



EOS® BARRIER DESIGN WORKSHEET

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www.EOSRemediation.com

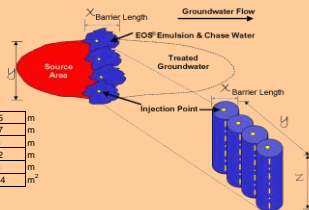
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Site Name:	Tronox Facility
Location:	Henderson, NV
Project No.:	2027

Step 1: Select a Substrate from the EOS® Family of Bioremediation Products

Substrate Selected (pick from drop down list)
For Product Literature Click Here

EOS® 598



Step 2: EOS® Consumption During Contaminant Biodegradation / Biotransformation

Section A: Treatment Area Dimensions

Length of treatment area parallel to groundwater flow, "L"
Width of treatment area perpendicular to groundwater flow, "W"
Minimum depth to contamination
Maximum depth of contamination
Treatment thickness, "z"
Treatment zone cross-sectional area, $A = W \cdot z$

100	ft	30.5	m
150	ft	45.7	m
15	ft	4.6	m
40	ft	12.2	m
25	ft	7.6	m
3,750	ft ²	348.4	m ²

Section B: Groundwater Flow Rate / Site Data

Soil Characteristics

Nominal Soil Type (pick from drop down list)

Sand

Total Porosity (accept default or enter n)

0.38 (decimal)

Effective Porosity (accept default or enter n_e)

0.10 (decimal)

Soil bulk density, (1-n)2.65 g/cc (accept calculated or enter dry bulk density)

1.64 g/cc

103 lbs / ft³

Hydraulic Characteristics

Hydraulic Conductivity (accept default or enter K)

321 ft/day

1.1E-01 cm/sec

Hydraulic Gradient (accept default or enter I)

0.01 ft/ft

Note: Since the hydraulic gradient (i = dh/dx) is negative, we ask you to enter -i in the EOS® Design Tool so that you can enter a positive number for convenience.

Non-reactive Transport Velocity, $V_r = -(K \cdot I) / n_e$

32.10 ft/day

9.724 m/day

Groundwater flow rate through treatment zone, $Q = K \cdot I \cdot A$

90040.50 gallons/day

340,864.04 L/day

Section C: Calculated Contact Length

Contact time (τ) between oil and contaminants (accept default or enter τ)

3

typical values 60 to 180 days, see comment

Calculated Contact Length (L) = τ * V_r

96.3

29.4

Treatment zone volume

375,000

10,818.8

Treatment zone groundwater volume (volume * effective porosity)

280,500

1,061,882

Section D: Design Lifespan For One Application

Estimated total groundwater volume treated over design life

0.5

typical values 5 to 10 years

Section E: Electron Acceptors

Inputs	Typical Value	GW Conc. (mg/L)	MW (g/mole)	e ⁻ equiv./mole	Stoichiometry Contaminant/H ₂ (wt wt H ₂)	Hydrogen Demand (g H ₂)
Dissolved Oxygen (DO)	0 to 8	3	32.0	4	7.94	23914.42134
Nitrate Nitrogen (NO ₃ -N)	1 to 10	5	62.0	5	12.30	25711.43822
Sulfate (SO ₄ ²⁻)	10 to 500	150	96.1	8	11.91	79639.5013
Tetrachloroethene (PCE), C ₂ Cl ₄			165.8	8	20.57	
Trichloroethene (TCE), C ₂ HCl ₃			131.4	6	21.73	
cis-1,2-dichloroethene (c-DCE), C ₂ H ₂ Cl ₂			96.9	4	24.05	
Vinyl Chloride (VC), C ₂ H ₃ Cl			62.5	2	31.00	
Carbon tetrachloride, CCl ₄			153.8	8	19.08	
Chloroform, CHCl ₃			119.4	6	19.74	
sym-tetrachloroethane, C ₂ H ₂ Cl ₄			167.8	8	20.82	
1,1,1-Trichloroethane (TCA), CH ₃ CCl ₃			133.4	6	22.06	
1,1-Dichloroethane (DCA), CH ₃ CHCl ₂			99.0	4	24.55	
Chloroethane, C ₂ H ₅ Cl			64.9	2	32.18	
Perchlorate, ClO ₄ ⁻			50	8	12.33	256542.4526
Hexavalent Chromium, Cr(VI)			52.0	3	17.20	
User added Chlorate, ClO ₃ ⁻		50	83	6	13.72	230491.8029
User added						
User added						

Section F: Additional Hydrogen Demand and Carbon Losses

Generation (Potential Amount Formed)	Typical Value	GW Conc. (mg/L)	MW (g/mole)	e ⁻ equiv./mole	Stoichiometry Contaminant/H ₂ (wt wt H ₂)	Hydrogen Demand (g H ₂)	DOC Released (moles)
Estimated Amount of Fe ²⁺ Formed	10 to 100	40	55.8	1	55.41	45075.9952	
Estimated Amount of Manganese (Mn ²⁺) Formed		5	54.9	2	27.25	11607.52099	
Estimated Amount of CH ₄ Formed	5 to 20		16.0	8	1.99		
Target Amount of DOC to Release	60 to 100		12.0				

Design Safety Factor:

1.0 typical values 1 to 3

Calculations assume:

- all reactions go to completion during passage through emulsified edible oil treated zone; and,
- perfect reaction stoichiometry.

EOS® Requirement Calculations Based on Hydrogen Demand and Carbon Losses

Stoichiometric Hydrogen Demand

3,063.0

DOC Released

3,063.0

EOS® Requirement Based on Hydrogen Demand and Carbon Loss

13,958

Step 3: EOS® Requirement Based on Attachment by Aquifer Material

Soil Characteristics

Effective treatment thickness, "z_e" (typically less than 40")

0.25

For Additional Information on Effective Thickness, Click Here

Weight of sediment to be treated

9,615,857

Adsorptive Capacity of Soil (accept default or enter site specific value)

0.0014 lbs EOS® / lbs sediment

EOS® Attachment by Aquifer Material¹

- Fine sand with some silt/clay 0.001 to 0.002 lbs EOS® / lbs soil
- Sand with higher silt/clay content 0.002 to 0.004 lbs EOS® / lbs soil

¹Default values provided based on laboratory studies completed by NCSU

For Additional Data, Click Here

EOS® Requirement Based on Oil Entrapment by Aquifer Material

13,462

Summary - How much EOS® do you need?

Suggested Quantity of EOS® for Your Project

34

drums

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