Appendix D: Tier I Estimation of Aqueous S-Methoprene Concentrations in Wild Rice Paddies & Caneberries

The single, screening-level concentration calculated with this model represents both short and long term surface water exposure and can be used for both aquatic ecological risk assessments and drinking water exposure assessments for human health risk assessment. The formula of the Tier I Rice Model v1.0 is as follows:

$$C_w = \frac{m_{ai}'}{0.00105 + 0.00013K_d}$$

and, if appropriate:

$$K_d = 0.01K_{oc}$$

where:

C_w = water concentration [µg/L]
m_{ai}' = mass applied per unit area [kg/ha]
K_d = water-sediment partitioning coefficient [L/kg]
K_{oc} = organic carbon partitioning coefficient [L/kg]

Calculations:

m_{ai}' (Kg/ha) = (0.0134 lbai/A) * 1.12 = 0.015
$K_d = 0.01K_{oc}$ = 0.01 * 23000 = 230 (L/kg)
C_w = **0.485 ug/L**

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m_{ai}' (Kg/ha) = (0.007 lbai/A) * 1.12 = 0.0078
$K_d = 0.01K_{oc}$ = 0.01 * 23000 = 230 (L/kg)
C_w = **0.253 ug/L**

Units Analysis

The Tier I Rice Model with commonly understood parameters (equation (5)) is:

$$C_w = \frac{m_{ai}'}{d_w + d_{sed}\left(\theta_{sed} + \rho_b K_d\right)}$$

Substituting the parameter values for sediment depth (d_{sed}=0.01 m), water depth (d_w=0.10 m), sediment bulk density (ρ_b=1300 kg/m^3), and porosity (θ_{sed}=0.509), we can develop the following expression with unit conversions in place:

$$C_w\left[\frac{\mu g}{L}\right] = \frac{m_{ai}'\left[\frac{kg}{ha}\right]10^{-4}\left[\frac{ha}{m^2}\right]10^{9}\left[\frac{\mu g}{kg}\right]}{0.10\,m + 0.01\,m\left(0.509 + 1300\left[\frac{kg}{m^3}\right]K_d\left[\frac{L}{kg}\right]10^{-3}\left[\frac{m^3}{L}\right]\right)}10^{-3}\left[\frac{m^3}{L}\right] \qquad (10)$$

Simplifying equation (10) forms the Tier I Rice Model expression (with units shown):

$$C_w\left[\frac{\mu g}{L}\right] = \frac{m_{ai}'\left[\frac{kg}{ha}\right]}{1.05[10^{-3}]\left[\frac{L\cdot kg}{ha\cdot \mu g}\right] + 1.3[10^{-4}]\left[\frac{kg^2}{ha\cdot \mu g}\right]K_d\left[\frac{L}{kg}\right]} \qquad (11)$$

The Tier I Rice Model v1.0 (equation (6)) is equation (11) written with implied units:

$$C_w = \frac{m_{ai}'}{0.00105 + 0.00013K_d} \qquad (6)$$

where:

C_w = water concentration [µg/L]
m_{ai}' = mass applied per unit area [kg/ha]
K_d = water-sediment partitioning coefficient [L/kg]