



Contaminated Media Forum

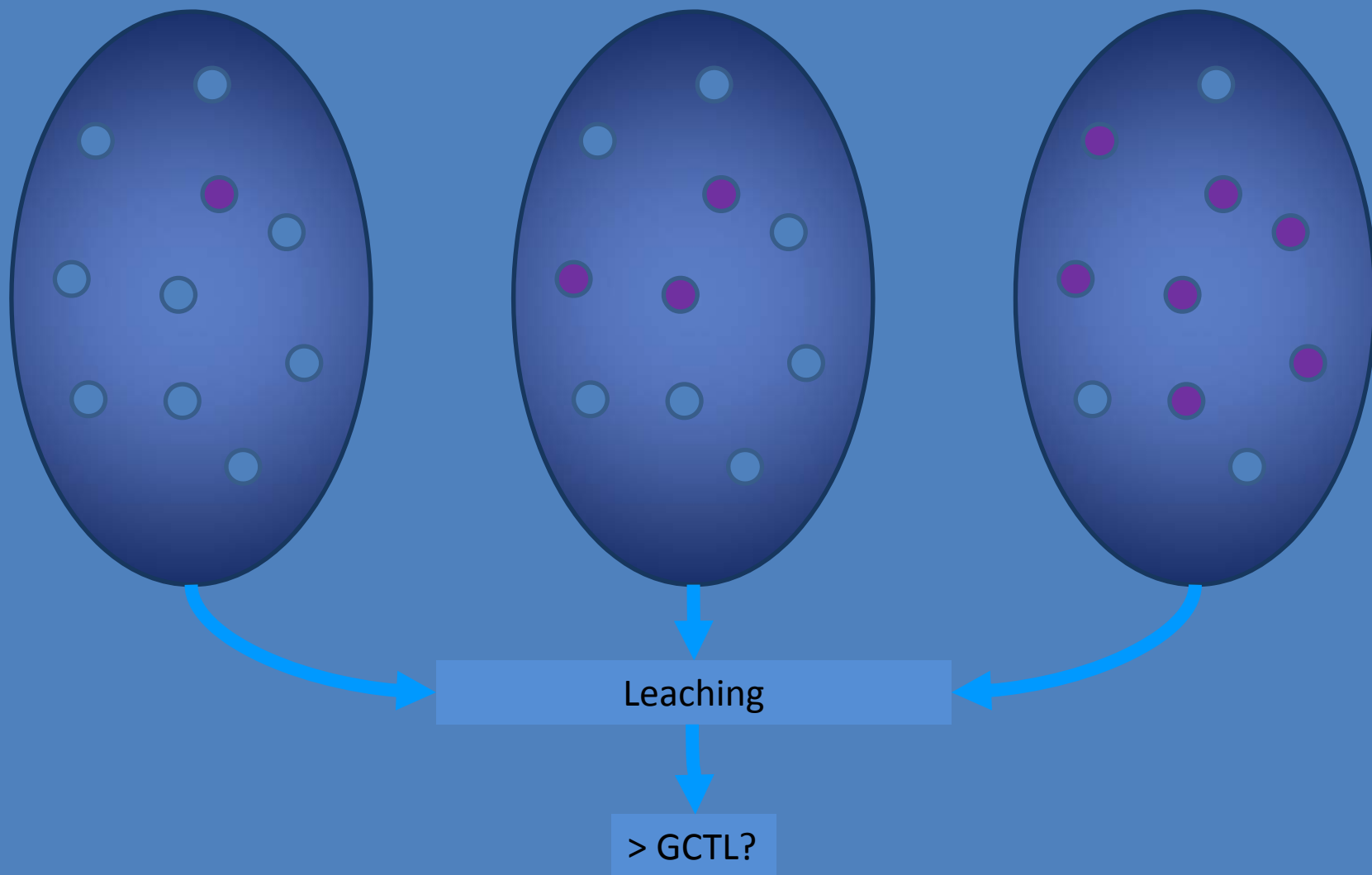
LEACHABILITY

November 3, 2015





Leachability Review





Current 62-777 Leachability Equation

$$LB\ SCTL = GCTL \times CF \times DAF \times \left[K_{oc} \times f_{oc} + \frac{\theta_w + \theta_a \times H'}{\rho_b} \right]$$

Term	Definition	Units	Default	Default Calc
GCTL	Groundwater cleanup target level	mg/L	<i>Table-specific value (62-777)</i>	
ρ_b	Dry soil bulk density	g/cm ³	1.5	
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.3	$\varpi\rho_b$
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.133962	$\eta - \theta_w$
η	Total soil porosity	L_{pore}/L_{soil}	0.433962	$1 - (\rho_b/\rho_s)$
K_{oc}	Soil-organic carbon partition coefficient	L/kg	<i>Chemical-specific value</i>	
f_{oc}	Fraction organic carbon in soil	g/g	0.002	
DAF	Dilution attenuation factor	Unitless	20	
H	Henry's Law constant	atm-m ³ /mol	<i>Chemical-specific value</i>	
H'	Henry's Law constant	Unitless		$H \times 41$
ϖ	Average soil moisture content	g_{water}/g_{soil}	0.2	
ρ_s	Soil particle density	g/cm ³	2.65	
CF	Conversion factor	mg/ μ g	0.001	



EPA Mass Limit Model

$$C_t = (C_w \times DAF \times I \times ED) / (\rho_b \times d_s)$$

Term	Definition	Units	Default	Default Calc
C_t	Screening level in soil	mg/kg		
C_w	Target Soil Leachate Concentration	mg/L	GCTL	
DAF	Dilution Attenuation Factor	Unitless	20	
I	Infiltration Rate	m/yr	0.18	
ED	Exposure Duration	yr	70	
ρ_b	Dry soil bulk density	kg/l	1.5	
d_s	Average source depth	m	Site Specific	



MN Soil Leaching Value Model

$$SLV = C_w \left(K_d + \frac{\theta_w + \theta_a H'}{\rho_b} \right) \left(1 + \frac{Kid_m}{IL} \right) \left(\frac{d_1 + d_2}{d_1} \right)$$

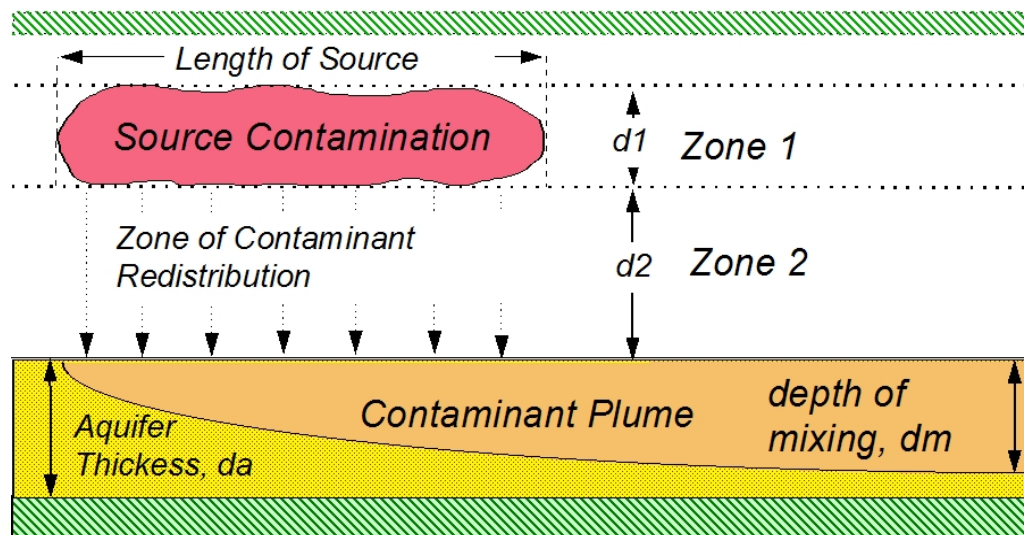
Term	Definition	Units	Default
C_w	Drinking Water Criteria	mg/L	
K_d	Soil-water Partition (Distribution) Coefficient <i>($K_{oc} \times f_{oc}$ for organics)</i>	L/kg	<i>Chemical specific</i>
f_{oc}	Fraction of Total Organic Carbon	%	0.20
θ_w	Volumetric Water Content	L_{water}/L_{soil}	0.15
θ_a	Volumetric Air Porosity	L_{air}/L_{soil}	0.26
$\theta_w + \theta_a$	Total Soil Porosity	L_{pore}/L_{soil}	0.41
H'	Henry's Law constant	unitless	Chemical Specific
ρ_b	Dry Soil Bulk Density	kg/L	1.5
DAF	Dilution Attenuation Factor	unitless	20
K	Aquifer Hydraulic Conductivity	cm/sec	5.00E-03
i	Hydraulic Gradient	feet/foot	0.005
d_m	Depth of Mixing	feet	15
I	Estimated Infiltration Rate	cm/yr	14
L	Length of Source Parallel to GW Flow	in feet	100
d_1	Thickness of Source Zone	feet	15
d_2	Thickness of Lower Uncontaminated Zone	feet	0



62-777 Equation & MN SLV Model

$$LB\ SCTL = GCTL \times CF \times DAF \times \left[K_{oc} \times f_{oc} + \frac{\theta_w + \theta_a \times H'}{\rho_b} \right]$$

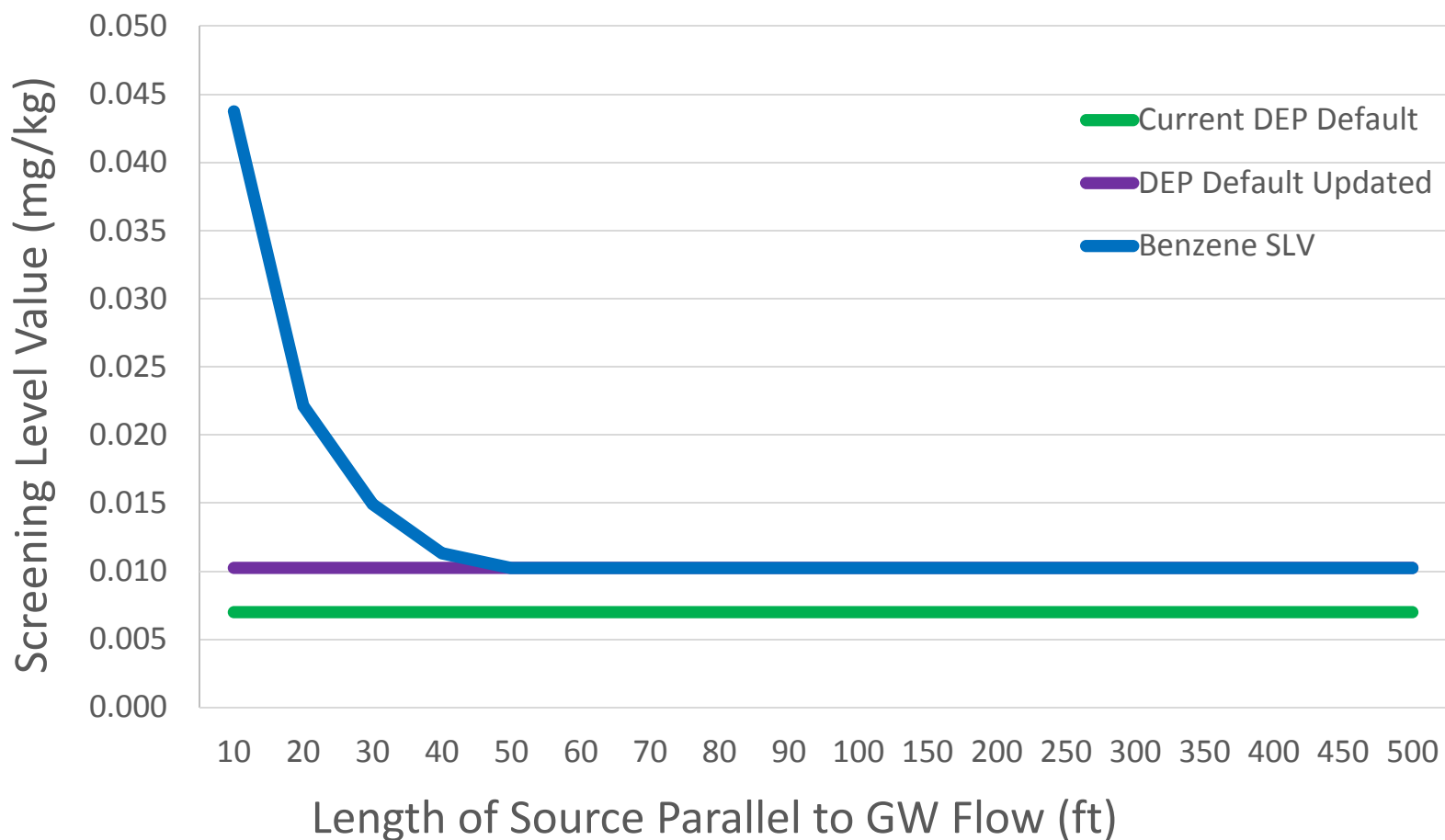
$$SLV = C_w \left(1 + \frac{K_{id} d_m}{IL} \right) \left(K_d + \frac{\theta_w + \theta_a H'}{\rho_b} \right) \left(\frac{d_1 + d_2}{d_1} \right)$$





Influence of Length of Source on MN SLV Model

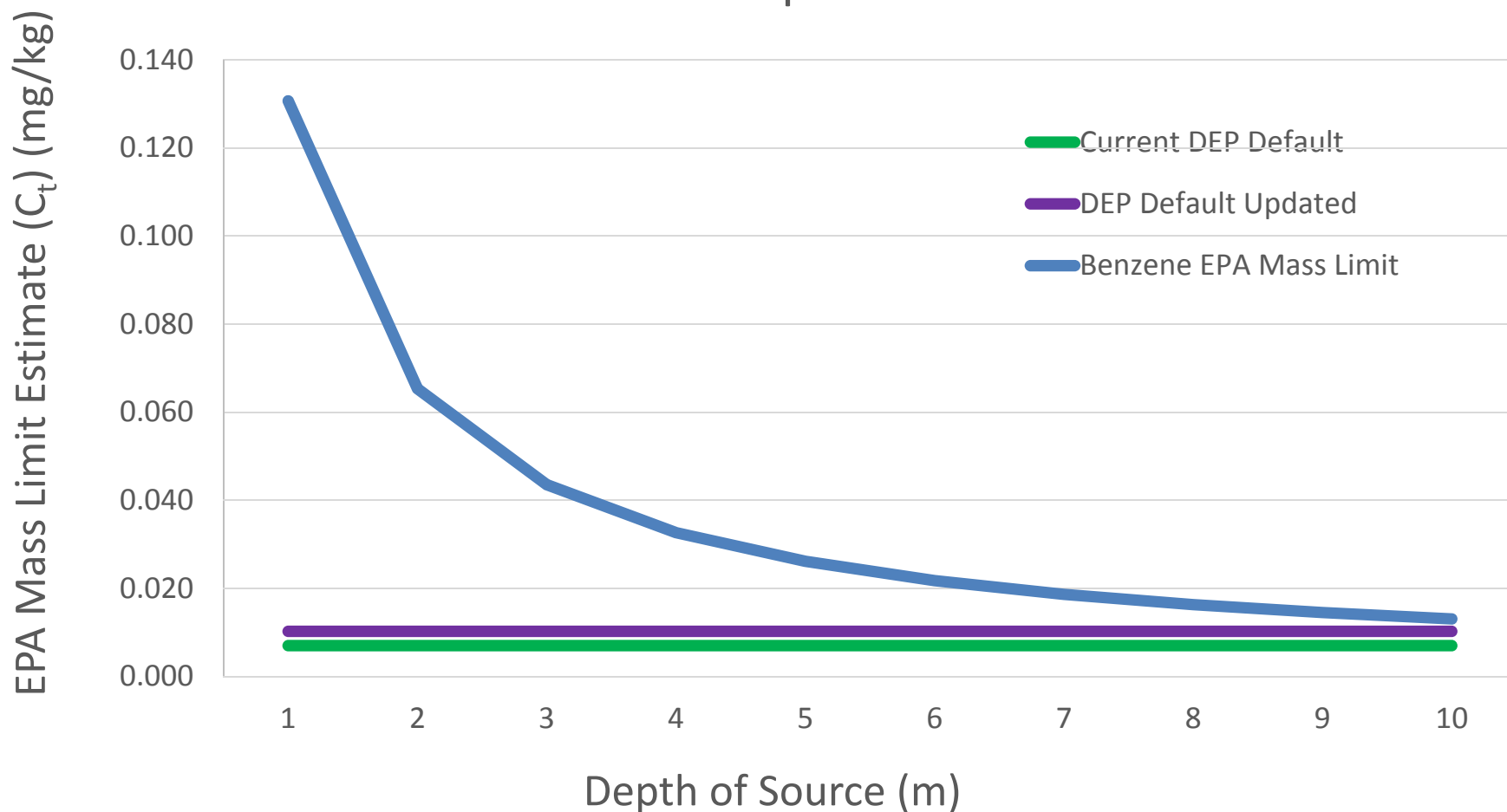
Screening Level Values vs Length of Source for Benzene





Influence of Depth of Source on EPA Mass Limit Model

EPA Mass Limit Model vs Depth of Source for Benzene





MN SLV Effect of CRF

SLV as Function of Length of Source and Contaminant Redistribution Factor

