

Emmetsburg Mass Discharge Calculations

Situation: High concentrations of Metolachlor found in shallow groundwater at former agricultural chemical dealer site. Monitoring suggests migration of Metolachlor to the southeast which could be towards city wells.

Objective: Estimate concentrations of Metolachlor that result in the city water supply using mass discharge calculations.

Assumptions: (Note: the following assumptions will likely overestimate impacts.

- No significant loss of contaminant (e.g., degradation, adsorption) as it migrates.
- Concentrations measured in monitoring wells are representative of the full cross section of the aquifer.

Mass Discharge of Metolachlor Plume (MD) = T x W x G x C

Where: T = Transmissivity of aquifer = 12,900 ft²/day (Source: Sourcewater Phase 1)

(12,900 ft²/day x 7.48 gal/ft² = 96,500 gal/day/ft)

W = Width of contaminant plume, assume = 100 ft. (Low Est.); 200 ft. (High Est.)

G = Hydraulic gradient = (89.8 ft. - 89.11 ft.) ÷ (210 ft.) = 0.0033 ft/ft (High Est.)

(Based on water level measurements from MW-2 and MW-15 on 5/6/08)

G = 0.0005 ft/ft (Source: Sourcewater Phase 1) (Low Est.)

C = Metolachlor concentration = 7.72 mg/L maximum (High Est.)

(Assume average plume concentration = ½ x Max = 3.86 mg/L) (Low Est.)

High Estimate: MD = 96,500 gal/day/ft x 200 ft. x 0.0033 x 7.72 x 10⁻⁶ = 0.5 gal/day

MD = 96,500 gal/day/ft x 200 ft. x 0.0033 x 2.17 x 10⁻⁶ = 0.14 gal/day

Low Estimate: MD = 96,500 gal/day/ft x 100 ft. x 0.0005 x 3.86 x 10⁻⁶ = 0.02 gal/day

MD = 96,500 gal/day/ft x 100 ft. x 0.0005 x 1.08 x 10⁻⁶ = 0.05 gal/day

Estimated Impact on Emmetsburg Water Supply: C_{ws} = MD ÷ Q

Where: C_{ws} = Concentration of Metolachlor in the water supply

Q = Daily water usage = 640,000 gal/day total; 286,500 gal/day Well #7

Location	High Estimate of Metolachlor	Low Estimate of Metolachlor	2012- High Estimate of Metolachlor	2012- Low Estimate of Metolachlor
Well #7 only	1.7 mg/L*	0.07 mg/L	0.48 mg/L	0.018 mg/L
Entire Water Supply	0.8 mg/L*	0.03 mg/L	0.22 mg/L	0.008 mg/L

* Exceeds HAL of 0.7 mg/L