

March 15, 2010

TO: John Callahan
Rick Huey

FROM: Jim Laughlin
(206) 440-4643

SUBJECT: REVISED Friday Harbor Vibratory Pile Monitoring Technical Memorandum.

Underwater Noise Levels

This memo summarizes the revised vibratory pile driving results measured at the Friday Harbor Ferry Terminal in January 2005. This memo supercedes the previous memo and updates the analysis to be in line with the current methodology so that the vibratory information is comparable with data from other terminals. Data was collected during vibratory pile driving at the Friday Harbor Ferry Terminal facility on during the month of January 2005.

One 24-inch diameter steel piles was monitored as it was driven into the substrate with an APE vibratory hammer. No frequency weighting (*e.g.*, A-weighting or C-weighting) was applied to the underwater acoustic measurements presented in this report. Underwater sound levels quoted in this report are given in decibels relative to the standard underwater acoustic reference pressure of 1 microPa.

Continuous sounds occur for extended periods and are associated with the use of a vibratory hammer. Continuous sounds may disturb whales when they exceed a criterion level of 120 dB RMS, according to current NMFS standards. Therefore, the 120 dB RMS criterion has been adopted in the present analysis.

Near Field Measurements

- Near field measurement were taken within 10 meters of the pile.
- Table 1 summarizes the results of the near field measurement locations for the pile monitored.
- No noise mitigation was utilized as part of these vibratory measurements.
- Broadband Root Mean Square (RMS) noise levels are reported in terms of the 30-second average continuous sound level and have been computed from the Fourier transform of pressure waveforms in 30-second time intervals.
- Average and highest RMS value measured is 162 dB RMS at the near field location.

Table 1: Summary Table of Underwater Monitoring Results at the Near Field Location.

Pile #	Hydrophone Depth	Distance To Pile (meters)	Absolute Peak (dB)	Average RMS Value (dB)
1	8.5 feet (midwater)	10	171	162

The results of Table 1 show the average RMS value of 162 dB RMS in the near field measurement for Pile 1. Average RMS values are appropriate for continuous sounds generated during vibratory driving.

Conclusions

Near field measurements were taken at the Friday Harbor Ferry terminal during vibratory pile driving. RMS values measured at the near field location were lower than previously reported because the methodology for analyzing non-impact continuous sound levels for vibratory driving had not yet been worked out until recently. The previous measurement reported for Friday Harbor ferry terminal was 177 dB RMS. When the Friday Harbor data is analyzed using the same methodology as the other subsequent terminals data for vibratory driving the results indicate that the new measurement is an average and overall peak of 162 dB RMS. This difference could be due to improvements in the windowing methods for RMS values since the initial measurement were taken.

If you have any questions please call me at (206) 440-4643.

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Attachments

cc: day file
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Pile 1 - Vibratory Hammer

Figure a. Waveform

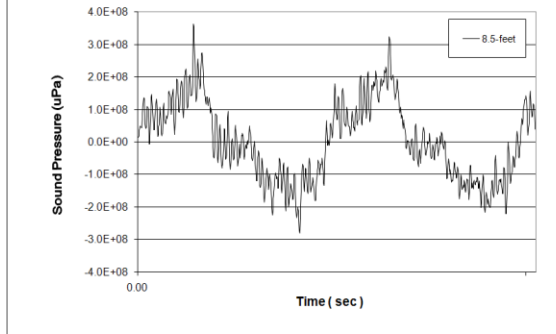


Figure b. Narrow Band Frequency Spectra

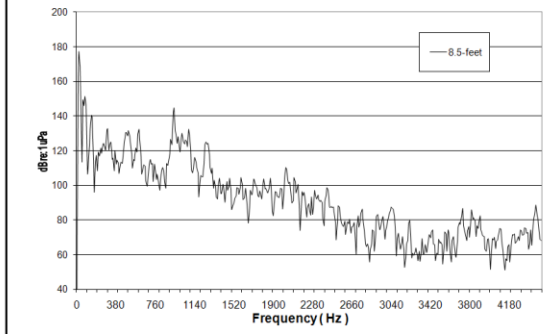


Figure c. Accumulation of Sound Energy

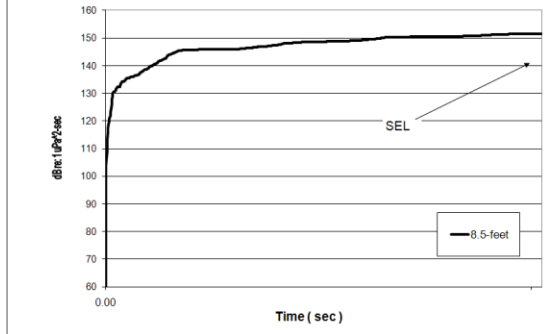


Figure d. Sound Pressure and Sound Energy Levels

Signal Analysis Sound Pressure / Energy Levels			
30 feet - 00:00:00	Peak	RMS _{90%} *	SEL
8.5-feet	171	162	152
11/4/2009			
*Impulse averaged over 90% of accumulated energy (5% to 95%)			