Acoustic dB Formulas with Air References

- Sound Pressure Level: $L_p(f) = 20 \log (P / P_{ref})$

  P = pressure rms in frequency band centered at f

  P_{ref} = 20 micro Pa

- Sound Intensity Level: $L_I(f) = 10 \log (I / I_{ref})$

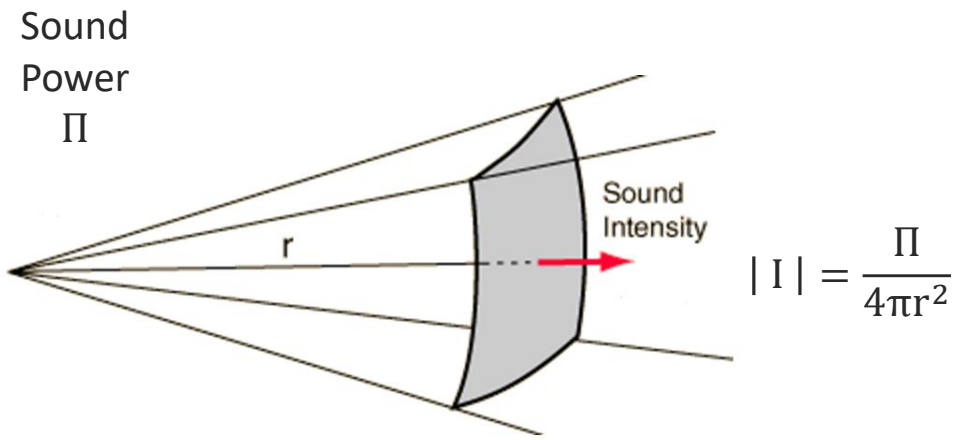
  I = intensity rms in frequency band centered at f

  I_{ref} = 1 pico W / m^2

- Sound Power Level: $L_w(f) = 10 \log (\Pi / \Pi_{ref})$

  Π = power rms in frequency band centered at f

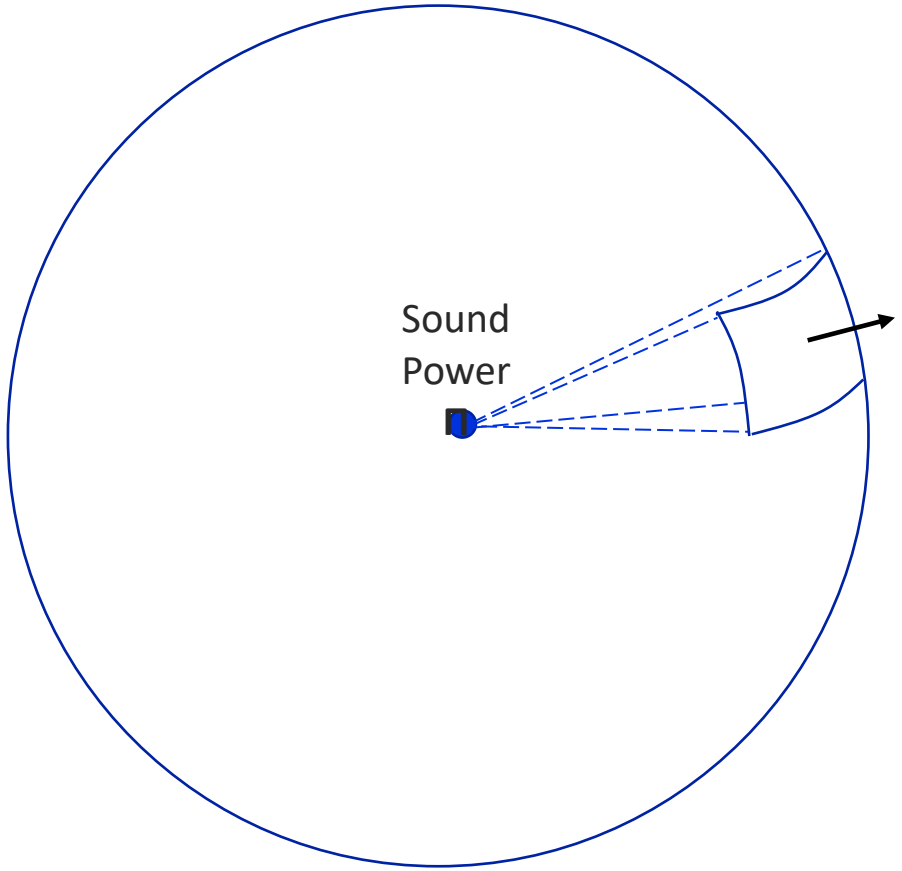
  Π_{ref} = 1 pico W



$$| I | = \frac{\Pi}{4\pi r^2}$$

- *Sound radiated uniformly into a spherical volume*
- *Sound intensity is the power carried by sound waves per unit area in a direction perpendicular to that area*
- *The basic sound power source model is a discrete point, monopole*

Propagation from a Point Source into a Spherical Volume, Uniform Radiation, Free-Field



- The intensity magnitude is calculated from power as

$$|\,I\,| = \frac{\Pi}{4\pi r^2}$$

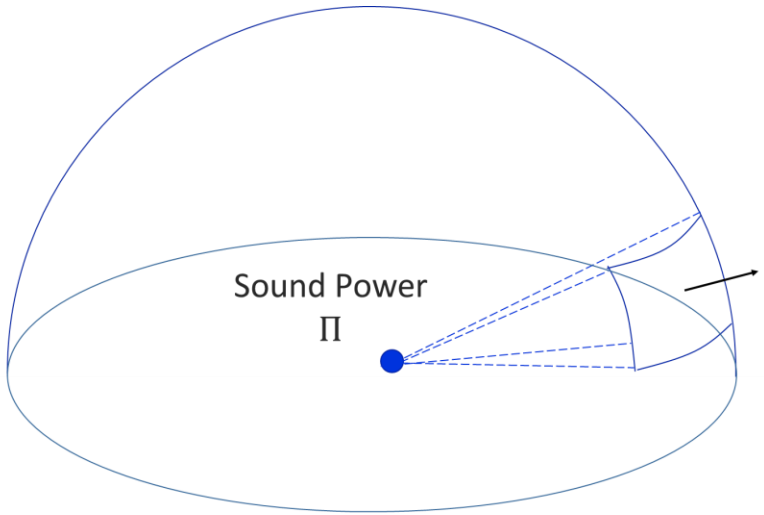
- The intensity magnitude is calculated from the measured pressure root-mean-square as

$$|\,I\,| = \frac{(p_{rms})^2}{\rho c}$$

ρ is the mass density of medium

c is the speed of sound in the medium

Propagation from a Point Source into a Hemispherical Volume, Uniform, Free-Field



- The source is at the center of the bottom
- The bottom surface is perfectly reflective

- The intensity magnitude is calculated from power as

$$|I| = \frac{\Pi}{2\pi r^2}$$

- The intensity magnitude is calculated from the measured pressure root-mean-square as

$$|I| = \frac{(p_{rms})^2}{\rho c}$$

ρ = air mass density
c = speed of sound

- The product ρc is called the characteristic impedance
- For normal air conditions, ρc = 415 Rayls
- 1 Rayl = 1 Pa sec/m