APPENDIX 4
Equations for the Development of Migration to Ground Water Remediation Standards

Equation 1a
Soil Migration to Ground Water Criteria for Inorganic Contaminants

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 22)

$$MGW_c = GWRS * \frac{mg}{1000\,\mu g} * \left\{ K_d + \frac{\theta_w + \theta_a * H'}{\rho_b} \right\} * DAF$$

Parameter	Definition	Units	Default
MGW_c	Soil migration to ground water criterion	mg/kg	Chemical-specific
GWRS	Ground water remediation standard	µg/L	Chemical-specific
K_d	Soil-water partition coefficient	L/kg	Chemical-specific
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
H'	Henry's law constant	unitless	Chemical-specific
ρ_b	Dry soil bulk density	kg/L	1.5
DAF	Dilution-attenuation factor	unitless	20

Equation 1b
Soil Migration to Ground Water Criteria for Organic Contaminants

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 24)

$$MGW_c = GWRS * \frac{mg}{1000\,\mu g} * \left\{ (K_{oc} * f_{oc}) + \frac{\theta_w + \theta_a * H'}{\rho_b} \right\} * DAF$$

Parameter	Definition	Units	Default
MGW_c	Soil migration to ground water criterion	mg/kg	Chemical-specific
GWRS	Ground water remediation standard	µg/L	Chemical-specific
K_{oc}	Soil organic carbon-water partition coefficient	L/kg	Chemical-specific
f_{oc}	Organic carbon content of soil	kg/kg	0.002
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
H'	Henry's law constant	unitless	Chemical-specific
ρ_b	Dry soil bulk density	kg/L	1.5
DAF	Dilution-attenuation factor	unitless	20

Equation 2
Dilution-Attenuation Factor

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 37)

$$DAF = 1 + \frac{K * i * d}{I * L}$$

Parameter	Definition	Units	Default
DAF	Dilution-attenuation factor	unitless	20
K	Aquifer hydraulic conductivity	m/year	15,808
i	Hydraulic gradient	m/m	0.003

d	Mixing zone depth	m	3.4
I	Infiltration rate	m/year	0.28
L	Length of area of concern parallel to ground water flow	m	30.5

Equation 3
Mixing Zone Depth

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 45)

$$d = (0.0112 * L^2)^{0.5} + d_a * \{1 - \exp[(-L * I)/(K * i * d_a)]\}$$

Parameter	Definition	Units	Default
d	Mixing zone depth	m	3.4
L	Length of area of concern parallel to ground water flow	m	30.5
d_a	Aquifer thickness	m	3.5
I	Infiltration rate	m/year	0.28
K	Aquifer hydraulic conductivity	m/year	15,808
i	Hydraulic gradient	m/m	0.003

Equation 4
Soil Saturation Limit

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 9)

$$C_{sat} = \frac{S}{\rho_b} * [(K_{oc} * f_{oc} * \rho_b) + \theta_w + (H' * \theta_a)]$$

Parameter	Definition	Units	Default
C_{sat}	Soil saturation limit	mg/kg	Chemical-specific
S	Water solubility	mg/L	Chemical-specific
ρ_b	Dry soil bulk density	kg/L	1.5
K_{oc}	Soil organic carbon-water partition coefficient	L/kg	Chemical-specific
f_{oc}	Organic carbon content of soil	kg/kg	0.002
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
H'	Henry's law constant	unitless	Chemical-specific
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18

Equation 5
Soil Leachate Migration to Ground Water Remediation Standards

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Target soil leachate concentration parameter in Equations 22 and 24)

$$MGW_{leachate} = GWRS * DAF$$

Parameter	Definition	Units	Default
$MGW_{leachate}$	Soil leachate migration to ground water remediation standard	µg/L	Chemical-specific
$GWRS$	Ground water remediation standard	µg/L	Chemical-specific

DAF	Dilution-attenuation factor	unitless	20

If a calculated soil migration to ground water criterion for a contaminant is greater than its soil saturation limit, a soil migration to ground water remediation standard does not apply.

If a calculated soil migration to ground water criterion for a contaminant is less than the soil reporting limit, the soil migration to ground water remediation standard defaults to the soil reporting limit.