Seismic noise monitoring and analysis were conducted as part of a study to evaluate the feasibility of building a new linear collider in northern Illinois, in close proximity to the Fermi National Accelerator Laboratory, just west of Chicago. The Seismic Analysis Code 2000 (SAC2000), free to IRIS members, was used to process data recorded at the Northern Illinois University seismic station, earthquake records downloaded from the IRIS Data Management Center via WILBERII, and data recorded by an engineering seismograph with high-frequency geophones. Power-spectral density estimates were computed from an autocorrelation series in most cases. Using the power density spectra routine of SAC2000, selecting autocorrelation windows of 20 s for the low-frequency data and 2 s for the high-frequency data, we have found distinctive seismic noise peaks among the different sites, regardless of the background noise level (e.g., Figure 1). Low-frequency waveform data typically shows microseism peaks at a frequency of 0.05-0.2 Hz for stations located in the Midwestern U.S. Microseism peak frequency did not decrease with increasing distance from Lake Michigan, suggesting the lake is not the primary source of the microseisms, which may be generated in ocean basins. To investigate local ground motion in more detail, noise from trains, traffic, air-conditioning units and water pumping equipment were recorded with an engineering seismograph in DeKalb, Illinois, using both vertical and horizontal geophones. These data were also analyzed using SAC2000. Train noise exhibits strong peaks in the 3-10 Hz range, both for the vertical and horizontal geophones. Spectra of recordings made near a water treatment plant in DeKalb showed peaks near 10, 30, 90, and 110 Hz, probably related to pumping and mechanical equipment (Figure 2). Seismic noise collected about 100 m from a municipal swimming pool with vertical geophones showed spectral peaks at about 10-30 Hz and 180 Hz. Horizontal geophones at the same location exhibited peaks at 5-15 Hz and 140 Hz. Pool activities, pumping equipment and traffic may contribute to this noise. Delineating particle motion at the recording sites will determine whether dominant motion is due to Rayleigh, Love or body waves. Two-dimensional geophone arrays will also be deployed in the future to determine the origin direction and velocity of each seismic noise component.

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