

**32.45. Model:** An electric current produces a magnetic field.

**Solve:** (a) The field of a household wire is

$$B = \frac{\mu_0 I}{2\pi d} = \frac{(2 \times 10^{-7} \text{ T m / A})(10 \text{ A})}{2 \text{ m}} = 1.0 \times 10^{-6} \text{ T} = 1.0 \mu\text{T}$$

(b) The earth's field is  $B_{\text{earth}} = 5 \times 10^{-5} \text{ T} = 50 \mu\text{T}$ , so  $B_{\text{wire}}/B_{\text{earth}} = 1.0 \mu\text{T}/50 \mu\text{T} = 0.02 = 2.0\%$ .

(c) The field of a transmission line is

$$B = \frac{\mu_0 I}{2\pi d} = \frac{(2 \times 10^{-7} \text{ T m / A})(200 \text{ A})}{20 \text{ m}} = 2.0 \times 10^{-6} \text{ T} = 2.0 \mu\text{T}$$

This is twice the field of part (a), which would probably not be *significantly* worse.

(d) Let's estimate that a fetus is 10 cm ( $\approx 4$  inches) from a 1 A current. Here the field is

$$B = \frac{\mu_0 I}{2\pi d} = \frac{(2 \times 10^{-7} \text{ T m / A})(1 \text{ A})}{0.1 \text{ m}} = 2.0 \times 10^{-6} \text{ T} = 2.0 \mu\text{T}$$

This is twice the field of part (a).