



EVALUATION OF SITE SOUND EMISSIONS

PROPOSED DELIVERY STATION Wallingford, CT

Revision 1

Prepared for: **Montante Construction**
Prepared by: **Benjamin C. Mueller, P.E.**
Reviewed by: **Daniel J. Young**
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1460 US Highway 9 North
Woodbridge, NJ 07095
Voice 973-731-7002
Fax 973-731-6680
acousticalconsultant.com

Suite 209

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INTRODUCTION

Ostergaard Acoustical Associates (OAA) was asked to assist with evaluation of potential sound emissions from a last mile delivery station to be located at the former site of a Bristol Myers Squibb facility in Wallingford, New Haven County, Connecticut. Specifically, the site is located on a large parcel east of Research Parkway and south of Carpenter Lane. Existing structures will be removed and a delivery station will be constructed in the northeast portion of the site. Parking will be located north of the building as well as a separate larger parking area in the southern portion of the site. The site is anticipated to operate at all hours, with delivery operations concentrated primarily during the day and intermittent line-haul truck arrivals and departures occurring throughout the day and night. Non-noise sensitive industrial uses are primarily west and north of the site, while residential areas are to the east and south. This report addresses the on-site noise radiated to neighboring off-site receptors. This report has been updated to include results from an ambient sound levels survey.

The purpose of this sound study is to analyze future site sound emissions for comparison with applicable code limits and to evaluate compatibility of the proposed use with the site and its surroundings.

Sound emissions from the facility were evaluated against applicable Town of Wallingford and the State of Connecticut noise codes. The site will contribute steady sound from rooftop HVAC equipment. The site will also experience intermittent sound from truck and car¹ movements.

Work by OAA was overseen by Benjamin C. Mueller, P.E., with assistance from OAA Staff Engineer Daniel J. Young and Staff Consultant John T. Baldassano. The representative at Montante Construction coordinating the project is Byron Deluke.

¹ Note that throughout this report, the term “car” collectively refers to personal passenger vehicles or local delivery vehicles including automobiles, vans, pick-ups, or SUVs. The term “truck” refers to heavy trucks such as over-the-road or line-haul trucks.

SITE AND VICINITY

Figure 1 is an aerial image obtained from Google Earth outlining the site in red. Figure 1 also shows ambient survey locations, which are discussed in a subsequent section.

The site currently comprises a large parcel formally used as a Bristol Myers Squibb facility. The campus is currently demolished with the exception of an office building fronting on Research Parkway which will remain but is not associated with the delivery station. Site access is provided via Research Parkway to the west and Carpenter Lane to the north. The site, and properties immediately north and west are in the IX, Industrial Expansion, District and are primarily industrial in use. There does appear to be a single residence fronting on Carpenter Lane, north of the site. A hotel is southwest of the site in the IX District. Farther west, about 2,000 feet from the proposed delivery station building, are residences fronting on Thorpe Avenue in the I-5, Interchange, District. Beyond is Interstate 91. Abutting the site to the east is a large electrical transmission right-of-way, also in the IX District. Residences are east of the right-of-way, about 600 feet from the building, in the RU-40 and RU-80, Rural, Districts. These eastern receptors are about 40 feet or more higher in elevation than the site. South of the site are additional residences in the RU-40 District.

Plans call for a new delivery station building to be located in the northeast portion of the site, where the Bristol Myer Squibb heliport was located. Associates will park in a lot north of the building. Truck docks are located south of the building. Delivery vehicles will be parked in the southern portion of the site, where the former main building existed. Delivery vehicles will queue and load along the west and east sides of the building. Personnel and delivery vehicles are anticipated to use both Research Parkway and Carpenter Lane access points; trucks are assumed to only use Research Parkway as this route has direct access to I-91.

Proposed plans call for the majority of delivery and personnel activity to occur during the daytime while line-haul truck activity will occur mostly a night; about 70% of the trucks are expected over the nighttime hours.



Figure 1 — Google Earth image showing the proposed delivery station facility site and vicinity in Wallingford, CT. The approximate site boundary is outlined in red. Ambient survey Locations 1 through 3 are also shown.

REGULATIONS/GOALS

When developing a site of this type, it is appropriate to consider how sound from the facility will likely be received, especially by noise-sensitive receptors. Sound produced by a typical delivery station is characterized by car and truck parking lot activity, such as idling and vehicle movement, as well as steady HVAC equipment. The noise from these sources was evaluated and compared to applicable noise code limits as well as acoustical goals based on professional experience. As a general practice, when motor vehicles are on-site, they are considered part of a site's sound emissions; when vehicles are on public roads, they are not.

State and local noise codes were reviewed. The Connecticut code is found at CGS Sections 22a-67 to 22a-76 and also in State Regulations Sections 22a-69-1 to 22a-69-7.4. The code regulates maximum sound emissions by source and receiving land uses when measured at the receiving property line. Class C land uses are nominally non-sensitive uses, such as this delivery station. Class B land uses are potentially noise-sensitive such as offices; Class A land uses include residences and other noise sensitive receptors. For sound propagating from Class C land uses to Class A land uses, in general maximum sound emissions are limited to 61 dB(A) during the daytime, that is 0700-to-2200 hours, and 51 dB(A) during the nighttime, 2200-to-0700 hours. The maximum sound emissions limit for Class C land uses to Class B uses is 66 dB(A) at all times. The limit from Class C to other Class C land uses is 70 dB(A) at all times. In addition, no impulsive sounds over 80 dB(A) may be produced at night to Class A receptors. These code limits only apply for stationary sources. The State also provides adjustments to the above limits for short term excursions based on the duration of the sound. If a source occurs for 15 minutes or less of any hour, the limits above may be increased by 3 dB. If the sound is for 7½ minutes or less, the limit is increased by 6 dB; if it occurs for 5 minutes or less, the limit is increased by 8 dB.

The State code, in Sections 14-80a-1 through 14-80a-10a, specifically limits noise from motor vehicles depending on speed and type of ground surface. For vehicles over 10,000 pounds, a vehicle traveling on a hard site is limited to 88 dB(A) at 50 feet if traveling under 35 mph and 92 dB(A) at 50 feet for speeds of 35 mph or more. For soft sites, the limits are 2 dB lower. For typical passenger vehicles, the limits for hard sites are 74 dB(A) for speeds less than 35 mph and 81 dB(A) for speeds greater than 35 mph; again, soft site limits are 2 dB lower in level.

The Town of Wallingford regulates sound under Ordinance No. 494 in a manner similar to the State. However, the Town regulates sound based on zoning as opposed to land use. For the most part, this still aligns with the State's approach, apart from residences to the west in the I-5 district and the single residence to the north and the hotel to the southwest, both located in the IX District. The Town code does not define the Interchange District in the noise ordinance. To be conservative, we have applied the residential code limits at all residential and receptors regardless of zone. Hotel patrons are considered as residences in this study. This aside, Town limits are the same as the State and require industrial districts to not exceed 61 dB(A) during the daytime, and 51 dB(A) during the nighttime at residential receptors. There is also a slight difference in the definition of daytime and nighttime. Wallingford uses slightly different periods than the State and defines the daytime as 0700-to-2000 hours; the nighttime is defined as the complementary hours. Motor vehicle noise is also regulated and is required to meet the State motor vehicle noise limits. It should also be noted that Wallingford's code has been approved by the State.

Ambient Sound Survey

In addition to meeting regulatory limits, it is important to minimize the acoustical impact of the site. To determine the acoustical impact, an ambient sound level survey was carried out in the vicinity of the site. OAA Staff Consultant John Baldassano visited the site on 28 April 2021 to deploy three 24-hour sound level monitors in the area to document existing ambient sound. The long-term monitors comprised either a Rion NL-52 or a Piccolo II real time sound level meter located within an enclosure with an external battery supply. Microphones were located either on a mast adjacent to the enclosure or attached to the meter itself. All microphones were fitted with a windscreen. Units were instructed to record detailed statistical time history data and hourly statistics for a 24-hour period. Data were acquired from about 1600 hours on Wednesday 29 April to 1500 hours on Thursday 29 April. All sound levels meters were calibrated before and after deployment using a Bruel and Kjaer Model 4231 sound level calibrator, which is calibrated by an outside calibration service annually. Location 1 is located on Wisk Key Wind Road, set back about 150 feet from the more well-traveled High Hill Road. Location 2 is northwest of the site and situated along Research Road near the intersection with Carpenter Lane. Location 3 typifies residential receptors southwest of the site and was located just north of 1232 Barnes Road near the end of the dead-end.

Weather conditions were appropriate for the survey. Temperatures ranged from 47-67 degrees Fahrenheit. Winds were moderate and ranged from 9-to-12 mph. Observations during

deployment and retrieval of the long-term monitors indicated that the acoustical environment is typical for a suburban environment. The soundscape was dominated by intermittent local and distant traffic flow, and seasonal insect noise at all measurement locations. Other noise sources included sporadic bird chirps and airplane passbys.

Acquisition of ambient sound data over the course of 24 hours results in an enormous amount of data. As a result, it is helpful to review data from a high level to assist with observing existing sound level trends. Hourly statistical data are particularly helpful to review. For example, the background sound level (L_{90}), which is the level that occurs over 90 percent of the measurement period and is best used to evaluate continuous noise sources such as HVAC. The L_5 , or level that occurs over 5 percent of the time, indicates the extent of intrusive noise sources in the area, such as dog barks, surges in traffic noise, or aircraft passbys. The purpose of this survey was to understand the existing acoustical conditions for comparison to project emissions. These data are important for use in establishing specific project noise goals to ensure no negative acoustical impact. Full time history graphs are provided in the Appendix; additional survey data is available upon request. A summary of results is as follows:

- ❑ All Locations followed similar trends. Sound levels during the daytime were higher than at night. Daytime sound levels averaged about 60 dB(A) while nighttime sound levels were around 45 dB(A). The lowest sound levels measured occurred from the late evening, around 2100 hours, and lasted until around 0400 hours, when morning rush hour starts.
- ❑ The lowest nighttime sound levels occurred around 2200 hours for all Locations, where levels hovered around 40 dB(A). Location 1, which is more remote from major roadways had more occurrences of these lows than other Locations.
- ❑ The highest sound levels, which are likely due to transient sound sources such as motor vehicles, was consistently above 55 dB(A) across daytime hours at all Locations. During the night, Locations 2 and 3 exhibited frequent high sound levels above 50 dB(A). Nighttime high-level events were less frequent at Location 1, but still occurred nonetheless. Maximum sound levels often approached 50 dB(A) and were well above 50 dB(A), and approaching 60 dBA, during the 2300, 0000, and 0400 hours.

Project Noise Goals

Based on OAA's experience, the State and local limits are in line with many noise ordinances found throughout the country. There are some discrepancies that need to be addressed, however. The Wallingford code does not provide adjustments for short-term excursions as the State does. In addition, Wallingford enforces the night code two hours earlier than the State does. These factors potentially make the local ordinance more stringent. Based on professional experience, noise code limits can apply throughout the property but are most commonly assessed and enforced at the location of inhabitants. Inaccessible or uninhabited portions of the property are generally not scrutinized.

Despite code differences, stationary sound sources, such as HVAC, are clearly regulated by State and local code and should be controlled to not exceed 51 dB(A) at all residential receptors. Local and State motor vehicle limits also align and should be complied with. However, given that motor vehicle sound is regulated in relation to the source, and not the receptor, establishing a project noise goal at potentially noise-sensitive receptors is warranted to minimize disturbance. To achieve this, the goal is for site sound to not deviate substantially from existing ambient sound levels.

The sound survey results shows that nighttime sound levels in the area can be in the 40 dB(A) range. Therefore, despite nighttime noise code limits being 51 dB(A), a project noise goal for HVAC equipment should be more aligned with 40 dB(A) to reduce any potential impact off-site. To minimize any acoustical impact of motor vehicle sound, OAA recommends that all vehicle sound emissions be controlled to not exceed 54 dB(A) at all residential dwellings. This limit is based on compliance with the nighttime code limit of 51 dB(A), with a 3 dB allowance for sources that occur for less than a 15-minute period. The ambient sound survey showed that meeting this goal, will result in no negative acoustical impact as receptors in the area routinely experience sound levels in excess of 55 dB(A), even during the nighttime hours. For non-residential neighbors, site sound should meet State and local limits and be controlled to meet 70 dB(A) at the neighboring industrially zoned properties.

EXPECTED SOUND EMISSIONS

Acoustical modelling software, specifically CadnaA, was used to create and analyze site sound emissions for the site. The model takes into account relevant parameters between the noise source and receptor positions of interest to predict how sound will propagate. In addition to distance attenuation, the model accounts for the effects of terrain, various types of ground cover,

shielding by structures, and reflections from buildings. In the model, buildings are white and the site property line is outlined in red. Delivery station loading areas are covered by a canopy, which is also modelled and shown in light blue. North is pointing up in all figures.

The acoustical model shows the results graphically as A-weighted sound level contours, in 1 dB increments, and tabulates the summed A-weighted sound levels at ten discrete locations typifying nearby receptors. Sound level contours are at ear height, 5 feet above grade. Locations B through D are at nearby industrial district uses and located at a ground floor elevation of 8 feet above grade. Location B is at the on-site office building to remain and Location D is the hotel. Locations E through H are at two-story dwellings and receptors are modelled at 15 feet above grade; Locations I through K are at single-story dwellings and modelled at 8 feet above grade. Location A is not used and reserved for future use.

Rooftop HVAC Sound

Rooftop HVAC equipment produces noise that is nominally steady in nature, and hence will not vary significantly over time. Plans call for 25 new rooftop equipment comprised of eight RTU, two condensing units (CU), eight heating and ventilation units (HV), and seven exhaust fans (EF). Units vary in size from 3-ton to 17.5-tons. The sound power level for all 25 HVAC units that will serve the building were included in the HVAC model using manufacturer's octave band sound data. Noise sources were placed 4 feet above the rooftop, and sound was projected off site. Figure 2 shows the results graphically and tabulates the summed A-weighted sound levels at the nearby receptor locations of concern. The results show that with all rooftop units operating, HVAC sound levels at off-site residential receptors are in the 18-to-33 dB(A) range.

This analysis shows that there is little concern about HVAC sound. HVAC sound is sufficiently controlled via distance and roof shielding effects so that this noise meets the project noise goal of 40 dB(A) by a wide margin, and is well below the 51 dB(A) nighttime State and local code limit by even wider margins. Based on the ambient survey, levels of this magnitude are not expected to be audible off-site. The industrial limit of 70 dB(A) is met by a significant margin as well. Note that for these model results to be realized, acoustical performance of HVAC equipment must be aligned with what was modelled.

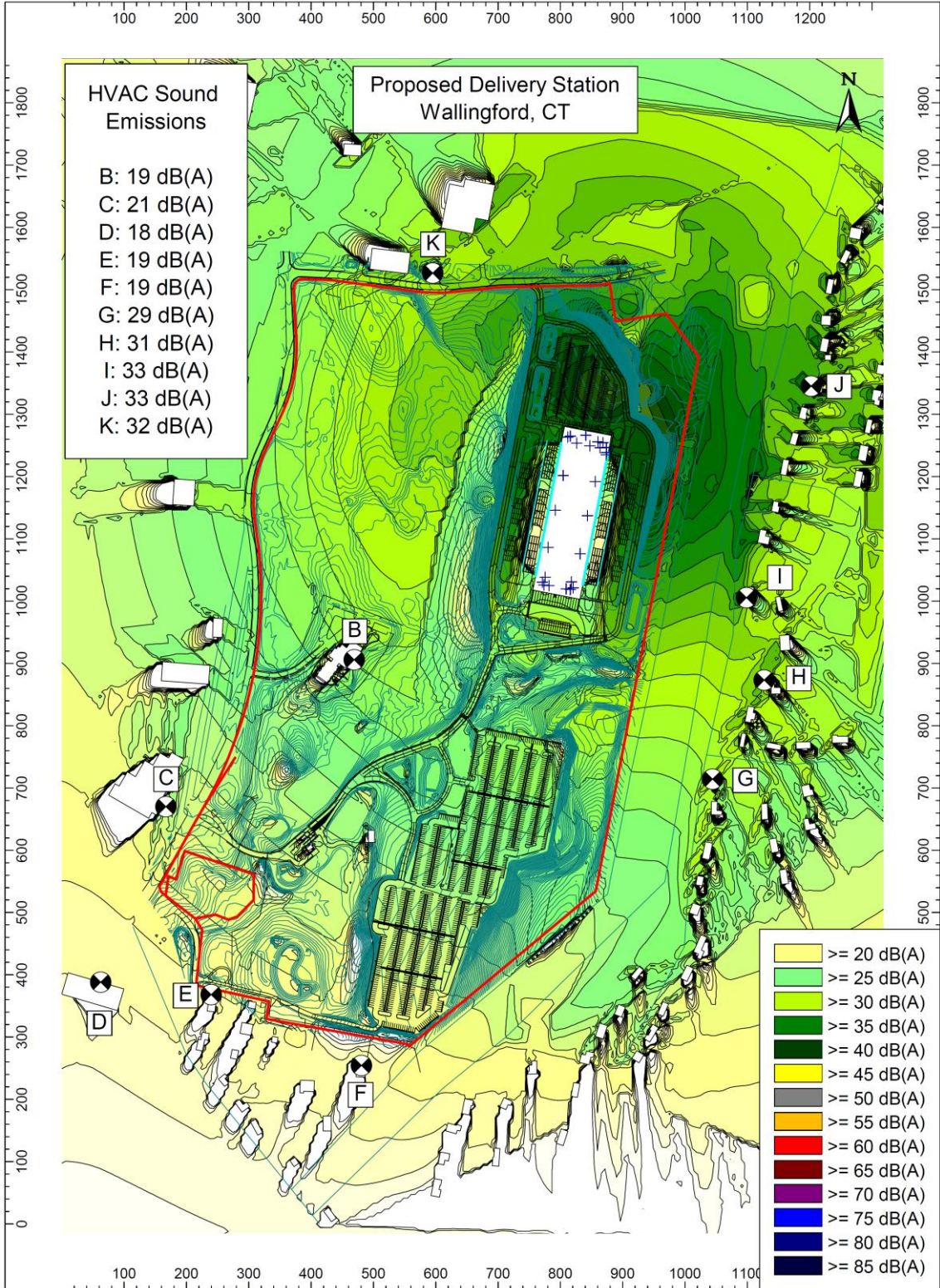


Figure 2 — A-weighted sound emission contours, 5 feet above grade, from rooftop HVAC equipment. Each of the 25 rooftop units shown with a blue + sign. Buildings shown in white; site property line outlined in red. Delivery canopy shown in light blue. A-weighted sound emissions tabulated at 8 feet above grade for all Locations except Locations F through H which are at 15 feet above grade.

Delivery and Personnel Activity

Sound emissions from delivery and personnel vehicles were analyzed. Delivery operations occur during daytime hours. Personnel activity is also primarily within the daytime hours, but there are shift changes during the nighttime hours. Busiest hourly traffic counts during the day are expected to include as many as 436 delivery vehicles and personnel vehicles; this equates to about 73 vehicles within a 10-minute period. To model worst-case conditions, 73 vehicle noise sources were placed around the site to represent an acoustical snapshot over a 10-minute period.

Figure 3 shows the model results for delivery operations, with vehicles represented as green “+”s. Based on data measured at similar facilities, personnel and delivery vehicles are acoustically equivalent. The model assumes each vehicle is contributing a maximum sound level of 59 dB(A) at 50 feet at the same time. The vehicle source height is 3 ½ feet above grade. Modelling all sources at their maximum is an extremely conservative approach since maximum sound levels of multiple sources will likely never synchronize in this manner.

The results in Figure 3 show that maximum emissions at all residential locations are below the daytime code limit by a wide margin. Sound emissions are also below average ambient sound levels documented. Although this peak condition will only occur during the daytime hours, the model also complies with nighttime code limits at residences. At industrial properties, the industrial project goal limit is met by wide margins. Results of this magnitude indicate that no acoustical issue is anticipated with on-site delivery operations or when employee shift changes and delivery operations occur at this site.

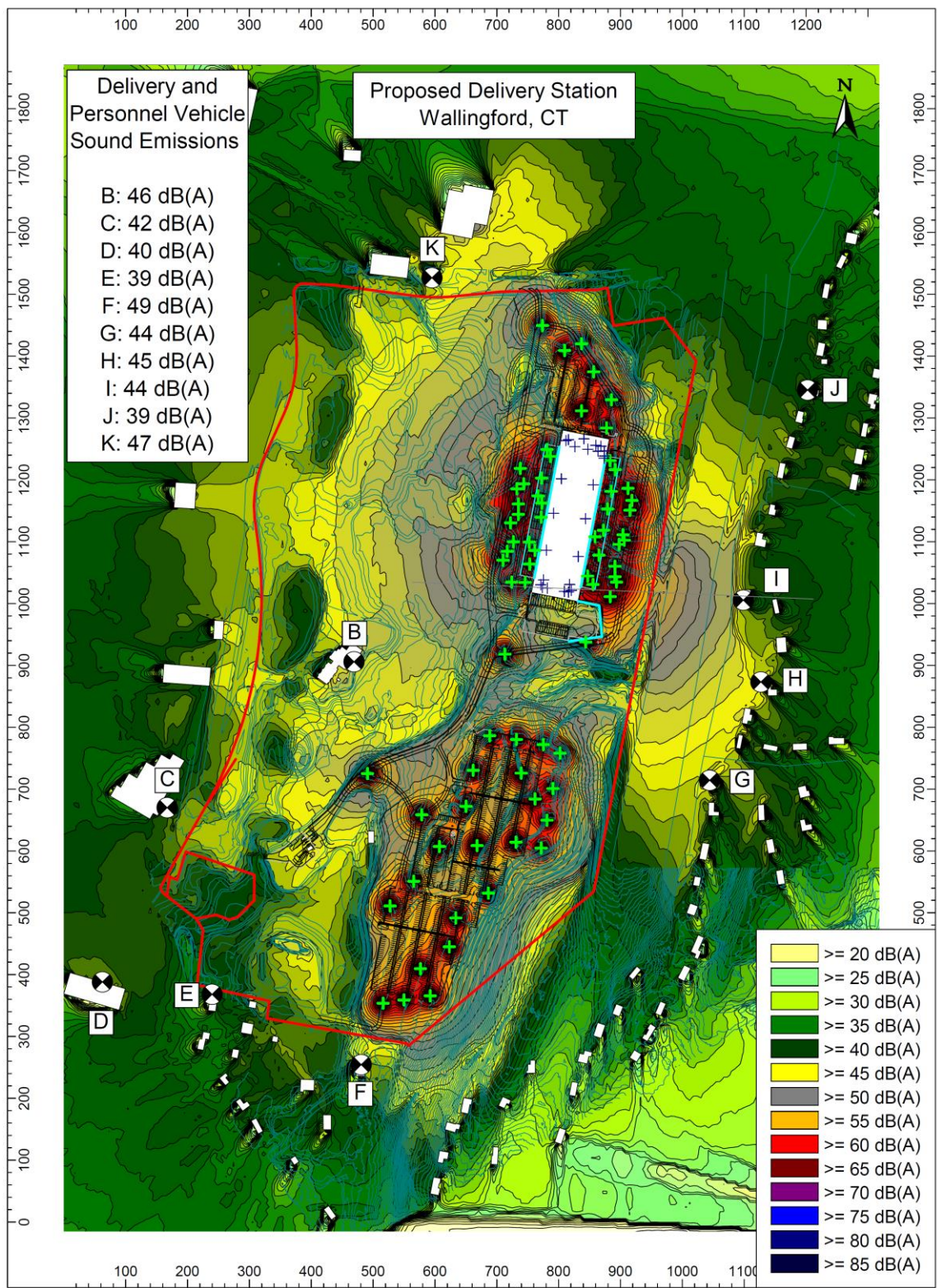


Figure 3 — A-weighted sound emission contours, 5 feet above grade, for 73 delivery and personnel vehicles operating simultaneously, shown with a green “+” sign. Buildings shown in white; site property lines outlined in red. Delivery canopy shown in light blue. A-weighted sound emissions tabulated at 8 feet above grade for all Locations except Locations F through H which are at 15 feet.

Heavy Truck Activity

OAA has had the opportunity to visit various delivery and logistics facilities over the years to survey and document the sounds of truck activity. Line-haul truck noise in a typical dock area can routinely produce maximum sound levels in the range of 79 dB(A) at 50 feet. This sound level was determined by looking at a wide variety of truck activity, such as truck movement, air brakes, back-up alarms, and coupling/decoupling, and distilling it to a single conservative maximum value for use in acoustical studies such as this. It is worth noting that coupling/decoupling is not an expected practice at delivery stations; trucks generally depart with their trailer when emptied. A driving truck exhibits slightly lower maximum sound levels of 74 dB(A) at 50 feet. The height of a truck source for all truck activity is modelled at 8 feet above grade. OAA has found that using these maximum sound limits at this height make this a very conservative approach to evaluating truck sound. When specific individual activities are modelled at their actual height and sound level, results are typically lower in level than predicted below. For example, many of the high sound level activities such as back-up alarms and air brakes occur at a height of 4 feet above grade, not 8 feet. It is also important to recognize that all truck noise is dynamic in nature. Maximum sound levels only occur for a short duration and are not representative of the constant sound level produced by on-site trucks.

Plans call for trucks to enter the site from Research Parkway then travel along the site road to a dock along the southern building façade. Peak traffic counts call for about 32 trucks per day, with about 17 of those trucks arriving during the night. Site operations are designed to not have truck activity coincide with outbound delivery operations. Most nighttime hours will see at most two trucks per hour. Sound from an individual truck was analyzed as it is unlikely that multiple truck sound level maximums will occur at the same time. Site constraints and safety needs also promote that more than one truck is not performing an action at the same time. Multiple locations were analyzed; the worst-case site sound emissions of interest are highlighted in Figures 4 and 5. Figure 4 shows a driving truck entering the site from Research Parkway. Figure 5 shows a truck exhibiting yard activity sound in the easternmost area of the truck court. Both truck sources are modelled at 8-feet above grade. The driving truck is modelled using 74 dB(A) at 50 feet and shown as a pink "+"; the truck dock activity is modelled using 79 dB(A) at 50 feet and shown as a white "+".

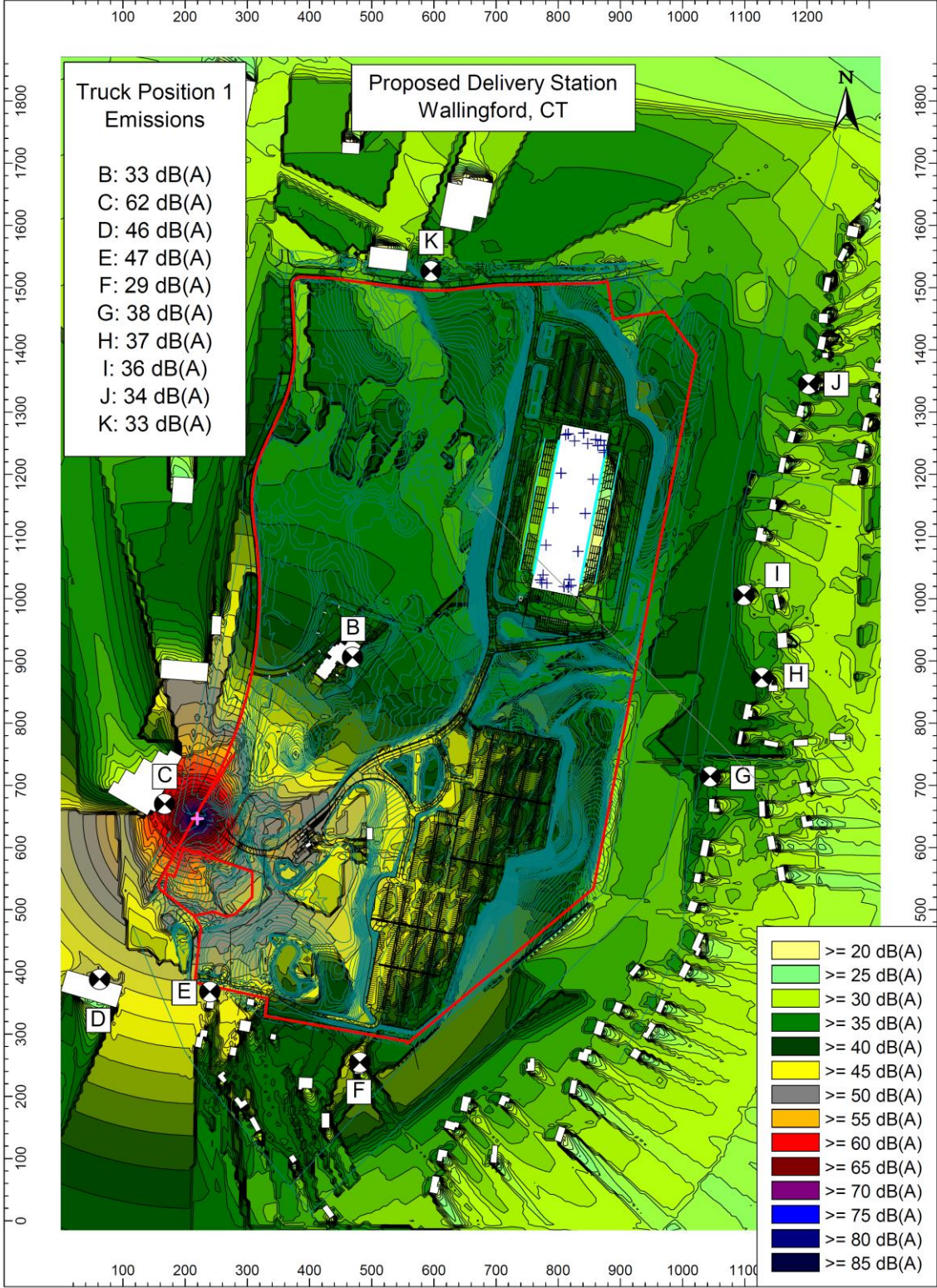


Figure 4 — A-weighted sound level contours, 5 feet above grade, expected for worst case driving truck activity, shown with a white “+” sign. Buildings shown in white; site property line shown in red. Delivery canopy shown in light blue. A-weighted sound emissions tabulated at 8 feet above grade for all Locations except Locations F through H which are at 15 feet above grade.

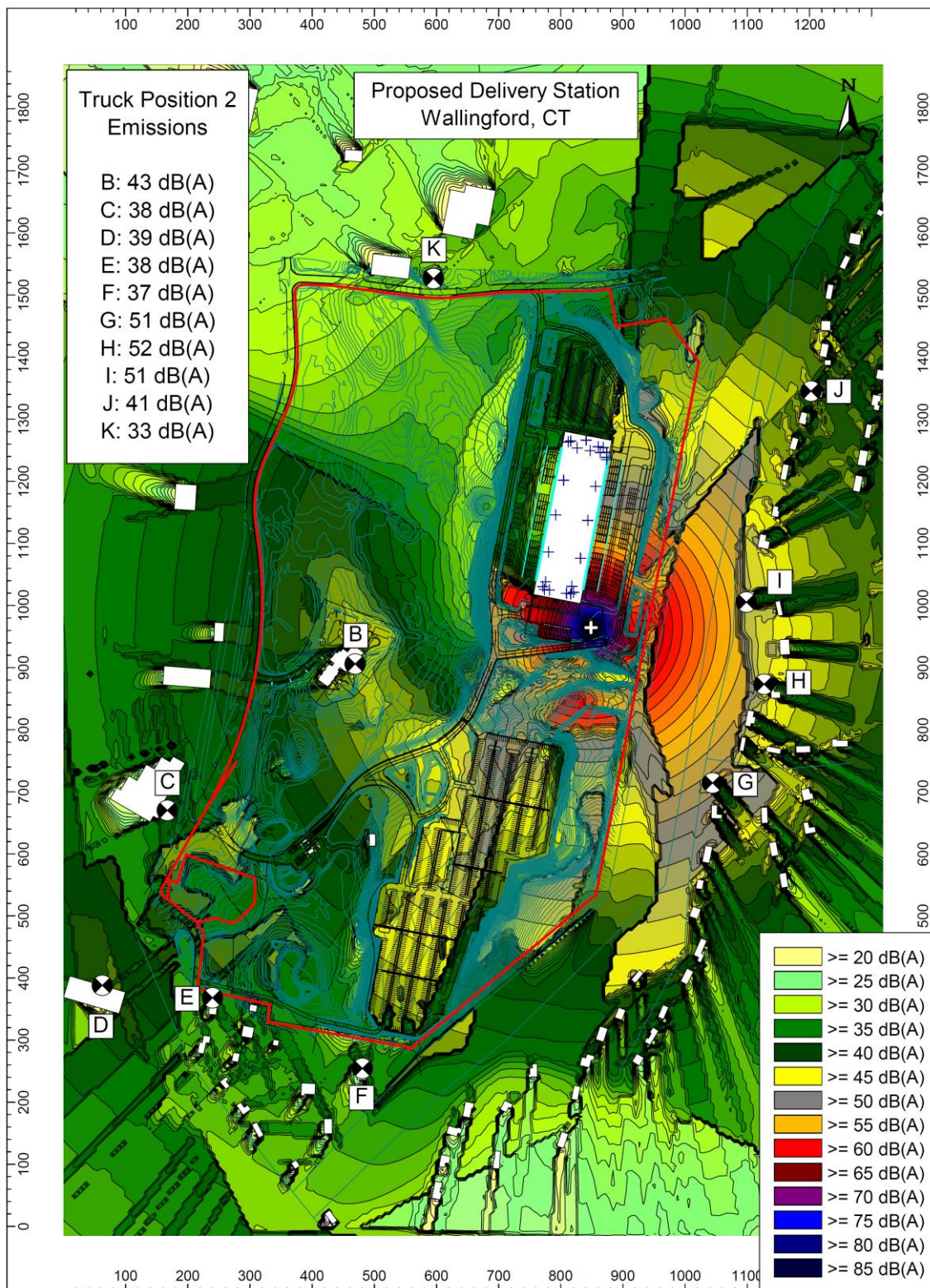


Figure 5 — A-weighted sound level contours, 5 feet above grade, expected for worst case heavy truck dock activity, shown with a white “+” sign. Buildings shown in white; site property line shown in red. Delivery canopy shown in light blue. A-weighted sound emissions tabulated at 8 feet above grade for all Locations except Locations F through H which are at 15 feet above grade.

Figure 4 shows that a driving truck when entering the site will contribute sound levels in the low 60's at the nearest industrial use. This meets town and State code limits by a margin of 7 dB. Maximum sound levels at the nearest residence, Location E, are 47 dB(A) and comply with project goals and both the day and nighttime code limits for steady noise sources.

Results in Figure 5 show that worst-case truck dock activity is expected to produce levels that approach, but do not exceed, the project goal of 54 dB(A) at all noise-sensitive receptors. The dramatic change in elevation and distance provides sufficient attenuation to meet the goal by several decibels. At eastern residences, emissions of this magnitude will be equal to or lower in level than a typical vehicle passby travelling along High Hill Road. Levels of this magnitude are expected only a handful of times given that only 1-to-2 trucks are expected per hour. In addition, sound emissions at industrial property lines meet the industrial project goal limit by a wide margin for all truck locations.

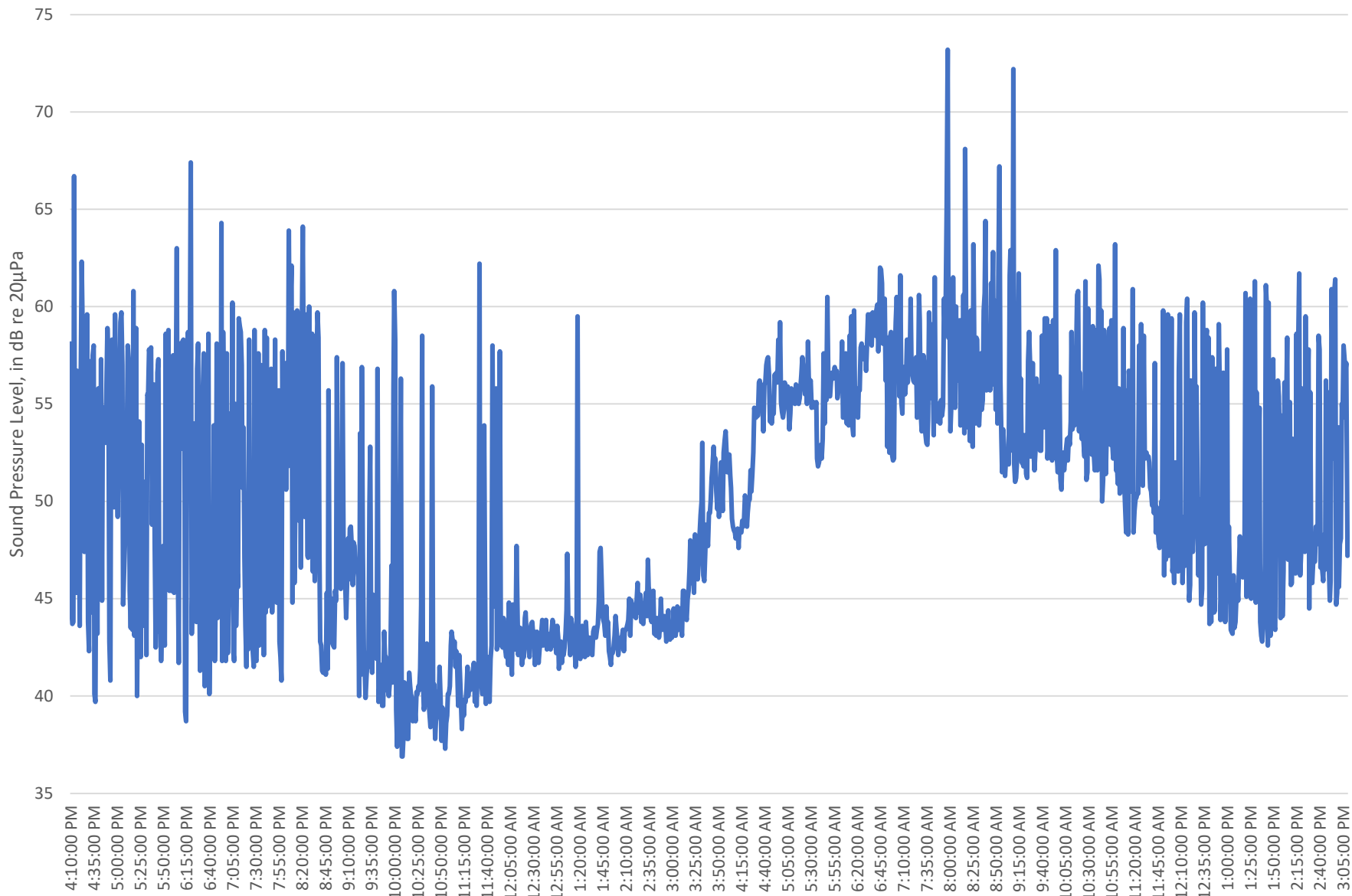
CONCLUSION

A last mile delivery facility is planned in Wallingford, CT, at a now abandoned pharmaceutical facility. The site is large and bordered on two sides by mostly non-noise sensitive uses. However, residences are nearby the site primarily to the east and south. State and local noise codes, as well as an ambient sound survey, were relied upon as criteria for site sound emissions. Project noise goals were established for rooftop HVAC equipment as well as onsite vehicles to minimize the acoustical impact at nearby residences.

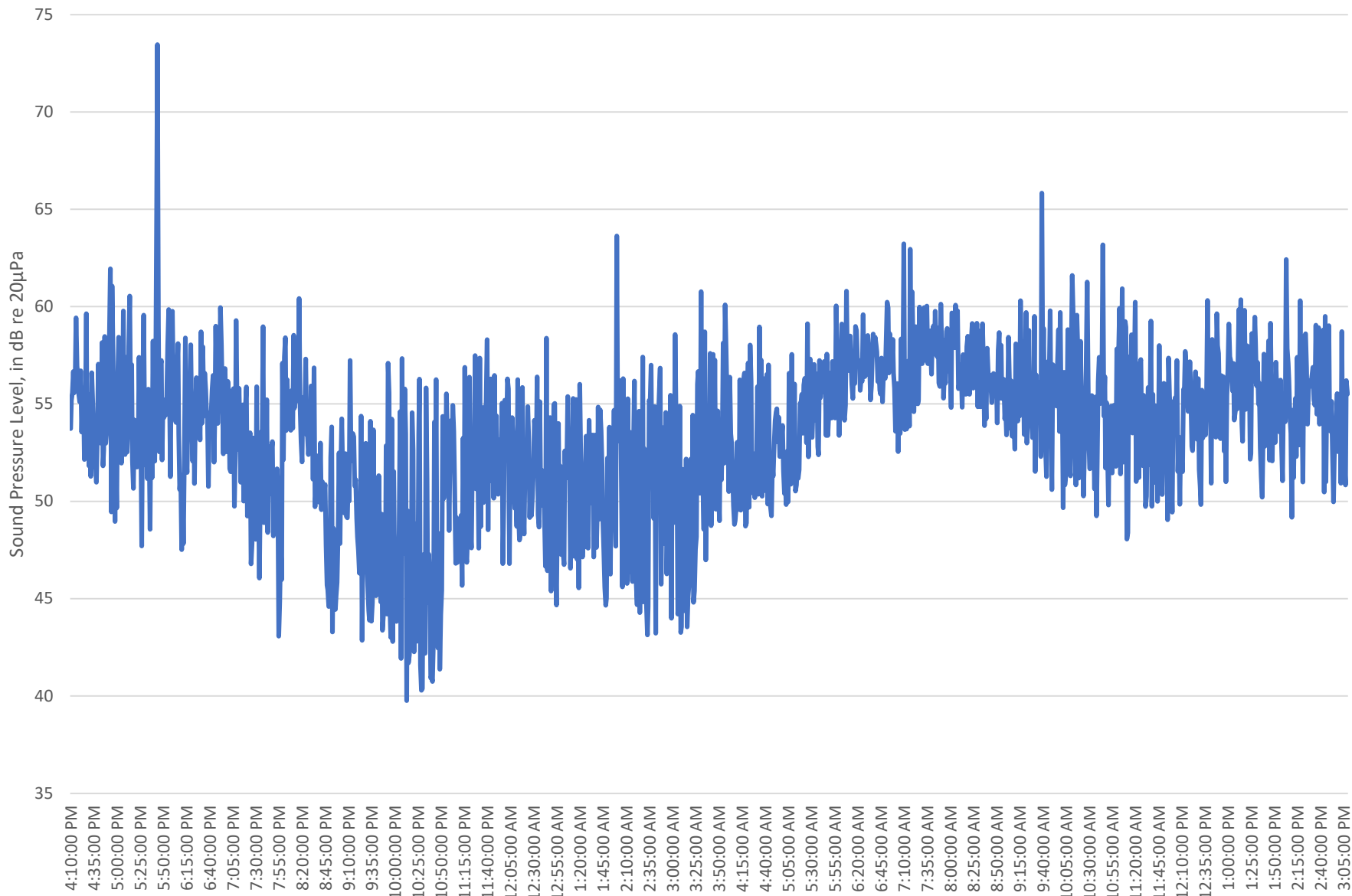
Based on results of analyses, steady HVAC site noise is expected to meet project goal and code limits at all nearby residential and industrial receptors by wide margins. In addition, HVAC site sound is of a low enough magnitude that it will not likely be audible at off-site vantage points. Proposed HVAC equipment arrangements can proceed, however, keep in mind that any modification to the arrangement may affect site sound emissions. Daytime and nighttime delivery, personnel, and truck operations also meet the project goal and code limits. No negative acoustical impact is anticipated from site operations and results support that site sound will conform and harmonize with existing sound in the vicinity.

APPENDIX

Time History Sound Pressure Level Data Obtained at Location 1
from 28-to-29 April 2021



Time History Sound Pressure Level Data Obtained at Location 2 from 28-to-29 April 2021



Time History Sound Pressure Level Data Obtained at Location 3
from 28-to-29 April 2021

