B. LAING ASSOCIATES
ENVIRONMENTAL CONSULTING
www.blaingassociates.com
103 Fort Salonga Road - Suite 5 Fort Salonga, NY 11768
(631) 261-7170, Fax: (631) 261-7454

June 9, 2022

Dana Levenberg, Town Supervisor
Supervisor's Office, Town of Ossining
Town of Ossining
16 Croton Ave. 3rd Floor
Ossining, NY 10562

Sent via: dlevenberg@townofossining.com

Re: Town of Ossining, Westchester County
Metro North Noise Data Preliminary Assessment

Dear Supervisor Levenberg,

Thank you for your patience in regard to this preliminary noise data assessment. It has taken a good amount of effort between our team and the MTA's Environmental Services team to transfer the large amount of data that was taken during the March 2nd to March 9th noise monitoring effort. In any case, our initial efforts were spent analyzing the data that was presented in the MTA Construction & Development Memorandum that was released to us dated April 27, 2022.

As a recap, the MTA Environmental Services (ES) team set up its noise monitoring equipment to collect data at 53 Old Albany Post Road, Gareth Hougham's residence, and the Croton Harmon Yard adjacent to refueling operations in the northern part of the parking lot. In review of the data, taken from March 2nd to March 9th, it is evident that Mr. Hougham's house experiences extended time periods of continuous low frequency noise. Low frequency noise has longer wave lengths and thus can travel further. In listening to a few samples of audio obtained from the ES team, during a range of time frames, our ears detect a very industrial sound. An example of low frequency noise is the bass of music. Low frequency noise also is associated diesel engine locomotives. Continuous low frequency noise can be a nuisance and annoyance. In addition, low frequency noise can induce vibrations in buildings (a sensation more felt than heard). The American National Standards Institute (ANSI) indicates that sounds in the 16, 31.5 and 63-Hz octave bands greater than 70 dB may result in noise-inducted rattles.

Data from the April 27th memo is provided in d(B)A. The average person's ear can detect sounds ranging from 20 to more than 10,000 Hz. Each frequency is detectable at different pressure levels and so, the system for sound measurement which mimics the human ear is an A-weighted decibel system or dB(A). As a point of reference, human conversations at a distance of two to three feet occurs between sound pressure levels (SPL) of 60 dB(A)-- with a calm voice-- to 75 dB(A) with a raised voice. A 3 dB(A) change in sound levels would be considered largely undetectable to the human ear, while a 6 dB(A) increase results in a generally audible change. A 10 dB(A) change in sound levels is approximately a doubling of sound wave pressure.

The MTA memo pulls out two sets of data, March 2 from 9PM to 10PM and March 5 from 3AM to 4AM, to compare in regard to Croton-Harmon Yard and 53 Old Albany Post Road in their finding's memo. These samples are compared to Mr. Hougham log of observed data during the same time frame. We analyze these findings here.

Below is screenshot of the table provided in the MTA memo in regard to the 3 sets of samples.

Time Period	Croton-Harmon Yard	53 Old Albany Post Road	Hougham's Rating (1-5)
3/2/2022, 9PM-10PM	70.0 dB(A)	57.2 dB(A)	2
3/5/2022, 3AM-4AM	70.1 dB(A)	50.0 dB(A)	5

*Houghams rating 1= no train noise/5=loudest it gets

The MTA translates the above data set that the nuisance noise Mr. Hougham hears does not correlate to the monitored data. This conclusion is based on Mr. Hougham's log rating of 2 (low train noise) during the March 2 data where results where high in dB(A)s and a 5 (loudest it gets) for March 5 where lower level of dB(A)s were recorded. Again, the results of the sound levels are A-weighted. In review of the initial data, A-weighting may be an inadequate weighted filter for this assessment. It is evident that Mr. Hougham's house experiences extended time periods of continuous low frequency noise. A-weighting filters decrease the contribution of low frequency noise due to the reduced sensitivity of human hearing at low frequencies. Humans are most sensitive sounds between 500 and 6,000 Hz. Low frequency noise (and the vibrating sensations it may induce) would be more adequately measured using C-weighting which looks at low frequency sound. As such, when analyzing the 53 Old Albany Post Road in the MTA table with the C-weighting the results for March 2nd is 65.5 LCeq and 64.6 LCeq for March 5th. Thus, although Mr. Hougham's sound level observations do not necessarily correlate with the A-Weighted results, it is evident that the decibel level is much greater when utilizing C-weighted filter for low frequency wavelengths. This shift in the octave band weighting does not directly identify Croton Harmon Yard as the source of the low frequency noise.

Reviewing the octave band analysis results, the noise monitoring data collected at Mr. Hougham's residence has greater than normal time periods of continuous low frequency noise in the infrasound region. Infrasound sounds are defined as sound waves that are 20 Hz or less. Infrasound sources that are not natural can include trains, air and road traffic and industrial processes. They can also include sources such as air-conditioning, compressors and loudspeakers. Infrasound waves can travel long distances and have little propagation attenuation in relatively stable atmospheric conditions. Utilizing the data provided by the MTA, Croton Harmon Yard and Mr. Hougham' data both depict similar power and so, much less attenuation between the two locations at the very low/lowest octave bands (8-31.5 K Hz) than would be calculated using the average over the entire spectrum. For example, the March 2nd data depicts the lowest octaves at upper 50 to low 60 dB(A) from Croton Harmon Yard and low to mid 50's dB(A) at Mr. Houghman's residence. Attenuation of the sound waves from one source to the monitored location is minimal despite the 3,072-foot distance between them. Using the standard reduction of 6 dB(A) per doubling of a distance with a 3,072-foot distance, we should see an approximate 36 decibel drop. This attenuation did not occur. However, this calculation is utilized for representative human hearing. The data results support what would be expected of infrasound sounds and also the low absorption coefficient of attenuation through air at these frequencies. Given the direct line-of-sight and no interfering barriers[1], these soundwave components area close match in terms of octave band composition (this in independent of the actual power-dB levels due to sound loss).

In contrast, we would see a higher absorption coefficient/sound attenuation in air with higher octave bands. The data shows that the octave bands around the 4-8K Hz drop out entirely from the Croton Harmon Yard to Mr. Hougham's residence. Higher frequency wavelengths are shorter than low frequency wavelengths and do attenuate to a much greater degree. For example, the March 2nd data depicts the octaves at around the 4-8 K Hz at the mid-50 dB(A) range from Croton Harmon Yard and 0-10 dB(A) at Mr. Houghman's residence (a 40 to 50 dB drop). The results for the March 5 data are similar. Attenuation of the higher frequency (i.e., shorter) sound waves from one source to another location is than the standard applied to an aggregated dB(A). Using the standard reduction of 6 dB(A) per doubling of a distance, we would see an approximate 36 decibel drop at 3,072-foot. The higher, 45 to 50dB drop is consistent with the results[2]. Finally, in the higher octave bands (approximate 16 kHz), we see levels begin to increase again. This can be attributed to very localized sources such as birds, insects, etc. that were heard during our sampling analysis.

Meteorological data was not provided as part of the raw data. These factors – wind, humidity, temperature- can affect the path of sound waves. Higher temperatures can increase the velocity of sound waves. Other environmental factors are the natural resources that may affect the transmission of sound waves. In between Mr. Hougham's location of residence and the Croton Harmon Yard is the Croton River (stretches of open water) and associated wetlands. Per NYSDEC Assessing and Mitigation Noise Impacts "… sound waves will bend towards water when it is cooler than the air and bounce along the highly reflective surface. Consequently, large water bodies between the sound source and the receptor may affect noise attenuation over distance." This is especially true for lower frequencies.

As such, there are many factors to consider when analyzing noise data. In this case, only the Bruel Kjaer data was provided. No adjustments for weather, etc., were made at this preliminary level of analysis.

The MTA memo summarizes through this data that "This report's overall conclusion is that sound from the Croton Harmon Yard is not producing a measurable noise impact on the surrounding communities and confirms the results of previous measurements that significant noise attenuation occurs over the great distance separating the source and receiver." This conclusion is based on the data that was collected during the monitoring period between March 2nd and March 9th. What is evident, based on listening to the raw data is that Mr. Hougham's house experiences prolonged, continuous low frequency sounds during periods of morning, day and night. Low frequency sounds/infrasound levels are also dominant at the Croton Harmon Yard. A diminished attenuation of sounds from the yard to Mr. Houghman's house is yconsistent with the low attenuation properties of infrasound waves. Additionally, the higher frequencies diminish at a much higher than average rate (and alost completely disappear). Thus, we have determined through the data that has been analyzed thus far, that we believe the Croton Harmon Yard is, at times, a major component of the registered sounds at Mr. Houghman's residence. However, there may be other components to the perceived sounds that are not identified or have been studied in this analysis. Further,

[1] Also, both occurrences were at night when the sound source from Route 9 was greatly diminished.
[2] That is, the 4k to 8k octave bands virtually disappear from the recorded levels at Mr. Hougham's house.

as previously noted, low frequency noise can induce vibrations in buildings and can exasperate the annoyance resulting from the perceived problem.

In conclusion, we note that only a small fraction of the data provided by MTA was analyzed. This initial analysis focused on the sampling points that MTA utilized in their April 27th memo. At this time, it is our recommendation to undertake the following:

- Review additional data to confirm/assess further connections between the source and receptor.
- Undertake modeling and quantification of the data in the next round of analysis to further examine the perceived sounds from the residents.
- Undertake another level of analysis to determine the recent manifestation of the issue. What changed that caused the nuisance sound to propagate to this location?
- MTA ES to evaluate/assess countermeasures (if tenable) in regards to receptor complaints.

Please let me know if you have any questions or comments in regard to the information provided herein. I would be happy to set up a meeting to review the data with the Town of Ossining and the concerned constituents and also to provide the constituents with the raw data and software for their review.

Thank you.

Best,

Danna M. Cuneo
Principal Scientist