

# Malathion Draft Biological Evaluation

In April 2016, EPA published draft biological evaluations for three pesticides: chlorpyrifos, diazinon, and malathion.

In January 2017, EPA completed final biological evaluations for these pesticides, after reviewing stakeholder comments. To view the final biological evaluations and the response to comments, please visit:

- [Chlorpyrifos final biological evaluation](#).
- [Diazinon final biological evaluation](#).
- [Malathion final biological evaluation](#).
- [Response to Comments \(PDF\)](#) (20 pp, 977 K, [About PDF](#))

We are maintaining the files for the draft versions of these biological evaluations for anyone who would like to review them to understand how they changed from draft to final. The links to the draft biological evaluation chapters for malathion are listed below:

- [List of document revisions since December 2015 posting \(DOCX\)](#) (3 pp, 20 K)
- [Instructions for Commenting on the Draft Biological Evaluations for Chlorpyrifos, Diazinon and Malathion \(PDF\)](#) (5 pp, 632 K)
- [Draft Malathion Executive Summary](#) (5 pp, 29 K)

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# **Chapter 1: Draft Malathion Problem Formulation for ESA Assessment** (79 pp, 913 K)

## **Attachments**

- [ATTACHMENT 1-1: Ecological Incidents \(DOCX\)](#) (2 pp, 17 K)
- [ATTACHMENT 1-2: CDL Crosswalk \(DOCX\)](#) (6 pp, 35 K)
- [ATTACHMENT 1-3: Method for Establishing the Use Footprint \(DOCX\)](#) (10 pp, 31 K)
- [ATTACHMENT 1-4: Process for Determining Effects Thresholds \(DOCX\)](#) (5 pp, 27 K)
- [ATTACHMENT 1-5: Method for Deriving Species Sensitivity Distributions for Use in Pesticide Effects Determinations for Listed Species \(DOCX\)](#) (22 pp, 228 K)
- [ATTACHMENT 1-6: Co-Occurrence Analysis \(XLSX\)](#) REVISED March 2016 (1 pp, 1.4 MB)
- [ATTACHMENT 1-7: Methodology for Estimating Exposures to Terrestrial Animals \(DOCX\)](#) REVISED March 2016 (18 pp, 84 K)
- [ATTACHMENT 1-8: Review of Open Literature Toxicity Studies for Pilot Chemical Biological Evaluations \(DOCX\)](#) (4 pp, 138 K)
- [ATTACHMENT 1-9: Applying a Weight-of-Evidence Approach to Support Step 2 Effects Determinations \(DOCX\)](#) REVISED March 2016 (18 pp, 4.3 MB)
- [ATTACHMENT 1-10: Aquatic Bin Assignments \(XLSX\)](#) REVISED March 2016 (1 pp, 363 K)
- [ATTACHMENT 1-11: Biological Information on Listed Species of Fish and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) REVISED March 2016 (44 pp, 93 K)
  - [ATTACHMENT 1-11 Supplemental Information 2: Fish Attribute Template \(XLSX\)](#) (2 pp, 20 K)
  - [ATTACHMENT 1-11 Supplemental Information 3: Federally Listed Fish Attribute Database \(XLSX\)](#) REVISED March 2016
- [ATTACHMENT 1-12: Biological Information on Listed Species of Aquatic Invertebrates and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) REVISED March 2016 (47 pp, 113 K)
  - [ATTACHMENT 1-12 Supplemental Information 1: Federally Listed Aquatic Invertebrate Database \(XLSX\)](#) REVISED March 2016 (1 pp, 890 K)
  - [ATTACHMENT 1-12 Supplemental Information 2: Aquatic Invertebrate Attribute Template \(XLSX\)](#) (2 pp, 20 K)

- [ATTACHMENT 1-13: Biological Information on Listed Species of Marine Mammals and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) (63 pp, 109 K)
- [ATTACHMENT 1-14: Biological Information on Listed Species of Marine Reptiles and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) (32 pp, 48 K)
- [ATTACHMENT 1-15: Biological Information on Listed Species of Corals and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) (9 pp, 37 K)
- [ATTACHMENT 1-16: Biological Information on Listed Species of Birds and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) (7 pp, 596 K)
- [ATTACHMENT 1-17: Biological Information on Listed Species of Mammals \(excluding marine species\) and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) (4 pp, 360 K)
- [ATTACHMENT 1-18: Biological Information on Listed Species of Reptiles \(excluding marine species\) and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) (3 pp, 161 K)
- [ATTACHMENT 1-19: Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) (3 pp, 210 K)
- [ATTACHMENT 1-20: Biological Information on Listed Species of Terrestrial Invertebrates and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) REVISED March 2016 (47 pp, 152 K)
  - [ATTACHMENT 1-20 Supplemental Information 3: Federally Listed Terrestrial Invertebrate Database \(XLSX\)](#) REVISED March 2016 (1 pp, 368 K)
- [ATTACHMENT 1-21: Biological Information on Listed Species of Plants and Lichens and Model Parameterization for Pesticide Effects Determinations \(DOCX\)](#) REVISED March 2016 (8 pp, 33 K)
  - [ATTACHMENT 1-21 Supplemental Information 1: Federally Listed Plant Attribute Database \(XLSX\)](#) REVISED March 2016 (1 pp, 13 MB)
  - [ATTACHMENT 1-21 Supplemental Information 2: Summary Plant and Lichen Information \(XLSX\)](#) REVISED March 2016 (1 pp, 352 Kb)
- [ATTACHMENT 1-22: Effects Arrays \(DOCX\)](#) (1 pp, 18 K)

## Appendices

- [APPENDIX 1-1: Regulatory History and Past Assessments for Malathion \(DOCX\)](#) (3 pp, 20 K)

- [APPENDIX 1-2: List of Current Malathion Registrations \(Registration Numbers and Label Stamp Dates\) \(DOCX\)](#) (9 pp, 31 K)
- [APPENDIX 1-3: Master Use Summary Table for Malathion \(XLSX\)](#) (1 pp, 160 K)
- [APPENDIX 1-4: Tank Mixes Specified on Malathion Product Labels \(DOCX\)](#) (7 pp, 24 K)
- [APPENDIX 1-5: Label Clarifications from Malathion Registrants \(PDF\)](#) (54 pp, 1.65 MB)
- [APPENDIX 1-6: Use Site, General Land Cover Class, and HUC2 Matrix for Malathion \(DOCX\) REVISED March 2016](#) (16 pp, 33 K)
- [APPENDIX 1-7: Malathion Scenario Development \(DOCX\)](#) (3 pp, 23 K)
- [APPENDIX 1-8: Usage Data for Malathion \(PDF\)](#) (9 pp, 2.37 MB)
- [APPENDIX 1-9: Degradate Line of Evidence \(DOCX\)](#) (7 pp, 46 K)
- [APPENDIX 1-10: Summary of Malathion Monitoring Data \(DOCX\)](#) (9 pp, 42 K)
- [APPENDIX 1-11: Multi-A.I. Formulation Analysis for Malathion \(DOCX\)](#) (4 pp, 25 K)
- [APPENDIX 1-12: ECOTOX Mixture Studies \(Malathion\) \(DOCX\)](#) (3 pp, 17 K)

## **Chapter 2: Draft Malathion Effects Characterization for ESA Assessment** (227 pp, 4.56 MB)

### **Attachments**

- [ATTACHMENT 1-1: Ecological Incidents \(DOCX\)](#) (2 pp, 17 K)
- [ATTACHMENT 1-4: Process for Determining Effects Thresholds \(DOCX\)](#) (5 pp, 27 K)
- [ATTACHMENT 1-5: Method for Deriving Species Sensitivity Distributions for Use in Pesticide Effects Determinations for Listed Species \(DOCX\)](#) (22 pp, 228 K)

### **Appendices**

- [APPENDIX 2-1: Data Used in the Data Array \(XLSX\)](#) (1 pp, 604 K)
- [APPENDIX 2-2: Accepted ECOTOX Database \(XLSX\)](#) (1 pp, 2.4 MB)
- [APPENDIX 2-3 Open Literature Review for Malathion \(DOC\)](#) (172 pp, 5.5 MB)
- [APPENDIX 2-4: OPPIN Bibliography for Malathion \(PDF\)](#) (265 pp, 2.46 MB)
- [APPENDIX 2-5: Malathion Rejected ECOTOX Bibliography \(DOCX\)](#) (1,733 pp, 1.8 MB)

- [APPENDIX 2-6: Malathion Species Sensitivity Distribution Analysis for Fish \(DOCX\)](#) (15 pp, 656 K)
- [APPENDIX 2-7: Additional Effects Arrays for Malathion \(DOCX\)](#) (1 pp, 14 K)
- [APPENDIX 2-8: Malathion Species Sensitivity Distribution Analysis for Aquatic Invertebrates \(DOCX\)](#) (9 pp, 449 K)
- [APPENDIX 2-9: Malathion Species Sensitivity Distribution Analysis for Birds \(DOCX\)](#) (4 pp, 77 K)

## **Chapter 3: Draft Malathion Exposure Characterization for ESA Assessment REVISED March 2016** (107 pp, 1.44 Mb)

### **Attachments**

- [ATTACHMENT 3-1: Background Document: Aquatic Exposure Estimation for Endangered Species \(DOCX\)](#) REVISED March 2016 (52 pp, 1.5 MB)
  - [ATTACHMENT 3-1 Supplemental Information 1: Static Bin Analysis \(XLSX\)](#) (1 pp, 85 K)

### **Appendices**

- [APPENDIX 1-3: Master Use Summary Table for Malathion \(XLSX\)](#) (1 pp, 160 K)
- [APPENDIX 1-6: Use Site, General Land Cover Class, and HUC2 Matrix for Malathion \(DOCX\)](#) REVISED March 2016 (16 pp, 33 K)
- [APPENDIX 1-7: Malathion Scenario Development \(DOCX\)](#) (3 pp, 23 K)
- [APPENDIX 3-1: Environmental Transport and Fate Data Analysis for Malathion \(DOCX\)](#) REVISED March 2016 (10 pp, 40 K)
- [APPENDIX 3-2: Malathion Fate Open Literature Review \(XLSX\)](#) (1 pg, 56 K)
- [APPENDIX 3-3: Spray Drift Considerations for Malathion \(DOCX\)](#) REVISED March 2016 (10 pp, 116 K)
- [APPENDIX 3-4: Aquatic EECs \(XLSX\)](#) REVISED March 2016 (1 pp, 3.18 MB)
  - [APPENDIX 3-4f: PWC Postprocessor Output \(ZIP\)](#) (1 file, 2.7 GB)
- [APPENDIX 3-5: Malathion Downstream Dilution \(DOCX\)](#) March 2016 (1 pp, 13 K)
- [APPENDIX 3-6: Input Parameters for Weight of Evidence Matrices \(XLSX\)](#)

## **Chapter 4: Draft Malathion Effects Determinations for ESA Assessment (DOCX)** (48 pp, 193 K)

### **Attachments**

- [ATTACHMENT 4-1: Terrestrial and Aquatic Weight of Evidence Matrices: Tool Methodology and Description \(DOCX\)](#) (31 pp, 2.08 MB)
- [ATTACHMENT 4-2: Regression Analysis of Exposure Response Data from Chronic Aquatic Toxicity Tests for Malathion, Diazinon and Malathion \(DOCX\)](#) (12 pp, 266 K)
  - [ATTACHMENT 4-2 Supplemental Information 1: Appendix A- Response Curve Modeling \(DOCX\)](#) (11 pp, 263 K)
  - [ATTACHMENT 4-2 Supplemental Information 2: Appendix B- Guidelines for Assessing Relative Quality of TRAP Analysis Graphs \(DOCX\)](#) (8 pp, 267 K)
  - [ATTACHMENT 4-2 Supplemental Information 3: Appendix C- Index and Tabular Results \(XLSX\)](#) (1 pp, 28 K)
  - [ATTACHMENT 4-2 Supplemental Information 4: Appendix D- TRAP Analysis Graphs and ECx Values \(PDF\)](#) (59 pp, 838K)
- [ATTACHMENT 4-3: Application of Web-ICE to Assess Risks of National Pesticide Registrations to Federally Listed Species \(DOCX\)](#) (9 pp, 44 K)
  - [ATTACHMENT 4-3 Supplemental Information 1: Acute Toxicity Prediction to Threatened and Endangered Species Using Interspecies Correlation Estimation \(ICE\) Models \(DOCX\)](#) (26 pp, 102 K)
  - [ATTACHMENT 4-3 Supplemental Information 1.1 \(DOCX\)](#) (5 pp, 467K)
  - [ATTACHMENT 4-3 Supplemental Information 1.2 \(XLSX\)](#) (1 pp, 155 K)
  - [ATTACHMENT 4-3 Supplemental Information 2: Analysis of Predicted vs. Empirical SSDs for Malathion \(DOCX\)](#) (21 pp, 87K)
  - [ATTACHMENT 4-3 Supplemental Information 3: Analysis of Predicted vs. Empirical SSDs for Chlorpyrifos \(DOCX\)](#) (19 pp, 81 K)
  - [ATTACHMENT 4-3 Supplemental Information 4: Analysis of Predicted vs. Empirical SSDs for Diazinon \(DOCX\)](#) (19 pp, 84 K)

### **Appendices**

- [APPENDIX 4-1: Effects Determination Tables \(XLSX\)](#) (1 pp, 511 K)
- [APPENDIX 4-2: Mixtures Analysis for Malathion \(DOCX\)](#) (14 pp, 106 K)
- APPENDIX 4-3: Weight of Evidence Matrices
  - [APPENDIX 3-6: Input Parameters for Weight of Evidence Matrices \(XLSX\)](#) (1 pp, 93 K)
  - [APPENDIX 4-3a: Amphibians All MAL \(XLSX\)](#) (1 pp, 574 K)
  - [APPENDIX 4-3b: Reptiles MAL \(XLSX\)](#) (1 pp, 370 K)
  - [APPENDIX 4-3c: Birds Passerine MAL \(XLSX\)](#) (1 pp, 356 K)
  - [APPENDIX 4-3d: Birds All other orders MAL \(XLSX\)](#) (1 pp, 592 K)
  - [APPENDIX 4-3e: Mammals All MAL \(XLSX\)](#) (1 pp, 600 K)
  - [APPENDIX 4-3f: Terrestrial Invertebrates Arachnids and Insects MAL \(XLSX\)](#) (1 pp, 637 K)
  - [APPENDIX 4-3g: Terrestrial Invertebrates Snails MAL \(XLSX\)](#) (1 pp, 425 K)
  - [APPENDIX 4-3h: Fish Cypriniformes MAL \(XLSX\)](#) (1 pp, 519 K)
  - [APPENDIX 4-3i: Fish Salmoniformes MAL \(XLSX\)](#) (1 pp, 342 K)
  - [APPENDIX 4-3j: Fish All other orders MAL \(XLSX\)](#) (1 pp, 667 K)
  - [APPENDIX 4-3k: Aquatic Invertebrates Insects and Crustaceans MAL \(XLSX\)](#) (1 pp, 289 K)
  - [APPENDIX 4-3l: Aquatic Invertebrates Mollusks Unionida1 MAL \(XLSX\)](#) (1 pp, 504 K)
  - [APPENDIX 4-3m: Aquatic Invertebrates Mollusks Unionida2 MAL \(XLSX\)](#) (1 pp, 557 K)
  - [APPENDIX 4-3n: Aquatic Invertebrates All other orders MAL \(XLSX\)](#) (1 pp, 327 K)
  - [APPENDIX 4-3o: MARINE species Coral MAL \(XLSX\)](#) (1 pp, 183 K)
  - [APPENDIX 4-3p: MARINE species Fish and Other Invertebrates MAL \(XLSX\)](#) (1 pp, 143 K)
  - [APPENDIX 4-3q: Plants General Ad-Tr MAL \(XLSX\)](#) (1 pp, 821 K)
  - [APPENDIX 4-3r: Plants Herbaceous Dicot Ab-As MAL \(XLSX\)](#) (1 pp, 395 K)
  - [APPENDIX 4-3s: Plants Herbaceous Dicot As-Ci MAL \(XLSX\)](#) (1 pp, 403 K)
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  - [APPENDIX 4-3u: Plants Herbaceous Dicot Er-Il MAL \(XLSX\)](#) (1 pp, 417 K)
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  - [APPENDIX 4-3z: Plants Herbaceous Dicot St-Ye MAL \(XLSX\)](#) (1 pp, 251 K)
  - [APPENDIX 4-3aa: Plants Woody Monocot Ag-Pr MAL \(XLSX\)](#) (1 pp, 186 K)
  - [APPENDIX 4-3bb: Plants Herbaceous Monocot Ai-Pi MAL \(XLSX\)](#) (1 pp, 437 K)
  - [APPENDIX 4-3cc: Plants Herbaceous Monocot Pi-Zi MAL \(XLSX\)](#) (1 pp, 275 K)
  - [APPENDIX 4-3dd: Plants Woody Dicot Ab-Ce MAL \(XLSX\)](#) (1 pp, 386 K)
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  - [APPENDIX 4-3ff: Plants Woody Dicot Cy-Cy MAL \(XLSX\)](#) (1 pp, 382 K)
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- [APPENDIX 4-3kk: Plants Woody Dicot Re-Te MAL \(XLSX\)](#) (1 pp, 385 K)
- [APPENDIX 4-3ll: Plants Woody Dicot Te-Zi MAL \(XLSX\)](#) (1 pp, 217 K)
- [APPENDIX 4-4: Risk Assessment for Cattle Ear Tag Use \(DOCX\)](#) (102 pp, 318 K)
- [APPENDIX 4-5: Analysis of Mosquito Adulticide Use \(DOCX\)](#) (4 pp, 29 K)
  - [APPENDIX 4-5 Supplemental Information 1: Mosquito Adulticide Animal Matrices \(XLSX\)](#) (1 pp, 102 K)
  - [APPENDIX 4-5 Supplemental Information 2: Mosquito Adulticide Plant Matrice \(XLSX\)](#) (1 pp, 93 K)
- [APPENDIX 4-6: Analysis of Seed Treatment and Granular Uses \(DOCX\)](#) (1 pp, 12 K)
- [APPENDIX 4-7: Refined Risk Analyses for 14 Listed Birds Exposed to Malathion \(DOCX\)](#) (18 pp, 268 K)
  - [APPENDIX 4-7 Supplemental Information 1: TIM/MCnest Metadata \(DOCX\)](#) (48 pp, 117 K)