

Uncertainty Analysis for EEM 4: In-Situ Biodegradation **Emission Rate for Benzene from Gasoline-Contaminated Soil**

Variable parameters are in bold:

Assumptions:	C =	10 ppm	soil concentration of benzene
	A =	2500 m ²	surface area
	D =	5 m	excavation depth
	beta =	1.5 g/cm ³	bulk density of the soil
	Mfrac =	0.15 %/100	moisture by weight

Equations used:

$$ER \text{ (g/sec)} = (C_g)(Q/60)(10^{-6})$$

$$C_g \text{ (ug/m}^3\text{)} = [(P_s)(M_w)(10^9)]/[(R)(T_s)]$$

$$Q \text{ (m}^3\text{/min)} = (1.0/1440)(S_v)(E_a)$$

Additional Parameters:

Pa =	95.2 mm Hg	vapor pressure of benzene at ambient temp. (298K)
Ps =	77.1 mmHg	vapor pressure of benzene at soil temp. (293K)
MW =	78 g/g-mol	molecular weight
Ta =	298 degrees K	ambient temperature
Ts =	293 degrees K	soil temperature
Ea =	0.349057 vol/vol	air-filled porosity
p =	2.65 g/cm ³	particle density
pv =	1.0 vol/vol	number of pore volumes vented per day

Point Estimates Using the Above Parameters/Equations:

Cg =	329131 ug/m ³	saturated vapor concentration
Q =	3 m ³ /min	exhaust flow rate
ER =	0.017 g/sec	total emission rate