APPENDIX B – NOISE MODELING APPROACH

Mathematical modeling was conducted to predict noise impacts from the proposed plant operations. Noise from an essentially localized source radiates out as it moves away from a source. The effect of distance on sound pressure levels (SPLs) is to cause them to spread out and decrease as they move away from the source. The noise level created by the source decreases at the rate of 6 dB per doubling of distance (referred to as the “inverse square law”). This common effect applies to all types of energy production originating from a point source that is not directional in nature. However, a certain amount of sound energy is absorbed in the air due to “molecular absorption.” Energy absorption can be ignored at short distances but should be considered for sound transmissions over large distances (Miller, 1975).

There are many attenuating factors that have to be addressed to predict accurately SPLs at sensitive receptors. Natural attenuation factors, such as precipitation, wind, temperature gradients, humidity, and natural barriers (i.e., trees, hills, and other topographical features), also help to decrease noise levels at the receiver (Beranek, 1992). In order to ensure that the noise modeling would remain conservative, these factors were not included in the initial modeling. Distance was the primary attenuation factor used for this particular project due to its accuracy, with additional attenuation derived from atmospheric absorption and soft ground absorption.

An outdoor noise source that has no objects or surfaces to reflect sound (other than the ground) is assumed to be a “nondirectional” source (i.e., it is radiated equally in all directions), the SPL at a distance “r” is given by (Beranek, 1992):

$$L_p(r) = L_w - 20\log(r/r_{ref}) + DI_{rcvr} - 10\log(\Omega/4\pi) - 0.5 - A_{combined\ rcvr}$$

Where:

L_w - known sound power level at the source (near field – about 3 feet away)

DI_{rcvr} - source directivity index in the receiver direction

$10\log(\Omega/4\pi)$ - represents the solid angle of sound propagation (- (-3) for a semispherical field)

0.5 - constant for using feet as units

$A_{combined\ rcvr}$ - combined attenuation from all significant attenuating mechanisms between the source and receiver.

r - distance in feet from noise source to receiver

r_{ref} - reference distance for sound power level calculations, usually 3 feet (near field) or 400 feet (far field).

The above equation specifies the use of the SPL at the source of the noise. Since the vendor specifications stated a requirement for the SPL at a distance of 3 feet from the source (which is a common reference used in noise measurements and computations called the “near field” noise level), the SPL at this point and also at a point 400 feet from the noise source (the “far field” noise level), were considered to be more appropriate for this study. Therefore, the noise propagation formula was solved algebraically for these terms and one or both were used in the noise level calculations throughout this study.

References for Appendix B

Beranek, L. L., and I. L. Ver. 1992. Noise and Vibration Control Engineering Principles and Applications. John Wiley & Sons, Inc. New York.

Miller, L. N. 1975. Engineering Control of Occupational Noise Exposure. Bolt, Beranek and Newman, Inc., Atlanta.