48. (a) We consider the radial field produced at points within a uniform cylindrical distribution of charge. The volume enclosed by a Gaussian surface in this case is $L\pi r^2$. Thus, Gauss' law leads to

$$E = \frac{|q_{\text{enc}}|}{\varepsilon_0 A_{\text{cylinder}}} = \frac{|\rho|\left(L\pi r^2\right)}{\varepsilon_0\left(2\pi r L\right)} = \frac{|\rho| r}{2\varepsilon_0} \ .$$

(b) We note from the above expression that the magnitude of the radial field grows with r.

(c) Since the charged powder is negative, the field points radially inward.

(d) The largest value of r which encloses charged material is $r_{\text{max}} = R$. Therefore, with $|\rho| = 0.0011 \text{ C/m}^3$ and $R = 0.050$ m, we obtain

$$E_{\text{max}} = \frac{|\rho| R}{2\varepsilon_0} = 3.1 \times 10^6 \text{ N/C} \ .$$

(e) According to condition 1 mentioned in the problem, the field is high enough to produce an electrical discharge (at $r = R$).