In an infinite medium, the total field $\psi(\boldsymbol{r})$ (velocity potential, or pressure if you want) is given by the volume integral

$$\psi(\boldsymbol{r}) = \int_{V_0} f(\boldsymbol{r}_0) g_\omega(\boldsymbol{r}|\boldsymbol{r}_0)\, \mathrm{d}v_0 \tag{1}$$

where $f(\boldsymbol{r}_0)$ is the source strength, and where $g_\omega(\boldsymbol{r}|\boldsymbol{r}_0)$ is the free-field Green's function.

Noting that the total field is also given by the Helmholtz-Kirchoff integral,

$$\psi(\boldsymbol{r}) = \iiint f_\omega(\boldsymbol{r}_0) g_\omega(\boldsymbol{r}_0|\boldsymbol{r}) dv_0 + \oiint \{g_\omega(\boldsymbol{r}_0|\boldsymbol{r}) \tfrac{\partial\psi(\boldsymbol{r}_0)}{\partial n_0} - \psi(\boldsymbol{r}_0) \tfrac{\partial g_\omega(\boldsymbol{r}_0|\boldsymbol{r})}{\partial n_0}\} dS_0, \tag{2}$$

Comparing equations (1) and (2) shows that the surface integral in (2) must vanish:

$$\begin{aligned} 0 &= \oiint \{g_\omega(\boldsymbol{r}_0|\boldsymbol{r}) \tfrac{\partial\psi(\boldsymbol{r}_0)}{\partial n_0} - \psi(\boldsymbol{r}_0) \tfrac{\partial g_\omega(\boldsymbol{r}_0|\boldsymbol{r})}{\partial n_0}\} dS_0 \\ &= \oiint \left\{ \frac{e^{ikR}}{4\pi R} \frac{\partial\psi(\boldsymbol{r}_0)}{\partial n_0} - \psi(\boldsymbol{r}_0) \frac{\partial}{\partial n_0} \frac{e^{ikR}}{4\pi R} \right\} dS_0 \\ &= \oiint \frac{e^{ikR}}{4\pi R} \{ \tfrac{\partial\psi(\boldsymbol{r}_0)}{\partial n_0} - ik\psi(\boldsymbol{r}_0)\} dS_0 \end{aligned}$$

The area of a sphere goes as R^2, so for the right-hand-side to go to 0, the integrand must go to 0 faster than R^{-2} as $R \to \infty$. Since $\frac{e^{ikR}}{4\pi}$ is oscillatory, it does not affect the convergence to 0. The condition for convergence is therefore[1]

$$\begin{aligned} \lim_{R\to\infty} \left(\frac{1}{R}\right) \left(\tfrac{\partial\psi(\boldsymbol{r}_0)}{\partial n_0} - ik\psi(\boldsymbol{r}_0) \right) \div R^{-2} &= 0 \\ \lim_{R\to\infty} R \left(\tfrac{\partial\psi(\boldsymbol{r}_0)}{\partial n_0} - ik\psi(\boldsymbol{r}_0) \right) &= 0 \\ \lim_{R\to\infty} R \left(\tfrac{\partial}{\partial n_0} - ik \right) \psi(\boldsymbol{r}_0) &= 0 \end{aligned}$$

This is the so-called Sommerfeld radiation condition, which must be satisfied by any field in an infinite medium.

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[1] For two functions $A(x)$ and $B(x)$ that approach 0 as $x \to \infty$, $A(x) \to 0$ faster than $B(x)$ if $\lim_{x\to\infty} \frac{A(x)}{B(x)} \to 0$.