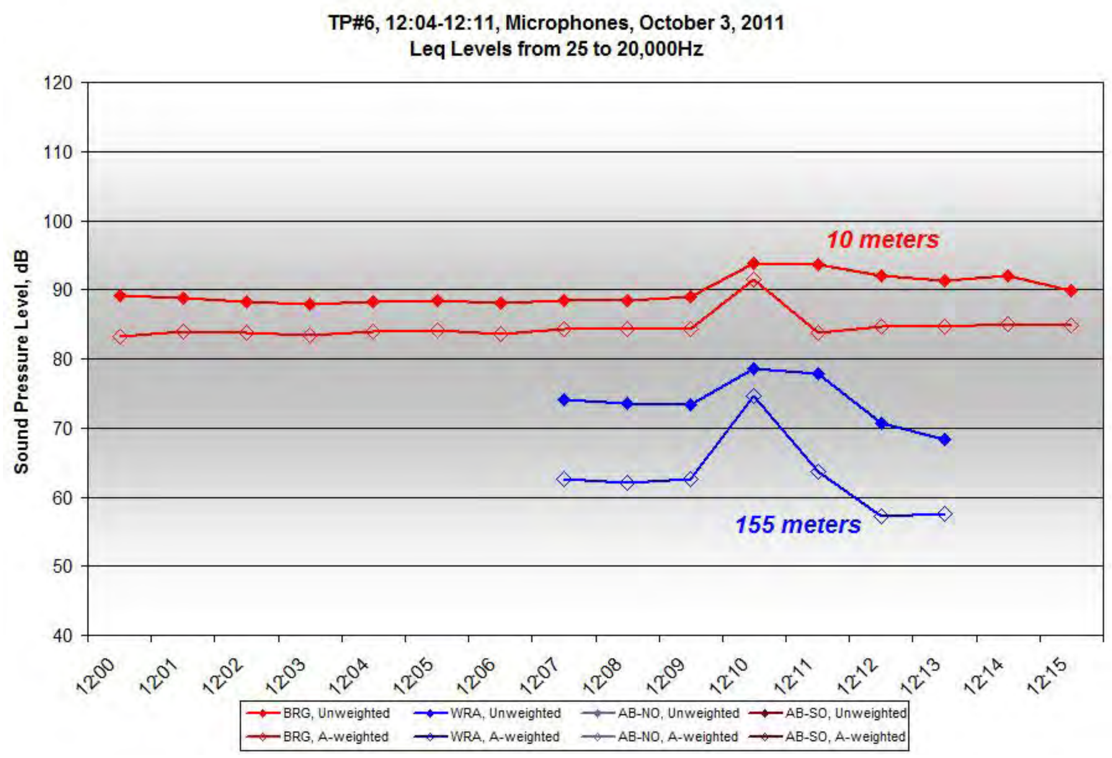

Figure C506. One-minute Unweighted and A-weighted Leq Level at TP#6, 12:04-12:11, on October 3, 2011

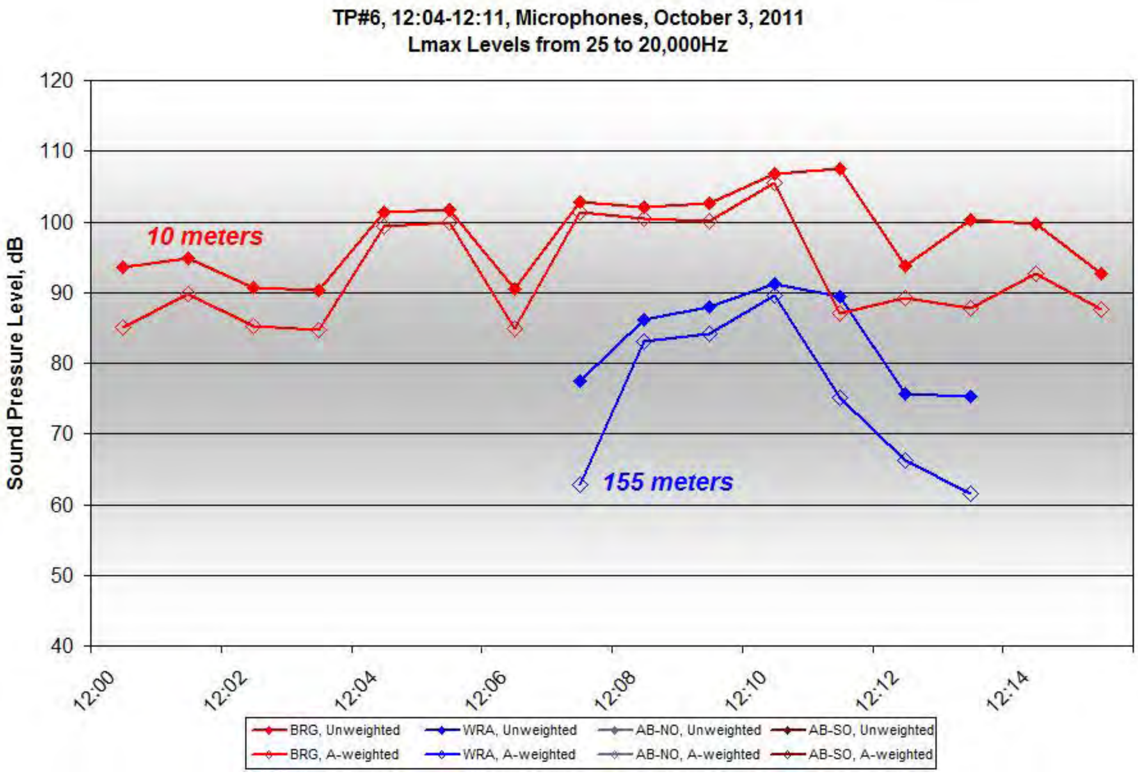

Figure C507. One-minute Unweighted and A-weighted Lmax Level at TP#6, 12:04-12:11, on October 3, 2011

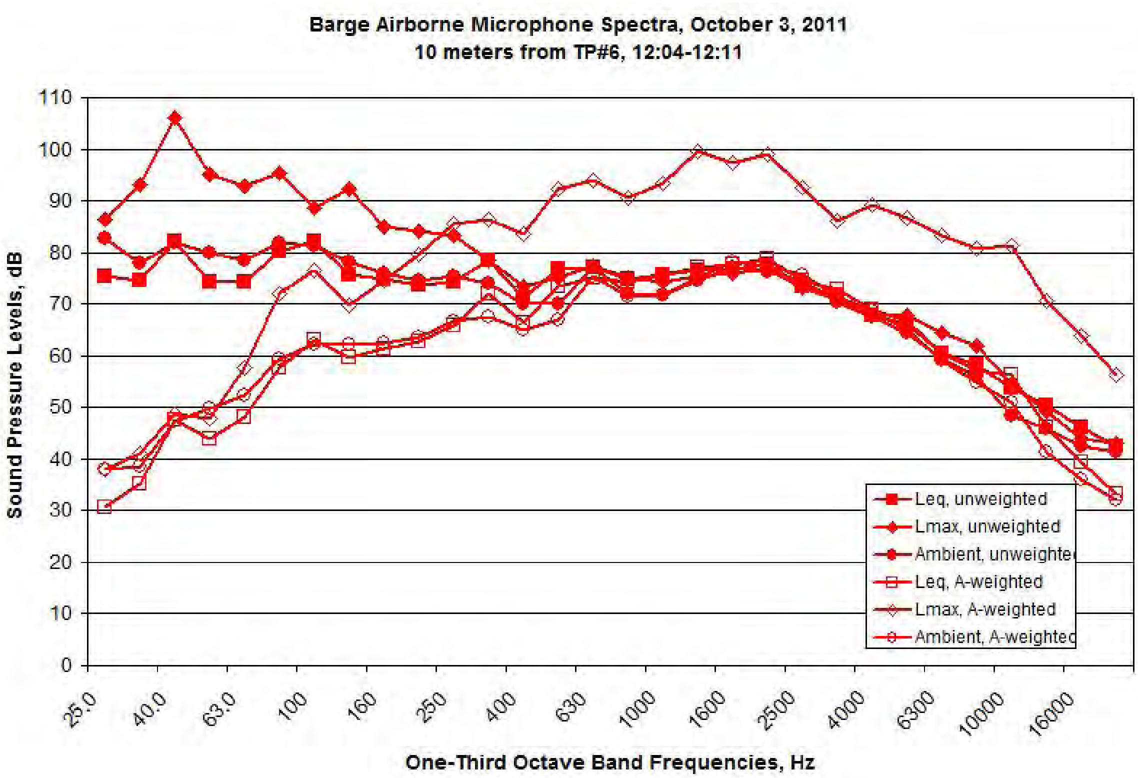

Figure C508. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#6, 12:04-12:11, on October 3, 2011

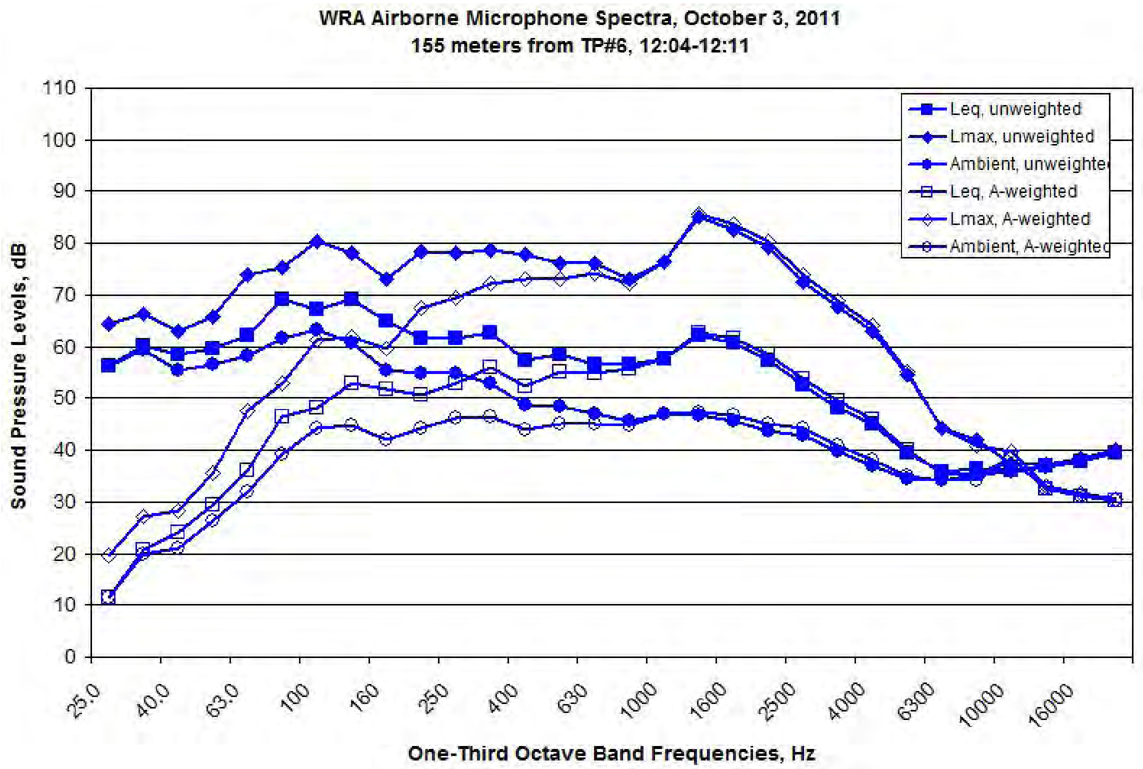

Figure C509. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#6, 12:04-12:11, on October 3, 2011

NO DATA AVAILABLE

Figure C510. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#6, 12:04-12:11, on October 3, 2011

NO DATA AVAILABLE

Figure C511. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#6, 12:04-12:11, on October 3, 2011

TP#4 (Bubble Curtain On Only)

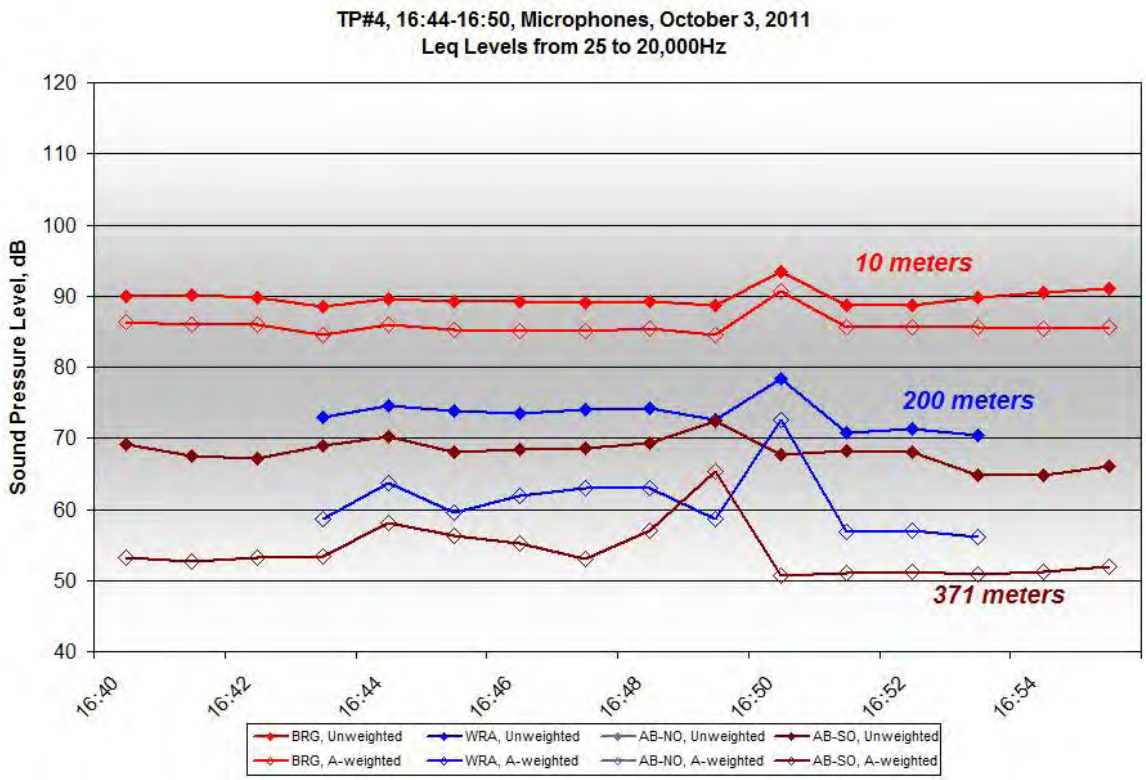

Figure C512. One-minute Unweighted and A-weighted Leq Level at TP#4, 16:44-16:50, on October 3, 2011

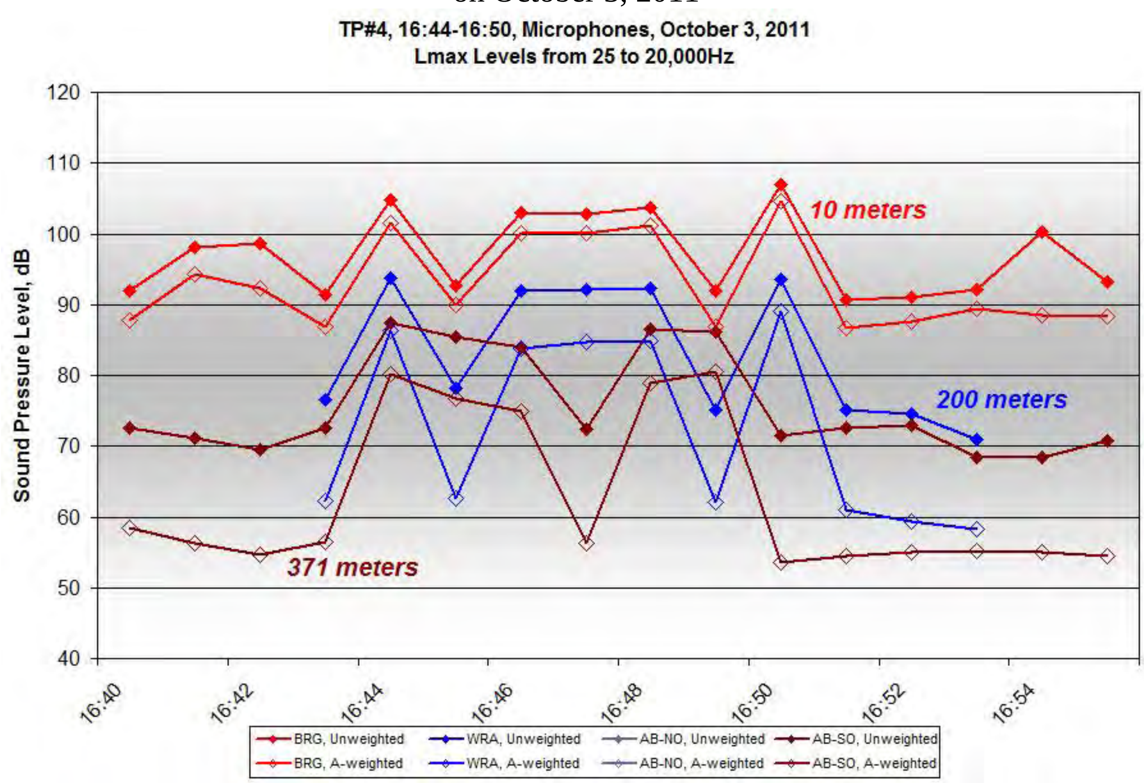

Figure C513. One-minute Unweighted and A-weighted Lmax Level at TP#4, 16:44-16:50, on October 3, 2011

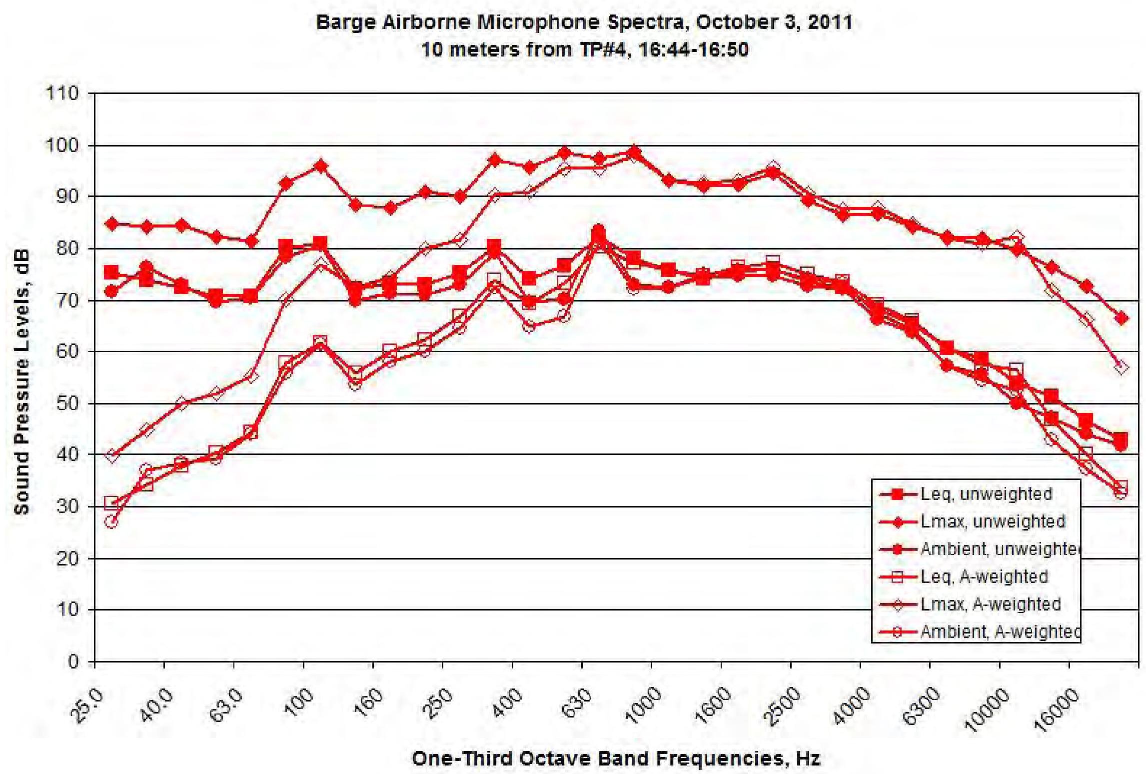

Figure C514. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#4, 16:44-16:50, on October 3, 2011

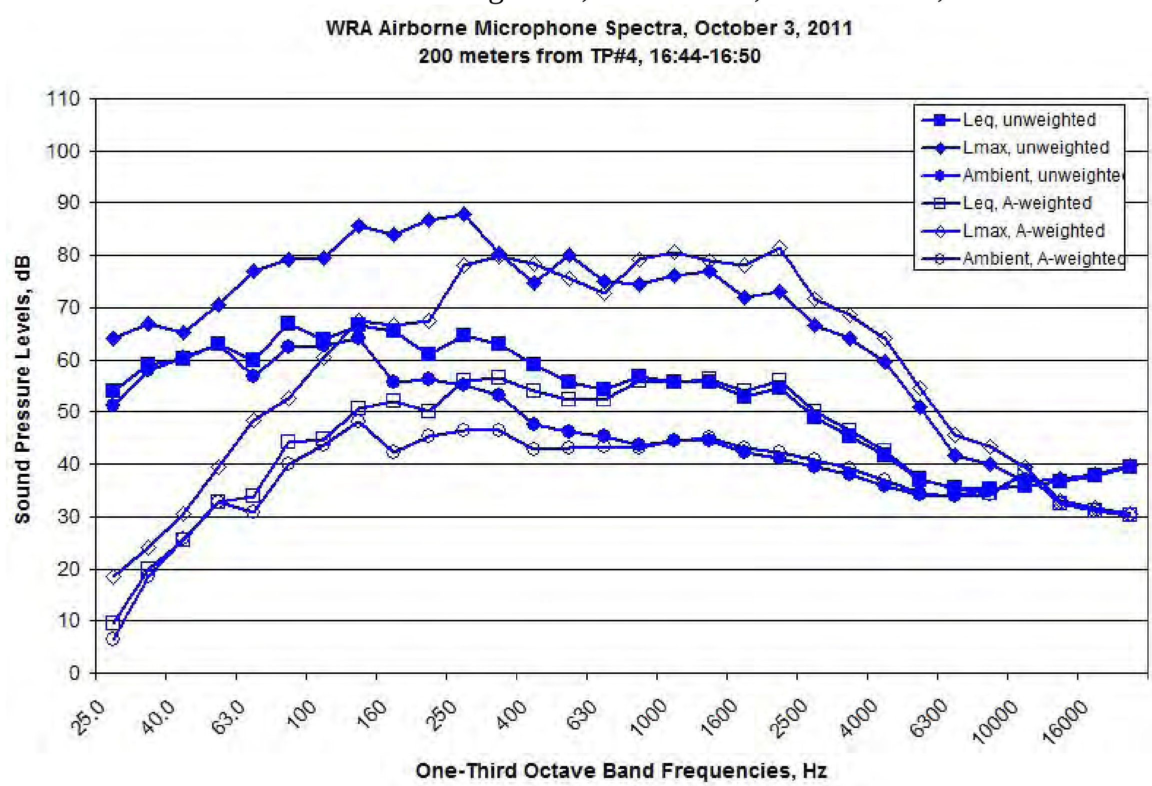

Figure C515. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#4, 16:44-16:50, on October 3, 2011

NO DATA AVAILABLE

Figure C516. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#4, 16:44-16:50, on October 3, 2011

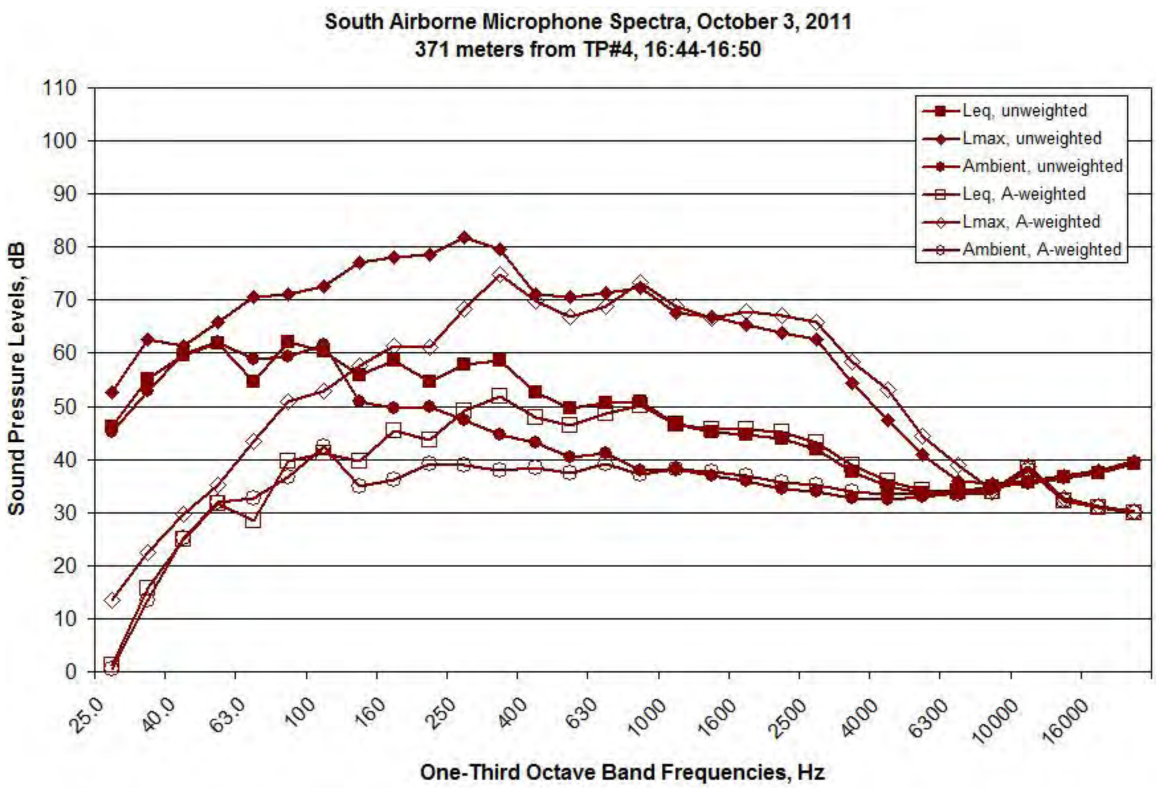

Figure C517. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#4, 16:44-16:50, on October 3, 2011

10/4/ 2011 – TTP#4 (Bubble Curtain On Only)

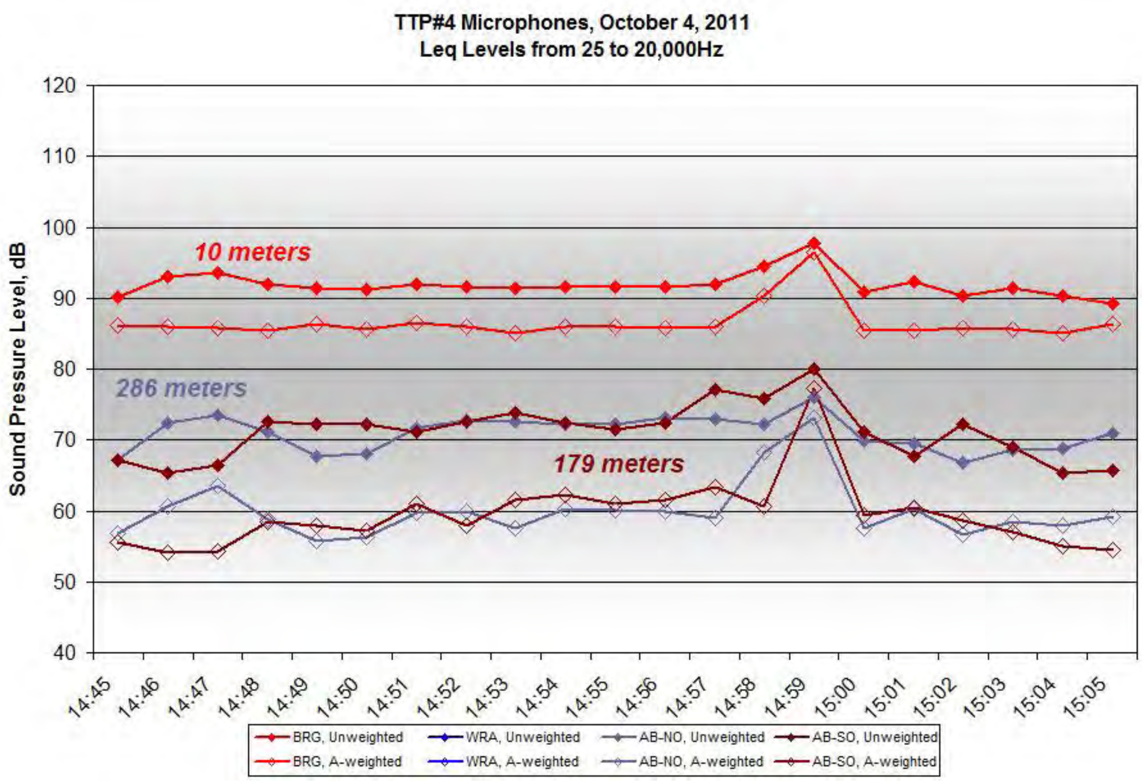

Figure C518. One-minute Unweighted and A-weighted Leq Level at TTP#4, 14:49-14:59, on October 4, 2011

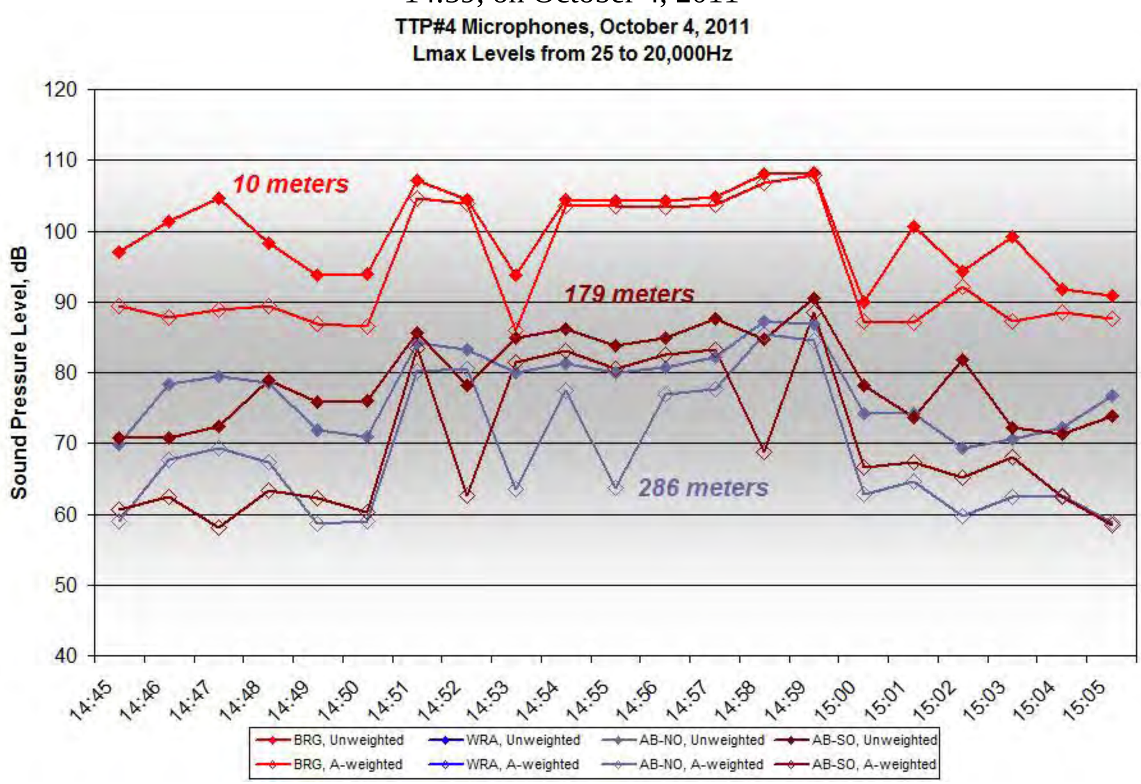

Figure C519. One-minute Unweighted and A-weighted Lmax Level at TTP#4, 14:49-14:59, on October 4, 2011

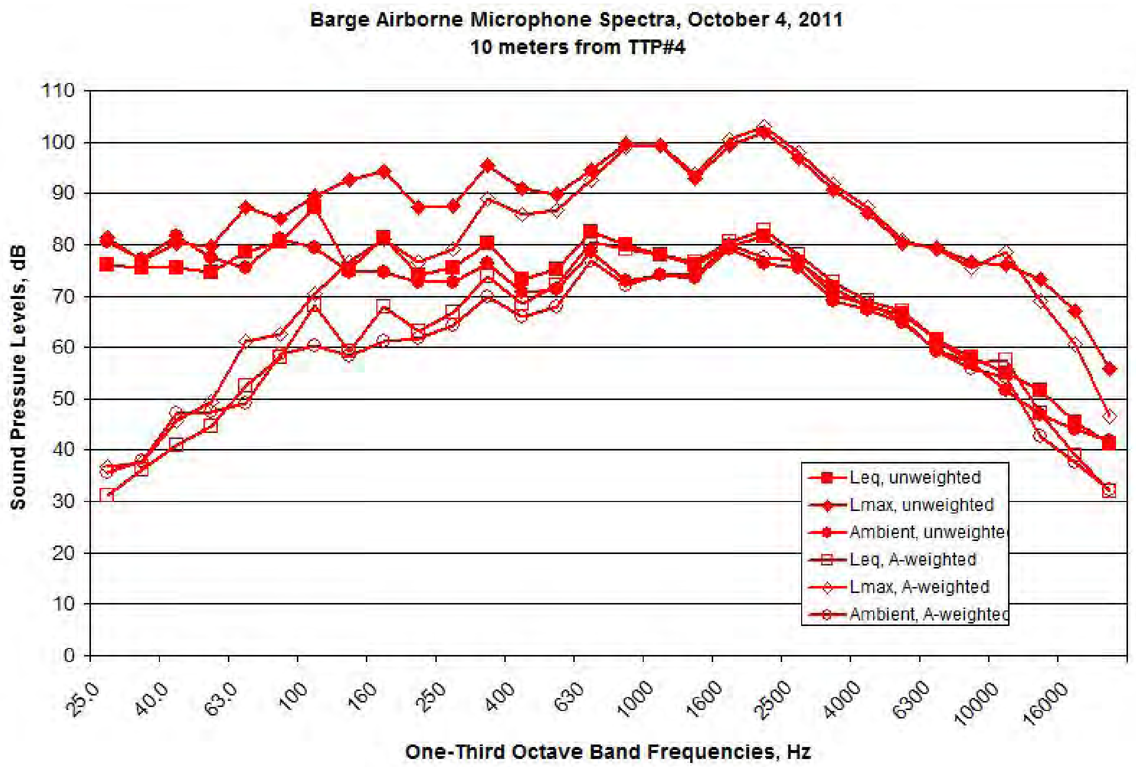

Figure C520. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TTP#4, 14:49-14:59, on October 4, 2011

NO DATA AVAILABLE

Figure C521. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TTP#4, 14:49-14:59, on October 4, 2011

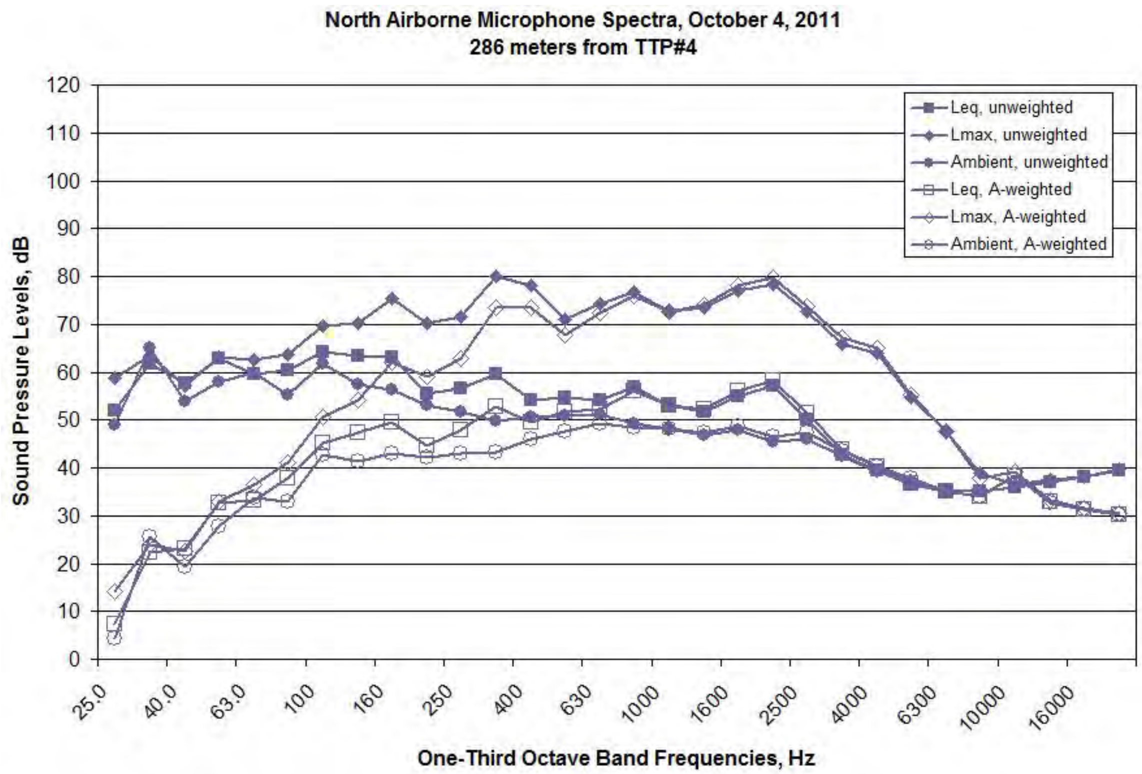

Figure C522. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TTP#4, 14:49-14:59, on October 4, 2011

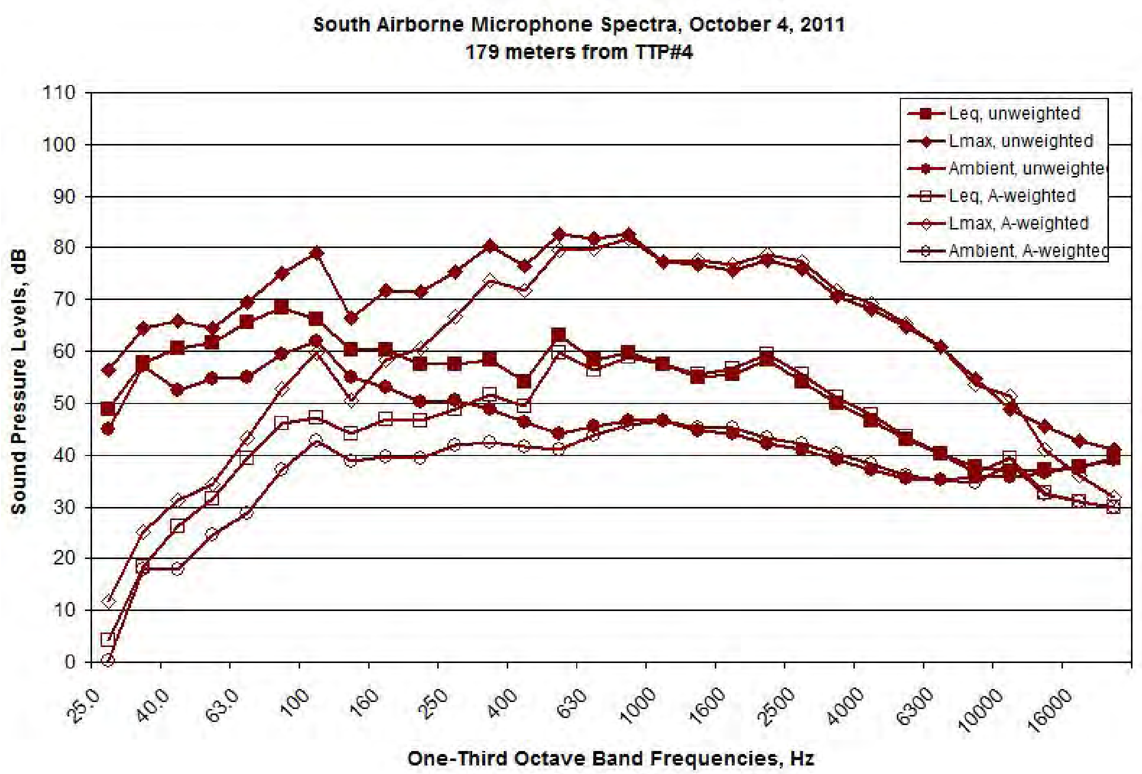

Figure C523. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TTP#4, 14:49-14:59, on October 4, 2011

10/8/2011 – TP#1 (Bubble Curtain On Only)

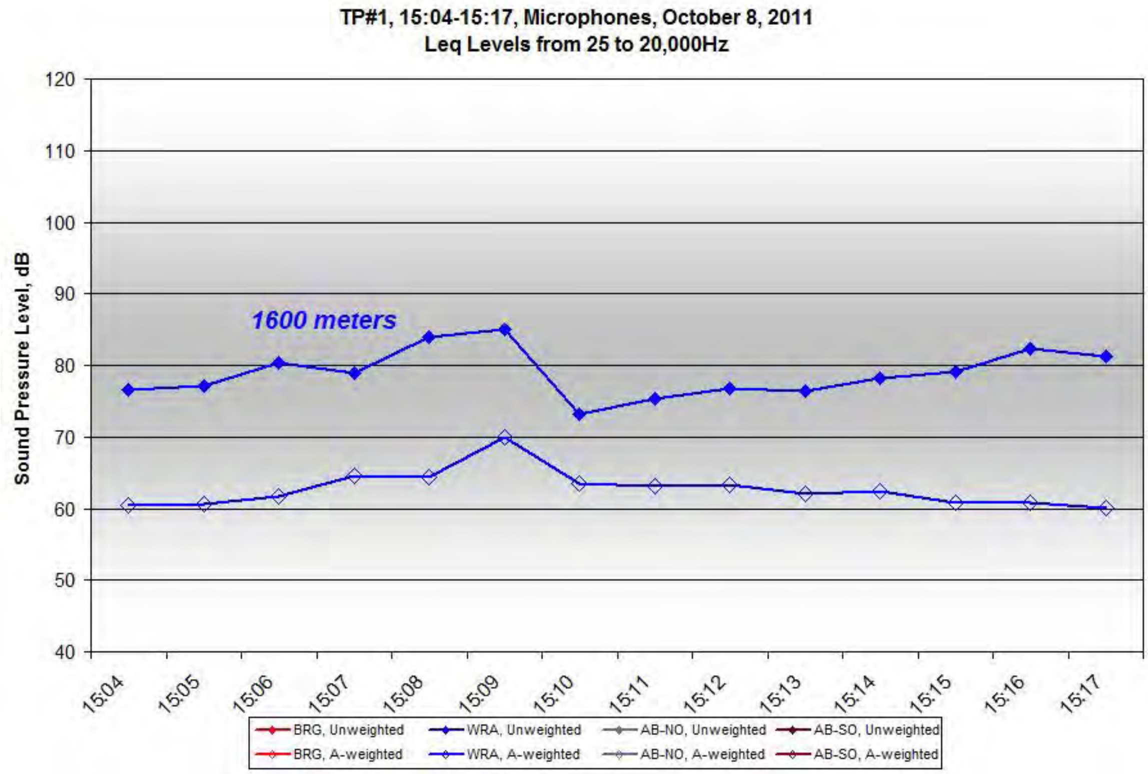

Figure C524. One-minute Unweighted and A-weighted Leq Level at TP#1, 15:04-15:17, on October 8, 2011

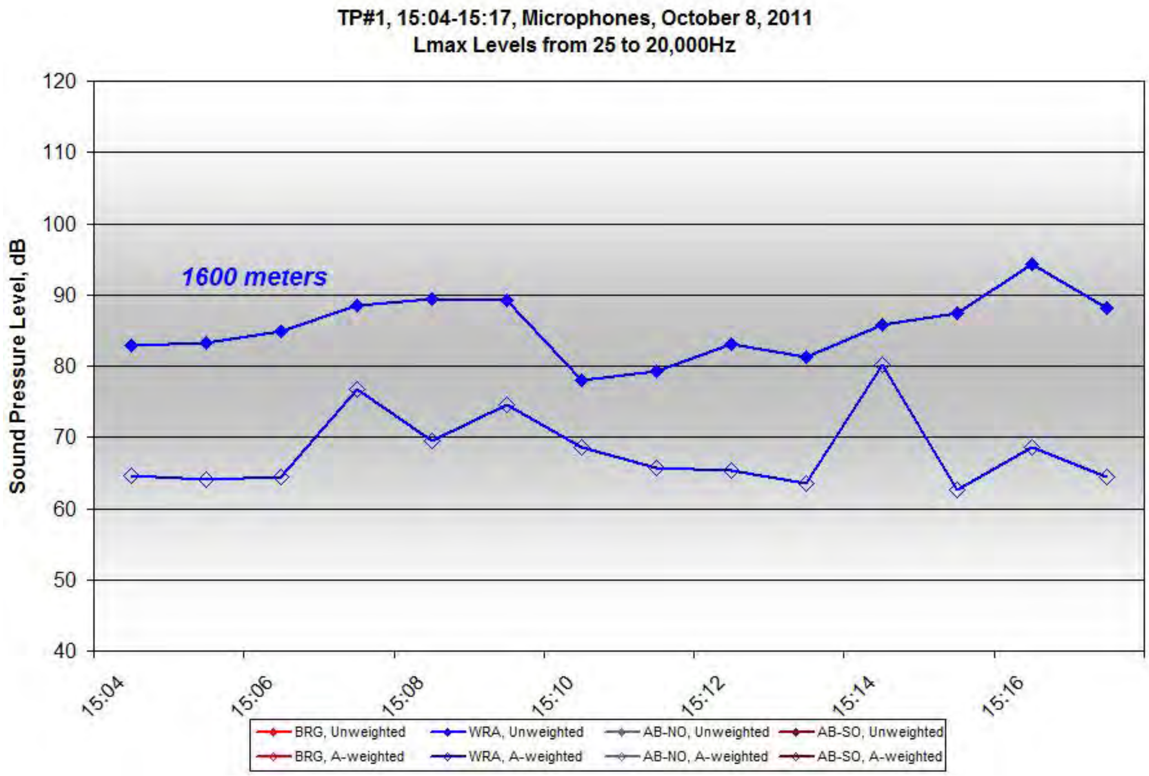

Figure C525. One-minute Unweighted and A-weighted Lmax Level at TP#1, 15:04-15:17, on October 8, 2011

NO DATA AVAILABLE

Figure C526. Average One-minute Unweighted and A-weighted Spectral Data Measured at the BRG Location during TP#1, 15:04-15:17, on October 8, 2011

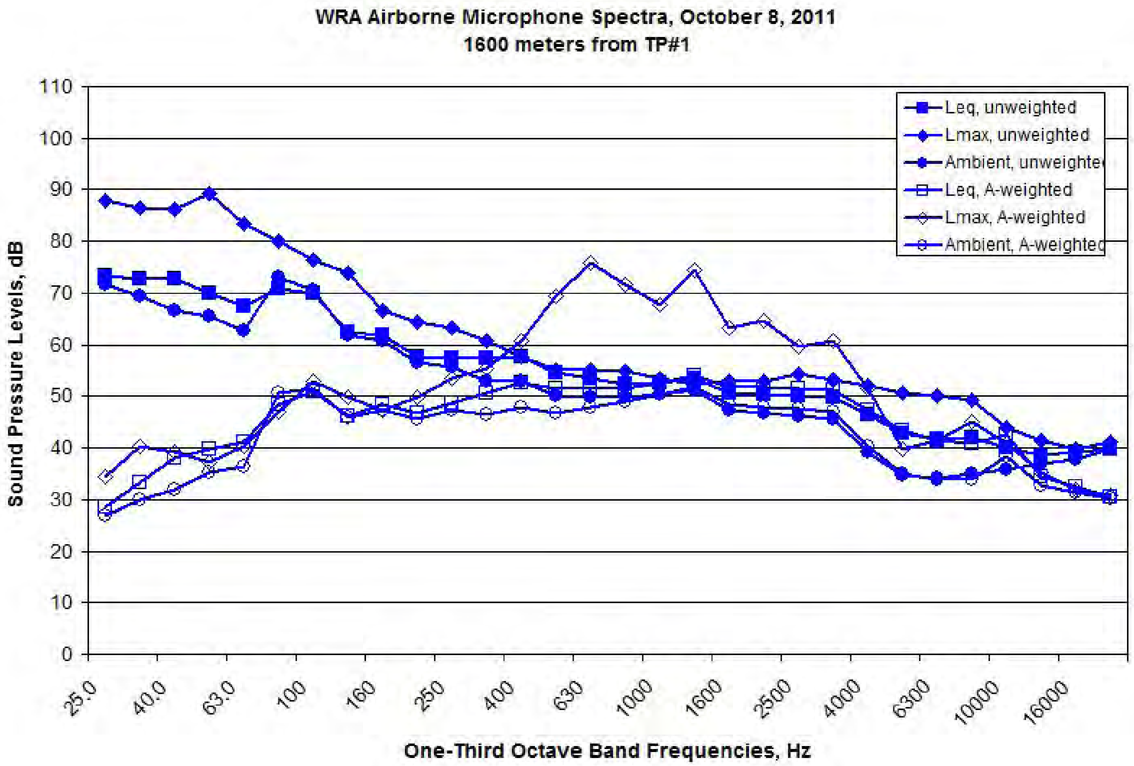

Figure C527. Average One-minute Unweighted and A-weighted Spectral Data Measured at the WRA Location during TP#1, 15:04-15:17, on October 8, 2011

NO DATA AVAILABLE

Figure C528. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-NO Location during TP#1, 15:04-15:17, on October 8, 2011

NO DATA AVAILABLE

Figure C529. Average One-minute Unweighted and A-weighted Spectral Data Measured at the AB-SO Location during TP#1, 15:04-15:17, on October 8, 2011

Airborne SEL for Vibratory Pile Driving

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	8/29/2011							
TTP#1 = 24"	Lat.	47° 45.171'	12:13-12:22	Un-weighted	122		107	
	Long.	122° 43.359'		A-weighted	114		101	
	Distance from Pile in meters				10	145	123	426
TTP#2 = 36"	Lat.	47° 45.151'	15:11-15:20	Un-weighted	123		106	102
	Long.	122° 43.425'		A-weighted	117		102	85
	Distance from Pile in meters				10	58	172	400
Date:	8/30/2011							
TTP#3 = 36"	Lat.	47° 45.077'	9:57-10:14	Un-weighted	121	107	111	
	Long.	122° 43.428'		A-weighted	117	92	103	
	Distance from Pile in meters				10	361	186	268
TTP#3 = 36"	Lat.	47° 45.077'	10:43-10:48	Un-weighted	119	98	102	
	Long.	122° 43.428'		A-weighted	113	86	95	
	Distance from Pile in meters				10	361	186	268
TP#3 = 36"	Lat.	47° 45.116'	13:13-13:20	Un-weighted	122	110	103	
	Long.	122° 43.473'		A-weighted	116	100	97	
	Distance from Pile in meters				10	442	223	356
TP#7 = 36"	Lat.	47° 45.071'	14:45-14:52	Un-weighted	119	96	99	
	Long.	122° 43.483'		A-weighted	114	87	93	
	Distance from Pile in meters				10	295	250	290
Date:	8/31/2011							
TTP#4 = 36"	Lat.	47° 45.011'	9:22-9:26	Un-weighted	119	107	97	
	Long.	122° 43.455'		A-weighted	112	93	93	
	Distance from Pile in meters				10	86	286	179
TTP#4 = 36"	Lat.	47° 45.011'	9:44-9:57	Un-weighted	127	97	103	
	Long.	122° 43.455'		A-weighted	117	98	94	
	Distance from Pile in meters				10	86	286	179
TP#13 = 48"	Lat.	47° 45.010'	12:04-12:11	Un-weighted	127	105	102	
	Long.	122° 43.508'		A-weighted	119	93	94	
	Distance from Pile in meters				10	272	337	231
TP#12 = 36"	Lat.	47° 45.012'	14:27-14:31	Un-weighted	120	99	96	
	Long.	122° 43.520'		A-weighted	113	85	90	
	Distance from Pile in meters				10	82	350	244

Airborne SEL for Vibratory Pile Driving - Continued

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	9/8/2011							
TP#3 RP#3 = 36"	Lat.	47° 45.118'	14:38-15:06	Un-weighted	124		106	
	Long.	122° 43.468		A-weighted	119		99	
	Distance from Pile in meters				10	92	223	356
TP#3 RP#2 = 36"	Lat.	47° 45.118'	16:21-16:32	Un-weighted	120	113	106	
	Long.	122° 43.468		A-weighted	113	108	99	
	Distance from Pile in meters				10	167	223	356
TP#3 RP#2 = 36"	Lat.	47° 45.118'	16:45-16:57	Un-weighted	120	111	107	
	Long.	122° 43.468		A-weighted	113	107	102	
	Distance from Pile in meters				10	87	223	356
Date:	9/10/2011							
TP#3 RP#1 = 36"	Lat.	47° 45.118'	10:53-10:59	Un-weighted			103	
	Long.	122° 43.468		A-weighted			98	
	Distance from Pile in meters				10	107	223	356
TP#2 = 36"	Lat.	47° 45.134'	12:58-13:05	Un-weighted			100	
	Long.	122° 43.485		A-weighted			94	
	Distance from Pile in meters				10	66	241	392
Date:	9/17/2011							
TP#2 = 36"	Lat.	47° 45.134'	11:26-11:38	Un-weighted	119		102	95
	Long.	122° 43.485		A-weighted	114		94	86
	Distance from Pile in meters				10	103	241	392
TP#3 MP#1 = 36"	Lat.	47° 45.120'	12:30-12:36	Un-weighted	115	107	97	93
	Long.	122° 43.466		A-weighted	106	98	89	82
	Distance from Pile in meters				10	92	223	356
TTP#2 = 36"	Lat.	47° 45.151'	14:09-14:24	Un-weighted	121	111	104	97
	Long.	122° 43.425		A-weighted	116	101	101	89
	Distance from Pile in meters				10	133	172	400
TP#3 MP#3 = 36"	Lat.	47° 45.119'	14:52-15:02	Un-weighted	118	109	99	95
	Long.	122° 43.480		A-weighted	111	100	92	86
	Distance from Pile in meters				10	93	223	356
TP#7 = 36"	Lat.	47° 45.071'	15:28-15:40	Un-weighted	122	111	100	98
	Long.	122° 43.483		A-weighted	117	109	96	92
	Distance from Pile in meters				10	75	250	290
TP#3 MP#2 = 36"	Lat.	47° 45.113'	16:09-16:17	Un-weighted	118	109	99	94
	Long.	122° 43.469		A-weighted	113	104	93	86
	Distance from Pile in meters				10	85	223	356

Airborne SEL for Vibratory Pile Driving - Continued

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	9/21/2011							
TP#10 = 36"	Lat.	47° 45.032'	13:42-13:48	Un-weighted	120	105	96	98
	Long.	122° 43.540'		A-weighted	115	100	90	90
	Distance from Pile in meters				10	117	348	288
TP#10 = 36"	Lat.	47° 45.032'	15:03-15:14	Un-weighted	122	109	104	104
	Long.	122° 43.540'		A-weighted	117	102	92	93
	Distance from Pile in meters				10	117	348	288
TP#9 = 36"	Lat.	47° 45.043'	16:49-17:00	Un-weighted	124	107	99	101
	Long.	122° 43.544'		A-weighted	118	102	93	93
	Distance from Pile in meters				10	145	344	304
Date:	9/22/2011							
TP#8 = 36"	Lat.	47° 45.069'	9:13-9:29	Un-weighted	123	115	102	100
	Long.	122° 43.531'		A-weighted	115	105	95	91
	Distance from Pile in meters				10	71	309	323
TP#11 = 48"	Lat.	47° 45.014'	15:21-15:28	Un-weighted	120	106	98	100
	Long.	122° 43.551'		A-weighted	112	96	89	91
	Distance from Pile in meters				10	112	375	279
Date:	9/23/2011							
TP#6 = 48"	Lat.	47° 45.088'	8:54-9:04	Un-weighted	124	115	102	100
	Long.	122° 43.511'		A-weighted	116	102	95	90
	Distance from Pile in meters				10	109	278	334
TP#5 = 48"	Lat.	47° 45.091'	11:26-11:39	Un-weighted	126	116	104	104
	Long.	122° 43.545'		A-weighted	119	105	94	92
	Distance from Pile in meters				10	110	316	365
TP#4, Batter = 36"	Lat.	47° 45.113'	15:42-16:16	Un-weighted	130	121	107	105
	Long.	122° 43.507'		A-weighted	122	115	101	97
	Distance from Pile in meters				10	80	266	371
Date:	9/24/2011							
TP#10 = 36"	Lat.	47° 45.032'	14:50-15:00	Un-weighted	118		98	99
	Long.	122° 43.540'		A-weighted	111		90	90
	Distance from Pile in meters				10	118	348	288
TP#9 RP#3 = 36"	Lat.	47° 45.043'	16:03-16:13	Un-weighted	120	107	100	100
	Long.	122° 43.544'		A-weighted	114	101	94	94
	Distance from Pile in meters				10	150	344	304

Airborne SEL for Vibratory Pile Driving - Continued

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	9/26/2011							
TP#8 = 36"	Lat.	47° 45.069'	10:30-10:48	Un-weighted	122		104	108
	Long.	122° 43.531'		A-weighted	116		96	96
	Distance from Pile in meters				10	147	309	323
TP#9 RP#1 = 36"	Lat.	47° 45.043'	11:18-11:33	Un-weighted	124		102	101
	Long.	122° 43.544'		A-weighted	121		97	96
	Distance from Pile in meters				10	140	344	304
Date:	9/29/2011							
TP#12 = 36"	Lat.	47° 45.012'	11:17-11:29	Un-weighted	120	109	98	104
	Long.	122° 43.520'		A-weighted	113	104	91	97
	Distance from Pile in meters				10	81	350	244
TP#9 RP#2 = 36"	Lat.	47° 45.043'	12:12-12:18	Un-weighted	120	106	103	105
	Long.	122° 43.544'		A-weighted	116	98	91	93
	Distance from Pile in meters				10	140	344	304
TP#11 = 48"	Lat.	47° 45.014'	16:29-16:43	Un-weighted	121	105	100	103
	Long.	122° 43.551'		A-weighted	111	99	92	94
	Distance from Pile in meters				10	120	375	279
TP#9 MP#1 = 36"	Lat.	47° 45.043'	17:02-17:09	Un-weighted	118	105	96	102
	Long.	122° 43.544'		A-weighted	108	96	87	91
	Distance from Pile in meters				10	140	344	304
Date:	9/30/2011							
TP#13 = 48"	Lat.	47° 45.010'	10:43-10:55	Un-weighted	121	110	103	107
	Long.	122° 43.508'		A-weighted	114	96	93	98
	Distance from Pile in meters				10	270	337	231
TP#9 MP#2 = 36"	Lat.	47° 45.041'	11:33-11:39	Un-weighted	118	104	95	100
	Long.	122° 43.563'		A-weighted	113	98	89	92
	Distance from Pile in meters				10	145	344	304
TP#5 = 48"	Lat.	47° 45.091'	14:28-14:47	Un-weighted	125	110	101	105
	Long.	122° 43.545'		A-weighted	119	102	91	96
	Distance from Pile in meters				10	190	316	365
TP#9 MP#3 = 36"	Lat.	47° 45.053'	15:12-15:19	Un-weighted	122	107	98	101
	Long.	122° 43.557'		A-weighted	117	101	92	94
	Distance from Pile in meters				10	145	344	304

Airborne SEL for Vibratory Pile Driving - Continued

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	**10/3/2011**							
TP#6 = 48"	Lat.	47° 45.088'	14:02-14:17	Un-weighted	116	103		
	Long.	122° 43.511'		A-weighted	108	93		
	Distance from Pile in meters				10	155	278	334
TP#4 = 36"	Lat.	47° 45.113'	17:54-18:04	Un-weighted	119	106	103	97
	Long.	122° 43.508'		A-weighted	111	100	97	90
	Distance from Pile in meters				10	200	266	371
Date:	**10/4/2011**							
TP#4 = 36"	Lat.	47° 45.113'	10:45-11:07	Un-weighted	122		104	102
	Long.	122° 43.508'		A-weighted	117		97	95
	Distance from Pile in meters				10	215	266	371
TTP#1 = 24"	Lat.	47° 45.171'	15:54-16:08	Un-weighted	119		104	94
	Long.	122° 43.359'		A-weighted	111		96	85
	Distance from Pile in meters				10	300	123	426
Date:	**10/5/2011**							
TP#1 = 36"	Lat.	47° 45.228'	16:28-16:52	Un-weighted		110		
	Long.	122° 43.483'		A-weighted		102		
	Distance from Pile in meters				10	205	310	556
Date:	**10/8/2011**							
TP#1 = 36"	Lat.	47° 45.228'	16:10-16:20	Un-weighted				
	Long.	122° 43.483'		A-weighted				
	Distance from Pile in meters				10	1600	310	556
Date:	**10/17/2011**							
TP#3 MP#3 = 36"	Lat.	47° 45.119'	12:58-13:07	Un-weighted		105		
	Long.	122° 43.480'		A-weighted		98		
	Distance from Pile in meters				10	105	223	356
TP#3 MP#2 = 36"	Lat.	47° 45.113'	15:16-15:25	Un-weighted		107		
	Long.	122° 43.469'		A-weighted		102		
	Distance from Pile in meters				10	105	223	356
TP#3 = 36"	Lat.	47° 45.116'	16:13-16:20	Un-weighted		106		
	Long.	122° 43.473'		A-weighted		101		
	Distance from Pile in meters				10	105	223	356

Airborne SEL for Vibratory Pile Driving - Continued

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	10/18/2011							
TP#3 RP#3 = 36"	Lat.	47° 45.118'	11:21-11:30	Un-weighted		106		
	Long.	122° 43.468'		A-weighted		101		
	Distance from Pile in meters				10	118	223	356
TP#3 RP#1 = 36"	Lat.	47° 45.118'	13:13-13:31	Un-weighted		110		
	Long.	122° 43.468'		A-weighted		103		
	Distance from Pile in meters				10	118	223	356
TP#3 RP#2 = 36"	Lat.	47° 45.118'	14:13-14:30	Un-weighted		109		
	Long.	122° 43.468'		A-weighted		104		
	Distance from Pile in meters				10	103	223	356
TP#3 MP#1 = 36"	Lat.	47° 45.120'	15:09-15:21	Un-weighted		106		
	Long.	122° 43.466'		A-weighted		101		
	Distance from Pile in meters				10	108	223	356
Date:	10/19/2011							
TP#9 MP#2 = 36"	Lat.	47° 45.041'	8:36-8:37	Un-weighted		91		
	Long.	122° 43.563'		A-weighted		84		
	Distance from Pile in meters				10	137	344	304
TP#9 MP#2 = 36"	Lat.	47° 45.041'	10:26-10:56	Un-weighted		107		
	Long.	122° 43.563'		A-weighted		99		
	Distance from Pile in meters				10	137	344	304
TP#9 MP#3 = 36"	Lat.	47° 45.053'	13:35-13:40	Un-weighted		98		
	Long.	122° 43.557'		A-weighted		92		
	Distance from Pile in meters				10	169	344	304
TP#9 MP#1 = 36"	Lat.	47° 45.043'	14:34-14:40	Un-weighted		96		
	Long.	122° 43.544'		A-weighted		89		
	Distance from Pile in meters				10	169	344	304
TP#9 = 36"	Lat.	47° 45.043'	15:55-16:12	Un-weighted		106		
	Long.	122° 43.544'		A-weighted		99		
	Distance from Pile in meters				10	169	344	304

Airborne SEL for Vibratory Pile Driving - Continued

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	**10/20/2011**							
TP#9 RP#3 = 36"	Lat.	47° 45.043'	8:40-8:56	Un-weighted		106		
	Long.	122° 43.544'		A-weighted		101		
	Distance from Pile in meters				10	146	344	304
TP#9 RP#1 = 36"	Lat.	47° 45.043'	10:51-11:02	Un-weighted		102		
	Long.	122° 43.544'		A-weighted		96		
	Distance from Pile in meters				10	146	344	304
TP#9 RP#2 = 36"	Lat.	47° 45.043'	11:46-11:55	Un-weighted		103		
	Long.	122° 43.544'		A-weighted		95		
	Distance from Pile in meters				10	146	344	304
TTP#4 = 36"	Lat.	47° 45.011'	13:33-13:40	Un-weighted		104		
	Long.	122° 43.455'		A-weighted		98		
	Distance from Pile in meters				10	128	286	179
TTP#4 = 36"	Lat.	47° 45.011'	14:03-14:13	Un-weighted		107		
	Long.	122° 43.455'		A-weighted		102		
	Distance from Pile in meters				10	128	286	179
TTP#3 = 36"	Lat.	47° 45.077'	15:26-15:36	Un-weighted		106		
	Long.	122° 43.428'		A-weighted		100		
	Distance from Pile in meters				10	150	186	268

Airborne SEL for Impact Pile Driving

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	9/1/2011							
TTP#1 = 24"	Lat.	47° 45.171'	11:30-11:37	Un-weighted	114		97	
	Long.	122° 43.359'		A-weighted	110		92	
	Distance from Pile in meters				10	527	123	426
TTP#2 = 36"	Lat.	47° 45.151'	15:40-15:52	Un-weighted	121		105	
	Long.	122° 43.425'		A-weighted	119		103	
	Distance from Pile in meters				11	415	172	400
Date:	9/10/2011							
TP#7 = 36"	Lat.	47° 45.071'	16:37-16:57	Un-weighted			99	
	Long.	122° 43.483'		A-weighted			93	
	Distance from Pile in meters				20	64	250	290
Date:	9/15/2011							
TP#3 RP#3 = 36"	Lat.	47° 45.118'	14:18-14:34	Un-weighted	119	108	101	100
	Long.	122° 43.468'		A-weighted	115	101	94	88
	Distance from Pile in meters				10	92	223	356
Date:	9/16/2011							
TP#3 RP#2 = 36"	Lat.	47° 45.118'	10:44-10:53	Un-weighted		105	99	95
	Long.	122° 43.468'		A-weighted		100	91	83
	Distance from Pile in meters				10	90	223	356
TP#3 RP#1 = 36"	Lat.	47° 45.118'	15:02-15:11	Un-weighted		105	100	98
	Long.	122° 43.468'		A-weighted		95	95	89
	Distance from Pile in meters				10	95	223	356
TP#3 = 36"	Lat.	47° 45.116'	16:10-16:16	Un-weighted		99	96	90
	Long.	122° 43.473'		A-weighted		88	88	79
	Distance from Pile in meters				10	90	223	356
Date:	9/17/2011							
TP#2 = 36"	Lat.	47° 45.134'	10:26-10:31	Un-weighted	116	105	101	93
	Long.	122° 43.485'		A-weighted	113	96	91	83
	Distance from Pile in meters				10	125	241	392
Date:	9/21/2011							
TTP#3 = 36"	Lat.	47° 45.077'	10:09-10:20	Un-weighted	119	106	102	99
	Long.	122° 43.428'		A-weighted	117	101	99	92
	Distance from Pile in meters				10	123	186	268

Airborne SEL for Impact Pile Driving - Continued

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
Date:	9/24/2011							
TP#10 = 36"	Lat.	47° 45.032'	14:05-14:12	Un-weighted	116		98	100
	Long.	122° 43.540'		A-weighted	112		89	90
	Distance from Pile in meters				10	118	348	288
Date:	9/26/2011							
TP#8 = 36"	Lat.	47° 45.069'	9:31-9:41	Un-weighted	117		97	100
	Long.	122° 43.531'		A-weighted	114		88	87
	Distance from Pile in meters				10	235	309	323
Date:	9/29/2011							
TP#12 = 36"	Lat.	47° 45.012'	10:18-10:23	Un-weighted	116	104	95	101
	Long.	122° 43.520'		A-weighted	113	98	88	93
	Distance from Pile in meters				10	81	350	244
TP#11 = 48"	Lat.	47° 45.014'	15:03-15:18	Un-weighted	115	105	97	100
	Long.	122° 43.551'		A-weighted	112	100	90	94
	Distance from Pile in meters				10	120	375	279
Date:	9/30/2011							
TP#13 = 48"	Lat.	47° 45.010'	9:52-9:56	Un-weighted	112	98	95	101
	Long.	122° 43.508'		A-weighted	109	89	88	92
	Distance from Pile in meters				10	163	337	231
TP#5 = 48"	Lat.	47° 45.091'	13:36-13:44	Un-weighted	119	105	96	98
	Long.	122° 43.545'		A-weighted	117	100	89	94
	Distance from Pile in meters				10	194	316	365
Date:	10/1/2011							
TP#9 RP#3 = 36"	Lat.	47° 45.043'	9:19-9:24	Un-weighted		103	94	94
	Long.	122° 43.544'		A-weighted		95	85	84
	Distance from Pile in meters				10	142	344	304
TP#9 RP#2 = 36"	Lat.	47° 45.043'	11:27-11:31	Un-weighted		104	96	101
	Long.	122° 43.544'		A-weighted		94	86	91
	Distance from Pile in meters				10	140	344	304
TP#9 RP#1 = 36"	Lat.	47° 45.043'	14:07-14:12	Un-weighted		103	18	99
	Long.	122° 43.544'		A-weighted		92	18	87
	Distance from Pile in meters				10	140	344	304

Airborne SEL for Impact Pile Driving - Continued

Event Description	Pile Coordinates		Time	Sensor	Measured Sound Pressure Level - SEL			
					Barge	WRA Boat	North Shore	South Shore
					SEL	SEL	SEL	SEL
TP#9 = 36"	Lat.	47° 45.043'	16:29-16:34	Un-weighted		108	92	98
	Long.	122° 43.544'		A-weighted		105	81	94
	Distance from Pile in meters				10	140	344	304
Date:	10/3/2011							
TP#6 = 48"	Lat.	47° 45.088'	12:04-12:11	Un-weighted	117	103		
	Long.	122° 43.511'		A-weighted	113	95		
	Distance from Pile in meters				10	155	278	334
TP#4 = 36"	Lat.	47° 45.113'	16:44-16:50	Un-weighted	116	101		95
	Long.	122° 43.508'		A-weighted	112	92		85
	Distance from Pile in meters				10	200	266	371
Date:	10/4/2011							
TTP#4 = 36"	Lat.	47° 45.011'	14:49-14:59	Un-weighted	121		101	103
	Long.	122° 43.455'		A-weighted	117		93	96
	Distance from Pile in meters				10	170	266	371
Date:	10/8/2011							
TP#1 = 36"	Lat.	47° 45.228'	15:04-15:17	Un-weighted		109		
	Long.	122° 43.483'		A-weighted		93		
	Distance from Pile in meters				10	1600	310	556

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APPENDIX D

ACOUSTIC MONITORING PLAN

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INTRODUCTION

This Acoustic Monitoring Plan (Plan) provides a protocol for conducting airborne and hydroacoustic measurements of pile-driving operations during the Test Pile Program (TPP) and Explosives Handling Wharf-1 (EHW-1) Pile Replacement Project. This Plan was developed to support the respective Biological Assessment (BA) and Incidental Harassment Authorization (IHA) compliance documents for each project. Both sets of documents provide a more in-depth discussion on the modeling assumptions and calculations for each project, and are incorporated here by reference. There are multiple acoustic measurement objectives which are described in more detail below.

Both the Test Pile Program and the EHW-1 Pile Replacement Project will be conducted at Naval Base Kitsap (NBK) at Bangor, Washington. The purpose of the Test Pile Program is to acquire accurate geotechnical and sound propagation data to validate design concepts, construction methods, and environmental analyses for the proposed second Explosives Handling Wharf (EHW-2), as well as other future projects at the NBK Bangor waterfront. The purpose of the EHW-1 Pile Replacement Project would be to remove and install piles and associated structures to maintain the structural integrity of the existing wharf. Repairs and maintenance at EHW-1 are needed due to deterioration of the structure and are necessary to maintain the functionality of the wharf and to support the operational requirements of the TRIDENT program.

NBK-Bangor is located on the Hood Canal approximately 20 miles due west of Seattle, Washington (Figure 1-Vicinity Map). NBK-Bangor provides berthing and support services to United States (U.S.) Navy submarines and other fleet assets.

Objectives:

The objectives for acoustic monitoring for both the Test Pile Program and the EHW-1 Pile Replacement project are similar. However, due to differences in the ESA consultation process for each project, acoustic monitoring requirements for ESA-listed fish and the marbled murrelets were not required for the EHW-1 project, but were required for the Test Pile Program. Both projects required acoustic monitoring to support the marine mammal permitting. Unless explicitly delineated below, the objectives generally apply for both projects.

The Navy will collect airborne and underwater acoustic measurements to:

1. **Empirically verify the modeled injury and behavioral disturbance zones.** These zones are also referred to as shutdown and buffer zones (respectively). These injury and behavioral disturbance zones are defined by criteria established by the regulatory agencies for marine mammals, fish, and marbled murrelets. Each zone encompasses the area within the underwater or airborne isopleth. Some zones require a shutdown of pile driving and others do not (e.g. injury zones for fish). See definitions below.

a. **Underwater Injury Zones:**
   i. **Shutdown (Injury) Zone**: 180 dB re 1 µPa rms isopleth for cetaceans; 190 dB re 1 µPa rms for pinnipeds.
   ii. In addition, for the TPP project, USFWS applied a new 183 SEL injury threshold for marbled murrelets. This injury threshold cannot be identified in real-time as it is a cumulative metric. It may be possible to empirically verify the actual SEL zone at the end of every impact pile driving day assuming that daily data processing can occur. The daily SEL will be included in the final report, whether or not daily processing is available. During the project, the shutdown zone was calculated (estimated) based on the number of impacts strikes per day. For TPP, the shutdown zone is 197 meters rounded up to 200 meters. For EHW-1, the injury metric was 180 dB peak and that shutdown zone was estimated to be 300 meters with an added 100 meter buffer for a total shutdown zone of 400 meters.
   iii. **Non-Shutdown Injury Zone:**
      1. While there are three injury isopleths for fish 206 dB peak; 187 dB re: 1µPa^2•sec (cumulative SEL) for fish greater than or equal to 2 grams; and 183 dB re: 1µPa^2•sec (cumulative SEL) for fish less than 2 grams, no shutdowns are required for fish in these zones.

b. **Airborne Injury Zones:**
   i. The current airborne injury level used for marbled murrelets is 92 dBA, however shutdowns are not required.
   ii. There is no airborne injury threshold for marine mammals, only a disturbance threshold discussed below.

c. **Underwater Buffer (behavioral disturbance) Zone:**
   i. The behavioral disturbance or buffer zone includes the area within the 160 dB re 1 µPa rms isopleth for marine mammals during impact pile driving, 120 dB re 1 µPa rms during vibratory pile driving and 150 dB re 1 µPa rms isopleth for marbled murrelets and fish. Shutdowns are not required for species seen in these zones, but a recording of the species behavior is required per the Marine Mammal Monitoring Plan and Marbled Murrelet Monitoring Plan.
   ii. The 120 dB behavioral disturbance isopleth for marine mammals from vibratory pile driving is modeled to extend for many miles. However, the Navy does not expect the 120 dB zone to actually extend as far as depicted in the BA and IHA. This large area also defined the Action Area in the BA (Figure 2), as it was assumed that this level would be above ambient conditions. If ambient conditions are louder than the 120 threshold then the threshold is less meaningful to the species because existing conditions would be louder. Therefore, the Navy will conduct acoustic monitoring during vibratory pile driving in order to determine the actual distance to the 120-dB isopleth for behavioral harassment or to background levels, whichever is greater.

d. **Airborne Buffer (behavioral disturbance) Zone:**

i. The distance to marine mammal airborne disturbance thresholds would be measured. These are currently 100 dB rms re 20 μPa (unweighted) for all pinnipeds except harbor seals. For harbor seals the threshold is 90 dB rms re 20 μPa (unweighted).

ii. There is no airborne behavioral threshold for marbled murrelets.

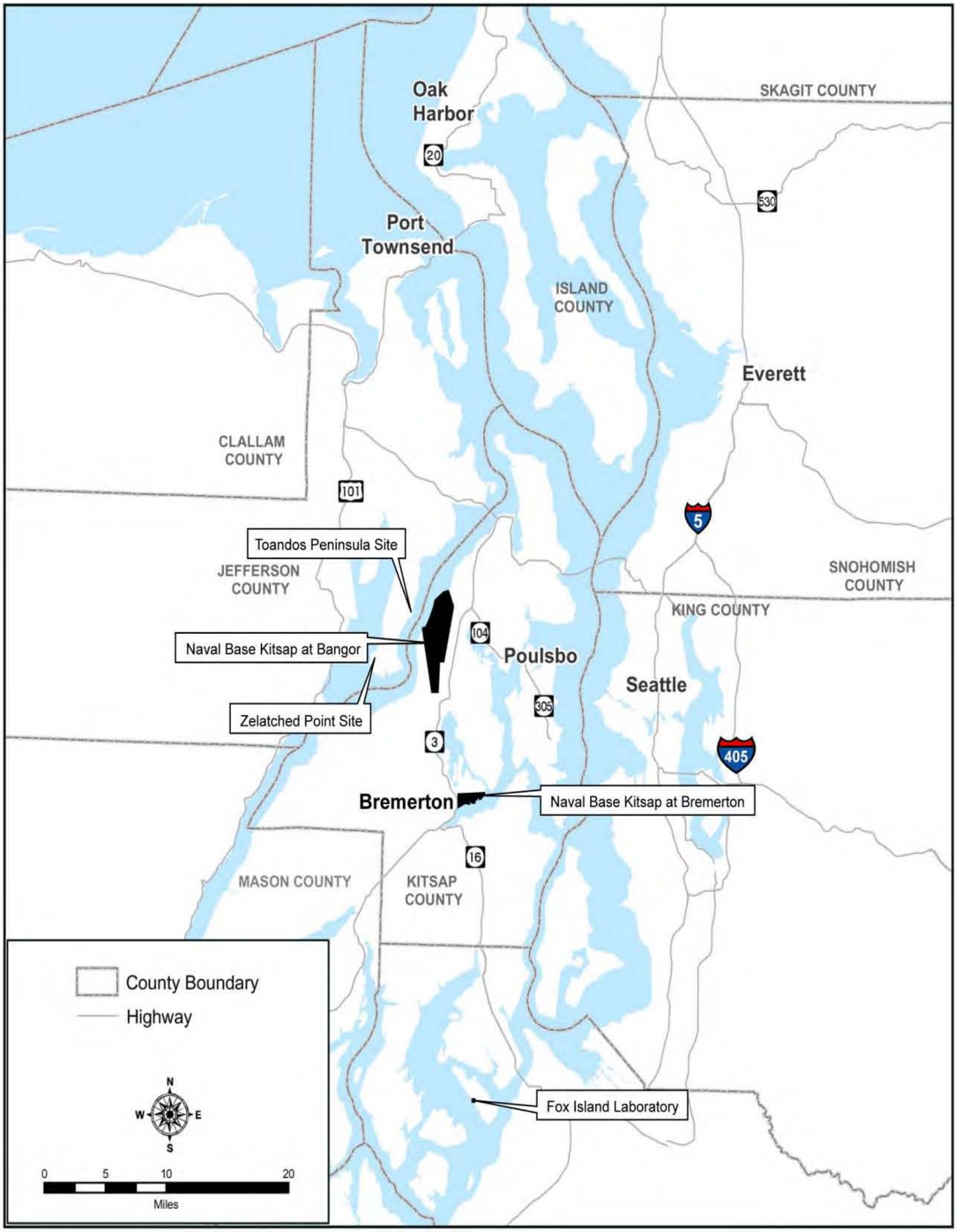
2. **To collect airborne and underwater ambient measurements.** Ambient conditions, both airborne and underwater, would be measured at the project site in the absence of construction activities to determine background sound levels.

3. **To determine the spreading loss occurring at the project location.**

4. **To measure the sound pressure levels produced by the use of the soft start technique to test the effectiveness of this method at reducing the sound levels during the initial stages of driving a pile**. The use of a soft start is currently requested by the regulators as a mitigation measure, but there is little data depicting the sound pressure levels produced by the soft start technique to verify its effectiveness.

5. **To determine the relative effectiveness of the sound attenuation system(s) (such as a bubble curtain) to verify noise reduction underwater as part of the Test Pile Program.** The modeling described in the BA and IHA documents assumes a 10 dB reduction in the initial sound pressure levels from use of properly deployed sound attenuation system. The only way to verify if in fact that level of reduction is achieved is to shut off the sound attenuation system for one minute and collect recordings during that time. The Navy proposes to test 7 piles for one minute each with the sound attenuation device temporarily turned off. Execution of this proposal will be dependent upon approval from USFWS as part of the Navy's ESA consultation for the Test Pile Program.

6. **To test the effectiveness of using a sound attenuation system with a vibratory hammer as part of the Test Pile Program.** This will be tested during the driving of three vibratory piles (one of each pile size).



(Source: Navy 2002; ESRI 2000)

Figure 1 Vicinity Map

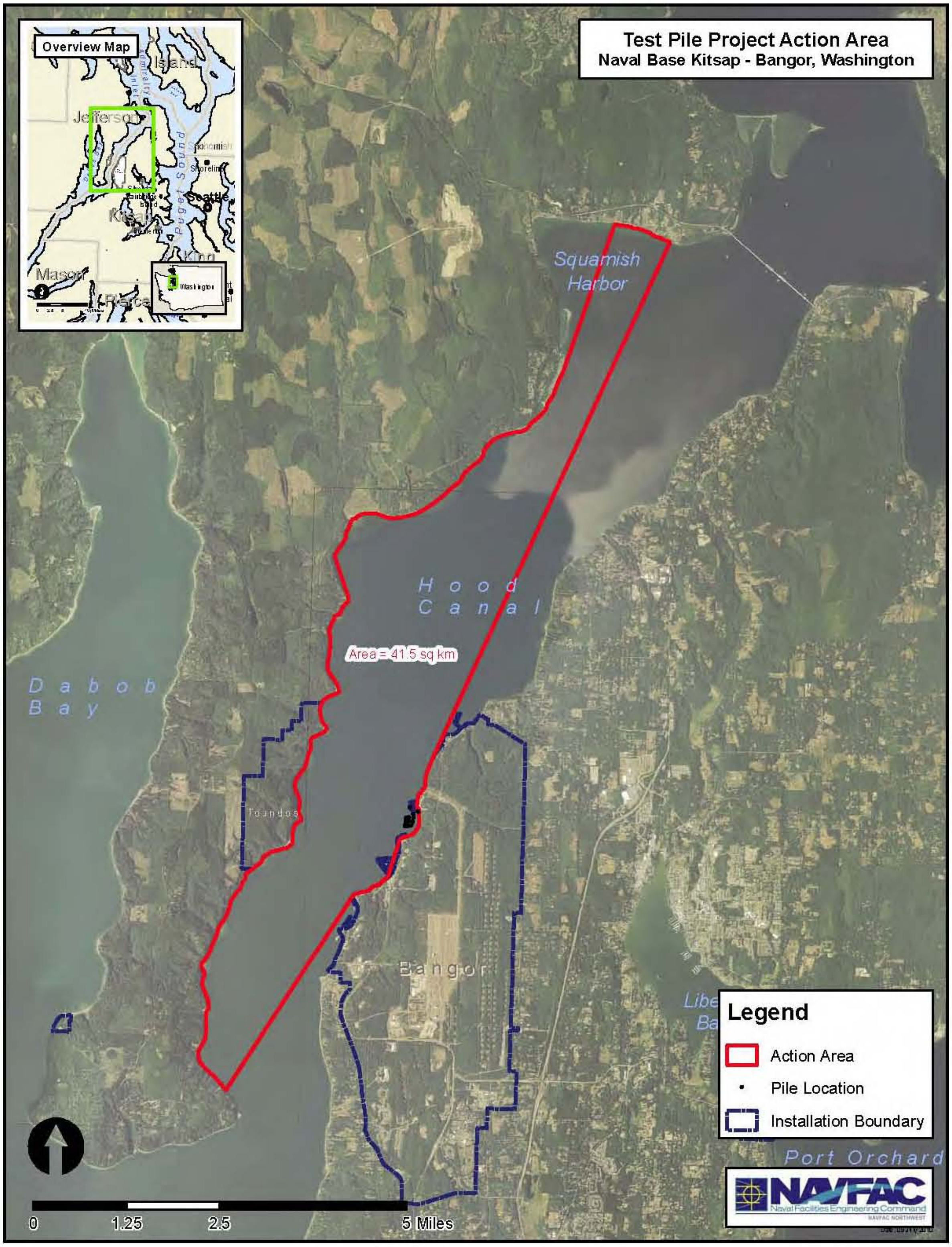


Figure 2 Action Area

The entirety of NBK-Bangor, including the land areas and adjacent water areas in Hood Canal, is restricted from general public access (Figure 3 Restricted Areas). Two Waterfront Restricted Areas (WRA) are associated with NBK-Bangor, Naval Restricted Areas 1 and 2 (33 CFR 334.1220). Naval Restricted Area 1 covers the area north and south along the Hood Canal encompassing the NBK-Bangor waterfront. The regulations associated with Naval Restricted Area 1 state that no person or vessel shall enter this area without permission from the Commander, Naval Submarine Base Bangor, or his/her authorized representative. Naval Restricted Area 2 encompasses the waters of Hood Canal within a circle of 1,000 yards diameter. The project area for both TPP and EHW-1 is located inside this WRA and depicted on Figure 3 in yellow.

Figure 3 Restricted Areas with Project Area Highlighted

PROJECT AREA

The project area is within the Hood Canal hydrologic unit code (HUC) #17110018 and the Water Resource Inventory Area 15 (Kitsap). The proposed TPP and EHW-1 repairs will occur on the northwest corner of NBK. The TPP will occur immediately south and west of Explosive Handling Wharf #1 (EHW-1) and north of the Marginal Wharf (Figure 4) inside the WRA. The proposed EHW-1 Pile Replacement Project will occur on the southwest corner of the existing Explosive Handling Wharf (Figure 5).

Figure 4 Test Pile Program Project Area

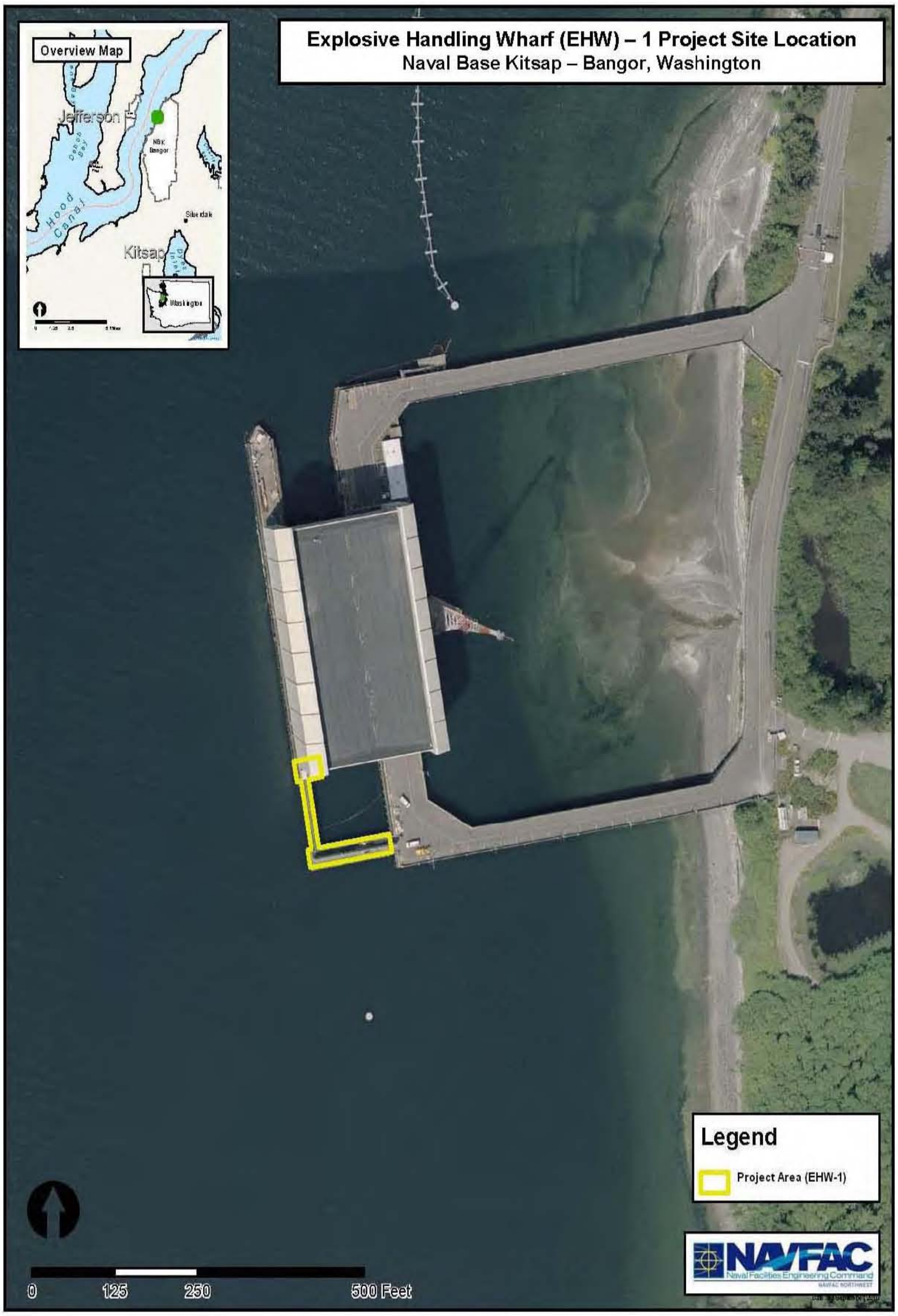


Figure 5 EHW-1 Project Area

PILE INSTALLATION LOCATION

Figure 6 indicates the location of the 29 piles to be driven for the TPP.

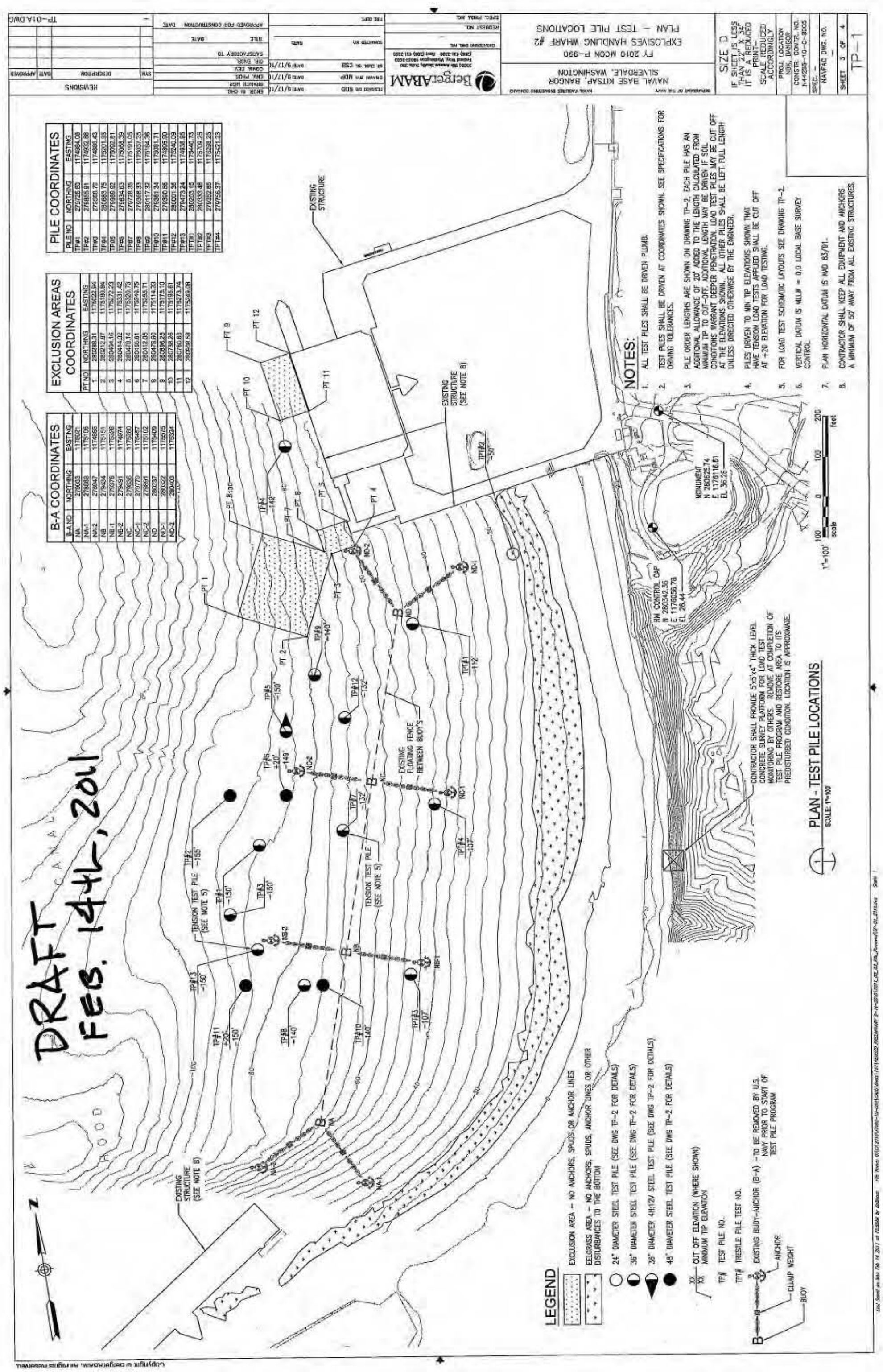


Figure 6 Test Pile Program Pile Installation Locations

Figure 7 provides a detailed graphic of the installation and removal activities that will occur at the EHW-1 Pile Replacement Project location.

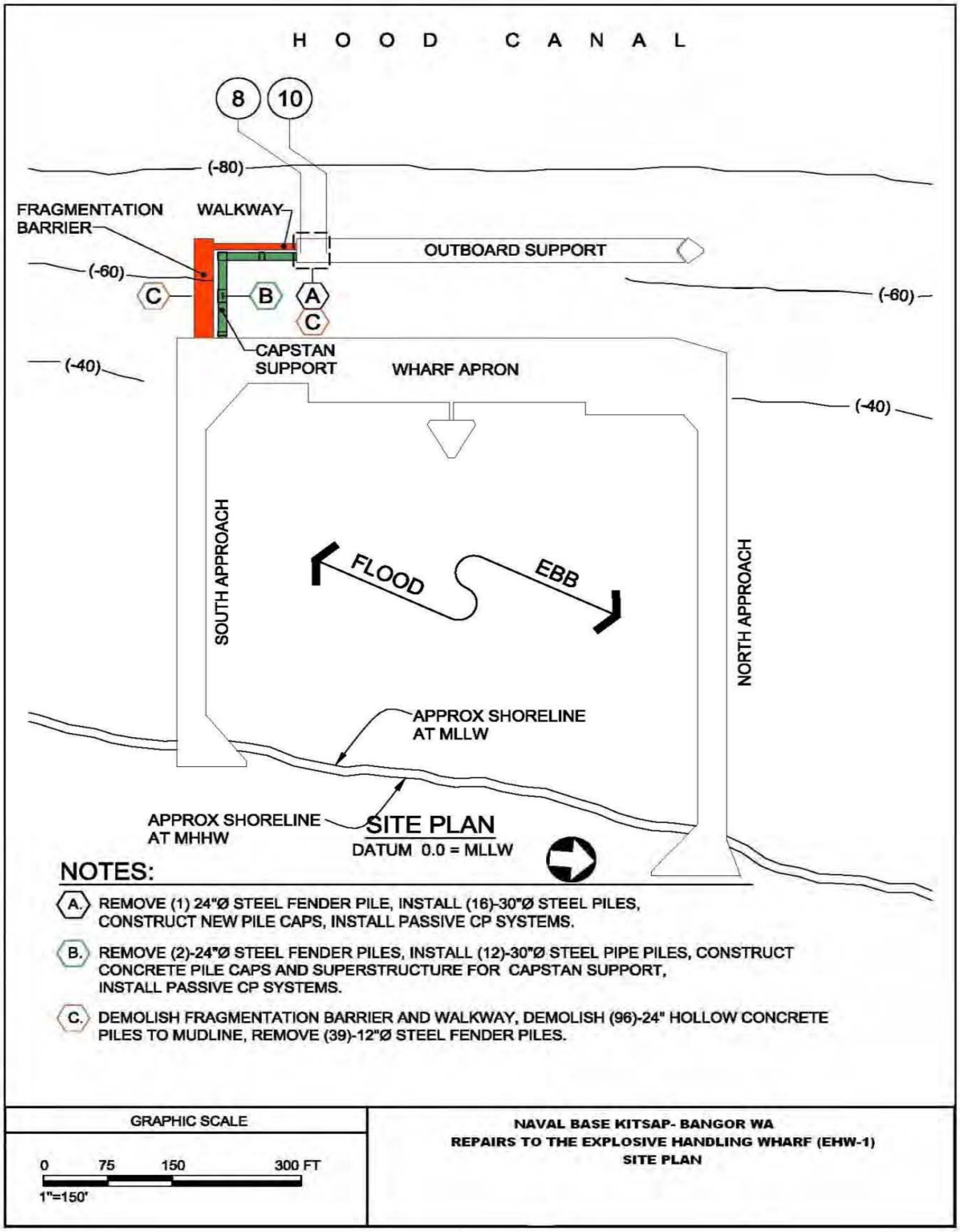


Figure 7 EHW-1 Pile Replacement Project Activities and Location

PILE INSTALLATION METHODS

Test Pile Program:

The Navy proposes to install and remove up to 29 test and reaction piles, conduct testing on select piles, and measure in-water noise propagation during pile installation and removal (Table 1). During the TPP, the Navy will test the effectiveness of existing soft-start (ramp-up) mitigation procedures currently in place for impact and vibratory hammers. The Navy will also use hydroacoustic monitoring to test the effectiveness of various noise attenuation devices, such as bubble curtains (both confined and unconfined) and temporary noise attenuation piles (TNAPs), during impact pile driving to determine the degree to which these measures will reduce energy levels emitted. For a description of these sound attenuation devices, including TNAPs, please see the Environmental Assessment. The presence and behavior of marine mammals and birds, especially alcids and Endangered Species Act-listed marbled murrelets, will also be monitored during pile installation and removal. Geotechnical and noise data collected during pile installation and removal will be integrated into the design, construction, and environmental planning for the Navy's proposed EHW-2.

Table 1
Test Pile Program Implementation Plan

Test Pile NO	Suggested Driving Sequence	Pile Type	Vibrate & Impact	Driving Shoe/End Hardening	Tension Load Test
TP#1	TBD	36"Ø x 3/4"T x 175'L	X	CUTTING SHOE *1	
TP#2	TBD	36"Ø x 3/4"T x 180'L	X	NONE	
TP#3	TBD	36"Ø x 3/4"T x 170'L	X	WELDED END HARDENING *2	
TP#4	TBD	36"Ø x 3/4"T x 195'L	X	NONE	
TP#5	TBD	48"Ø x 1"T x 195'L	X	CUTTING SHOE *1	
TP#6	TBD	48"Ø x 1"T x 185'L	X	WELDED END HARDENING *2	
TP#7	TBD	36"Ø x 3/4"T x 170'L	X	CUTTING SHOE *1	X
TP#8	TBD	36"Ø x 3/4"T x 185'L	X	WELDED END HARDENING *2	
TP#9	TBD	36"Ø x 3/4"T x 190'L	X	CUTTING SHOE *1	
TP#10	TBD	36"Ø x 3/4"T x 180'L	X	CUTTING SHOE *1	X
TP#11	TBD	48"Ø x 1"T x 175'L	X	NONE	
TP#12	TBD	36"Ø x 3/4"T x 180'L	X	WELDED END HARDENING *2	
TP#13	TBD	48"Ø x 1"T x 175'L	X	NONE	

Test Pile NO	Suggested Driving Sequence	Pile Type	Vibrate & Impact	Driving Shoe/End Hardening	Tension Load Test
TTP #1	TBD	24"Ø x 5/8"T x 115'L	X	CUTTING SHOE *1	
TTP #2	TBD	36"Ø x 1"T x 150'L	X	NONE	
TTP #3	TBD	36"Ø x 1"T x 145'L	X	WELDED END HARDENING *2	
TTP #4	TBD	36"Ø x 1"T x 150'L	X	NONE	
*1 – Inside edge cutting shoe *2 –Welded end hardening using 90 ksi weld material TP# - Test Pile Number (See figure 2-2 for locations) Ø – Diameter of the test piles L – Length = Mudline + 60’ Embedment + 20 MLLW cut off + 20” Driving Allowance T – Wall thickness TBD – To Be Determined					

The Test Pile coordinates are provided in Table 2.

Table 2
Test Pile Program Pile Location (NAD 83, ft)

PILE COORDINATES		
PILE NO	NORTHING	EASTING
TP#1	279725.50	1174984.06
TP#2	279855.91	1174932.88
TP#3	279964.19	1175021.60
TP#4	280683.75	1175201.93
TP#5	279989.92	1175092.81
TP#6	279834.63	1175068.39
TP#7	279728.35	1175191.05
TP#8	279629.57	1175175.52
TP#9	279311.95	1175073.94
TP#10	279361.34	1175081.71
TP#11	279390.56	1174895.90
TP#12	279448.97	1174868.36
TP#13	279473.24	1174938.95
TPT#1	280203.15	1175440.73
TPT#2	280333.46	1175709.25
TPT#3	279352.85	1175298.25
TPF#1	279610.34	1175416.49
TPF#2	279905.65	1175463.32

EHW-1 Pile Replacement Project:

Under the Navy's proposed action, ninety six 24-inch diameter concrete piles would be removed, thirty nine 12-inch steel fender piles would be removed and three 24-inch diameter steel fender piles would be removed. In addition, a total of twenty eight 30-inch diameter hollow, open-ended steel pipe piles would be installed and filled with concrete on the southwest corner of EHW-1. All concrete piles would be removed with a pneumatic chipping hammer or other similar concrete demolition tool. All of the steel pipe piles would be installed/removed with a vibratory hammer, rather than an impact hammer. Based on the Navy's experience replacing piles during previous repair cycles at the EHW-1 facility, the Navy feels that use of a vibratory hammer would be sufficient; the impact hammer has yet to be required to accomplish installation. However, during pile installation, depending on local geotechnical site conditions, some piles may be driven (proofed[1]) for the final few feet with an impact hammer. During typical construction projects, impact proofing is only required every 4-5 piles. Per consultation with USFWS under the ESA, impact pile driving (which would only take place during proofing) would not occur on more than five days for the duration of any pile driving window and no more than one pile would be proofed in a given day. Furthermore, impact pile driving, or proofing, would be limited to 15 minutes per pile (up to five piles total). All piles driven by an impact hammer would be surrounded by a bubble curtain or other sound attenuation device over the full water column to minimize in-water noise. The presence and behavior of marine mammals and birds, especially alcids and Endangered Species Act-listed marbled murrelets, will be monitored during pile installation and removal activities.

METHODOLOGY

The following section describes the methodology to be implemented to achieve the acoustic monitoring objectives of the EHW-1 Pile Replacement Project and the Test Pile Program. The two projects have nearly identical acoustic measurement requirements. Therefore, the Acoustic Monitoring Plan was developed by the Navy taking into consideration the similar logistical (temporal), environmental (i.e. bathymetry, current speed etc.) (spatial), and security requirements. As a result, the acoustic monitoring locations and methodologies for each project are the same.

To take advantage of the allocation of resources that will be deployed in the same area and to meet logistical and security constraints that are in place within the WRA regarding the number of vessels and personnel that are allowed inside, assets deployed in this area will be used to fulfill the acoustic monitoring requirements of both projects. For instance, the hydroacoustic monitoring boat which will be inside the WRA will take "spot-recordings" for each project. Also, hydrophones and microphones recording the ambient underwater and airborne conditions present at the NBK waterfront would be utilized by both projects. However, hydrophones and microphones which are being used to record reference data for each pile will be separate for each project. For instance, each pile will have its own hydrophone recording at 10 meters from the

[1] "Proofing" is driving the pile the last few feet into the substrate to determine the capacity of the pile. The capacity during proofing is established by measuring the resistance of the pile to a hammer that has a piston with a known weight and stroke (distance the hammer rises and falls) so that the energy on top of the pile can be calculated. The blow count in "blows per inch" is measured to verify resistance, and pile compression capacities are calculated using a known formula.

source for underwater measurements and ~50 feet from the source for airborne measurements. Additionally, since the size of far-field action area for each project is expected to be similar, acoustic and protected species (i.e. marine mammals and marbled murrelet) monitors in this area will also be utilized for both projects. A monitoring coordinator will identify to the marine species monitoring team and acoustic team which hammer is operating (the hammer from the TPP or the hammer from EHW-1). This will allow each project to report separately the acoustic results specific to the piles from that project.

In considering the locations for the stationary and vessel-based hydrophones the Navy also took into account environmental factors (bathymetry, current speed, and vessel traffic, etc.) that may affect monitoring. Figure 8 shows the approximate bathymetry for Hood Canal. Due to depths, currents, and vessel transits in the Hood Canal, certain locations were not suitable for stationary hydrophone placement. Therefore, multiple vessels will be used to characterize the far-field sounds outside of the WRA from vibratory and impact pile driving. These vessels will not be stationary, but moving throughout the Hood Canal to characterize sound fields. Per security requirements, all vessels outside the WRA will remain outside the WRA for the duration of the TPP or EHW-1 project.

Far-field monitoring will occur for all pile types and installation/removal methods. We would note that even if the Navy reduces the number of platforms at some point in the project, there will always be far-field monitoring. Based on the acoustic monitoring plan the following underwater hydrophones would be on-site during the duration of the project - 10 meters for each pile, the hydroacoustic vessel inside the WRA (50-400 meters), and at minimum, one far-field hydrophone (i.e. either stationary in the middle or far side of Hood Canal or from a vessel with the capability to take recordings at various points in the far-field area).

There is one vessel proposed to be inside the WRA to measure the near-field sounds. Per security requirements, all vessels will be swept and cleared before being allowed to enter the WRA. All equipment will be inspected before being allowed to enter the WRA. The near-field vessel must remain inside the WRA for the duration of the TPP or EHW-1 Project. The vessels will not be allowed to transit in/out of the WRA daily or weekly. If the vessel inside the WRA needs to be replaced due to mechanical failure of some kind (engine, propeller etc.) the replacement vessel must be swept and cleared before entering the WRA.

All personnel associated with the acoustic, marine mammal, and marbled murrelet monitoring will follow the requirements and commands of the Officer in Charge of security for the WRA.

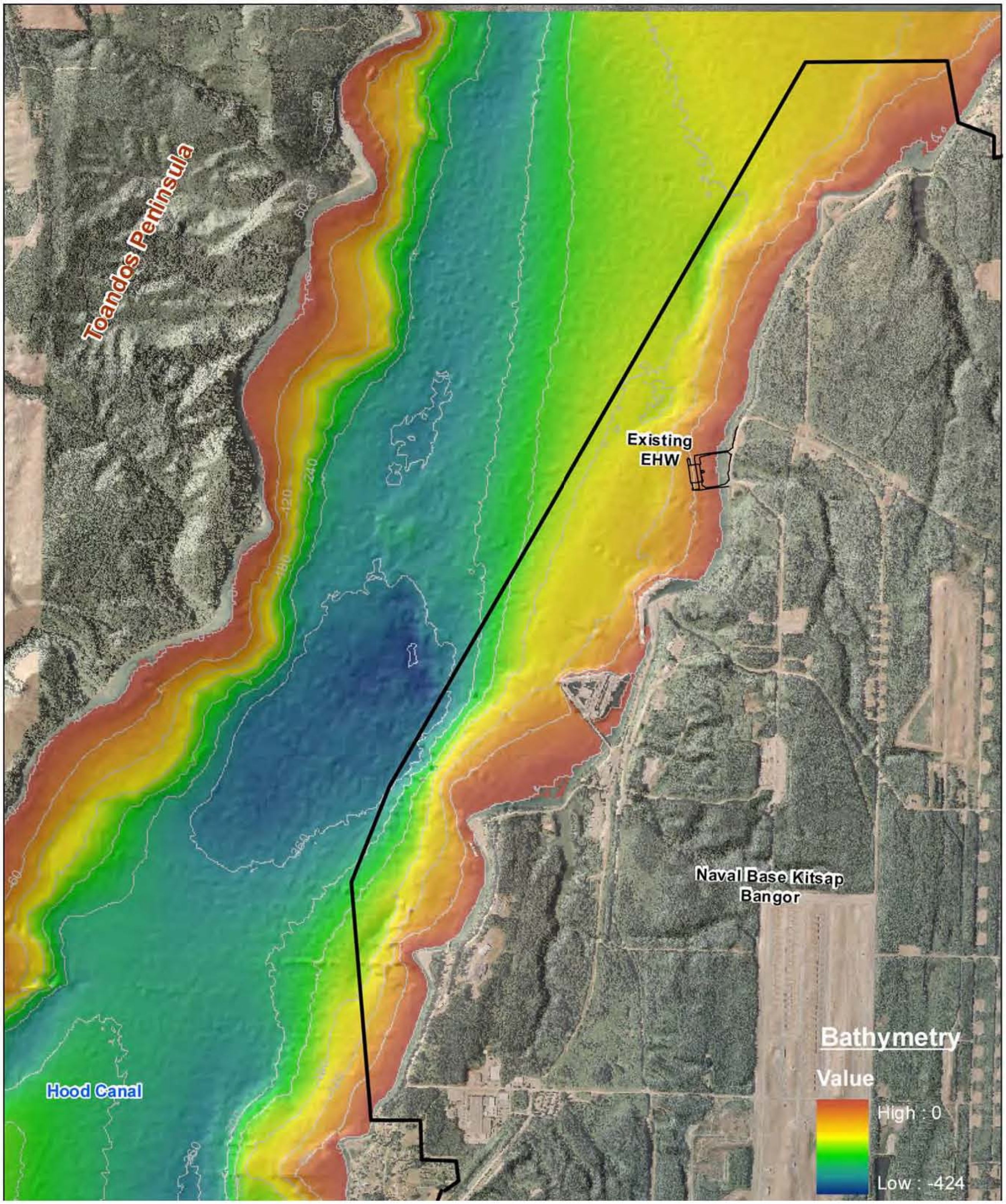


Figure 8 NBK Bangor Bathymetry and Topographic Relief

Acoustic Measurement Locations:

Hydrophones are proposed to be located in the following areas and are shown on Figure 9-Acoustic and Marine Mammal Monitoring Locations.

Stationary Hydrophones:

- A stationary 2-channel hydrophone recording system will be suspended from the pile driving barge 10 meters from the pile being driven, for each pile driven as part of either the TPP or EHW-1 Project. This data is not real-time. One hydrophone would be placed at approximately mid-depth and the other at a position closer to the bottom. Because the hydrophones would be supported from a floating platform, the depth with respect to the bottom would vary due to tidal changes and current effects. This is assumed to be a continuous recording of the pile being driven, but will be verified by contractor equipment availability. The data will be analyzed after the completion of the projects.
- Prior to monitoring, a standard depth sounder will record depth before pile driving commences and then be turned off so as not to interfere with acoustic monitoring. The hydrophone will be attached to a nylon cord or a steel chain if the current is swift enough to cause strumming of the line. The nylon cord or chain will be attached to an anchor that will keep the line 10 meters from the pile. The nylon cord or chain will be attached to a float or tied to a static line at the surface 10 meters from the pile. The distance will be measured by a tape measure, where possible, or a range-finder. There will be a direct line of acoustic transmission through the water column between the pile and the hydrophone in all cases.
- A stationary 2-channel hydrophone array will be deployed near the Toandos Peninsula at approximately 1800 – 2400 meters from the pile from an anchored floating raft (Figure 10-Toandos Floating Raft with Hydrophones). The rafts are about 4-5 feet long and tied to an anchored mooring ball. This data is not real-time. The Toandos hydrophones are assumed to be a continuous recording of the piles being driven, but will be verified by contractor equipment availability.
- One hydrophone would be placed at approximately mid-depth under neutral tide conditions (mean water depth) and the other at a position approximately 2 feet above the bottom during low tide. Because the Toandos hydrophones would be supported from a floating platform, the depth with respect to the bottom would vary due to tidal changes and current effects.
- The hydrophones include a 35 foot to 100 foot signal line. The Sound Level Meters (SLMs) log the data and it is it downloaded after the event. They also include recorders so the event is recorded for subsequent analysis.
- The Toandos raft and anchor point would be marked with a visible buoy and any necessary lighting. The raft would be equipped with a weatherproof, water resistant instrument case that houses a digital recording device, power supply, and charge converter. Two hydrophones would be strung from the raft and connected to a weighted signal line. The purpose for two depths would be to provide an indication of differences in ambient and pile driving sound near the bottom and at approximately mid-depth.

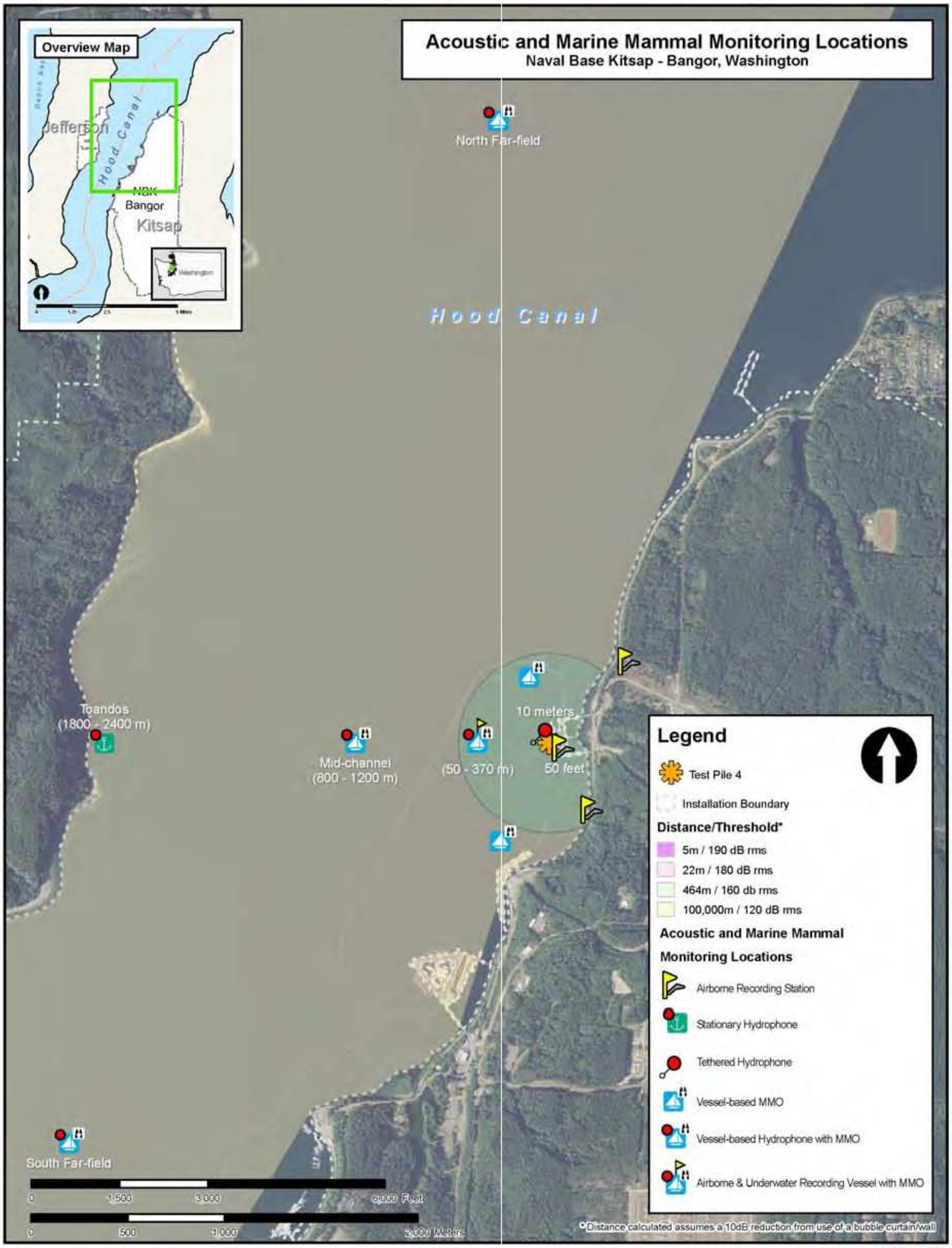
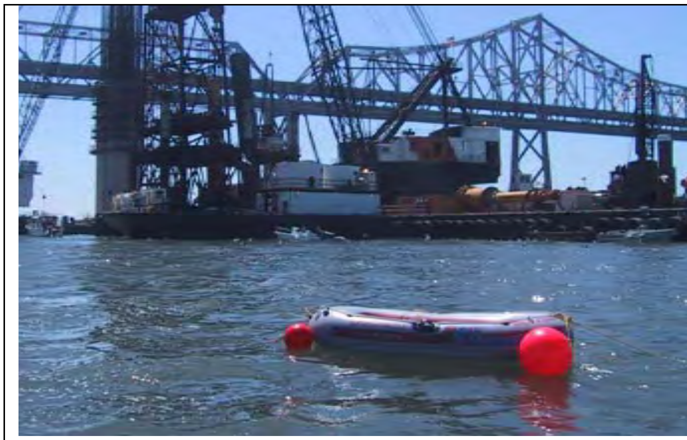
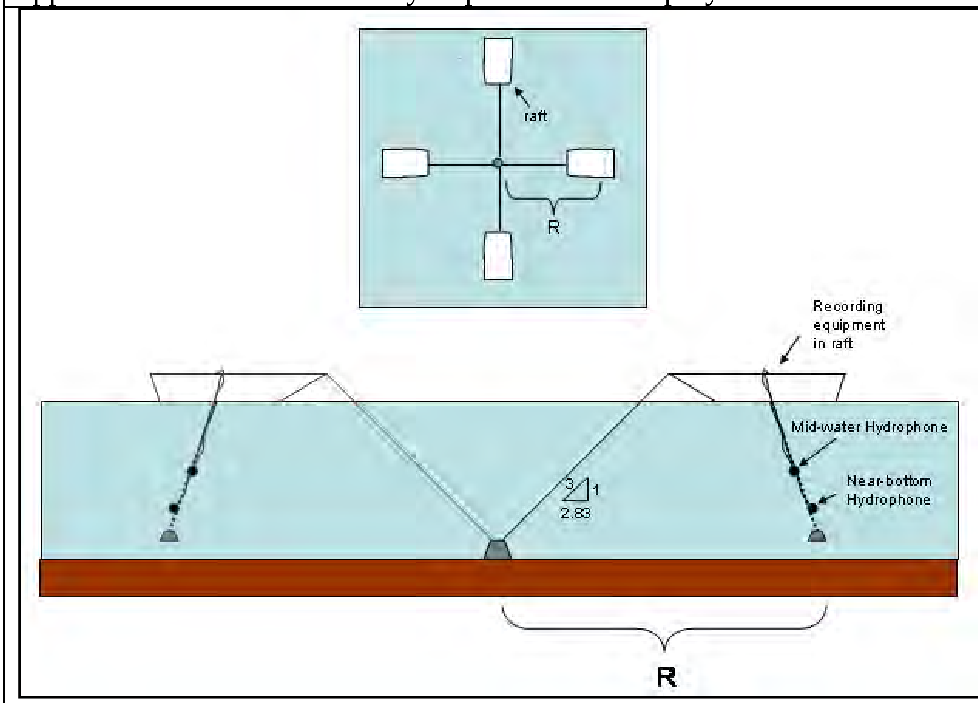


Figure 9 Acoustic and Marine Mammal Monitoring Locations



A raft deployed in a busy work area of San Francisco Bay where current speeds approached two knots. Two hydrophones were deployed from this raft.



Schematic of raft deployment, showing the range of positioning due to current effects

Figure 10 Toandos Floating Raft with Hydrophones

- Noise effects on the all hydrophones (stationary and vessel based) will influence the measurement noise floor. The primary noise effects will be flow noise and cable strumming during stronger tidal currents. Both of these effects will be minimal around slack tide periods that would occur for about 2 hours, four times per day. Flow noise cannot be reduced or eliminated and the effect will be dependent on the strength of the current and the strength of ambient sounds. Strumming sounds will be reduced by minimizing signal cable tension (i.e. attaching the signal lines to a separately weighted line) and isolating the signal cables from direct contact with the current.
- The hydrophone calibration will be checked at the beginning of each day of monitoring activity.

Stationary Microphones:

- For each pile being driven as part of either the TPP or EHW-1 project, a stationary microphone will be located on the pile driving barge at ~50 feet from the pile being driven to record airborne measurements. This data is not real-time. It will be recorded and analyzed after the completion of the projects. The microphone will be located so that there is a direct line of acoustic transmission through the air between the microphone and the pile in all cases.
- Two land-based microphones are proposed to measure the airborne sound levels north and south of the project area. The locations shown on Figure 9 are approximate and will be determined by ease of access (terrain restrictions and presence of a road) and security permission.
- The microphones will be calibrated at the beginning of each day of monitoring activity.

Vessel-based Hydrophones:

- One acoustic vessel with a 2-channel hydrophone array will be inside the WRA to monitor near-field and real-time isopleths for marine mammals, fish, and marbled murrelets.
- The SLMs provide real time output, but they provide an estimate of pulse RMS because they would be based on a fixed time constant whereas the marine mammal RMS for pulses (impact pile strikes) is based on the duration of the pulse, which is usually 50 – 70 milliseconds and the impulse setting of the SLM is 35 milliseconds. So the SLM would slightly overestimate the pulse RMS.
- For vibratory sounds, the SLMs can measure in real time because the sounds are continuous and are not sensitive to the time constant.
- This vessel will also have an airborne microphone for recording airborne sounds. This vessel must remain inside the WRA and will be moored inside the WRA in the evenings, possibly tied up to the pile driving barge (mooring still to be determined).
- Three acoustic vessels all proposed to deploy a 2-channel hydrophone array will be used outside the WRA to collect data on the far-field sound levels (the 120 dB zone). These are currently proposed to be in real-time, subject to equipment availability. These vessels must remain outside the WRA for the duration of the project and must be moored outside of the WRA in the evenings. After the first few weeks of the project (when the majority of the testing will occur for the TPP), two of these vessels will no longer be needed. In the first few weeks of the TPP, these vessels will be used to identify where the 120 isopleth is located. Once that task has been accomplished, they will be removed from the project effort.
- During all vessel-based recordings (inside or outside the WRA), the engine and any depth or fish finders must be off. The vessel goes temporary silent and is drifting. The spot recordings will be made and the hydrophone pulled back on board the vessel. Then the vessel will move to another location. The continuous noise recordings of the piles will occur from the 10 meter stationary hydrophone and the Toandos recorder. All other vessel-based hydrophones are "spot-recordings." The duration of the spot recordings will determined by the acoustician in the field and based on current site conditions and type of pile driving activity occurring.

Measures to Meet Objectives:

1. **Empirically verify the modeled injury and behavioral disturbance zones.**
    a. Underwater sound pressure levels would be continuously monitored during the entire duration of each pile being driven from at least one hydrophone location.
    b. Most sound pressure levels will be monitored in real time. Some data will be collected and analyzed after the project is completed. For example the stationary hydrophones at 10 m and the stationary hydrophones at Toandoes will not be real-time.
    c. Sound levels will be measured in Pascals, which are easily converted to decibel units (e.g. 1000 Pascals = 180 dB).
    d. Monitoring equipment will be set to a minimum frequency range of 10 Hz to 20 KHz and a minimum sampling rate of 44,000 Hz. To facilitate further analysis of data, the underwater signal will be recorded as a text file (.txt) or other compatible format (e.g., .xls).
    e. Underwater acoustic measurements will be coordinated with the Pile Driving Engineer on the barge to be certain that the acousticians are aware of when the pile driving will be initiated and when it is completed. This is especially important for the far-field locations that will not be within line-of-site of the pile driving barge and will not be able to see flags being raised for initiation or cessation of pile driving. Coordination will be with radios and cell phones for far-field locations and with radios, cell phones, and flags for near-field measurements.
    f. During vibratory pile driving the far-field vessels will begin “searching” for the actual 120 dB isopleths at approximately 3 kilometers. They will adjust their position (closer/farther) from the pile location based on the real-time measurements. The 120 dB isopleth is expected to be miles closer than the result modeled.

2. **To collect airborne and underwater ambient measurements.** Ambient conditions, both airborne and underwater, would be measured at the project site in the absence of construction activities to determine background sound levels.
    a. Underwater ambient levels are intended to be recorded over the frequency range from 10 Hz to 20 kHz. Ambient conditions will be recorded for one minute every hour of the work day, for one week of each month of the TPP.
    b. Measurements will be taken at varying distances from the source (i.e., pile).
    c. Airborne levels would also be recorded as unweighted and A-weighted and reported in both. Airborne sounds will be recorded over the entire work day. In addition, USFWS requested that airborne sound be taken in such a way to determine the SEL, Leq, and Lmax. The plan is to measure the Leq over 1 minute intervals so we can provide the Leq for the driving event (e.g. 5 -15 min). This is for vibratory and impact pile driving. So if it takes 5 minutes, then we will have a 5 min Leq. If it takes 15 min, then we’ll have a 15 min Leq. SEL: The sound descriptor SEL represents the sound in an event or all the accumulated energy for an event, like a dose. The event could be a single pile strike, a pile driving event,

a period of time, etc. Unless directed otherwise, the Navy will provide the SEL for the driving of a pile (impact or vibratory).

d. These measurements will begin at the standard airborne distance of 50 feet from the source (first measurement on the pile driving barge) and extend outward in 50 foot increments as possible. For areas over the water, the acoustic vessel (which will have a microphone on board) will attempt to collect measurements as close to the 50 foot intervals as possible.
e. The land-based microphones currently proposed north and south of the existing EHW-1 will also collect information necessary to characterize the airborne sound fields and determine the distances to the marine mammal and marbled murrelet isopleths.

3. **To determine the underwater spreading loss occurring at the project location**.
    a. Three vessels outside the WRA will be used to collect measurements on the far-field locations. Data will be collected in such a way as to report the levels in peak, rms, and SEL and determine if 15 log is appropriate in this area or if a higher or lower transmission loss constant is applicable.
    b. In addition to the vessels which will be moving throughout the Action Area trying to determine the distance to the 120 dB threshold, the stationary hydrophone at Toandos Peninsula will provide information necessary to determine if sound levels are above or below the behavioral threshold for fish. Certain nearshore areas along Toandos Peninsula are considered critical habitat for certain fish species. As such, this data station will provide information on whether or not critical habitat and nearshore areas are receiving sounds at or below the disturbance threshold for fish. Injury levels are not expected in this nearshore area along Toandos Peninsula.

4. **To measure the sound pressure levels produced bythe use of the soft start technique to test the effectiveness of this method at reducing the sound levels during the initial stages of driving a pile**.
    a. Underwater acoustic measurements will be coordinated with the Pile Driving Engineer on the barge to be certain that the acousticians are aware of when the pile driving will be initiated so they may record the soft start sounds. This will be implemented using a radio, cell phone, and green and red flags. The pile driving engineer will wait until they have received confirmation from the acousticians that the recordings are ready to begin before the Engineer commences the soft start. The Engineer will notify the acousticians when the soft start is complete.

5. **To determine the relative effectiveness of the sound attenuation system(s) (such as a bubble curtain) to verify noise reduction underwater as part of the Test Pile Program.**
    a. While all pile driving with different sound attenuation systems will be recorded, it will not be possible to determine the 10 dB reduction modeled unless the sound attenuation system (eg. bubble curtain) is turned off temporarily. The Navy is in consultation with USFWS regarding the specifics of this test, the current proposal is to turn the sound attenuation device off for one minute, for up to 7 piles

towards the end of pile driving for each pile. The sound produced during successive strikes at the end of pile driving are expected to be most consistent and are also likely to be the highest sound levels produced during impact pile driving since resistance to driving will be greatest when the pile is close to its embedment depth.

6. **To test the effectiveness of using a sound attenuation system with a vibratory hammer as part of the Test Pile Program.**
    a. This will be tested during the driving of three vibratory piles (one of each size). The sound attenuation system proposed for this test is a bubble curtain, but other technologies may be tested as well if possible.

Additional Considerations:

Timing and Consolidation of Testing Objectives:

In order to reduce environmental impacts to wildlife from impact pile driving, as well as to create efficiencies in the TPP schedule and maximize use of assets to reduce cost, the Navy will try to do all pile testing without an impact hammer during the first several weeks of the TPP in late July and early August. This will allow unattenuated impact pile driving (testing only) to occur when the fewest marbled murrelets are expected to be present in the action area. The testing of the soft-start, sound attenuation device efficiency during vibratory pile driving of all pile sizes, and the sound attenuation system on and off during impact pile driving will all occur in the initial weeks of the TPP. The acoustic team and marine mammal team will work cooperatively to identify and monitor the isopleths. Once the actual in-site measurements have been made in the initial weeks and the isopleths zones identified, the measurement and monitoring effort will be adaptively managed accordingly. It is expected that two far-field acoustic vessels will not be necessary past the initial first 3 weeks. One acoustic vessel will remain in Hood Canal and serve as a MMO platform. The raft at Toandos may remain for the duration of the project if it is found to be collecting useful data from that location (approximately 2 miles away from the project site). The Toandos hydrophone is not real-time. The hydrophone string located 10 meters from the pile being driven will remain on site and record data from each pile. This hydrophone is also not real-time.

Baseline Environmental and Construction Equipment Data:

Prior to and during the pile driving activity, environmental data will be gathered, such as wind speed and direction, air temperature, humidity, surface water temperature, water depth, wave height, weather conditions, and other factors that could contribute to influencing the underwater sound levels (e.g., aircraft, boats, etc.). Start and stop time of each pile-driving event will be recorded. The start and stop time at which the sound attenuation device is turned on and off will be recorded, if this is approved by USFWS.

The contractor will supply the acoustics specialist with the substrate composition, hammer model and size, hammer energy settings and any changes to those settings during the piles being monitored, depth pile driven, blows per foot for the piles monitored, and total number of strikes to drive each pile that is monitored.

Equipment:

Table 3 details the equipment that will be used to monitor underwater and airborne sound pressure levels. All applicable equipment will have National Institute of Standards and Technology (NIST) traceable calibration.

Table 3
Equipment for Acoustic Sound Monitoring

Item	Specifications	Quantity	Description	Usage
Hydrophone with 35 to 100 feet of cable	Reson Model TC-4013 with Receiving Sensitivity- 211dB ±3dB re 1V/µPa or Reson Model TC-4033 with –Sensitivity 203 dB re V/µPa	8	 TC-4013  TC-4033	Capture underwater sound pressures and convert to voltages that can be recorded/analyzed by other equipment.
Signal Conditioning Amplifier	PCB Model 422E13 charge converter Amplifier Gain- 0.1 mV/pC to 10 V/pC Transducer Sensitivity Range- 10^{-12} to 10^{3} C/MU	8		Adjust signals from hydrophone to levels compatible with recording equipment.
Multi-gain signal conditioner	PCB Model 480M122 battery-powered signal conditioning (multi-gain)	8		

Item	Specifications	Quantity	Description	Usage
Portable Digital Audio Recorder (2-channel)	Sampling Rate- 44K Hz or greater	4	 Several models available with similar specifications	Records audio signals received by hydrophone.
SLM Battery Power	9-volt batteries	34	9-volt small batteries (e.g., Duracell)	Provides power to Multi-gain signal conditioner (3 each) and SLM (1 each)
Digital Audio Recorder Battery power	12-volt gel-cell battery 2.5 to 25 amp-hour	4	12-volt portable battery	Provides power to digital audio recorders
Digital Audio Recorder Battery power	2.5-volt batteries	20	Provides internal battery to digital audio recorders	Internal battery
Weather-proof enclosure	Pelican case to protect from water and weather	4	Pelican case approximately 20-inches L x 18 inches W, 8 inches D	Houses underwater data acquisition, storage and power equipment
Microphone (free field type)	Range- 30 – 120 dBA Sensitivity- -29 dB ± 3 dB (0 dB = 1 V/Pa)	1	Connected to Sound Level Meter	Monitoring airborne sounds from pile driving activities (if not raining).
ANSI Type 1 Sound Level Meter or Laptop computer	Compatible with digital analyzer	1	Equipped with ½-inch diameter microphone described above	Measures received acoustic signals and outputs analog audio signal to digital audio recorder

Item	Specifications	Quantity	Description	Usage
Calibrator (pistonphone-type)	Accuracy- IEC 942 (1988) Class 1	1		Calibration check of hydrophone and microphone in the field. Includes hydrophone and microphone calibrator coupler
Weighted line/chain marked in 5-foot increments to attach hydrophone and anchoring weights.	-	1		Takes the strain off of the hydrophone cables preventing damage.
Various surface floats.	Buoys and raft for each unattended measurement position	Up to 3		To keep the hydrophone at the appropriate position. Raft is attached to anchored bouy and equipped with hydrophone kit..

<table>
<tr><th>Item</th><th>Specifications</th><th>Quantity</th><th>Description</th><th>Usage</th></tr>
<tr><td colspan="3">
</td><td colspan="2"></td></tr>
<tr><td colspan="3">2-channel system showing SLMs, Multi-gain amplifiers, 12-volt battery and headphones</td><td colspan="2">Hydrophones used to measure underwater sounds</td></tr>
</table>

SIGNAL PROCESSING

Post-analysis of the sound level signals will include determination of the maximum absolute value of the instantaneous pressure within each strike, Root Mean Square (RMS) value for each pile strike, mean and standard deviation/error of the RMS for all pile strikes of each pile, rise time, number of strikes per pile and per day, number of strikes exceeding 206 dB_{peak}, number or percent of individual strikes exceeding 183 dB Sound Exposure Level (SEL) and 187 dB SEL, SEL of the pile strike with the maximum absolute peak sound pressure, mean SEL, and cumulative SEL (cumulative SEL = single strike SEL + 10*log (# hammer strikes)) and a frequency spectrum both with and without mitigation (if approved), between a minimum of 10 and 20,000 Hz for up to eight successive strikes with similar sound levels. Calculation methodology is provided in Appendix A. When possible the single strike SEL for each hammer strike will be estimated and then these values will be accumulated for the cumulative SEL value (See Appendix A).

ANALYSIS

Analysis of the data from the San Francisco-Oakland Bay Bridge Pile Driving Demonstration project indicated that 90 percent of the acoustic energy for most pile driving impulses occurred over a 50- to 100-millisecond period with most of the energy concentrated in the first 30 to 50 milliseconds (Illingworth and Rodkin, Inc. 2001). The RMS values computed for this project will be computed over the duration between where 5 percent and 95 percent of the energy of the pulse occurs. Cumulative energy levels and SEL will be calculated from the data between 5 and 95 percent of the energy of the individual pulse. The SEL energy plot will assist in interpretation of the single-strike waveform. The single-strike SEL, along with the total number of strikes per pile and per day, will be used to calculate the cumulative SEL for each pile and each 24-hour period.

In addition a waveform analysis of the individual absolute peak pile strikes will be performed to determine any changes to the waveform with the sound attenuation devices. A comparison of the frequency content with and without noise attenuation will be conducted (if approved). Units of underwater sound pressure levels will be dB re: 1 micropascal and units of SEL will be re: 1 $micropascal^2 sec$.

An analysis of the change in the waveform and sound levels with and without the sound attenuation device (if approved) will be conducted.

REPORTING

A draft report, including data collected and summarized from all phases, will be submitted to the Navy, USFWS, and NMFS within 60 days of the completion of hydroacoustic monitoring. The results will be summarized in graphical form and include summary statistics and time histories of impact sound values for each pile. A final report will be prepared and submitted to the Navy, USFWS, and NMFS within 30 days following receipt of comments on the draft report from the Navy. A daily email report will be sent to USFWS and NMFS on days when impact pile driving occurs. The preliminary "real-time" results of where the isopleths were located will be provided to the Services for the days when impact pile driving occurs. If there are any "showstoppers" then the Navy will call USFWS and NMFS immediately.

The final report will include:

- Size and type of piles;
- A detailed description of the sound attenuation devices used, including design specifications for the bubble curtains (or other devices used during TPP);
- The impact or vibratory hammer force (energy rating) used to drive or extract the piles, and the make and model of the hammer;
- Description of the sound monitoring equipment;
- Distance between hydrophones and pile;
- Depth of the hydrophones and depth of water at hydrophone locations;
- Distance from the pile to the water's edge;
- Depth of water in which the pile was driven;
- Depth into the substrate that the pile was driven;
- Physical characteristics of the bottom substrate into which the piles were driven;
- The total number of strikes to drive each pile and for all piles driven during a 24-hour period;
- Total number of strikes to drive each pile that is monitored;
- Ranges and means for peak, RMS, and SELs for each pile;
- Ambient underwater sound pressure level(s) reported in RMS;
- The results of the airborne noise measurements including the dBA, unweighted, Lmax, Leq, and SEL. Airborne acoustical data will be provided in 1/3 octave bands in the frequency range of 10 and 20 kHz;
- Results of the acoustic measurements, including the frequency spectrum, ranges and means including standard deviation/error for peak and RMS SPLs, single-strike and cumulative SEL for both projects for pile installation and pile removal;
- The report will provide underwater acoustical data between 10 Hz and 20 kHz in 1/3 octave bands and by depth of hydrophone as possible;
- Results of the monitoring with and without the attenuation system for impact and vibratory testing (TPP only), as well as a comparison of sound pressure levels recorded during the use of a soft start when the hammer is operating at reduced capacity versus sound pressure levels recorded when the hammer is operating at normal capacity to determine the amount of sound pressure level reduction from this mitigation measure;
- An estimation of the number of strikes that exceeded the cumulative SEL threshold and an estimation of the distance at which the peak and cumulative SEL values reach the respective thresholds and the distance at which the RMS values reach the relevant marine life thresholds and background sound levels;
- Vibratory monitoring results will include the maximum and overall average RMS calculated from 30-second RMS values during the drive of the pile;
- Description of any observable marine mammal, fish, or bird behavior in the immediate area and, if possible, correlation to underwater sound levels occurring at that time.

REFERENCES

Illingworth & Rodkin, Inc. 2001. Final Data Report: Noise and Vibration Measurements Associated with the Pile Demonstration Project for the San Francisco-Oakland Bay Bridge East Span. August 2001.

APPENDIX A

Calculation of Cumulative SEL

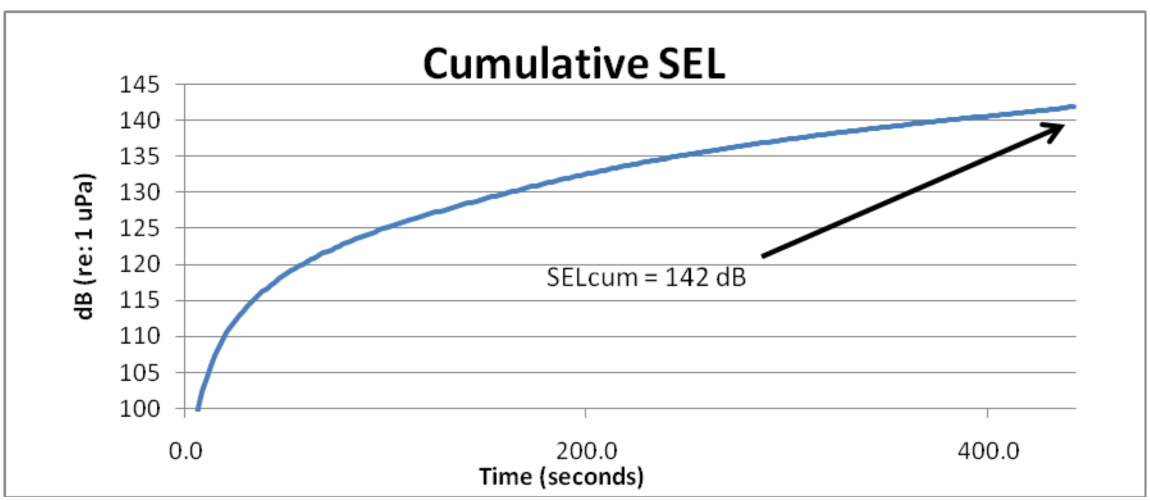
An estimation of individual SEL values can be calculated for each pile strike by calculating a 1-second Leq for each individual pile strike. As can be seen in equation 1 below the SEL is essentially a subset of the LEQ function. When the time interval for the Leq is set to one second it is equal to the SEL. The accumulated SEL values produced by calculating a 1 second Leq for each pile strike can then be accumulated for each pile strike.

Calculating a cumulative SEL from individual SEL values cannot be accomplished simply by adding each SEL decibel level arithmetically. Because these values are logarithms they must be added logarithmically. Perhaps the easiest method for adding decibels logarithmically

$$L_{eq,T} = 10\lg\left(\frac{1}{T}\int_0^T \frac{p^2(t)}{p_0^{\ 2}}dt\right) \quad dB \qquad = \qquad SEL = 10\lg\left(\int_{-\infty}^{\infty} \frac{p^2(t)}{p_0^{\ 2}}dt\right) \quad dB \qquad \text{(eq. 1)}$$

Calculating a cumulative SEL from individual SEL values cannot be accomplished simply by adding each SEL decibel level arithmetically. Because these values are logarithms they must first be converted to antilogs and then accumulated. Perhaps the easiest method for this is to divide each SEL decibel level by 10 and then take the antilog. This will convert the decibels to units of microPascals. Paste these values into a spreadsheet and then sort from smallest to largest value. In a separate column starting with the second row of these values add this value to the one above it and then repeat this process to the last row of data. The last value in this column is the cumulative SEL in units of microPascals squared second. Next convert the microPascal values to dBSEL by dividing each value by the total number of values and calculating the log base 10 of each of these values, then multiply by 20 to get dBSEL.

It is recommended that you also plot these values on a cumulative plot such as the one below.

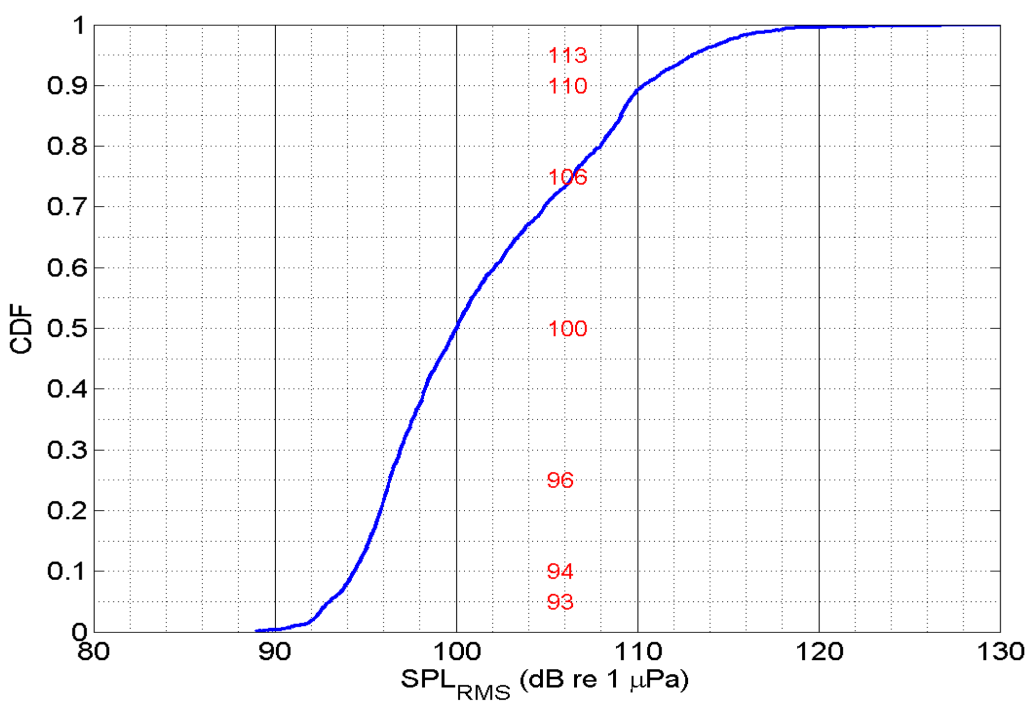


APPENDIX B

Calculation of a Cumulative Distribution Function and Plot for Background Sound Level Analysis

Data from three full 24-hour cycles (minimum) are used to calculate a 30-second Root Mean Square (RMS) value for each 30-second period for the entire dataset. The RMS should be calculated for both the full frequency range recorded as well as a separate dataset which has been passed through a high pass filter thus eliminating those frequencies below 1000 Hz. These datasets are then grouped into 24-hour periods. To determine if the data is approximately log-normal in distribution, each 24-hour period is plotted as a Probability Density Function (PDF). Each 24-hour period can be plotted on the same PDF plot. The plots should be approximately log normal in distribution and thus can be used in the further analysis. Each day of data should have an approximately Gaussian sigmoid shape, the differences between them and the ideal might be hard to spot, but the sigmoid from day to day will show noticeable variation. Data which does not approximate a log normal distribution should be excluded from further analysis.

The Cumulative Distribution Function (CDF) plot is obtained by plotting the normalized cumulative sum vs. the bin location. You can also get the PDF from plotting the normalized bin count vs. the bin location. The normalized bin count is obtained by dividing the count column by (number of data points multiplied by the space between 2 consecutive bins). This provides the integral of the PDF equal to 1. See: http://www.vertex42.com/ExcelArticles/mc/Histogram.html



APPENDIX E

AIR BUBBLE MITIGATION SYSTEM

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APPENDIX E

Air Bubble Curtain Underwater Sound Mitigation System

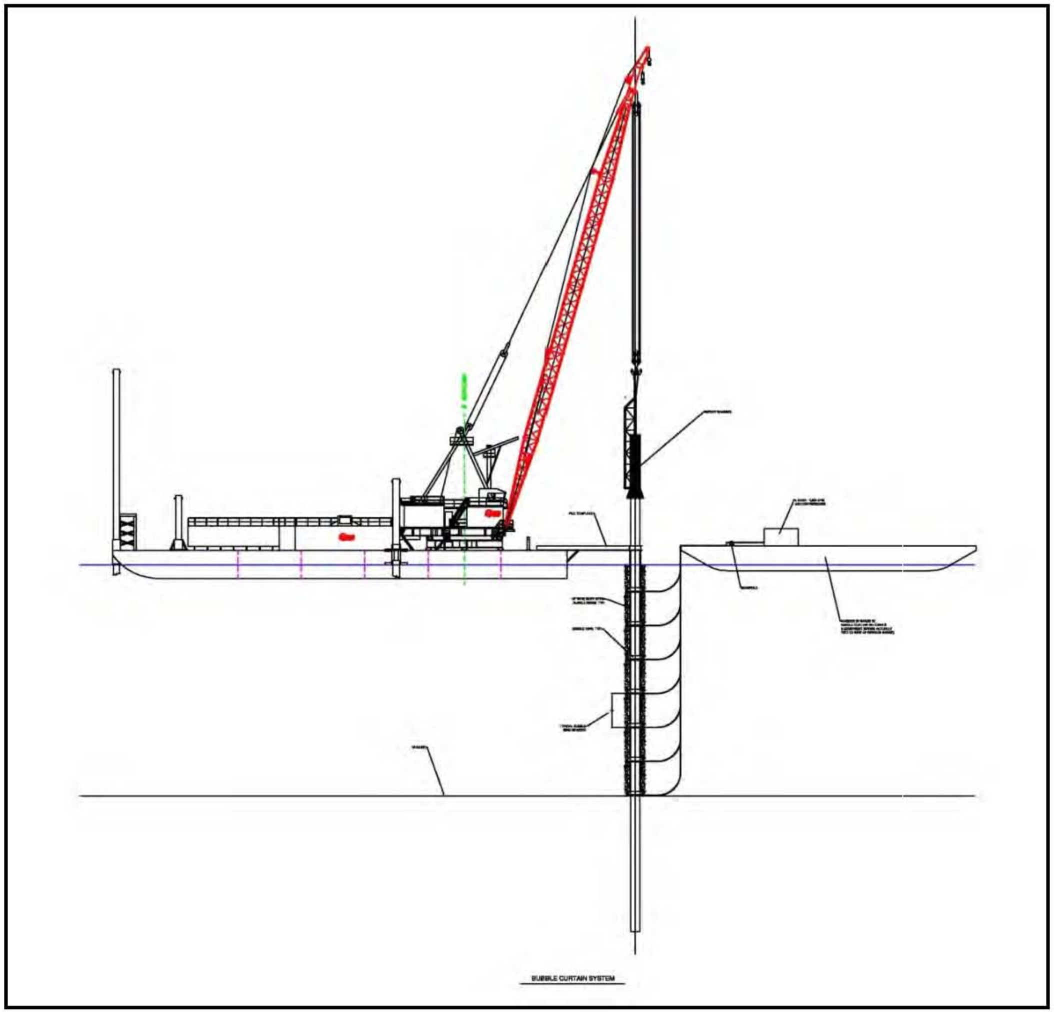

Figure E-1. Bubble Curtain Design

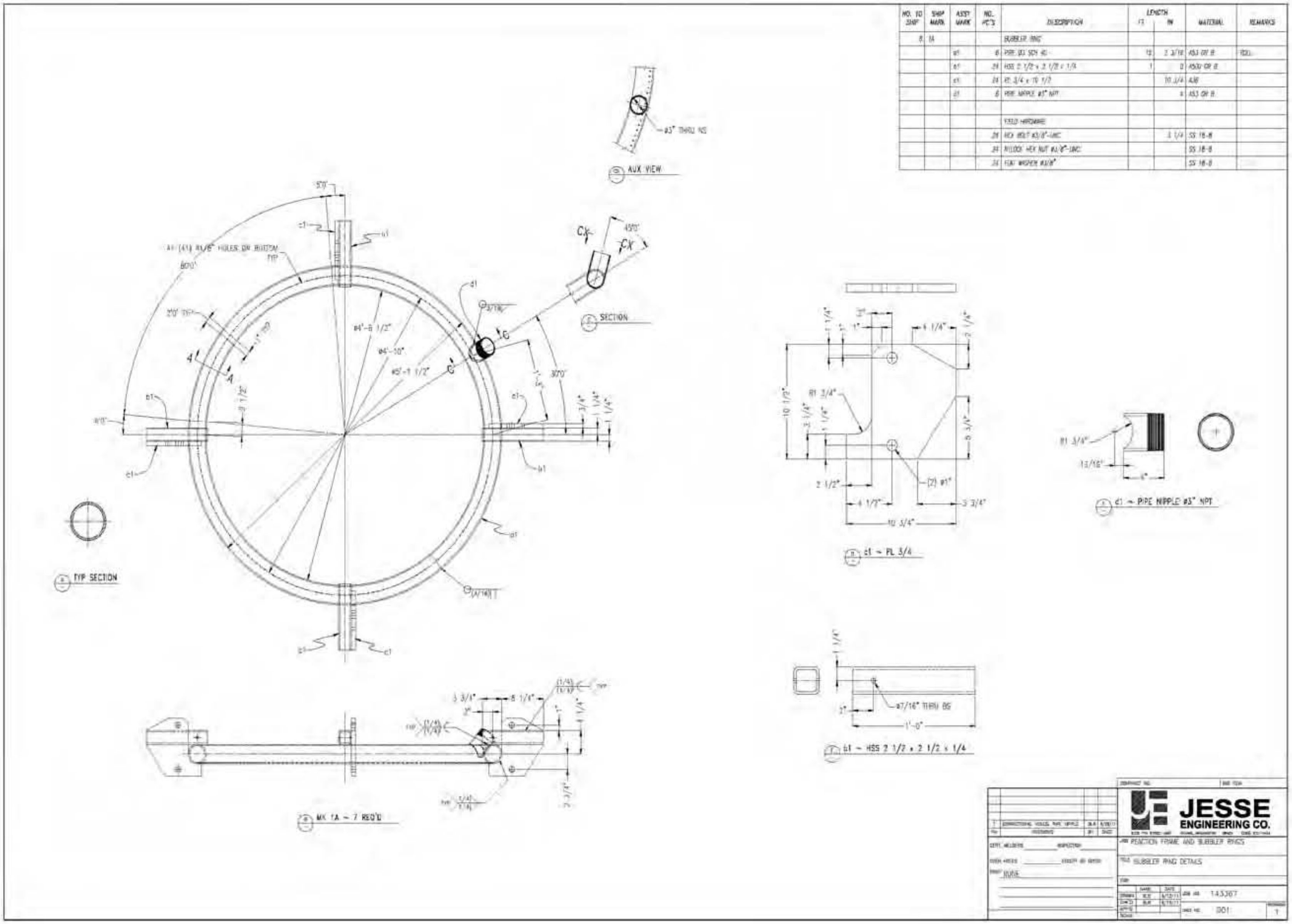

Figure E-2. Bubble Curtain Shop Drawings

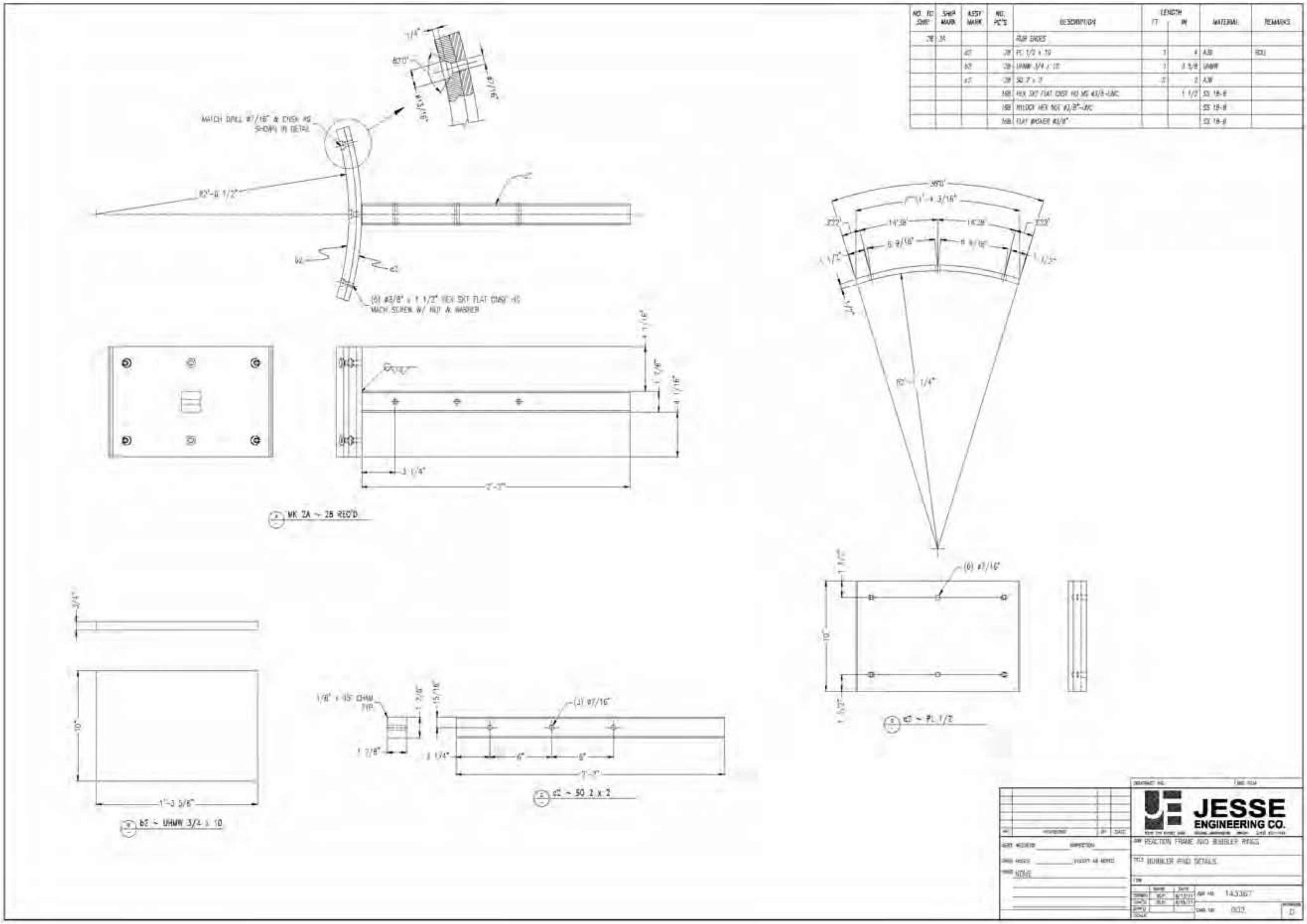

Figure E-2. Bubble Curtain Shop Drawings (continued)

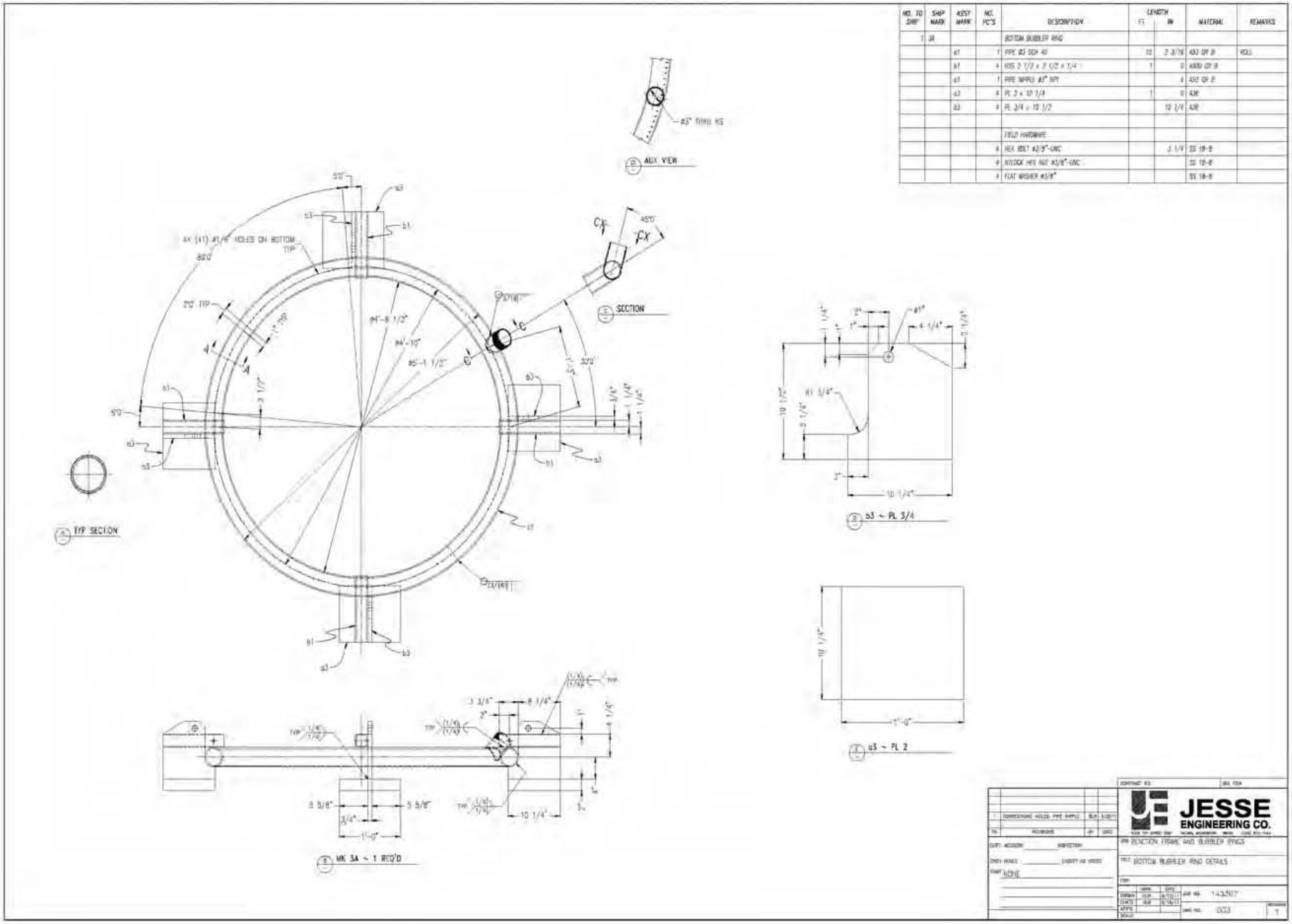

Figure E-2. Bubble Curtain Shop Drawings (continued)