Glossary of Noise Control Terminology

1 General

1.01 oscillation. Variation, usually with time, of the magnitude of a quantity with respect to a specified reference when the magnitude is alternately greater and smaller than the reference.

1.02 sound. (a) Oscillation in pressure, stress, particle displacement, particle velocity, etc., in a medium with internal forces (e.g., elastic or viscous), or the superposition of such propagated oscillations. (b) Auditory sensation evoked by the oscillation described above.

1.03 noise. Undesired sound.

1.04 vibration. Oscillation of a parameter that defines the motion of a mechanical system.

1.05 displacement1. Quantity that specifies the change of position of a particle, or body, with respect to a reference frame.

2 Periodic Quantities

2.01 periodic quantity. Oscillating quantity whose values recur for certain increments of the independent variable. If a periodic quantity v is a function of time t, then $v = f(t) = f(t+T)$, where T, a constant, is a period of v.

2.02 period. Smallest increment of an independent variable for which a function repeats itself.

2.03 frequency. For a function periodic in time, the reciprocal of the period. Unit, hertz (Hz).

2.04 audio frequency. Frequency of a sound wave normally audible to humans. Unit, hertz (Hz). Audio frequencies range roughly from 15 Hz to 20 kHz.

2.05 ultrasonic frequency. Frequency higher than the nominal audio frequency range. Unit, hertz (Hz).

2.06 infrasonic frequency. Frequency lower than the nominal frequency range. Unit, hertz (Hz).

2.07 peak-to-peak value. Algebraic difference between extremes of an oscillating quantity.

2.08 simple harmonic quantity. Periodic quantity that is a sinusoidal function of the independent variable. Thus $y = A\ sin(\{omega\}t + \{phi\})$, where y is the simple harmonic quantity, A is the amplitude, {omega} is the angular frequency, and {phi} is the phase of the oscillation. The maximum value of a simple harmonic quantity is amplitude A.

2.09 simple harmonic motion. Motion such that the displacement is a sinusoidal function of time.

3 Waves.

3.01 wave. Disturbance propagating in a given direction such that the quantity serving as a measure of the disturbance varies with position and time in a manner that at pairs of neighboring positions the disturbance is similar except for a time difference. The velocity of propagation of the disturbance is equal to the distance between neighboring positions divided by the time difference.

3.02 wavefront. For a progressive wave in space, continuous surface that is a locus of points having the same phase at a given instant.

3.03 wavelength. For a periodic wave in an isotropic medium, perpendicular distance between two wavefronts in which the displacements have a difference in phase of one complete period. Unit, meter (m).

3.04 fundamental. Component of a periodic wave having the lowest frequency.

3.05 harmonic. Sinusoidal quantity that has a frequency which is an integral multiple of the fundamental.

3.06 subharmonic. Sinusoidal quantity having a frequency that is an integral submultiple of the fundamental.

3.07 signal. (a) Disturbance used to convey information. (b) Information to be conveyed over a communication system.

3.08 sound field. Region containing sound waves.

3.09 free progressive wave. Wave in a medium free from boundary effects.

3.10 free field. Field in a homogeneous, isotropic medium free from boundaries.

3.11 longitudinal wave. Wave in which the direction of displacement at each point of the medium is normal to the wavefront.

3.12 compressional wave. Wave in an elastic medium which causes an element of the medium to change its volume without undergoing rotation. A compressional wave is a longitudinal wave.

3.13 transverse wave. Wave in which the direction of displacement at each point of the medium is parallel to the wavefront.

3.14 plane wave. Wave in which the wavefronts are everywhere parallel planes normal to the direction of propagation.

3.15 spherical wave. Wave in which the wavefronts are concentric spheres.

3.16 standing wave. Periodic wave having a fixed distribution in space which is the result of interference of progressive waves of the same frequency and kind. Such waves are characterized by the existence of nodes or partial nodes and antinodes that are fixed in space.

3.17 speed of sound. At a temperature of 15 degrees Celsius, the speed of sound in air at sea level is approximately 341 m/s, and is proportional to the square root of absolute temperature; symbol, *c*.

3.18 refraction. Process by which the direction of sound propagation is changed as a result of a spatial variation in the speed of sound in the medium.

3.19 specular reflection. Phenomenon by which a sound wave is returned by a surface separating two media at an angle from the normal equal to the angle of incidence.

3.20 diffracted wave. Wave whose front has been changed in direction by an obstacle or other nonhomogeneity in a medium, other than by reflection or refraction.

3.21 diffraction. Process that produces a diffracted wave.

4 Spectrum.

4.01 spectrum. (a) Description, for a function of time, of the resolution of a signal into components, each of different frequency and (usually) different amplitude and phase. (b) "Spectrum" is also used to signify a continuous range of components, usually wide in extent, within which waves have some specified common characteristic; e.g., "audio frequency spectrum."

4.02 spectrum density. Limit, as the bandwidth approaches zero, of the mean-square amplitude divided by bandwidth.

4.03 power spectrum density. Limit, as the bandwidth approaches zero, of sound power divided by bandwidth. Unit, watt per hertz (W/Hz).

4.04 line spectrum. Spectrum whose components occur at a number of discrete frequencies.

4.05 pure tone. (a) Line spectrum consisting of a signal at a single frequency. (b) Sound wave, the instantaneous sound pressure of which is a simple sinusoidal function of time. Also referred to as a discrete tone, see 8.09.

4.06 complex tone. Sound wave containing simple harmonic components of different frequencies.

4.07 octave [2]. Two frequencies are an octave apart if the ratio of the higher frequency to the lower frequency is two.

4.08 continuous spectrum. Spectrum of a wave whose components are continuously distributed over a frequency region.

4.09 frequency weighting [2]. Process of modifying the amplitudes and phases of selected components of a spectrum.

4.10 A-frequency weighting [2]. Frequency weighting of a spectrum according to a standardized frequency response curve. Other standardized frequency weightings (e.g. B,C) are sometimes used.

5 Pressure, Velocity, Energy, and Power.

5.01 static pressure. Pressure that would exist at a point in the absence of a sound wave. Unit, pascal (Pa); symbol, *P*{sub s}. One pascal is equal to one newton per square meter.

5.02 instantaneous sound pressure. At some specified time, the total instantaneous pressure at a point in a medium minus the static pressure at that point. Unit, pascal (Pa); symbol, *p*.

5.03 sound pressure amplitude [2]. Absolute value of the instantaneous pressure. Unit, pascal (Pa).

5.04 peak sound pressure. Greatest value of the absolute instantaneous sound pressure within a specified time interval. Unit, pascal (Pa).

5.05 effective sound pressure. Root-mean-square value of the instantaneous sound pressure at a point, during a given time interval. Unit, pascal (Pa). The effective sound pressure is commonly referred to as the sound pressure.

5.06 sound exposure. Time integral of squared, instantaneous frequency-weighted sound pressure over a stated time interval or event. Unit, pascal-squared second; symbol, *E*. If frequency weighting is not specified, A-frequency weighting is understood.

5.07 particle velocity. In a sound field, the velocity caused by a sound wave of a given infinitesimal part of the medium, with reference to the medium as a whole. Unit, meter per second (m/s); symbol, *u*. The terms "instantaneous particle velocity," "effective particle velocity," and "peak particle velocity" have meanings that correspond with those of the related terms used for sound pressure.

5.08 sound energy. Total energy in a given part of a medium minus the energy that would exist at that same part of the medium with no sound waves present. Unit, joule (J).

5.09 sound-energy flux. Time rate of flow of sound energy for one period through a specified area. Unit, watt (W); symbol, *J*.

5.10 sound intensity. Average rate of sound energy transmitted in a specified direction at a point through a unit area normal to this direction at the point considered. Unit, watt per square meter (W/m{sup 2}); symbol, *I*.

5.11 sound power. Sound energy radiated by a source per unit of time. Unit, watt (W); symbol, *W*.

5.12 point source. Source that radiates sound as if from a single point.

6 Levels.

6.01 level. In acoustics, logarithm of the ratio of a quantity to a reference quantity of the same kind. The base of the logarithm (always ten, unless otherwise specified), the reference quantity, and the *kind* of level shall be specified. Examples of kinds of levels are sound power level and sound intensity level. For common logarithms on the base ten, the symbol for logarithm is "lg."

6.02 bel. Unit of level when the base of the logarithm is ten, and the quantities concerned are proportional to power. Symbol, B.

6.03 decibel [3]. Unit of level equal to one tenth of a bel. Symbol, dB.

6.04 sound power level. Logarithm of the ratio of a given sound power in a stated frequency band or with a stated frequency weighting, to the reference power of one picowatt (1 pW). Unit, bel (B); symbol, *L*W.

6.05 noise power emission level4. A-weighted sound power level. Unit, bel (B).

6.06 sound pressure level. Ten times the logarithm of the ratio of the time-mean-square pressure of a sound, in a stated frequency band or with a stated frequency weighting, to the square of the reference sound pressure of 20 micropascal. Unit, decibel (dB); symbol, *L*{sub *p*}.

6.07 band pressure level. Sound pressure level for sound contained within a restricted frequency band. Unit, decibel (dB); symbol, *L*{sub *p*b}. A band may be identified by its nominal lower and upper band edge frequencies, or by its nominal midband frequency and nominal bandwidth. The nominal width of the band may be indicated by a prefatory modifier, e.g., octave-band sound pressure level, one-third-octave-band sound pressure level, or 50- Hz band level at 400 Hz.

6.08 A-weighted sound pressure level. Ten times the logarithm of the ratio of A-weighted squared sound pressure to the squared reference sound pressure of 20 micropascal, the squared sound pressure being obtained with fast (F) (125-ms) exponentially weighted time averaging. Alternatively slow (S) (1000-ms) exponentially weighted time averaging may be specified. Unit, decibel (dB); symbol, *L*{sub A}.

6.09 maximum A-weighted sound pressure level. Greatest fast (125-ms) A-weighted sound pressure level, within a stated time interval. Unit, decibel (dB); symbol, *L*{sub AFmax}.

6.10 peak A-weighted sound pressure level. Level of peak sound pressure with A-frequency weighting, within a stated time interval. Unit, decibel (dB); symbol, *L*{sub Apk}.

6.11 equivalent continuous A-weighted sound pressure level [5]. A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval, has the same time-mean-square sound pressure as a sound under consideration which varies with time. Unit, decibel (dB); symbol, *L*{sub AeqT}.

6.12 sound exposure level. Ten times the logarithm of the ratio of a given time integral of squared instantaneous A-weighted sound pressure, over a stated time interval or event, to the product of the squared reference sound pressure of 20 micropascals and reference duration of one second. The frequency weighting and reference sound exposure may be otherwise if stated explicitly. Unit, (dB); symbol, L_{AE}.

6.13 sound intensity level. Ten times the logarithm of the ratio of a given sound in a stated direction to the reference sound intensity of 1 picowatt per square meter (1 pW/m{sup 2}). Unit, decibel (dB); symbol, L_I.

7 Instruments and Devices.

7.01 sound level meter. Device used to measure sound pressure level with a standardized frequency weighting and indicated exponential time weighting for measurements of sound pressure level, or without time weighting for measurement of time- average sound pressure level or sound exposure level.

7.02 integrating-averaging sound level meter. Device for measuring the level of time-mean-square frequency-weighted sound pressure during a stated time interval.

7.03 filter. Device for separating waves on the basis of their frequency.

7.04 bandpass filter. Filter with a single transmission band or passband with relatively low attenuation extending from a lower band-edge frequency greater than zero to a finite upper band- edge frequency.

7.05 filter nominal midband frequency. For a set of contiguous one-third octave bandpass filters, frequency of a specified series such as the preferred frequency series that includes 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, and 1000 hertz, extended by successive multiplication or division by 10. For a set of contiguous octave bandpass filters, the nominal midband frequency is one of a series such as the preferred frequency series that includes 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, and 8000 hertz, extended by successive multiplication or division by 10. Unit, hertz (Hz).

7.06 spectrum analyzer. Device used to determine the frequency spectrum of a sound.

7.07 silencer; muffler. Duct designed to reduce the level of sound. The sound reducing mechanisms may be either absorptive or reactive, or a combination.

7.08 Helmholtz resonator. Hollow, rigid-walled, cavity used as a resonator. The cavity may be partially or completely filled with a porous material.

7.09 hearing protector. Personal device worn to reduce harmful auditory or annoying subjective effects of sound.

7.10 earplug. Hearing protector that is inserted into the ear canal.

7.11 earmuff. Hearing protector worn over the pinna of an ear.

7.12 porous sound absorber. Material with interconnected voids that presents resistance to airflow through the material.

7.13 duct lining. Layer of porous material placed on the inner surface of a duct to attenuate sound that propagates through the duct.

8 Noise.

8.01 ambient noise. All-encompassing sound at a given place, usually a composite of sounds from many sources near and far.

8.02 background noise. Total of all sources of interference in a system used for the production, detection, measurement, or recording of a signal, independent of the presence of the signal.

8.03 white noise. Noise for which the spectrum density is independent of frequency over a specified range.

8.04 pink noise. Noise for which the spectrum density varies as the inverse of frequency.

8.05 steady noise [5]. Noise with neglibly small fluctuations of level within the period of observation.

8.06 non-steady noise [5]. Noise whose level varies significantly during the period of observation.

8.06.1 fluctuating noise [5]. Noise whose level varies continuously and to an appreciable extent during the period of observation.

8.06.2 intermittent noise [5]. Noise whose level abruptly drops to the level of the background noise several times during the period of observation, the time during which the level remains at a constant value different from that of the ambient being of the order of 1 s or more.

8.06.3 impulsive noise [5]. Noise consisting of a series of bursts of sound energy, each burst having a duration less than approximately 1 s.

8.06.3.1 isolated burst of sound energy [5]. Single burst of sound energy or a series of bursts with intervals longer than 0,2 s between the individual bursts.

8.06.3.2 quasi-impulsive noise [5]. Series of noise bursts of comparable amplitude with intervals shorter than 0,2 s between the individual bursts.

8.07 discrete tone [5]. A discrete tone can be either a sinusoidal variation (see 4.05, pure tone), in which case the frequency spectrum would show a single "spike" at the sinusoidal frequency, or, more typically, a non-sinusoidal variation, in which case the spectrum would show a spike at the fundamental frequency and other spikes at harmonics of the fundamental.

8.08 broad-band noise [5]. Noise in which the acoustic energy is distributed over a relatively wide range of frequencies. The spectrum is generally smooth and continuous, although it may vary significantly from "flat." If the broad-band sound does not contain any significant discrete tones, the sound will lack a subjective quality of pitch or tonality.

8.09 narrow-band noise [5]. Noise in which the acoustic energy is concentrated in a relatively narrow range of frequencies. The spectrum will generally show a localized "hump" or peak in amplitude. Narrow-band sound may be superimposed on broad-band sound. If the narrow-band sound does not contain any significant discrete tones, the sound will generally lack a subjective quality of pitch or tonality.

8.10 noise emission [5]. Airborne sound radiated by a well- defined noise source (e.g. a machine under test).

8.11 noise immission [5]. Airborne sound received at the ear of an observer being a composite of all sounds in the vicinity of the observer.

8.12 noise induced temporary threshold shift. Temporary hearing loss resulting from exposure to noise. Abbreviation, NITTS.

8.13 noise induced permanent threshold shift. Permanent hearing loss resulting from exposure to noise. Abbreviation, NIPTS.

9 Building Acoustics.

9.01 sound absorption. At a specified frequency or in a specified frequency band, property of a material or an object whereby sound energy is converted into heat by propagation in a medium or when sound strikes the boundary between two media.

9.02 echo. Reflected sound wave that arrives with sufficient magnitude and time delay as to be distinguishable from a sound wave received directly from a source.

9.03 reverberation. Sound that persists in an enclosed space, as a result of repeated reflection or scattering, after the sound source has stopped.

9.04 reverberation time. Of an enclosure, for a stated frequency or frequency band, time that would be required for the level of the time-mean-square sound pressure in the enclosure to decrease by 60 dB, after the source has been stopped. Unit, second (s).

9.05 decay rate. At a stated frequency, time rate at which sound pressure level decreases in a room. Unit, decibel per second (dB/s). Decay rate d in a reverberant room is related to reverberation time T by $T = 60 \text{ dB} / d$.

9.06 Sabine absorption. Sound absorption defined by the Sabine reverberation-time equation. Unit, metric sabin. In a reverberant room of volume V, speed of sound c, and decay rate d, Sabine absorption is $A = 0.921\ Vd / c$.

9.07 room absorption. Sum of Sabine absorptions due to objects and surfaces in a room, and due to dissipation of energy in the medium within the room. Unit, metric sabin. With $A\{\text{sub } i\}$ as the Sabine absorption of the ith surface or object or medium in a room, total room absorption is $A = \{\text{sigma}\}A\{\text{sub } i\}$.

9.08 sound absorption coefficient. Ratio of Sabine absorption of a surface to the area of the surface. Unit, metric sabin per square meter, often omitted. With $a\{\text{sub } i\}$ as the Sabine absorption coefficient of the ith surface whose area is $S\{\text{sub } i\}$, the Sabine absorption attributed to the surface is $A\{\text{sub } i\} = S\{\text{sub } i\}a\{\text{sub } i\}$.

9.09 noise reduction coefficient. Arithmetic mean of sound absorption coefficients at 250, 500, 1000, and 2000 Hz, rounded to the nearest 0.05 metric sabin per square meter.

9.10 reverberation room. Room having a long reverberation time, specially designed to make the sound field therein as diffuse as possible.

9.11 live room. Room characterized by a relatively small amount of sound absorption.

9.12 random incidence. Incidence of sound waves successively from all directions with equal probability. If an object is in a diffuse sound field, the sound is said to strike the object at random incidence.

9.13 direct sound field. That portion of a sound field, in an enclosure, which arrives from the sound source without having undergone any reflection.

9.14 diffuse sound field. Sound field in which the time average of the mean-square sound pressure is everywhere the same and the flow of acoustic energy in all directions is equally probable.

9.15 anechoic room. Test room whose surfaces absorb essentially all of the incident sound energy over the frequency range of interest, thereby affording nearly free-field conditions over the measurement surface.

9.16 hemi-anechoic room. Test room with a hard, reflecting floor whose other surfaces absorb essentially all the incident sound energy over the frequency range of interest, thereby affording nominally free-field conditions above a reflecting plane.

9.17 dead room. Room characterized by a relatively large amount of sound absorption and a relatively short reverberation time.

9.18 average sound pressure level in a room. Ten times the logarithm of the ratio of the space and time average of squared sound pressure to the squared reference sound pressure, the space average being taken over the total volume of the room, except for the regions of the room where the direct field of the source and the near field of the boundaries are of significance. Unit, decibel (dB).

9.19 noise reduction. Between two rooms in a specified frequency band, difference between the space-time average sound pressure levels in the two enclosed spaces when one or more sound sources operates in one of the rooms. Unit, decibel (dB).

9.20 transmission loss. Of a partition, for a specified frequency or frequency band, difference in decibels between the average sound pressure levels in the reverberant source and receiving rooms, plus ten times the logarithm of the ratio of the area of the common partition to the total Sabine absorption in the receiving room. Unit, decibel (dB); abbreviation, TL.

9.21 structure-borne sound. Sound for which a significant portion of the transmission path from source to receiver takes place in a solid structure rather than through a liquid or gas.

9.22 flanking sound transmission. In sound transmission measurement, the transmission of sound from the sound source room to the receiving room by paths other than through the partition under test. Flanking transmission may include structure-borne sound transmission.