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March 8, 2010



Mr. Mark Montanari, Chairman
Town of Littleton Planning Board
37 Shattuck Street
P.O. Box 1305
Littleton, MA 01460

Re: Littleton – Peer Review of Noise Study
Aggregate Industries Northeast Region, Inc., 149 Ayer Road, Littleton, MA

Dear Members of the Board:

In accordance with our engineering agreement dated February 10, 2010, Woodard & Curran has provided technical peer review services relative to Aggregate Industries Northeast Region, Inc.'s Site Plan Application dated December 22, 2009 for their facility located at 149 Ayer Road, Littleton, MA.

The peer review services included review of the noise study prepared by Tech Environmental, Inc., consultant for Aggregate Industries. The peer review was conducted by our subconsultant Eric Reuter, Principal of Reuter Associates. Mr. Reuter is an experienced noise consultant with expertise in computer modeling, field assessment and abatement of environmental noise.

The noise/sound study peer review included a site visit to assess existing conditions and proposed changes to the operations, and a technical and regulatory review of the following studies:

- The Air Permit Application for Non-Major Comprehensive Plan Approval application submitted to the MassDEP Central Regional Office, dated October 28, 2009, relative to the noise survey, Chapter 6.
- The Sound Study for Aggregate Industries New Nonmetallic Mineral Processing Plant dated February 5, 2010.
- The Supplemental Sound Study for Aggregate Industries New Nonmetallic Mineral Processing Plant dated February 22, 2010.

Attached for the Board's review is Mr. Reuter's letter report summarizing his findings and recommendations. We will attend the Planning Board meeting on March 11, 2010 to discuss the findings and recommendations with you, and answer any questions you may have.

We appreciate the opportunity to assist the Littleton Planning Board with the peer review of this project. Please call me at 978-557-8150 with any questions or if I can provide any additional information.

Sincerely,

WOODARD & CURRAN INC.

Carol A. Harris
Vice President

March 8, 2010

Carol Harris, Vice President
Woodard & Curran
35 New England Business Center
Andover, MA 01810

SUBJECT: Aggregate Industries Quarry – Peer Review of Community Noise Study

Dear Carol,

At your request, I have reviewed several reports relating to the community noise study prepared by Tech Environmental, Inc. on behalf of Aggregate Industries Northeast Region, Inc., related to the proposed relocation of the processing operations at their quarry in Littleton, MA.

I understand the proposed changes to the quarry operations consist of the following:

- Relocation of the secondary and tertiary crushers (both cone crushers), stockpiles, and haul truck loading operations to the northeastern portion of the site.
- Installation of four new screens in this area.
- Installation of new conveyor equipment in this area.

I understand that the existing primary crusher and associated plant will remain unmodified in its current location, and that the daily, weekly and annual production of the facility will remain as it is currently.

Community Noise Assessment

In any community noise project, there are three basic steps that are typically taken in order to assure compliance:

1. *Establish Criteria* – The goal of any engineering project is to determine the best method to achieve an established design goal. In community noise studies, it is critical that design criteria, generally in the form of community noise level limits, be established before any noise control engineering is undertaken.
2. *Conduct Predictive Modeling and Noise Control Engineering* – Modeling of noise impacts and controls allows all parties (applicant, municipal review boards, community) to determine whether a proposed project is feasible within the constraints of the established criteria.

3. *Demonstrate Compliance* – While modeling is an important tool in estimating impacts, it is important that the applicant be required to demonstrate compliance when a project is complete and operational.

Applicable Noise Criteria

For projects in Littleton, an applicant must comply with both the Massachusetts Department of Environmental Protection's (MassDEP) policy on noise and Littleton's noise bylaw.

Massachusetts Department of Environmental Protection Noise Policy

The MassDEP established its policy on noise in the document DAQC Policy 90-001, and the Commonwealth of Massachusetts 310 CMR 7.10 provides for enforcement of the policy. This policy is as follows:

A source of sound will be considered to be violating the Department's noise regulation (310 CMR 7.10) if the source:

1. *Increases the broadband sound level by more than 10 dB(A) above ambient, or*
2. *Produces a "pure tone" condition.*

The ambient level is defined by the descriptor L_{90} , and represents the sound pressure level exceeded during 90% of a (typically) one-hour measurement interval.

In cases of proposed expansion or alteration of an existing facility, MassDEP typically requires that this ambient level be measured with the existing facility shut down in order to represent the condition that would exist in its absence.

Compliance is required at both the facility property line and any critical receptors (homes, schools, etc.).

MassDEP requires that a study be conducted as part of any air plan application. While an air plan application is not generally required for a facility whose only polluting emission is noise, noise must be considered when applying for air plan approval because of other pollutants, such as dust, smoke, etc.

MassDEP may enforce these criteria for any facility in response to a noise complaint.

Littleton Noise Bylaw

The Littleton Zoning Bylaw, in Chapter 173, Article XVII provides limits for community noise as follows:

District	Day (decibels)	Night (decibels)
Residential	50	40
Business	55	45
Industrial	65	50

These are assumed to be A-weighted sound pressure levels.

Daytime is defined as the hours between 7 a.m. and 9 p.m. on all days except Sundays and holidays, and between 12 p.m. and 9 p.m. on Sundays and holidays.

The bylaw also provides the following adjustments to the levels above for noise sources with particular attributes:

Type	Decibels
Dominant Tone	5 less
Impulsive	5 less
Sporadic	10 more

These limit are to be met at the site property line. In cases where the property line is also a zoning district boundary, the limit for the zone on the opposite side of the line from the source should be used.

Community Noise Modeling

Depending on the complexity of a project, several different methods of modeling may be employed to predict receptor sound levels. However, whether prediction consists of a hand calculation, a spreadsheet model, or a commercially available noise modeling software package, there are standard formulae that are used in predicting noise propagation.

The most commonly used standard is ISO 9613:1996 – *Attenuation of Sound During Propagation Outdoors*, published by the International Standards Organization. This standard provides calculation methods for barrier attenuation, atmospheric absorption, wind and other factors that affect the path of sound from source to receiver.

When performing calculations per ISO 9613, or most other standards, the sound levels emitted by each individual source of noise are defined using the metric Sound Power Level (L_w). In order to assess the L_w of an existing source, measurements are typically made in accordance with ANSI 12.56-1999/ISO 3746:1995 – *Determination of sound power levels of noise sources using sound pressure*.

As with any model, it is impossible to account for all the variables present in a particular environment. These tools allow engineers to predict noise levels with reasonable accuracy, and to evaluate various methods of noise control. However, they should not be trusted to predict to within the 0.1 dB precision that the calculations often yield.

Demonstration of Compliance

Because of the inherent margin of error with predictive modeling described above, it is advisable for an applicant to be required to demonstrate compliance with whatever criteria apply to the project. There are several factors to be considered when developing a compliance monitoring protocol, including:

- Duration and frequency of monitoring.
- Appropriate number and locations of monitors.
- Whether monitoring will be attended or unattended.
- Which descriptor will be used (average, maximum, etc.)
- Prevention of tampering with equipment or altering results.
- Determination of which party or parties will pay for the monitoring.
- Selection of an expert to review and interpret the results.
- Establishment of penalties and enforcement procedures for violations.

A program for monitoring should be developed that is fair and agreeable to all concerned parties, and practical in its requirements.

Most municipalities do not have the resources to respond to individual complaints, making it imperative that all of the details of such a program be established before approval for a project is granted. This alleviates the burden on the town when complaints do arise.

Review of Applicant's Noise Study

Aggregate Industries Northeast Region, Inc. (AI) hired Tech Environmental, Inc. (TE) of Waltham, MA, to prepare a noise study as part of their applications to the Town of Littleton for site plan approval and the Massachusetts MassDEP for a Non-Major Comprehensive Plan Approval.

Tech Environmental has issued several reports on behalf of AI as the approval process has moved forward. I understand the timeline to be as follows:

October 28, 2009 – Initial noise study included as section 6 of the Air Pollution Control Plan Application submitted to MassDEP and submitted to the Littleton Planning Board in the site plan application on December 22, 2009.

February 1, 2010 – MassDEP issues a Statement of Technical Review Deficiency relating to AI application, including several noise-related issues.

February 5, 2010 – In apparent response to the concerns of the abutters, TE issues an updated study that provides predicted noise levels at each home along White Tail Way. This study does not yet address the deficiencies listed in MassDEP's Statement of Technical Deficiency.

February 17, 2010 – AI and TE meet with MassDEP to determine appropriate corrections for the deficiencies outlined in MassDEP's February 1 letter.

February 22, 2010 – A third version of the noise study is issued to MassDEP and the Town of Littleton. The purpose of this study is to address the deficiencies noted by MassDEP. While this includes additional receptor locations, none of the sources, noise control or original receptors is modified.

Issues Addressed in Review Process

While most of the issues that I have raised in the process of reviewing these studies have been satisfactorily addressed by Aggregate Industries and Tech Environmental, I feel that it is important to document this process. Following are specific issues and, if applicable, the resolution for each.

Existing Background Noise Levels

At the time that I began my review, TE's original noise study and the February 5 revision were available. Although MassDEP had issued the statement of deficiency, I was unaware of it until several days later.

My principal criticism of these studies was that the existing ambient noise conditions had not been adequately assessed. The assessment at each receptor location consisted of a single attended measurement while the facility was operational.

I have provided consulting services to several projects subject to MassDEP plan review, and my experience has been that MassDEP typically requires the ambient noise levels to be assessed without the facility operating. The common interpretation of the Noise Policy is that a facility may increase the background by 10 dBA above the level that would exist in its absence, not the level that it already produces.

MassDEP also typically requires measurement and impact analysis at the facility's property lines, in addition to critical receptors. In this study, TE did not provide existing or predicted levels at the property lines.

Further, for a facility of this size, I would typically conduct unattended monitoring over the course of several days, reported in hourly intervals, in order to understand how noise

levels change over the course of a day or week. This also helps to filter anomalous events that are not typically part of the environment.

I contacted Thomas Cussan, Permit Section Chief at the Central Regional Office of MassDEP to ask for clarification on MassDEP's interpretation of the policy relative to this project. It was from him that I learned of the Statement of Technical Review Deficiency that had been issued, and that it identified some of these concerns.

Specifically, the letter cited two deficiencies related to existing ambient noise:

- The ambient survey should have been conducted without the facility operating.
- The survey and modeling should have included property line receptor locations.

In response to this letter, AI and TE met with MassDEP on February 17, 2010 to address these issues. As a result of that meeting, additional ambient measurements were conducted while AI was not operational, and property-line locations were included.

An updated study including these data and modeling results at the property-line locations was submitted as part of a revised application to MassDEP on February 22, 2010. I understand that MassDEP issued a draft permit on February 25, 2010, suggesting that they are satisfied with these revisions to the study. However, to my knowledge, a copy has not yet been submitted to the Planning Board.

I remain critical of the quantity of ambient measurement performed. For a project of this scale, I would have conducted continuous monitoring for several days. However, this monitoring would be in support of the MassDEP application only, as Littleton's Noise Bylaw does not consider existing conditions. This is likely beyond the purview of the Board.

It should be noted that TE's ambient measurements with the facility operating were used to estimate changes in level at each receptor location after the relocation of the plant. While I (and MassDEP) disagreed with their assertion that the plant existed before noise policy and was therefore part of the background, the measurements conducted did serve to demonstrate the existing facility impact.

Stockpiles as Noise Control

Proposed noise control for the facility includes permanent berms along the northern and eastern property boundaries, sound barrier walls to be affixed to equipment, and the stockpiles of product that will be created by the new equipment.

In my experience, it is common for quarries to claim stockpiles as means of noise control. I am generally critical of this claim, as stockpiles have the potential to disappear as a result of a spike in demand or lull in production.

The revised Permit Site Plan prepared by Hancock Associates, dated January 27, 2010, shows the largest stockpiles, which I understand to be for the most popular products, to be located farthest from the residential abutters. This places the majority of the haul truck activity behind these 40' piles. Under normal circumstances, this will provide acoustical shielding.

Depletion of these stockpiles, which I understand to be unexpected but possible, would degrade the effectiveness of this noise control. Compliance at some receptors may be difficult to demonstrate under this condition if it were to occur.

Receptor Elevations

The noise study reported predicted sound levels at each receptor, including each of the homes along White Tail Way at an elevation of 5 feet above grade. This is a fairly typical receptor height for a person standing outdoors. It would be appropriate for a property-line receptor location.

I requested that for a small sample of residential receptors, a calculation be performed at an elevation of 15 feet above grade, as this is a typical second-story window height. In the summer months, bedroom windows are often left open at night, and as the facility operates early in the morning, there is a potential for impact.

Tech Environmental promptly provided the results. Levels at each of the receptors modeled comply with both the MassDEP and Littleton criteria.

Backup Alarms

Conventional backup alarms meet all definitions of tonal noise sources, as they are designed to emit a single frequency. Both the MassDEP policy and Littleton's Noise Bylaw restrict tonal sources. As MassDEP has granted a draft permit, I'll concentrate here on the local criteria.

As transcribed in Page 3 of this letter, Littleton's Noise Bylaw provides an adjustment of 5 dB to the maximum allowable noise level when the noise source is tonal. This would reduce the limit from 50 dBA to 45 dBA for residential receptors.

In their study, Tech Environmental spread the expected usage of backup alarms on the site over a 1-hour period, and used the resulting level for their calculations. This resulted in a 15-dB reduction in sound level. Some noise criteria, most notably those provided in the 1974 EPA "Levels Document", provide recommended average sound level limits calculated on a 24-hour basis. These 24-hour sound levels are calculated from hourly-average levels, and it would be appropriate to spread the noise from a short-duration source over a 1-hour period for this type of calculation.

However, both the MassDEP and Littleton criteria provide absolute sound level limits, regardless of usage or duration of each source. For this reason, I requested that Tech Environmental recalculate receptor sound levels for backup alarms in the stockpile area using the full sound power level at a sample of homes along White Tail Way. The highest of these predicted levels is be 44.7 dBA. This is just below the limit of 45 dBA.

This difference of 0.3 dB is very small and, based on my experience, well within the margin of error of the model. I expect that backup alarms will occasionally exceed the 45-dBA limit at some residential receptors.

A statement was made by Tech Environmental during the February 25 Littleton Planning Board hearing that backup alarms are exempt from local regulations because they are mandated by OSHA for safety purposes. While this may be true on a public way, I would defer to the town's legal counsel to determine whether this applies to vehicles operating on private land.

During my site visit to the quarry, I was told that AI has changed the backup alarms on their on-site equipment to a type that produces broadband noise instead of a tone. These tend to be much less audible and less objectionable than the traditional tonal type. Further, they have requested that their customers use this type of alarm to replace any conventional alarm that fails. However, they have no ability to require it.

Berm Construction Timetable

The two planned 30-foot earthen berms comprise a major component of the proposed noise control for the facility. The first of these, along the boundary between the site and the homes on White Tail Way, has been constructed. However, construction of the second, along the eastern side of the site, is contingent upon the Conservation Commission review. This berm, if approved, will be built over the course of one to two years. This means that receptor sound levels to the east of the site will exceed the predicted levels, and in some cases the limits of the Noise Bylaw, during that time.

I asked for confirmation that none of the residential receptors will be left unprotected during this period. Tech Environmental confirmed that this is the case. Only industrial receptors will be affected.

Summary

Following is a summary of each of the points above:

- *Monitoring of Existing Ambient Levels* – At the request of MassDEP, measurements without the facility operating were conducted at several locations. However, these measurements were very short in duration, and no continuous monitoring was conducted. An applicant would typically be required to do more

extensive monitoring for a project of this scale.

- *Stockpiles as Noise Control* – The noise study takes noise-control credit for active material stockpiles. Though perhaps unlikely, it is possible that these could be temporarily depleted to the point where they would no longer be effective.
- *Receptor Elevations* – The study originally used receptor elevations of 5 feet above grade for the residences. At my request, four receptors were calculated at 15 feet above grade to represent a second-story window. At both elevations, predicted levels are very close to, but do not exceed, the limits.
- *Backup Alarms* – Conventional backup alarms emit noise that is tonal in nature, lowering the limit of the Noise Bylaw to 45 dBA. The highest predicted level is 44.7 dBA, which is very close to the limit. A determination should be made as to whether these are exempt from regulation because they are required by OSHA.
- *Berm Construction Timetable* – One of the two berms that comprise a important part of the noise control for this project awaits approval from the Conservation Commission. If approved, it will be built over an extended period of time, exposing some industrial receptors to noise levels in excess of the limit during the interim.

Conclusions and Recommendations

The noise modeling for this project was generally well executed. Acquisition of source sound levels and modeling of propagation to receptors were done in accordance with the industry standards.

That said, it is important to note that the predicted levels at many receptors are very close to both the MassDEP and Littleton limits – within 0.1 dB in some cases. The margin of error in this modeling process is not well known, but I consider these predicted levels to be well within that margin. This is offset somewhat by the conservative approach taken of modeling all sources operating simultaneously. However, I expect that there is a risk that actual community noise levels would exceed the limits during this operational condition.

In my opinion, there is substantial risk of violation in proceeding with such small margins for error. It is important that this risk be placed on the applicant, and not the town or its residents. As such, I recommend that the board do the following:

- ***Make demonstration of compliance a condition of approval.***

A program of monitoring should be developed with the input of all parties. As outlined on Page 4 of this letter, the following points should be considered:

- Duration and frequency of monitoring.
- Appropriate number and locations of monitors.
- Whether monitoring will be attended or unattended.
- Which descriptor will be used (average, maximum, etc.)
- Prevention of tampering with equipment or altering results.
- Determination of which party or parties will pay for the monitoring.
- Selection of an expert to review and interpret the results.

- ***Establish clear and meaningful penalties for violations.***

It is important that when a violation occurs, there is a well-established penalty and course of action to be taken. The penalty should be sufficiently meaningful to the applicant that they will be motivated to work quickly to resolve the violation.

Please feel free to contact me with any questions.

Sincerely,



Eric L. Reuter, INCE Bd. Cert.
Principal