In our previous discussions of acoustic power P_a associated *e.g.* with "point" sound sources, the context was always with regard to ***propagating*** sound – *i.e.* sound ***radiation*** – purely ***real*** (and/or ***time-averaged***) acoustic power.

We see from above that the ***real*** component of the complex acoustic power of a monopole sound source – which is associated with ***propagating*** sound energy – is indeed a constant, whereas the ***imaginary*** component of the complex acoustic power of a monopole sound source – which is associated with ***non-propagating*** acoustic energy – ***is*** explicitly r-dependent, and especially so in the "***near***" zone, when $kr \ll 1$.

The purely ***real***, ***scalar*** ***frequency*** ***domain*** potential, kinetic and total acoustic energy densities associated with a "point" monopole sound source radiating monochromatic, radially-outgoing spherical waves are:

$$w_a^{potl}(r,\omega) \equiv \frac{1}{4}\frac{\left|\tilde{p}(r,\omega)\right|^2}{\rho_o c^2} = \frac{1}{4}\frac{1}{\rho_o c^2}\frac{B_o^2}{r^2} = \frac{\rho_o B_o^2}{4z_o^2 r^2} \;\; \left(Joules/m^3\right)$$

$$w_a^{kin}(r,\omega) \equiv \frac{1}{4}\rho_o\left(\tilde{u}_r(r,\omega)\cdot\tilde{u}_r^*(r,\omega)\right) = \frac{1}{4}\rho_o\left|\tilde{u}_r(r,\omega)\right|^2 = \frac{\rho_o B_o^2}{4z_o^2 r^2}\left[1+\left(\frac{1}{kr}\right)^2\right] \;\; \left(Joules/m^3\right)$$

$$w_a^{tot}(r,\omega) \equiv w_a^{potl}(r,\omega) + w_a^{kin}(r,\omega) = \frac{\rho_o B_o^2}{4z_o^2 r^2} + \frac{\rho_o B_o^2}{4z_o^2 r^2}\left[1+\left(\frac{1}{kr}\right)^2\right] = \frac{\rho_o B_o^2}{4z_o^2 r^2}\left[2+\left(\frac{1}{kr}\right)^2\right] \;\; \left(Joules/m^3\right)$$

Note that the ratio of potential energy density to kinetic energy density is:

$$\frac{w_a^{potl}(r,\omega)}{w_a^{kin}(r,\omega)} = \frac{\frac{1}{4}\frac{\left|\tilde{p}(r,\omega)\right|^2}{\rho_o c^2}}{\frac{1}{4}\rho_o\left|\tilde{u}_r(r,\omega)\right|^2} = \frac{\cancel{\frac{\rho_o B_o^2}{4z_o^2 r^2}}}{\cancel{\frac{\rho_o B_o^2}{4z_o^2 r^2}}\left[1+\left(\frac{1}{kr}\right)^2\right]} = \frac{1}{\left[1+\left(\frac{1}{kr}\right)^2\right]} \le 1$$

In the "near" zone, $kr \ll 1$ where the complex radial particle velocity, ***specific*** acoustic impedance, energy flow velocity, acoustic intensity and power are largely ***reactive*** (*i.e.* ***imaginary***), $w_a^{potl}(r,\omega) \ll w_a^{kin}(r,\omega)$. Only in the "***far***" (*i.e.* radiation) zone, when $kr \gg 1$, and moreover, when $kr \to \infty$ (*i.e.* in free-field conditions) does $w_a^{potl}(r,\omega) \approx w_a^{kin}(r,\omega)$.

Please see/look at plots of the above complex acoustic quantities associated with the point acoustic monopole, available on the Physics 406 Software web-page, at the following URL:

http://online.physics.uiuc.edu/courses/phys406/406pom_sw.html