UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Subject: Tier II Aquatic Exposure Assessment for Selected Malathion Agricultural Uses in California, Oregon, and Idaho: Endangered Species (ES) Consultation Package

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Tier II aquatic exposures for malathion were requested by the Field and External Affairs Division (FEAD) to support an endangered species consultation package for salmon in California, Oregon, Washington, and Idaho. FEAD staff provided specific scenarios to be modeled and the label associated with the crops of interest. The selected malathion use scenarios included the following:

Table 1. Requested Crop Scenarios for California, Oregon and Idaho

State	Crop
California	Alfalfa Strawberries Lettuce Walnuts Citrus Dates
Oregon	Cherries Apples Asparagus Onions
Idaho	Potatoes

Tier II PRZM/EXAMS modeling was conducted to estimate the impacts of runoff and spray drift from aerial and ultra low volume (ULV) spray application of malathion to a 10 ha field on estimated environmental concentrations in an adjacent small, static water body (1 hectare surface area, 2 meters deep). Standard PRZM/EXAMS exposure scenarios were selected to best represent specific crops in the California, Oregon, and Idaho region. The selected scenarios for malathion are shown in Table 2.

Table 2. Proposed PRZM/EXAMS Scenarios for FEAD Endangered Species Evaluation of Malathion in the Pacific Northwest

Requested Scenario	Current Scenario	Surrogate
California Alfalfa	CA alfalfa	NA
California Strawberry	NA	CA lettuce
California Lettuce	CA lettuce	NA
California Walnut	NA	CA almond
California Citrus	CA citrus	NA
California Dates	NA	CA fruit
Oregon Cherries	NA	OR apple
Oregon Apples	OR apples	NA
Oregon Asparagus	NA	OR snapbeans
Oregon Onions	NA	OR snapbeans
Idaho Potatoes	ID potatoes	NA

Surrogate exposure scenarios were selected to represent either the major crop grouping (e.g, almonds in CA to represent walnuts in CA) in a specific state or to represent a regionally-conservative exposure scenario (e.g., lettuce in California to represent strawberries in California). Major land resource areas (MLRA) were used to match requested and available scenarios (Austin, 1972). The MLRA represents land resource mapping units which are based on agricultural production and land resources within states and regions. They were designed to allow for regional agricultural planning. The requested scenario for mosquito control in California will be provided in a separate assessment using the spray drift models, AgDrift and/or AgDisp.

Table 3 provides the crop specific application information used to estimate exposures. Estimated environmental concentrations of malathion are shown in Table 4. The highest EECs are associated with the citrus use. Peak concentrations ranged from 7.7 to 77.4 µg/L. Lowest estimated environmental concentrations were identified from uses on asparagus and alfalfa (non-ULV). Malathion loading among the tested scenarios can be explained by the differences in maximum label application rates and in the use of ULV application methods where indicated.

For all crops, aerial spray drift appears to be a significant component of the initial loadings to the small water body.

Table 3. Summary of Malathion Aquatic Model Scenarios					
State & Crop	**Scenario**	**Application Rate (lbs/acre)**	**# of Applications**	**Application Interval (days)[2]**	**First Application[3]**
California Alfalafa (ULV)[1]	CA alfalfa	1.24	2	7	June 1
California Alfalfa	CA alfalfa	2.46	2	7	June 1
California Strawberries	CA lettuce	10	4	7	June 1
California Lettuce	CA lettuce	2.46	2	7	June 1
California Walnuts	CA almond	15.33	2	7	August 1
California Citrus	CA citrus	25.37	4	7	July 1
California Dates	CA fruit	4.25	6	7	May 1
Oregon Cherries (ULV)[1]	OR apple	1.24	4	7	August 1
Oregon Cherries	OR apple	8.0	4	7	June 1
Oregon Apples	OR apple	14.4	2	7	July 1
Oregon Asparagus	OR snapbean	1.27	2	7	June 1
Oregon Onions	OR snapbean	2.03	2	7	June 1
Idaho Potatoes	ID potato	4.3	2	7	May 1

[1]Ultra Low Volume Spray assumes 50% spray drift due to default assumptions of very fine to fine droplet size spectrum, 20 mph wind speed, and 20 foot release height

[2] Number of applications and application intervals supplied by FEAD and based on information provided in BEAD Quantitative Usage Analysis (QUA).

[3]Applications timing based on open literature web search including University of California Integrated Pest Management website (http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html) and USDA Crop Profiles website (http://pestdata.ncsu.edu/cropprofiles/)

Table 4. Summary of Predicted Malathion Aquatic EECs				
State & Crop	**Scenario Modeled**	**1/10 Year Peak (ppb)**	**1/10 Year 21-Day Average (ppb)**	**1/10 Year 60-Day Average (ppb)**
California Alfalafa (ULV)	CA alfalfa	39.1	11.2	3.9
California Alfalfa	CA alfalfa	7.8	2.2	0.8
California Strawberries	CA lettuce	36.2	18.7	8.9
California Lettuce	CA lettuce	8.5	3.1	1.1
California Walnuts	CA almond	48.9	14.7	5.2
California Citrus	CA citrus	77.4	28.7	13.4
California Dates	CA fruit	15.1	7.0	4.6
Oregon Cherries (ULV)	OR apple	42.7	20.3	9.6
Oregon Cherries	OR apple	32.1	14.9	6.9
Oregon Apples	OR apple	47.6	15.5	5.5
Oregon Asparagus	OR snapbean	7.7	2.4	0.9
Oregon Onions	OR snapbean	12.3	1.4	0.9
Idaho Potatoes	ID potato	16.6	6.5	2.4

Tier II PRZM/EXAMS modeling was conducted using the PE4.V01 shell (August 13, 2003). Environmental fate input parameters for malathion were obtained from the malathion RED and registrant-submitted environmental fate studies, Table 5.

Table 5. PRZM/EXAMS Input Parameters for Methyl Parathion		
Parameters	Input Value and Unit	
Soil Partition Coefficient, Koc	151 L/Kg (Average Koc)	
Molecular Weight	330	
Solubility in Water	1450 mg/L	
Hydrolysis $T_{1/2}$	6.21 day at pH 7	
Aqueous Photolysis $T_{1/2}$	97.88 days	
Aerobic Soil Metabolism $T_{1/2}$	3.0 days	
Anaerobic Aquatic Metabolism $T_{1/2}$	7.64 days	
Aerobic aquatic metabolism $T_{1/2}$	3.27 days	