**Methomyl Executive Summary for Final Biological Evaluation**

This Biological Evaluation (BE) assesses potential risks that registered uses of methomyl (PC code 090301) may pose to an individual of a listed species or designated critical habitat. The federal action considered in this BE is the Registration Review for methomyl, which encompasses the review of all the registered uses, and the approved product labels for all pesticide products containing methomyl.

The term “listed species” includes those that are federally listed as endangered and threatened, as well as those that are proposed and candidates for listing and experimental populations. The methods employed in this BE follow the Revised Method for National Level Listed Species Biological Evaluations of Conventional Pesticides (referred to as the “Revised Method”) [[1]](#footnote-2). The Revised Method incorporates input from the public, US Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS) and US Department of Agriculture (USDA).

In March 2020, EPA released the Revised Method for National Level Listed Species Biological Evaluations (BEs) of Conventional Pesticides. EPA used the Revised Method to conduct the draft BE for methomyl. On March 17, 2020, EPA released the draft BE for methomyl for public comment. EPA received public comments on the proposed Revised Method and the methomyl BE through July 2, 2020, which included a 45-day extension of the original public comment period. Updates to the Revised Method and updates that were specific to methomyl were implemented in the final BE.

As described in the Revised Method, EPA’s development of this BE includes two steps. The BE includes an evaluation of whether an individual of a listed species is reasonably expected to be exposed to a pesticide at a level that results in a discernible effect, and, if so, distinguishes effects that are likely to adversely affect an individual of a species from those that are not likely to adversely affect an individual. This process is also applied to the designated critical habitat of listed species (when available). In Step 1, for every listed species and designated critical habitat, EPA determines whether methomyl will have No Effect (NE) or May Affect (MA) (separate determinations made for each species and critical habitat). For those species and critical habitats with MA determinations, in Step 2, EPA will determine if methomyl is Not Likely to Adversely Affect (NLAA) or Likely to Adversely Affect (LAA) an individual species or critical habitat. Details on the method, models and tools used for making NE, NLAA and LAA determinations are provided in the Revised Method document.

1. General Information

Methomyl is an insecticide used on a wide variety of terrestrial food and feed crops, terrestrial non-food crops, greenhouse food/non-food, and non-agricultural indoor and outdoor sites. There are currently 3 active registrants of methomyl with 34 active product labels (16 Section 3s, 18 Special Local Needs), which include formulated products and technical grade methomyl (see **APPENDIX 1-1**). All of the formulated methomyl products, with the exception of the fly bait products, are Restricted Use Pesticides (RUPs) – meaning that they can only be applied by, or under the supervision of, a certified applicator. Methomyl can be applied in a liquid, granular (corn only), scatter bait, bait station, or as a brush-on paste. Aerial and ground application methods (including broadcast, soil incorporation, orchard airblast, and chemigation) are allowed. Registered labels require applications to use a buffer of 25 feet for ground and 100 feet for aerial applications around natural and artificial bodies of water. Additionally, granular products require a 25-foot (ground) buffer zone adjacent to waterbodies (see **APPENDIX 1-2** for details).

This BE assesses all currently registered labels. **APPENDIX 1-2** provides the master use summary table summarizing all currently registered use patterns. **APPENDICES 1-3** and **3-1** provide additional details on how these uses were modeled.

Methomyl enters the environment via direct application to use sites. It may move off-site via spray drift and runoff. Studies indicate that the major route of methomyl transformation in the environment is aerobic and anaerobic biodegradation. There are data that indicate that abiotic hydrolysis under neutral and acidic conditions, photodegradation, and volatilization do not play a significant role in the degradation and dissipation processes. Based on methomyl’s aerobic soil metabolism and aerobic and anaerobic aquatic metabolism data, methomyl is not considered persistent in the environment. Information on leaching and adsorption/desorption indicate that methomyl is considered mobile. Low octanol/water partition coefficient (log Kow 0.12) suggests that the chemical will have a low tendency to accumulate in aquatic and terrestrial organisms. Methomyl has no degradates that are considered residues of toxicological concern.

Methomyl is an N-methylcarbamate insecticide. Carbamate insecticides act by inhibiting acetylcholinesterase, thereby reducing the degradation of the cholinergic neurotransmitter acetylcholine. As a result, intersynaptic concentrations of acetylcholine increase as the neurotransmitter accumulates leading to increased firing of the postsynaptic neurons which may lead to convulsions, paralysis, and death of an organism exposed to the chemical. Acetylcholinesterase inhibition is rapidly reversed in many taxa once exposure to an N-methylcarbamate insecticide has ended (see **Chapter 3** for details).

Methomyl is classified as highly toxic to birds and mammals on an acute exposure basis. Growth and reproductive endpoints were also affected in chronic studies at a variety of concentrations in birds and mammals, with mammals showing greater sensitivity than birds. Methomyl is highly toxic to beneficial insects and bees on an acute exposure basis, and it exhibits toxicity to adult bees on a chronic exposure basis. Methomyl is classified as very highly toxic to freshwater fish and moderately toxic to estuarine and marine fish on an acute exposure basis. Methomyl is characterized as very highly toxic to freshwater and estuarine and marine invertebrates on an acute exposure basis. There are reported ecological incidents involving methomyl use for aquatic animals, birds, mammals, terrestrial invertebrates, and terrestrial plants which are detailed in **Chapter 2**.

1. Exposure Methods

Exposure estimates are based primarily on fate and transport model results. Aquatic exposures (surface water and benthic sediment pore water) are quantitatively estimated for representative methomyl uses in specific geographic regions within generic habitats (referred to as bins) using the Pesticide Root Zone Model (PRZM5) and the Variable Volume Water Model (VVWM)[[2]](#footnote-3) in the Pesticides in Water Calculator (PWC) version 2.001. Aquatic exposure results for the bin(s) most appropriate for the species and/or critical habitat being assessed are discussed in **Chapter 3**. Also discussed in **Chapter 3** are available water monitoring data for methomyl. For terrestrial exposures, existing models [*i.e*., AgDRIFT, earthworm fugacity model, Terrestrial Herpetofaunal Exposure Residue Program Simulation (T-HERPS), Terrestrial Residue Exposure model (T-REX) and portions of the Terrestrial Investigation Model (TIM)] were combined and modified into a single tool that is referred to as the MAGTool (**Chapter 4**). This assessment replaces EPA’s TerrPlant model with the Plant Assessment Tool (PAT), the latter is a more refined exposure model for terrestrial, wetland and aquatic plants**.**

1. Overlap Analyses

Step 1 of the BE involves an analysis of the potential overlap of the action area and individual species ranges and critical habitat. The action area was derived in ArcGIS 10.8 by combining the data layers representative of methomyl potential uses plus off-site transport. The overlaps of action area and individual species’ ranges or critical habitats were calculated. This analysis used spatial data of species’ ranges and habitats from the Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS). In the contiguous United States (ConUS), agricultural potential use sites are represented using the USDA Crop Data Layer (CDL) (**APPENDIX 1-5**). Other data sources are used to represent agricultural areas in states and US territories outside of the contiguous United States, for which the CDL is not available (**APPENDIX 1-6)**. All species or critical habitats with some overlap of the action area and their range or designated critical habitat, or with some overlap on species that the listed species depends on (**Chapter 4**) are assessed in the MAGTool to make LAA/NLAA determinations. Between the draft BE and the final BE, several UDLs were updated include splitting alfalfa and other agricultural grasses (non-grazing area) from the pasture/rangeland (grazing areas).

1. Effects Determinations

This BE makes effects determinations (NE, NLAA or LAA) for 1,805 listed species, and 791 designated critical habitats. For each species and designated critical habitat, the effects determination is based on the methodology detailed in **Chapter 1** of this BE and the Revised Method document[[3]](#footnote-4). NE determinations were made for 218 listed species and 236 critical habitats. MA determinations were made for the 1587 species and 555 critical habitats. All species given a MA determination at Step 1 progressed to the Step 2 analysis where an NLAA or LAA determination is made. NLAA determinations were made for 489 species, and 274 species’ critical habitats. LAA determinations were made for 1098 species and 281 critical habitats. Specific species determinations are provided in **APPENDIX 4-1.**

The MAGTool estimates the number of individuals of a listed species that are potentially affected, incorporating the degree of overlap of a species range with potential use sites and associated usage data for a chemical (and associated off site transport areas) into the effects determinations. Using the toxicity endpoints for each taxon (**Chapter 2**), the MAGTool utilizes both deterministic and probabilistic methods to assess how likely methomyl will adversely affect an individual of a given species. To help determine the potential for risk, the MAGtool incorporates many of EPA’s standard pesticide exposure models to estimate exposures to listed species and their prey, pollination, habitat, and dispersal vectors (PPHD). Details on the individual effects determinations are found in **APPENDIX 4-1**. If the model estimates are not considered representative of the exposure of the species (due to an inconsistency in the exposure model and assessed species’ habitat), a qualitative analysis is conducted. In those cases, EPA makes either a LAA or a NLAA determination based on a qualitative weight of evidence. For each LAA determination, this assessment employs three categories (*i.e.,* strongest, moderate and weakest) to characterize the strength of the weight of evidence. Each species or critical habitat was assigned a weak, moderate or strong evidence in the LAA determination based on multiple factors, including: the impact of using less conservative assumptions in the analysis, the quality of the species range or usage data, impacts to both the species and PPHD as opposed to only one, the presence of reported incidents involving the species taxa or PPHD taxa, the presence of monitoring data that exceeds endpoints, exposure only due to spray drift and the likelihood of drift into a species habitat (*e.g*., if the species inhabits forests).

For approximately 61% of all species and 36% of critical habitats, an LAA determination was made. Of the species LAA determinations, 34% were considered to have strongest evidence of LAA, 37% were considered to have moderate evidence of LAA, and 29% were considered to have weakest evidence of LAA. Of the critical habitat LAA determinations, 60% were considered to have strongest evidence of LAA, 18% were considered to have moderate evidence of LAA, and 22% were considered to have weakest evidence of LAA. In considering prominent risk drivers, the Corn Use Data Layer (UDL) was cited as the top use site associated with impacts to species or critical habitats with LAA determinations. Other UDLs frequently cited included Vegetables and Ground Fruit, Alfalfa, Other Grains~~,~~ and Other Orchards. When interpreting UDL rankings based on impact to the species, it is important to remember the UDLs are not mutually exclusive from one another. Therefore, other influences related to this lack of independence may influence the high rankings of given layers. LAA determinations were made for species across all taxa. For certain species and critical habitats, there were uncertainties in the methomyl effects determinations based on the resolution of spatial data, resolution of usage data, and the threshold for assessing impacts on PPHD (detailed in **Chapter 4**). **Tables 1** and **2** summarize the NE, NLAA and LAA determinations for species and critical habitats (respectively). **Tables 1** and **2** summarize the NE, NLAA and LAA determinations for species and critical habitats.  **Table 3** summarizes the strength of evidence classifications for the LAA determinations.

**TABLE 1. Summary of Species Effects Determinations for Methomyl (Counts by Taxon).**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Taxon** | **Step 1 Effects Determinations** | | **Step 2 Effects Determinations** | | **Totals** |
| **No Effect** | **May Affect** | **Not Likely to Adversely Affect** | **Likely to Adversely Affect** |
| Mammals | 1 | 101 | 33 | 68 | 102 |
| Birds | 2 | 105 | 33 | 72 | 107 |
| Amphibians | 1 | 37 | 3 | 34 | 38 |
| Reptiles | 1 | 45 | 17 | 28 | 46 |
| Fish | 0 | 192 | 17 | 175 | 192 |
| Plants | 180 | 770 | 306 | 464 | 950 |
| Aquatic Invertebrates | 3 | 206 | 28 | 178 | 209 |
| Terrestrial Invertebrates | 30 | 131 | 52 | 79 | 161 |
| Total | 218 | 1587 | 489 | 1098 | 1805 |
| Percent of total | 12% | 88% | 27% | 61% |  |

**TABLE 2. Summary of Critical Habitat Effects Determinations for Methomyl (Counts by Taxon).**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Taxon** | **Step 1 Effects Determinations** | | **Step 2 Effects Determinations** | | **Totals** |
| **No Effect** | **May Affect** | **Not Likely to Adversely Affect** | **Likely to Adversely Affect** |
| Mammals | 2 | 31 | 9 | 22 | 33 |
| Birds | 8 | 23 | 7 | 16 | 31 |
| Amphibians | 3 | 22 | 6 | 16 | 25 |
| Reptiles | 4 | 12 | 6 | 6 | 16 |
| Fish | 1 | 105 | 12 | 93 | 106 |
| Plants | 196 | 264 | 213 | 51 | 460 |
| Aquatic Invertebrates | 4 | 67 | 6 | 61 | 71 |
| Terrestrial Invertebrates | 18 | 31 | 15 | 16 | 49 |
| Total | 236 | 555 | 274 | 281 | 791 |
| Percent of total | 30% | 70% | 35% | 36% |  |

**Table 3. Classification of LAA Determinations by Strength of Evidence.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Strength of LAA call** | **Species range** | | **Critical Habitat** | |
| **Number** | **% of LAA determinations** | **Number** | **% of LAA determinations** |
| Strongest evidence of LAA | 376 | 34% | 169 | 60% |
| Moderate evidence of LAA | 408 | 37% | 51 | 18% |
| Weakest evidence of LAA | 314 | 29% | 61 | 22% |

1. Available at: <https://www.epa.gov/endangered-species/revised-method-national-level-listed-species-biological-evaluations-conventional> [↑](#footnote-ref-2)
2. The exposure models can be found at: <http://www.epa.gov/pesticides/science/models_pg.htm> [↑](#footnote-ref-3)
3. USEPA. 2020. *Revised Method for National Level Listed Species Biological Evaluations of Conventional Pesticides*. March 12, 2020. Environmental Fate and Effects Division. Office of Pesticide Programs. U.S. Environmental Protection Agency. Available at <https://www.epa.gov/endangered-species/revised-method-national-level-listed-species-biological-evaluations-conventional>. [↑](#footnote-ref-4)