January 15, 2016

Victoria Schmitt, PE
La Plata County Planning
211 Rock Point Drive
Durango, CO 81301

Dear Victoria:

I have reviewed the report titled ”King II Coal Mine Haul Truck Noise Assessment” submitted by Wave Engineering dated January 4, 2016. This report was produced by Wave Engineering for GCC Energy LLC in response to the Aimone-Martin Associates (AMA) review of a previous truck noise study in which critical study elements were missing. It is my opinion the Wave Engineering study provides important information needed to assess the impacts of coal mine haul truck noise on the local community along County Road 120.

Limitations of the Previous Noise Study

The previous noise study was conducted by Engineering Dynamics, Inc. and titled “Noise Assessment King II Coal Mine” dated November 2013. This study was performed to assess noise levels and provide commentary on the levels in relation to existing noise standards. The report did not include a discussion of possible mitigation measures.

The following is a brief summary of the Engineering Dynamics report:

- Measurements included C-weighted noise recorded at the on-site mine fan and at 7 residents and A-weighted measurements of truck noise recorded at the intersection of CR120 and the mine entrance road
- Truck noise recorded over 22 hrs averaged 55.2 dBA as measured 50 ft from CR120 centerline
- Average noise at residences ranged 54.2 to 67.6 dBC; high values were attributed to wind and vehicle (not specified) noise; background noise was not subtracted for these values
- Noise levels at residents over the monitoring period did not exceed the CRS 25-12-103 criteria or COGCC Sec. 803 criteria when wind and man-made noises were factored out to isolate only truck noise
- Exact locations of measurements at structures as they related to existing noise codes and guideline compliance were not identified
- Only daytime measurements were recorded; no nighttime measurements were made which are critical for complete compatibility assessments

In summary, the previous study did not directly address noise associated with coal haul trucks traveling along CR120 where impacts have been noted by the citizens. Further, nighttime measurements were not made in response to the objectionable nature of nighttime truck traffic. The study did not include measurements of background noise in the absence of haul trucks as well as other non-coal vehicles.

Recommendations for a Second Study

It was proposed by AMA that a truck noise study be conducted to include background noise in the absence of coal haul trucks and employ appropriate noise metrics that included nighttime assessments. Mine truck noise was to be compared with noise generate at receptors (houses) and other roadway noise on a week day and weekend day and include nighttime measurements. The study should use appropriate measurement techniques and equipment at distance commensurate with standard noise studies and statues limiting noise and include the standard 50 ft from road centerline and 25 ft from residents. Other study elements included truck noise at various travel speeds, on gravel and paved sections as well as sections of steepest grade, and address the source of the noise (e.g., motor versus tire). Units must include dBA and dBC (to include low frequency noise components) as well as day-night average over 24 hr. The latter is critical as resident complaints focused on truck noise at night that has affected sleep.

Study Elements used by Wave Engineering

Study elements used by Wave Engineering incorporated those recommended by AMA. Additional study parameters of interest were weather details of temperature, humidity and wind and frequency content of noise measurements critical to human perception. Noise modeling was used to address distance effects of noise as well as mitigation options.

Findings by Wave Engineering

It was the opinion of Wave Engineering that Colorado statute 25-12-107 is assumed to apply to vehicle traffic and proposed an upper limit to truck noise of 86 dBA at a point 50 ft from roadway.

The following is a summary of finding from the Wave Engineering Study:

<u>Roadway noise on flat roads for gravel and pavement:</u>
Surprisingly, non-haul truck roadway noise was similar in amplitude to coal haul trucks while some pick-ups were louder simply based on the fact that the haul trucks traveled at slower speeds than other vehicles on both pavement and gravel when passing houses (trucks slowed to 10 mph when passing residents).

<u>Roadway noise on grade for paved sections:</u>
Travel direction and payload (traveling loaded versus empty) were evaluated. Loaded trucks going uphill were louder than non-truck traveling uphill and unloaded trucks traveling downhill by about 4 dBA and 4 dBC. The effects of shifting going uphill was most distinguishable. When trucks were asked to slow to 10 mph traveling uphill, the noise was 4 dBA quieter than when traveling 17 to 21 mph. Since uphill travel at 10 mph may pose safety issues, requiring this speed uphill may not represent a mitigation option. *AMA is in agreement with this.*

Roadway noise for gravel roads with grade and flat:
Coal trucks traveling 10 mph on slight grades were louder than cars and trucks traveling faster on gravel road with slight grade. Coal truck travel at two speed ranges on flat gravel road sections were evaluated and it was found that a travel speed of 16 to 21 mph produced noise 7 to 8 dBA louder than when traveling at 10 to 12 mph. When grade was a factor, haul truck noise slightly exceeded non-haul truck noise.

Baseline noise at residents:
In the absence of traffic, background noise at residents was well below noise from traffic. The highest values in terms of dBC (this metric used for low frequency noise components that affect perception) were due to wind gusts in excess of 10 mph.

Summary:
Overall, in many cases the noise of cars and pickup trucks traveling faster than coal truck generated noise at residents that often exceeded coal truck noise. However, Wave Engineers felt that a measure of day-night noise was a better metric to use to assess coal truck noise impacts. As such, modeling of L_{DN} was performed to obtain predictions of night noise at residence locations.

I agree with this statement and feel the night noise levels are of the greatest concern to residents along CR120.

Modeling of day-night noise

Noise modeling was used to develop attenuation models of noise as a function of distance from the road to predict impact. The software used allowed the modeling of the many complex variables of terrain, vehicle counts and speed, road grade, pavement types, effects of walls and buildings and weather conditions.

Several scenarios were modeled with different truck counts to predict day-night sound levels L_{DN} and evaluate different mitigation options using the HUD criteria, where

L_{DN} below 65 decibels are “Acceptable”
L_{DN} of 65 to 75 are “Normally Unacceptable”

Although the HUD model applies to HUD-funded housing, it is a good model to use for the day-night noise metric that best affects compatibility for assessment in this case

The scenarios included various count combinations of background vehicles, mine non-truck traffic and haul trucks and assumptions of haul truck running times during the day and night. Travel speeds were realistic of the speeds currently in use on gravel and paved road and near residents. The speed of 35 mph on the steep hill was used even though the trucks travel at slower speeds.

Important findings from modeling are as follows:

- Under the current truck count, noise at one home exceeded the HUD “Acceptable” limit. The worst case for future truck counts resulted in noise at four homes that fell in the “normally unacceptable” range.
- Modeling with mitigation included barriers that apparently were effective only for one home close to the road while barriers were not effective to reduce noise for homes farther from the road.

- As expected, a truck speed reduction to 25 (on paved roads) and 10 mph reduced the haul truck noise. It is noted that speed reduction is currently practiced.
- Limiting haul truck traffic to daytime hours also reduced noise impact. However the economic impact of this approach was not studied.
- Wave Engineering felt that the source of truck noise at speeds less than 30 mph was chiefly from the engine and transmission and that tire noise was not an issue at current travel speeds.
- Barriers of the right height (unspecified) along with reducing truck speed (which is currently the practice) were noted as a noise reduction options
- Limiting truck trips at night was noted as a way to reduce overall impact (e.g., cumulative effects) while the noise from individual trucks would still occur.

Review of Mitigation Options in the AMA Review

GCC Energy requested that Wave Engineering review possible mitigation efforts discussed in the AMA review report dated August 24, 2015 and comment on the effectiveness and feasibility of efforts typically considered to reduce roadway noise. This discussion was very useful and, for the most part, the Wave Engineering assessments were in agreement with those provided by AMA. Many of the mitigation options were already implemented or are being considered by GCC Energy as noted in the Wave Engineering report.

Summary

I find that the Wave Engineering noise study is a thorough evaluation of vehicle and background noise impacts. The study provides sufficient information for GCC Energy LLC to make an informed decision on mitigation options and continue to keep haul truck noise as low as possible on CR120.

Yours truly.

Dr. Catherine Aimone-Martin
Blasting and Vibration Consultant