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PREVENTION, PESTICIDES AND TOXIC
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MEMORANDUM

SUBJECT: Section 18 Ecological Risk Assessment for the Control of Asian Rust on Soybeans using Metconazole

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## I. Risk Assessment Summary and Conclusions

EFED has reviewed the emergency exemption Section 18 request to use the fungicide, metconazole, to control Asian rust on soybeans throughout the United States. The proposed label formulations of metconazole are Caramba, Headline-Caramba co-pack, and Operetta. The current risk assessment is based on the formulation with the highest application rate, Caramba, in order to determine the most conservative screening assessment. The proposed liquid formulation, Caramba, may be applied by both ground and aerial methods. The proposed treatment rate for soybeans is 0.056 lb a.i./acre applied no more than two times per growing season in 10 to 21-day intervals or earlier if conditions are favorable for Asian soybean rust.

### Aquatic Organisms

No acute LOCs are exceeded for aquatic organisms (freshwater fish and invertebrates and aquatic plants). No chronic LOCs are exceeded for freshwater invertebrates. There are no exceedances based on the chronic early life stage study for freshwater fish. **However, there are chronic exceedances for both ground and aerial application based on the freshwater fish full life cycle reproduction and growth test.** The estimated residues are two times greater than the NOAEC (RQ = 2.0-2.2). Statistically significant endpoints in the study included reduction in survival and growth of young fish greater than 62 days old.

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Estuarine/marine toxicity studies were not submitted for metconazole. Therefore, toxicity values for similar conazole pesticides (tetraconazole, fenbuconazole, and tebuconazole) were used to estimate risk quotients for metconazole. The mean and confidence interval ($5^{th}$ – $95^{th}$ percentile) were determined based on the toxicity values. There are no exceedances for mysid, oyster, or chronic fish for the entire range of the confidence interval around the mean. Acute Endangered and Acute Restricted Use LOCs are exceeded for estuarine/marine fish for the lower range ($5^{th}$ percentile) of the confidence limit. It is important to stress that this value is based on only two toxicity studies. However, it is recommended that an estuarine/marine fish toxicity study be completed for metconazole.

Submitted toxicity studies of metconazole technical and the formulated product, Caramba, indicate that the formulated product may be substantially more toxic than the active ingredient to aquatic organisms. In order to evaluate the risk to aquatic organisms due to Caramba 90 SL application to soybeans, the toxicity values need to be compared to estimated residue concentrations due to spray drift. Further refinement utilizing spray drift modeling is necessary to determine the effect on aquatic organisms.

**Terrestrial Organisms**

There are no acute or chronic exceedances for both the oral-dose and dietary exposure scenarios for birds at the proposed label rate. There are no acute oral dose-based LOCs exceeded for mammals for both one and two applications per year. In addition, no mammalian chronic oral dose-based LOCs are exceeded for one application per year. However, **chronic oral dose-based LOCs are exceeded for small (15 g) and medium (35 g) mammals consuming short grass after two applications per year using *maximum* EECs.** The RQs are 1.36 and 1.17, respectively. There are no exceedances for the remaining food types and size groups. There were no mammalian acute or chronic exceendances based on the *mean* EECs. Chronic mammalian dietary-based LOCs are not exceeded for both single and double applications. Chronic exposure of mammals to metconazole may result in increases in parental effects such as increased ovarian weights. Reproduction effects observed included increased gestation length in dams, decreased post-implantation survival, reduced litter size in $F_2$ pups, and reduced body weight gain in pups.

These risks to mammals are a concern for non-endangered and endangered species that forage on short grasses. Patterns of metconazole use are such that they coincide in time and space to areas frequented by mammalian wildlife. These areas have been of demonstrated use by wildlife as sources of food and cover. The potentially problematic wildlife food items, such as short grass, are likely to be present in and around the treated areas. Therefore, there is a potential for adverse direct and indirect effects to non-endangered and endangered mammals.

In order to avoid chronic reproductive risks to mammals, alternative application rates are suggested. Currently, the proposed maximum application rate is 0.056 lb a.i./A applied twice per year. A minimum of a 7-day interval between applications was assumed for this assessment; however, the risks to terrestrial mammals do not significantly increase when the application interval is reduced to 1 day. Risks are not avoided until the application interval is set at 52 days, which may not be realistic for use during the growing season. **At the application rate of 0.4 lb a.i./A (6.83 fl oz/A) applied twice per year with a minimum of a 6-day interval, there are no chronic mammalian exceedances.**

**Threatened and Endangered Species**

Threatened and endangered mammals may potentially be affected through *chronic* exposure. Levels of concern were exceeded for small (15g) and medium (35g) mammals consuming short grass. Several of the listed mammals occurring with counties containing soybean-growing areas (based on

LOCATES database) were excluded from the consideration of risk based on their size and diet. Three listed mice species are co-located with soybean-growing counties that may be exposed to metconazole residues by feeding on short grass. These listed species include the Alabama beach mouse, Perdido Key beach mouse, and the Preble's jumping mouse. There is a potential for a "may effect" classification for these species. Further refinement of the use area is necessary to determine the effect on these listed mice species.

Threatened and endangered freshwater fish may potentially be affected through *chronic* exposure to metconazole residues. In addition, there is a potential for threatened and endangered estuarine/marine fish to be affected through acute exposure pending a metconazole toxicity test. The LOCATES database which identifies those U.S. counties that both grow soybeans and have federally-listed endangered or threatened fish was not performed for these species. Further analysis is necessary to determine the effect on these listed fish species.

**Table 1: Summary of Risks for the use of Metconazole to control Asian Rust on Soybeans.**

| | Acute Risk | Acute Restricted Use | Acute Endangered Species | **Chronic Risk** | Risk for Plants |
|---|---|---|---|---|---|
| Avians | | | | | |
| **Terrestrial Mammals** | | | | Metconazole RQ = 1.1 - 136* | |
| Terrestrial Insects | | | | | |
| Terrestrial Plants- Seedling Emergence and Vegetative Vigor | | | | | |
| Freshwater Fish- Acute | | | | | |
| Freshwater Fish- Early Life Cycle | | | | | |
| **Freshwater Fish- Full Life Cycle** | | | | Metconazole RQ = 2.0-2.8 | |
| Estuarine/Marine Fish[1] | | Possible Risk | Possible Risk | | |
| Freshwater Invertebrates | | | | | |
| Estuarine/Marine Invertebrates[1] | | | | | |
| Freshwater Vascular - Plants | Risk not determined- no submitted toxicity study | | | | |
| Freshwater Non-vascular plants (green algae) | | | | | |
| Estuarine/marine Non-vascular plants | Risk not determined- no submitted toxicity study | | | | |

[1] Estuarine/Marine Toxicity data were not submitted. Risk is estimated based on toxicity to similar conazole pesticides. See Table 11.

* Chronic exceedance for small (15g) to medium (35g) mammals whose diet consists of short grasses.

## II. Key Uncertainties and Information Gaps

The following uncertainties and information gaps were identified:

- Toxicity data for estuarine/marine organisms were not submitted by the registrant; therefore, measurement endpoints were estimated based on toxicity studies of several similar conazole pesticides: tetraconazole, fenbuconazole, and tebuconazole. The most conservative toxicity approach using a confidence interval ($5^{th}$ – $95^{th}$ percentile) based on the toxicity values was performed for risk assessment.

- Submitted toxicity studies of metconazole technical and the formulated product, Caramba, indicate that the formulated product may be substantially more toxic than the active ingredient to aquatic organisms. Further refinement utilizing spray drift modeling is necessary to determine the effect on aquatic organisms.

- The mammalian chronic risk quotients were calculated based the maximum estimated residue concentration (based on Kenaga monograph) and the default foliar dissipation half-life value of 35 days. These inputs resulted in exceedances of the mammalian chronic LOC. Chronic LOCs are not exceeded based on mean residue EECs. Using the default residue half-life presents uncertainty in the RQ. Submission of a foliar dissipation study that estimated a true residue half-life on soybeans may alter the risk quotients and determine if the quotients will exceed the LOCs.

- The risk assessment did not include metconazole degradates. Metconazole degradates were not analyzed in any of the terrestrial field studies. Registrant-submitted data for a common degradate, 1,2,4-triazole, are under review.

- The potential for endocrine disruptor related effects was observed in mammalian and avian reproduction toxicity studies using metconazole. There is also a potential for endocrine distruptor related effects due to the toxicity of the degradates of metconazole, including 1,2,4-triazole. Toxicity data is not available for the degradates. This risk assessment has not included an evaluation of the relative risk of metconazole and its degradates for endocrine disruption and as such is a source of uncertainty in this assessment.

- Metconazole is a chiral compound. The active ingredient of metconazole is a mixture of four (cis and trans) diastereoisomers. A combination of cis and trans mixtures were used in toxicity testing. The fungicidal activity of the compound has been found to be associated largely with the cis-isomer (Belgium Monograph, 2004). The risk assessment does not take into account the difference in the mode of action of the enantiomers of metconazole or their differences in fate or toxicity in the environment.

## III. USE CHARACTERIZATION

Metconazole is a member of the triazole group of fungicides. It inhibits sterol biosynthesis by inhibiting the Cytochrome P450-dependent C-14 demethylase reaction. Sterol biosynthesis inhibition

The new label formulations of metconazole proposed for Section 18 registration are Caramba, Headline-Caramba co-pack, and Operetta for use on soybeans throughout the United States (Table 2). If approved, metconazole will be used to combat Asian soybean rust (*Phakopsora pachyrhizi*). The current risk assessment is based on the formulation with the highest application rate in order to determine the most conservative screening assessment. The proposed liquid formulation, Caramba, will be applied by both ground and aerial methods. The proposed treatment rate for soybeans is 0.056 lb a.i./acre applied no

more than two times per growing season in 10 to 21-day intervals or earlier if conditions are favorable for Asian soybeans rust.

**Table 2. Application rates for Metconazole Formulated Products**

| **Active Ingredient** | metconazole | metconazole + pyraclostrobin | metconazole + pyraclostrobin |
|---|---|---|---|
| **Trade Name** | Carambra | Headline-Carambra co-pack | Operetta |
| **Formulation** | 90 SL | 90 SL Carambra + 2.09EC Headline | 180EC (80 g/L metconazole + 100 g/L pyraclostrobin) |
| **% Active Ingredient** | 8.6% a.i. by weight (0.75 lb/gal) | 8.6% a.i. (0.75 lb.gal) metconazole + 23.6% (2.09 lb/gal) pyraclostrobin | 21.6% a.i. – 9.6% a.i. metconazole + 12% pyraclostrobin (0.67 lb/gal metconazole + 0.83 lb/gal pyraclostrobin) |
| **Rate of Application** | 0.96-1.14 oz ai/A, 8.2-9.6 fl oz/A | 0.72 oz ai/A metaconazole + 1.17 oz ai/A pyraclostrobin, 6.08 fl oz/A metconazole + 3.56 fl oz/A pyraclostrobin | 2.1-2.54 oz ai/A (0.93-1.12 oz a.i./A metaconazole + 1.17-1.34 oz ai/A pyraclostrobin), 8.9-10.75 fl oz a.i./A |
| **Rate of Application (lb ai/A)** | 0.056 lb a.i./A | 0.0356 lb a.i./A | 0.063 lb total product/A |
| **Number of Applications** | 1 -2 | 1 | 1-2 |
| **Interval between applications** | 10-21 days or earlier if disease develops | | |

## IV. ANALYSIS

### A. Exposure Characterization

#### *1. Aquatic Organism Exposures*

Metconazole is a new chemical, for which no monitoring data are available in the United States. Estimated Environmental Concentrations (EECs) for aquatic ecosystems assessments were estimated based on EFED's Tier II aquatic models: PRZM (Pesticide Root Zone Model) and EXAMS (EXposure Analysis Modeling System). **PRZM** is used to simulate pesticide transport as a result of runoff and erosion from an 10-ha agricultural field and **EXAMS** considers the environmental fate and transport of pesticides and predicts EECs in an adjacent small water body (10,000-$m^2$ pond, 2-m deep with no outlet), with the assumption that the small field is cropped at 100%. The model is designed to estimate pesticide concentrations found in water at the edge of the treated field. As such, it provides high-end values of the pesticide concentrations that might be found in ecologically sensitive environments following pesticide application. PRZM-EXAMS is a multi-year runoff model that also accounts for spray drift from multiple applications. The location of the field is specific to the crop being simulated using site specific information on the soils, weather, cropping, and management factors associated with the scenario. The crop/location scenario is intended to represent a high-end exposure site on which the crop is normally grown. Based on historical rainfall patterns, the small water body receives multiple runoff events during the years simulated.

Calculations are carried out with the linkage program shell - PE4VO1.pl - which incorporates the standard scenarios developed by EFED. Additional information on these models can be found at: http://www.epa.gov/oppefed1/models/water/index.htm. The input parameters used in this assessment were selected from the environmental fate data submitted by the registrant and in accordance with US EPA-OPP EFED water model parameter selection guidelines, *Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides*, Version II, February 28, 2002.

Input parameters used in the Tier II PRZM/EXAMS model for ecological assessment of metconazole in surface water sources were based on the proposed application rate and the fate properties of metconazole. Both aerial and ground spray methods were considered (Table 3). Aquatic exposure characterization was based on a Mississippi soybean application scenario which was selected to represent a wide range of soil and environmental conditions of the growing area. The application dates for the scenario is June 1. The assumption was made that soil incorporation did not occur.

Three application interval scenarios are presented: 7, 14, and 21 days. There is an increase in the estimated concentrations as the application interval increases. This may be due to rain events occurring after the application date. There is some uncertainty involved with the application date and rain events in the model. The 21-day scenario resulted in rainfall closer to the time of application.

The model results are presented in Table 4. Peak EEC values were used to determine acute risks. The 21-day average EEC values were used to determine chronic risks to aquatic invertebrates. The 60-day average EEC values were used to determine chronic risks to aquatic fish. The PRZM/EXAMS output files from the ecological exposure assessment are presented in **Appendix A**.

**Table 3. PRZM/EXAMS Input Parameters for Metconazole Use**

| Parameter | Input Value and Unit |
|---|---|
| Maximum Application Rate | 0.056 lb a.i./A |
| Maximum Number of Applications | 2 |
| Method of application | Aerial and Ground |
| Minimum Interval between Applications | 7, 14, and 21 days |
| Partition Coefficient $K_d$ | 7.91 mg/L |
| Henry's law constant | $2.18*10^{-12}$ atm $m^3$/mol |
| Hydrolysis | 0 days |
| Aerobic Soil Metabolism | 458.1 days |
| Aerobic Aquatic Metabolism ($t_{1/2}$) | 916.2 days |
| Anaerobic Aquatic Metabolism ($t_{1/2}$) | 990.0 days |
| Aquatic Photolysis $t_{1/2}$ (days) | 72.6 days |
| Vapor pressure | $1.58*10^{-8}$ torr |
| Solubility in water (pH 7, 20°C) | 30.4 mg/L |
| Molecular Wt. | 319.8 g/mol |

| Table 4. PRZM/EXAMS Estimated Concentrations of Metconazole in Surface Water for Aquatic Exposure | | | |
|---|---|---|---|
| **Scenario** | **Peak Conc. (ppb)** | **21 day Conc. (ppb)** | **60 day (ppb)** |
| **Mississippi Soybeans** | | | |
| **Two aerial applications w/ 7 days interval** | 6.63 | 6.59 | 6.53 |
| **Two aerial Applications w/ 14 days interval** | 6.73 | 6.70 | 6.64 |
| **Two aerial Applications w/ 21 days interval** | 7.11 | 7.09 | 7.03 |
| | | | |
| **Two ground applications w/ 7 days interval** | 5.90 | 5.87 | 5.83 |
| **Two ground applications w/ 14 days interval** | 6.01 | 5.98 | 5.94 |
| **Two ground applications w/ 21 days interval** | 6.42 | 6.33 | 6.23 |

2. *Terrestrial Organism Exposures*

Terrestrial wildlife exposure estimates are typically calculated for birds and mammals emphasizing a dietary exposure route for uptake of pesticide residues on vegetative matter and insects. These exposures are considered as surrogates for terrestrial-phase amphibians as well as reptiles. For exposure to terrestrial organisms, pesticide residues on food items are estimated, based on the assumption that organisms are exposed to a single pesticide residue in a given exposure scenario. The residue estimates from spray applications are based on a nomogram by Hoerger and Kenaga (1972) as modified by Fletcher et al. (1994) that correlated residue levels, based on application rate, on various terrestrial items immediately following application in the field. The maximum and mean residue concentration for each food group was derived from literature and tolerance data. Specifically, for every 1 lb ai/acre of application, the resulting maximum concentration on short grass is 240 ppm, on tall grass is 110 ppm, on broad-leaved plants/small insects is 135 ppm, and on seeds/large insects is 15 ppm. For every 1 lb ai/acre of application, the resulting mean concentration on short grass is 85 ppm, on tall grass is 36 ppm, on broad-leaved plants/small insects is 45 ppm, and on seeds/large insects is 7 ppm.

Determination of residue dissipation over time on food items following single and multiple applications are predicted using a first-order residue degradation half-life with EFED's "T-REX_v1.1" model. The risk assessment uses a default foliar dissipation half-life estimate of 35 days. This half-life is used in lieu of representative foliar dissipation data for metconazole. A magnitude of residues in soybeans study was submitted with an application rate 0.07 lb ai/A, applied twice, at a 10-day re-treatment interval (Leonard, 2005). The study reported combined residues of metconazole (cis and trans isomers) of 1.00-2.43 and 1.29-3.36 ppm, respectively, in/on treated forage and hay samples harvested 7 days after last application and <0.01-0.05 ppm in/on seed collected 30 or 31 days after last treatment. Because the residue samples on forage and hay were only collected at one time point, these values can not be used to estimate a degradation half-life.

The screening-level risk assessment for metconazole uses maximum predicted residues as the measure of exposure to estimate risk. The predicted maximum residues of metconazole that may be expected to occur on selected avian or mammalian food items immediately following application (at the maximum annual or seasonal label rate) for soybeans is presented in Table 5.

**Table 5. Estimated Environmental Concentrations for Avian and Mammalian Food Items following Single and Double Applications at 0.05 lb a.i./A with 7-day interval between applications**

| Number of Applications | Food Items | EEC (ppm) Maximum Predicted Residue | EEC (ppm) Mean Predicted Residue |
|---|---|---|---|
| 1 Application | Short grass | 13.50 | 4.78 |
| | Tall grass | 6.19 | 2.03 |
| | Broadleaf/forage plants and small insects | 7.59 | 2.53 |
| | Fruits, pods, seeds, and large insects | 0.84 | 0.39 |
| 2 Applications | Short grass | 25.25 | 8.94 |
| | Tall grass | 11.57 | 3.79 |
| | Broadleaf/forage plants and small insects | 14.20 | 4.73 |
| | Fruits, pods, seeds, and large insects | 1.58 | 0.74 |

The residues or estimated environmental concentrations (EECs) on food items are compared both directly with subacute dietary toxicity data and converted to an ingested whole body dose (single oral dose), as is the case for small mammals and birds. The EEC is converted to oral dose by multiplying the EEC by the percentage of body weight consumed as estimated through allometric relationships. These consumption-weighted EECs (i.e. EEC equivalent dose) are determined for each food source and body size for mammals (15, 35, and 1000 g) and birds (20, 100, and 1000 g). The EEC equivalent doses for birds and mammals are given in Tables 6 and 7, respectively.

**Table 6. Avian EEC equivalent dose adjusted for body weight for metconazole application on soybeans twice per year**

| EEC equivalent dose (mg/kg-body weight) | Avian Classes and Body Weights | | |
|---|---|---|---|
| | small 20 g | mid 100 g | large 1000 g |
| Percent Body Weight Consumed | 114% | 65% | 29% |
| Short Grass | 29 | 16 | 7 |
| Tall Grass | 13 | 8 | 3 |
| Broadleaf plants/small insects | 16 | 9 | 4 |
| Fruits/pods/large insects | 2 | 1 | 0 |

**Table 7. Mammalian EEC equivalent dose adjusted for body weight for metconazole application on soybeans twice per year**

| EEC equivalent dose (mg/kg-body weight) | Mammalian Classes and Body weight | | | | | |
|---|---|---|---|---|---|---|
| | Herbivores/ Insectivores | | | Granivores | | |
| | 15 g | 35 g | 1000 g | 15 g | 35 g | 1000 g |
| Percent Body Weight Consumed | 95% | 66% | 15% | 21% | 15% | 3% |
| Short Grass | 24 | 17 | 4 | | | |
| Tall Grass | 11 | 8 | 2 | | | |
| Broadleaf plants/sm Insects | 13 | 9 | 2 | | | |
| Fruits/pods/seeds/lg insects | 1 | 1 | <<0.01 | <<0.01 | <<0.01 | <<0.01 |

## B. Ecological Effects Characterization

In screening-level ecological risk assessments, effects characterization describes the types of effects a pesticide can produce in an animal or plant. This characterization is based on registrant-submitted studies that describe acute and chronic effects toxicity information for various aquatic and terrestrial animals and plants.

**Appendix B** summarizes the results of all of the registrant-submitted toxicity studies for this risk assessment. Toxicity testing reported in this section does not represent all species of birds, mammals, or aquatic organisms. Only a few surrogate species for both freshwater fish and birds are used to represent all freshwater fish (2000+) and bird (680+) species in the United States. For mammals, toxicity studies are limited the laboratory rat. Also, neither reptiles nor amphibians are tested. The risk assessment assumes that avian and reptilian and terrestrial-phase amphibian toxicities are similar. The same assumption is used for fish and aquatic-phase amphibians.

Metconazole is moderately toxic to freshwater fish on an acute basis. Chronic growth effects were observed in an early life stage study with the rainbow trout that resulted in a NOAEC of 1.14 mg/L based on mortality and sublethal effects. In addition, a rainbow trout full life cycle study resulted in a NOAEC of 0.0029 mg/L based on survival and growth of fish more than 62 days old. The pesticide is moderately toxic to freshwater invertebrates. Reproductive chronic effects were observed for freshwater invertebrates (NOAEC = 0.078 mg/L). The green algae toxicity test resulted in an $EC_{50}$ value of 1.7 mg/L.

The chemical is slightly toxic to birds on an acute oral basis. It is slightly toxic to the bobwhite quail and practically non-toxic to the mallard duck on a subacute dietary basis. In a Northern bobwhite quail reproduction study, there were statistically significant reductions in the percent normal hatchlings of viable embryos, and reductions in the number of 14-day surviving chicks and reduced body weight of chicks. The NOAEC and LOAEC were determined to be 60 and 120 mg/kg diet, respectively (Johnson & Ahmed, 1999). Metconazole is moderately toxic to mammals on an oral acute basis. Reproductive chronic effects were also observed in mammals. In the 2-generation reproduction study with rats (Willoughby, 1992), reproductive toxicity including increased ovarian weights in first generation females, increased gestation length in $F_1$ dams, decreased post-implantation survival, reduced litter size, and reduced body weight gain in offspring resulted in NOAEL and LOAEL values of 8 and 32 mg/kg bw, respectively. There were no statistically significant toxic effects to terrestrial plants based on a seedling emergence study at the highest application rate (0.086 lb ai/A). There were no statistically significant toxic effects to

terrestrial plants based on a vegetative vigor study, except for the shoot length of soybeans (NOAEC = 0.024 lb ai/A). Metconazole is practically non-toxic to honeybees on an acute contact basis. Toxic effects were observed in a honeybee oral acute study resulting in a $LD_{50}$ and NOAEC of 85 and 6 µg a.i./bee, respectively. **Tables 8 and 9** summarize the most sensitive ecological toxicity endpoints for aquatic organisms, terrestrial organisms, and aquatic and terrestrial plants, respectively, which were used for risk characterization. Details of the toxicity studies are provided in **Appendix B.**

**Table 8. Summary of Acute and Chronic Aquatic Toxicity Data used for Risk Quotient Calculation for Metconazole Application**

| Species | Acute Toxicity | | | Chronic Toxicity | |
|---|---|---|---|---|---|
| | $LC_{50}$ (mg/L) | $EC_{50}$ (mg/L) | Category of Toxicity (Study Reference) | NOAEC / LOAEC (mg/L) | Most Sensitive Endpoint (Study Ref) |
| Rainbow Trout *Salmo gairdneri* Freshwater Fish | 72-h 2.1 | -- | Moderately Toxic (Toy R., 1990) | -- | -- |
| Rainbow Trout *Onchorhynchus mykiss* Freshwater Fish | -- | -- | -- | 95-day 0.00291/ 0.01 | Growth and survival of young fish (Zok S., 2001) |
| Water flea *Daphnia magna* Freshwater Invertebrate | -- | 48-hr 4.2 | Moderately Toxic (Toy, 1990) | 21-day 0.078/0.16 | Reproduction (Jatzek, 2002) |
| Sediment Chironomids *Chironomus riparius* | 10-day 3.33 | -- | England, 1997 | 28-day 2.12 | England, 1997 |
| Aquatic Plant: Green Algae Tier II (*Selenastrum capricornutum*) | | 72-hr 1.7 mg/L | | 72-hr 0.38 mg/L | Toy, 1990 |

**Table 9. Summary of Terrestrial Acute and Chronic Toxicity Data used for Risk Quotient Calculation for Metconazole Application to Soybeans**

| Species | Acute Toxicity | | | | Chronic Toxicity | |
|---|---|---|---|---|---|---|
| | $LD_{50}$ | Acute Oral Toxicity | $LC_{50}$ | Subacute Dietary Toxicity | NOAEC(L)/ LOAEC(L) | Affected Endpoints |
| Northern Bobwhite Quail (*Colinus virginianus*) | 787 mg/kg-bwt | Slightly Toxic (Hakin, 1992a) | 1057 mg ai/kg-diet | Slightly Toxic (Hakin, 1991a) | 60/120 mg ai/ kg diet | Reproduction and Growth Johnson & Ahmed, 1999 |
| Mallard duck (*Anas platyrhynchos*) | -- | -- | >5200 mg ai/kg-diet | Practically Non-Toxic (Hakin, 1991b) | 60/400 mg ai/ kg diet | Reproduction Hakin, 1992c |
| Laboratory rat (*Rattus norvegicus*) female | 410 mg/kg-bwt | Moderately Toxic (Gardner, 1990a) | -- | -- | 8/ 32 mg/kg bw/ day | Parental mortality and offspring toxicity Willoughby, 1992 |
| Terrestrial Plants Seedling Emergence* | Non-Endangered Plants $EC_{50}$ > 0.086 lb ai/A for all species tested Endpoints: Emergence and survival | | | | Endangered Plants NOAEC/ LOAEC= 0.086/ <0.086 lb ai/A | Aufderheide, 2000b |
| Terrestrial Plants Vegetative Vigor* | Non-Endangered Plants $EC_{50}$ > 0.098 lb ai/A soybean is most sensitive species Endpoint: Shoot length | | | | Endangered Plants NOAEC/ LOAEC= 0.024/ 0.045 lb ai/A | Aufderheide, 2000a |

* species tested: monocot: onion, oat; dicot: lettuce, radish, soybean, sugarbeet

## V. RISK CHARACTERIZATION

Results of the exposure and toxicity effects data are used to evaluate the likelihood of adverse ecological effects on non-target species. For the assessment of metconazole risks, the risk quotient (RQ) method is used to compare exposure and measured toxicity values. Estimated environmental concentrations (EECs) are divided by acute and chronic toxicity values. The RQs are compared to the Agency's Levels of Concern (LOCs). These LOCs are the Agency's interpretive policy and are used to analyze potential risk to non-target organisms and the need to consider regulatory action. These criteria are used to indicate when a pesticide's use as directed on the label has the potential to cause adverse effects on non-target organisms. **Appendix C** of this document summarizes the LOCs used in this risk assessment.

1. *Nontarget Aquatic Animals, Invertebrates, and Plants*

Surface water estimated environmental concentrations (EECs) resulting from metconazole application to soybeans were predicted with the Tier II models PRZM_EXAMS. Aquatic exposure characterization was based on a Mississippi soybean scenario. The proposed rate was 0.056 lb a.i./acre for two applications during the growing season spaced 7 -21 days apart. Both aerial and ground spray applications were considered.

The EECs were highest based on the 21-day application interval, therefore these values were used for the aquatic screening assessment. Peak EECs were compared to acute toxicity endpoints to derive acute RQs. The 60-day EECs were compared to chronic toxicity endpoints (NOAEC values) to derive chronic RQs for fish, and 21-day EECs were compared to chronic toxicity endpoints for invertebrates. For aquatic non-vascular plants, peak EECs were compared to acute $EC_{50}$ and NOAEC toxicity endpoints to derive acute non-endangered and endangered species RQs, respectively. Acute and chronic RQs for freshwater organisms are summarized in Table 10.

No acute LOCs are exceeded for aquatic organisms (freshwater fish and invertebrates and aquatic plants) (Table 10). There were no exceedances based on the chronic early life stage study for freshwater fish. However, there were exceedances for both ground and aerial application based on the full life cycle reproduction and growth chronic test. The EECs were two times greater than the NOAEC. Statistically significant endpoints in the study included reduction in survival and growth of young fish greater than 62 days old.

A benthic chironomid study resulted in a NOAEC of 2.12 mg ai/L after 28 days of exposure. The NOAEC value was compared to a benthic pore water EEC generated from PRZM/EXAMS model using the application rate 0.056 lb ai/A with a 21-day interval following aerial application (data not shown). The RQ of 0.0032 was calculated by dividing the 21-day EEC (6.77 µg/L) by the NOAEC (2120 µg/L). The resulting RQ does not indicate a concern for benthic organisms.

Estuarine/marine toxicity studies were not submitted for metconazole. For risk characterization purposes, toxicity values for similar conazole pesticides were used to estimate risk quotients for metconazole (Table 11). Toxicity values are given for tetraconazole, fenbuconazole, and tebuconazole. The toxicity values for each species were similar among the chemicals suggesting that these species have similar sensitivity to these chemicals. The mean and confidence interval ($5^{th}$ – $95^{th}$) was determined for the three chemicals based on a T-distribution assuming the values were log-normally distributed. RQs were determined by dividing the EECs for metconazole were divided by the lower and upper confidence interval amongst the chemicals. There are no exceedances for chronic fish or acute mysid and oyster for the entire range of the confidence interval for estuarine/marine organisms. The Acute Endangered and Acute Restricted use LOC is exceeded for estuarine/marine fish for the lower ($5^{th}$ percentile) range of the confidence limit. It is important to stress that this value is based on only two toxicity studies. However, it is recommended that an estuarine/marine fish study be completed for metconazole.

**Table 10. Estimated Risk Quotients for Freshwater Organisms: 10-day interval**

| Species | Toxicity (μg/L) | Reference | Crop Scenario | EEC (μg/L) | Acute RQ | Chronic RQ |
|---|---|---|---|---|---|---|
| Rainbow Trout | $LC_{50}$= 2100 | Toy, 1990 | Aerial | 7.11 | 0.0034 | -- |
| | | | Ground | 6.42 | 0.0031 | -- |
| | Early Life Stage Reproduction NOAEC = 1140 | Mitchell, 1996b | Aerial | 6.53 | -- | 0.0062 |
| | | | Ground | 5.83 | -- | 0.0055 |
| | Full Life Cycle Reproduction and Growth NOAEC= 2.91 | Zok, 2001 | Aerial | 6.53 | -- | 2.42 + |
| | | | Ground | 5.83 | -- | 2.14 + |
| *Daphnia magna* | $EC_{50}$ = 4200 | Toy, 1990 | Aerial | 7.11 | 0.0017 | -- |
| | | | Ground | 6.42 | 0.0015 | -- |
| | Reproduction NOAEC = 78 | Jatzek, 2002 | Aerial | 6.59 | -- | 0.0909 |
| | | | Ground | 5.87 | -- | 0.0812 |
| Green Algae | $EC_{50}$ = 1700 | Toy, 1990 | Aerial | 7.11 | Non-endangered Acute RQ=0.004<br>Endangered Acute RQ = 0.019 | |
| | NOAEC = 380 | | Ground | 6.42 | Non-endangered Acute RQ=0.0038<br>Endangered Acute RQ=0.0169 | |

+ exceeds Chronic LOC (>1.0)

**Table 11. Estuarine/Marine Toxicity values from various conazoles, estimate RQ values for Metconazole (A: Aerial; G: Ground application)**

| Estuarine/Marine | Tetra-conazole Toxicity | Fenbu-conazole Toxicity | Tebu-conazole Toxicity | Mean ($5^{th}$-$95^{th}$ confidence interval (µg/L)) | Met-conazole EEC (µg/L) | Estimated Metconazole RQ for confidence interval[1] |
|---|---|---|---|---|---|---|
| Sheepshead minnow *Cyprinodon variegatus* | $LC_{50}$ > 3400 µg/L | $LC_{50}$ = 1800 µg/L | $LC_{50}$ = 5900 µg/L | 3850 (16.3 - $6.5*10^5$) | A 7.11 | **0.44**** – $1.1*10^{-5}$ |
| | | | | | G 6.42 | **0.39**** – $9.9*10^{-6}$ |
| Sheepshead minnow- Early Life Stage Chronic Study | -- | -- | NOAEC = 21.9 µg/L | -- | A 7.03 | 0.3210 |
| | | | | | G 6.23 | 0.2845 |
| Sheepshead minnow- Full Life Cycle Chronic Study | -- | -- | NOAEC = 19 µg/L | -- | A 7.03 | 0.3700 |
| | | | | | G 6.23 | 0.3279 |
| Eastern oyster *Crassostrea virginica* | $EC_{50}$ = 440 µg/L | $EC_{50}$ = 630 µg/L | $EC_{50}$ = 490 µg/L | 520 (300 – 880) | A 7.11 | 0.0237 – 0.008 |
| | | | | | G 6.42 | 0.0214 – 0.007 |
| Mysid shrimp *Americamysis bahia* | $EC_{50}$ = 990 µg/L | $EC_{50}$ = 1200 µg/L | $EC_{50}$ = 2700 µg/L | 1630 (312 – 6892) | A 7.11 | 0.023 – 0.001 |
| | | | | | G 6.42 | 0.0206 – 0.0009 |

[1] The below notation will be used to denote values that exceed the Levels of Concern (LOC)
* exceeds Acute Endangered LOC (>0.05)
** exceeds Acute Restricted Use LOC (>0.10)
*** exceeds Acute LOC (>0.5)
+ exceeds Chronic LOC (>1.0)

2. *Nontarget Terrestrial Animals*

**Avian Risk**

The EEC's for terrestrial exposure were derived from the Kenaga nomograph, as modified by Fletcher et al. (1994), based on a large set of field residue data. The EECs were calculated by the T-REX Version 1.1 model and corresponding avian acute and chronic risk quotients are based on the most sensitive subacute dietary $LC_{50}$, single oral dose $LD_{50}$, and NOAEC for birds. Single-oral dose acute studies represent the upper range of the quantity of pesticides birds could potentially ingest with their diet. Subacute dietary studies represent the lower range of the quantity of pesticide potentially ingested.

Calculations for oral dose risk quotients are based on a Northern bobwhite quail oral acute $LD_{50}$ of 787 mg/kg body weight (Hakin, 1992a). RQs for oral dose-based scenarios are calculated by dividing the consumption-weighted equivalent dose (Table 6) by the body weight-adjusted $LD_{50}$. The avian $LD_{50}$ is adjusted for body weight according to the following equation:

$$\text{Adjusted Avian } LD_{50}\,(\text{mg/kg bw}) = LD_{50}\,(\text{mg/kg bw}) * \left(\frac{AW\,(g)}{TW\,(g)}\right)^{1.15-1}$$

(USEPA, 1993)

The assessed weight (AW) is the body weight of the wildlife species of concern. An adjusted $LD_{50}$ is calculated for three weight classes of birds (20, 100, and 1000 g). The test weight (TW) is the body weight of the species used in the toxicity study. In this case, the weight of the bobwhite quail is estimated to be 200 g. The adjusted $LD_{50}$ is 567, 722, and 1020 mg/kg bw for the weight classes 20, 100, and 1000 g birds, respectively. The acute RQs for birds based on single-oral dose oral studies are summarized in Table 12.

Calculations for acute and chronic dietary-based risk quotients are based on a Northern Bobwhite quail subacute dietary $LC_{50}$ of 1057 mg/kg diet (Hakin, 1991a) and a chronic NOAEC of 60 mg/kg diet (Johnson & Ahmed, 1999) (Table 13). These endpoints are not adjusted for body weight. RQs for single and double applications per year for soybeans were determined.

There are no acute or chronic exceedances for both the oral-dose and dietary exposure scenarios for the all size classes of birds exposed to all food groups at the proposed label rate with a 7-day interval and applied once and twice per year.

**Table 12. Avian acute Oral DOSE-based Risk Quotients for metconazole application on soybeans[1]**

| No. Applications per year | Food Items | Avian Oral Dose Based[2] Acute RQs | | |
|---|---|---|---|---|
| | | 20 g | 100 g | 1000 g |
| 1 Application | Short Grass | 0.03 | 0.01 | <<0.01 |
| | Tall Grass | 0.01 | 0.01 | <<0.01 |
| | Broadleaf plants/sm insects | 0.02 | 0.01 | <<0.01 |
| | Fruits/pods/lg insects | <<0.01 | <<0.01 | <<0.01 |
| 2 Applications | Short Grass | 0.05 | 0.02 | 0.01 |
| | Tall Grass | 0.02 | 0.01 | <<0.01 |
| | Broadleaf plants/sm insects | 0.03 | 0.01 | <<0.01 |
| | Fruits/pods/lg insects | <<0.01 | <<0.01 | <<0.01 |

[1] based on a Northern bobwhite quail oral acute $LD_{50}$ of 787 mg/kg body weight (Hakin, 1992a)
[2] RQs are calculated by dividing the consumption-weighted equivalent dose (Table 6) by the body weight-adjusted $LD_{50}$

**Table 13. Avian acute and chronic DIETARY-based Risk Quotients for metconazole application on soybeans[1]**

| Application number | Food Items | Maximum EEC (mg/kg) | Acute RQ ($EEC/LC_{50}$) | Chronic RQ (EEC/ NOAEC) |
|---|---|---|---|---|
| 1 application | Short grass | 13.50 | 0.01 | 0.23 |
| | Tall grass | 6.19 | 0.01 | 0.10 |
| | Broadleaf plants/small insects | 7.59 | 0.01 | 0.13 |
| | Fruits, pods, seeds, and large insects | 0.84 | <<0.01 | 0.01 |
| 2 applications | Short grass | 25.25 | 0.02 | 0.42 |
| | Tall grass | 11.57 | 0.01 | 0.19 |
| | Broadleaf plants/small insects | 14.20 | 0.01 | 0.24 |
| | Fruits, pods, seeds, and large insects | 1.58 | <<0.01 | 0.03 |

[1] based on a Northern bobwhite quail subacute dietary $LC_{50}$ of 1057 mg/kg diet (Hakin, 1991a) and a chronic NOAEC of 60 mg/kg diet (Johnson & Ahmed, 1999)

**Mammalian Risk**

EECs and corresponding mammalian acute and chronic RQs for single and double annual applications of metconazole on soybeans were determined using the T-REX Version 1.1 model (Tables 14 - 17). Calculations for both oral dose-based and dietary-based risk quotients were based on an acute laboratory female mouse adjusted $LD_{50}$ value of 231 mg/kg bw (Gardner, 1990a) and a chronic reproductive effect NOAEC of 8 mg/kg bw (Willoughby, 1992). Two acute oral mammalian toxicity studies using the technical product were provided (Appendix B). The study that resulted in the most conservative toxicity value was used to estimate a risk quotient. A laboratory female mouse $LD_{50}$ of 410 mg/kg bw was the most conservative value compared to the laboratory female rat $LD_{50}$ of 595 mg/kg bw. It is important to note that the acute toxicity results for mice and rats do not appear to fall the normally assumed relationship between toxicity and test animal body weight. The standard assumption incorporated into the screening-level risk assessment is that mammal sensitivity to a toxicant increases with increasing body weight. This assumption is derived from allometric relationships established for organism metabolism rates and for organ surface areas. In contrast to this assumption, the available acute mammalian toxicity data for metconazole suggests that increasing mammal body weight is associated with decreased sensitivity to the compound. The extent to which the metconazole effects data depart from the screening-level assessment will contribute to the overall uncertainty associated with the mammal risk assessment. Admittedly, with only two species for comparison and with those species exhibiting fairly close $LD_{50}$ values, the strength of the relationship between body weight and acute sensitivity cannot be determined with a great deal of certainty and extrapolation of these observations to body weight-based assumptions of chronic sensitivity is also uncertain. Nevertheless, if the observed pattern for metconazole is real and applicable to both acute and chronic effects, then the screening risk assessment assumptions would lead to an overestimation of the sensitivity of mammals to metconazole and so overestimate risks. If the available data actually represent a situation where body weight has little impact on mammal sensitivity, the screening-level assumptions would still represent an overestimation of sensitivity and so overestimate risk for mammals with body weights greater than the tested organisms.

With these uncertainties in mind, the allometric equation was used in this assessment to predict the toxicity of metconazole to different size groups of mammals. While the mammal toxicity in the studies did not follow the expected pattern based on body weight, the toxicity values were not substantially different from each other, therefore limiting the uncertainty. There was a difference of 185 mg/kg bw in the $LD_{50}$ values in the rat and mouse studies. Currently, the allometric equations in the TREX model are based on the body weight of the laboratory rat. In order to adjust for the body weight of the mouse the following equation was used:

$$\text{Adjusted Mammalian } LD_{50}\,(\text{mg/kg bw}) = LD_{50} * \left(\frac{TW\,(g)}{AW\,(g)}\right)^{0.25}$$

(USEPA, 1993)

The assessed weight (AW) is the body weight of the laboratory rat (estimated as 350 g). The test weight (TW) is the weight of the mouse used in the toxicity study (estimated as 35 g). The adjusted $LD_{50}$ is 231 mg/kg bw for the laboratory mouse.

Oral dose-based RQ values were calculated by dividing the consumption-weighted equivalent dose (Table 7) by the body weight-adjusted $LD_{50}$ (Table 14). The mammalian $LD_{50}$ is adjusted for body weight using the same equation above. The assessed weight (AW) is the body weight of the wildlife species. An adjusted $LD_{50}$ is calculated for each weight class of mammal (15, 35, and 1000 g). The test weight (TW) is the weight of the species used in the toxicity study. In this case, the weight of the laboratory rat (350 g) is used because the original $LD_{50}$ has been already adjusted for body weight. For

chronic oral dose-based RQ calculations, the NOAEC (8 mg/kg bw) was adjusted for body weight using the same procedure.

There are no acute oral dose-based LOCs exceeded for mammals for both one and two applications per year using maximum EECs (Tables 15 and 16). In addition, no chronic oral dose-based LOCs are exceeded for one application per year. However, mammalian chronic oral dose-based LOCs are exceeded for small (15 g) and medium (35 g) mammals consuming short grass for *two* applications per year. The RQs are 1.36 and 1.17, respectively. There are no exceedance for the remaining food types and size groups.

Acute dietary-based LOCs were not determined because a subacute dietary laboratory test is not regularly performed. For both single and double applications, mammalian chronic dietary-based LOCs are not exceeded for all food types (Table 17).

For this risk assessment, the risk quotients that were compared to the LOCs were calculated using maximum EECs. Risk quotients were also calculated based on mean EECs for both single and double annual applications. There were no mammalian acute or chronic exceendances for both oral based and dietary based scenarios when using the mean EECs (data not shown).

**Table 14. Mammalian adjusted $LD_{50}$ and NOAEL values for metconazole application on soybeans**

| Mammalian Class | Assessed Body Weight | Adjusted $LD_{50}$[1] | Adjusted NOAEL[2] |
|---|---|---|---|
| Herbivores/ Insectivores | 15 | 508 | 17.58 |
| | 35 | 411 | 14.23 |
| | 1000 | 178 | 6.15 |
| Granivores | 15 | 507 | 17.58 |
| | 35 | 411 | 14.23 |
| | 1000 | 178 | 6.15 |

[1]Adjusted $LD_{50}$ based on an acute laboratory mouse adjusted $LD_{50}$ value of 231 mg/kg bw for females (Gardner, 1990a). Adjusted $LD_{50}$= $LD_{50}$ * (test species body weight/assessed body weight)$^{0.5}$
[2]NOAEL (0.5) based chronic reproductive NOAEC of 8 mg/kg diet (Willoughby, 1992). The NOAEL was adjusted based on body weight and consumption. Adjusted NOAEL= NOAEL * (test species body weight/assessed body weight)$^{0.5}$

**Table 15. Mammalian acute and chronic Oral DOSE-based risk quotients for ONE application per year of metconazole on soybeans using maximum EEC equivalent doses**

| **Oral Dose-based RQs**[2] (daily dose/adjusted $LD_{50}$ or NOAEL) | 15 g mammal | | 35 g mammal | | 1000 g mammal | |
|---|---|---|---|---|---|---|
| | Acute | Chronic | Acute | Chronic | Acute | Chronic |
| Short Grass | 0.03 | 0.73 | 0.02 | 0.63 | 0.01 | 0.33 |
| Tall Grass | 0.01 | 0.33 | 0.01 | 0.29 | 0.01 | 0.15 |
| Broadleaf plants/sm insects | 0.01 | 0.41 | 0.01 | 0.35 | 0.01 | 0.19 |
| Fruits/pods/lg insects | <<0.01 | 0.05 | <<0.01 | 0.04 | <<0.01 | 0.02 |
| Seeds (granivore) | <<0.01 | 0.01 | <<0.01 | 0.01 | <<0.01 | <<0.01 |

[1] The oral dose-based RQs are calculated by dividing the maximum EEC equivalent dose (Table 7) by the adjusted $LD_{50}$ for acute values and the adjusted NOAEL for chronic values (Table 14) for each food category and animal class.

**Table 16. Mammalian acute and chronic Oral DOSE-based risk quotients for TWO applications per year of metconazole on soybeans using maximum EEC equivalent dose[1]**

| Oral Dose-based RQs[2] (daily dose/adjusted $LD_{50}$ or NOAEL) | 15 g mammal | | 35 g mammal | | 1000 g mammal | |
|---|---|---|---|---|---|---|
| | Acute | Chronic | Acute | Chronic | Acute | Chronic |
| Short Grass | 0.05 | **1.36 +** | 0.04 | **1.17 +** | 0.02 | 0.62 |
| Tall Grass | 0.02 | 0.63 | 0.02 | 0.54 | 0.01 | 0.28 |
| Broadleaf plants/sm insects | 0.03 | 0.77 | 0.02 | 0.66 | 0.01 | 0.35 |
| Fruits/pods/lg insects | <<0.01 | 0.09 | <<0.01 | 0.07 | <<0.01 | 0.04 |
| Seeds (granivore) | <<0.01 | 0.02 | <<0.01 | 0.02 | <<0.01 | 0.01 |

[1] The oral dose-based RQs are calculated by dividing the maximum EEC equivalent dose (Table 7) by the adjusted $LD_{50}$ for acute values and the adjusted NOAEL for chronic values (Table 14) for each food category and animal class.
[2] The below notation will be used to denote values that exceed the Levels of Concern (LOC)
+ exceeds Chronic LOC (>1.0)

**Table 17. Mammalian chronic DIETARY-based risk quotients for metconazole application on soybeans[1]**

| Mammalian Maximum Chronic EEC (mg/kg diet) | | | | | Dietary –Based Mammalian Chronic RQ | | | |
|---|---|---|---|---|---|---|---|---|
| # Appl | Short Grass | Tall Grass | Broadleaf Plants/ Small Insects | Fruits/ pods/ large insects | Short Grass | Tall Grass | Broadleaf Plants/Small Insects | Fruits/pods/ large insects |
| 1 application | 13.50 | 6.19 | 7.59 | 0.84 | 0.08 | 0.04 | 0.05 | 0.01 |
| 2 applications | 25.25 | 11.57 | 14.20 | 1.58 | 0.16 | 0.07 | 0.09 | 0.01 |

[1] NOAEC = 8 mg/kg diet (based on mammalian chronic reproductive toxicity test (Willoughby, 1992))

## Risk to Non-target Terrestrial and Semi-aquatic Plants

Two Tier II terrestrial plant studies were submitted which tested the toxicity of metconazole: seedling emergence (Aufderheide, 2000b) and vegetative vigor (Aufderheide, 2000a). In these studies, the highest application rate was 0.086 lb a.i./acre which was applied to four dicot and two monocot species. In the seedling emergence study, there were no statistically significant toxic effects observed at the highest application rate for the measured endpoints. In the vegetative vigor study, the soybean was the most sensitive species and shoot length was the most sensitive endpoint with a NOAEC and LOAEC of 0.024 and 0.045 lb ai/A, respectively. The $EC_{50}$ value was greater than the highest concentration tested for all species in the vegetative vigor study. The $EC_{25}$ value was not provided in the study; therefore, acute RQs for terrestrial plants were not determined. Acute RQs for endangered plant species were calculated by dividing the EEC by the NOAEC value (data not shown). There are no exceedances for endangered terrestrial plant species. At the proposed application rate of 0.056 lbs ai/acre/application, risks to terrestrial plants are not likely.

## Non-Target Insects

EFED currently does not quantify risks to terrestrial non-target insects. Risk quotients are therefore not calculated for these organisms. Metconazole is practically non-toxic to honey bees (96-hr acute contact $LD_{50}$ > 100 µg/bee and acute oral $LC_{50}$ = 85 µg/bee, Harrison & Hillaby, 1991). In addition,

metconazole was not found to be toxic to earthworms in two submitted studies. There was no significant difference in the percent weight loss in the 14-day study ($LC_{50}$> 1000 mg ai/kg substrate) and no significant difference in percent biomass increase and reproduction in the 56-day study ($LC_{50}$ > 1.8 mg ai/kg substrate). Based on these studies, the risks are not likely for metconazole to have adverse effects on pollinators and other beneficial insects.

**Alternative Scenarios**

In order to avoid chronic reproductive risks to mammals, alternative application rates are suggested. Currently, the proposed maximum application rate is 0.05625 lb a.i./A applied twice per year. The label did not specify the interval between applications. The label states: "make a second application 10 to 21 days later or earlier if monitoring shows disease development or if conditions are conducive for disease infection." A minimum of 7 days was assumed for this assessment; however, the risks to terrestrial mammals do not significantly increase when the application interval is reduced to 1 day. Risks are not avoided until the application interval is set at 52 days, which may not be realistic for use during the growing season. **At the application rate of 0.04 lb a.i./A (6.83 fl oz/A) applied twice per year with a minimum of a 6-day interval, there are no chronic mammalian exceedances.** By default, the degradation half-life is set to 35 days. Risks are not avoided unless the half-life is less than 4 days (at the application rate 0.05625 lb a.i./A applied twice per year with a 7-day interval).

**Endocrine Disruption Assessment**

The potential for endocrine disruptor related effects was observed in mammalian and avian toxicity studies submitted to the Agency. In the 2-generation reproduction study with rats (Willoughby, 1992), reproductive toxicity including increased ovarian weights in first generation females, increased gestation length in $F_1$ dams, decreased post-implantation survival, reduced litter size, and reduced body weight gain in offspring resulted in NOAEL and LOAEL values of 8 and 32 mg/kg bw, respectively. In a Northern bobwhite quail reproduction study, there were statistically significant reductions in the percent normal hatchlings of viable embryos, and reductions in the number of 14-day surviving chicks and reduced body weight of chicks. The NOAEC and LOAEC were determined to be 60 and 120 mg/kg diet, respectively (Johnson & Ahmed, 1999). These reproductive effects could be an indicator of potential endocrine disruption in birds and mammals.

There are a number of degradates of metconazole, including 1,2,4-triazole, which are formed by biotic and abiotic processes. To date, none of these degradates has been identified as possessing the potential for endocrine disruption. In addition, the registrant has not submitted, nor has the Agency requested, studies on the potential for endocrine disruption for any of these degradates resulting from the use of metconazole. Until such time as the Agency determines that any of these degradates have the potential to be an endocrine disruptor, this risk assessment has not included an evaluation of the relative risk of metconazole degradates for endocrine disruption and as such is a source of uncertainty in this assessment.

EPA is required under the Federal Food, Drug, and Cosmetic Act (FFDCA), as amended by the Food Quality Protection Act (FQPA), to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) *"may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other such endocrine effects as the Administrator may designate."* Following the recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there were scientific bases for including, as part of the program, the androgen and thyroid hormone systems, in addition to the estrogen hormone system. EPA also adopted EDSTAC's recommendation that the Program include evaluations of potential effects in wildlife. For pesticide chemicals, EPA will use The Federal Insecticide, Fungicide, and

Rodenticide Act (FIFRA) and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCA authority to require the wildlife evaluations. As the science develops and resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP). When the appropriate screening and/or testing protocols being considered under the Agency's EDSP have been developed, metconazole may be subjected to additional screening and/or testing to better characterize effects related to endocrine disruption.

## VI. Threatened and Endangered Species Concern

### 1. *Action Area*

For listed species assessment purposes, the action area is considered to be the area affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. At the initial screening-level, the risk assessment considers broadly described taxonomic groups and so conservatively assumes that listed species within those broad groups are collocated with the pesticide treatment area. This means that terrestrial plants and wildlife are assumed to be located on or adjacent to the treated site and aquatic organisms are assumed to be located in a surface water body adjacent to the treated site. The assessment also assumes that the listed species are located within an assumed area which has the relatively highest potential exposure to the pesticide, and that exposures are likely to decrease with distance from the treatment area. This risk assessment presents the use of metconazole on soybeans fields in the proposed seven states and establishes initial collocation of species with treatment areas.

If the assumptions associated with the screening-level action area result in RQs that are below the listed species LOCs, a "no effect" determination conclusion is made with respect to listed species in that taxa, and no further refinement of the action area is necessary. Furthermore, RQs below the listed species LOCs for a given taxonomic group indicate no concern for indirect effects upon listed species that depend upon the taxonomic group covered by the RQ as a resource. However, in situations where the screening assumptions lead to RQs in excess of the listed species LOCs for a given taxonomic group, a potential for a "may affect" conclusion exists and may be associated with direct effects on listed species belonging to that taxonomic group or may extend to indirect effects upon listed species that depend upon that taxonomic group as a resource. In such cases, additional information on the biology of listed species, the locations of these species, and the locations of use sites could be considered to determine the extent to which screening assumptions regarding an action area apply to a particular listed organism. These subsequent refinement steps could consider how this information would impact the action area for a particular listed organism and may potentially include areas of exposure that are downwind and downstream of the pesticide use site.

### 2. *Taxonomic Groups Potentially at Risk*

Based on available screening level information, it is unlikely that metconazole will have *acute* toxic effects on endangered or threatened aquatic or terrestrial organisms, including plants. There are no *acute* LOC's exceeded for mammals, however the *chronic* LOC's are exceeded for mammals consuming short grass. Threatened and Endangered mammals may potentially be affected through chronic exposure. The LOCATES database was used to identify those U.S. counties that both grow soybeans and have federally-listed endangered or threatened species. A preliminary analysis has been conducted of this county overlap of crop and listed species (**Appendix D**).

Levels of concern were only exceeded for small (15g) and medium (35g) mammals consuming short grass. Several of the listed mammals occurring with counties containing soybean-growing areas were excluded from the consideration of risk based on their size and diet. Large mammals not likely to be

at risk include the American and Louisiana black bear, Canadian Lynx, red wolf, gray wolf, ocelot, and two jaguarundi species. In addition, the large aquatic mammal species such as the Northern right whale, West Indian Manatee, and the Hawaiian Monk Seal are also not likely at risk. Smaller mammals occurring with counties containing soybean-growing areas were excluded from the consideration of risk based on their diet. Those species not likely to consume short grass are the black-footed ferret, gray bat, Indiana bat, Ozark and Virginia big-eared bats, Carolina northern squirrel, Delmarva Peninsula fox squirrel, and the Virginia northern flying squirrel. Three mice species are co-located with soybean farms that may be exposed to metconazole residues by feeding on short grass. These include the Alabama beach mouse, Perdido Key beach mouse, and the Preble's jumping mouse. There is a potential for a "may effect" classification for these species. Further refinement of the use area is necessary to determine the effect on these mice species.

## Formulation Product Toxicity

Submitted toxicity studies of metconazole technical and the formulated products indicate that the formulated products may be substantially more toxic than the active ingredient. The original formulated product toxicity tests were conducted on the Caramba 60 SL formulation. The new Caramba 90 SL formulated product contains similar ingredients to 60 SL. The major difference is the concentration of the active ingredient. The quantity of solubilizer/surfactant in the 90 SL is provided in the same ratio as the 60 SL formulation. Two aquatic Caramba 90 SL toxicity studies, using *Daphnia magna* and green algae, indicated that it is less toxic than Caramba 60 SL. In order to evaluate the risk to aquatic organisms due to Caramba 90 SL application to soybeans the toxicity values would need to be compared to estimated residue concentrations due to spray drift. Further refinement utilizing spray drift modeling is necessary to determine the effect on aquatic organisms.

**Table 18. Comparison of Aquatic Toxicity of Metconazole Technical and Formulation Products**

| | **Metconazole technical** | **90 SL** | **60 SL** |
|---|---|---|---|
| Rainbow Trout-acute | 72 hr<br>$LC_{50}$=**2.1 mg ai/L** | | 96 hr<br>$LC_{50}$=14.83 mg/L formulation<br>**(0.8898 mg ai/L)** |
| Rainbow Trout-chronic-early life cycle | 28 day<br>NOAEC=**1.14 mg ai/L** | | 28 day<br>NOAEC=<br>0.242 mg/L formulation<br>**(0.0145 mg ai/L)** |
| Daphnia magna-acute | 48 hr<br>$EC_{50}$=**4.2 mg ai/L** | $EC_{50}$=9.3 mg/L formulation<br>**(0.82 mg ai/L)** | 48 hr<br>$EC_{50}$=0.365 mg/L formulation<br>**(0.0219 mg ai/L)** |
| Daphnia magna-chronic | 21 day NOAEC=<br>**0.078 mg ai/L** | | 21 day NOAEC=<br>0.021 mg/L formulation<br>**(0.00126 mg ai/L)** |
| Algae-acute | 72 hr<br>$EC_{50}$ =**1.7 mg ai/L** | 72 hr<br>$EC_{50}$=3.94 mg/L formulation **(0.348 mg ai/L)**<br>NOAEC=1.82 mg/L formulation **(0.160 mg ai/L)** | 72 hr<br>$EC_b50$=5.13 mg/L formulation<br>**(0.3078 mg ai/L)**<br>$EC_r50$=8.28 mg/L formulation |

# APPENDIX A: PRZM/EXAMS OUTPUT

stored as Metsoyb1.out **"Two Aerial Applications, 7 days interval"**
Chemical: Metconazole
PRZM environment: MSsoybeanC.txt "modified Satday, 12 October 2002 at 17:07:44"
EXAMS environment: pond298.exv "modified Thuday, 29 August 2002 at 16:33:30"
Metfile: w13893.dvf "modified Wedday, 3 July 2002 at 09:06:20"
Water segment concentrations (ppb)

| Year | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 1961 | 0.7159 | 0.7138 | 0.7077 | 0.6602 | 0.5821 | 0.2694 |
| 1962 | 1.395 | 1.391 | 1.381 | 1.363 | 1.347 | 1.03 |
| 1963 | 2.144 | 2.139 | 2.103 | 2.067 | 2.039 | 1.647 |
| 1964 | 2.591 | 2.583 | 2.551 | 2.507 | 2.484 | 2.126 |
| 1965 | 3.077 | 3.067 | 3.037 | 2.978 | 2.942 | 2.529 |
| 1966 | 3.129 | 3.121 | 3.102 | 3.078 | 3.075 | 2.903 |
| 1967 | 3.712 | 3.7 | 3.656 | 3.638 | 3.612 | 3.242 |
| 1968 | 4.749 | 4.73 | 4.677 | 4.575 | 4.509 | 3.919 |
| 1969 | 4.942 | 4.926 | 4.874 | 4.772 | 4.712 | 4.398 |
| 1970 | 5.12 | 5.106 | 5.057 | 5.017 | 4.957 | 4.679 |
| 1971 | 4.809 | 4.8 | 4.76 | 4.668 | 4.65 | 4.524 |
| 1972 | 5.823 | 5.801 | 5.714 | 5.566 | 5.466 | 4.802 |
| 1973 | 5.739 | 5.722 | 5.653 | 5.578 | 5.521 | 5.16 |
| 1974 | 5.931 | 5.914 | 5.86 | 5.793 | 5.751 | 5.396 |
| 1975 | 5.377 | 5.374 | 5.36 | 5.33 | 5.307 | 5.118 |
| 1976 | 5.058 | 5.047 | 5.005 | 4.937 | 4.91 | 4.828 |
| 1977 | 5.031 | 5.016 | 4.96 | 4.913 | 4.877 | 4.741 |
| 1978 | 5.661 | 5.644 | 5.602 | 5.504 | 5.43 | 4.94 |
| 1979 | 5.731 | 5.715 | 5.666 | 5.584 | 5.515 | 5.216 |
| 1980 | 7.633 | 7.597 | 7.457 | 7.208 | 7.104 | 6.012 |
| 1981 | 6.685 | 6.668 | 6.643 | 6.577 | 6.535 | 6.455 |
| 1982 | 6.99 | 6.969 | 6.885 | 6.784 | 6.71 | 6.406 |
| 1983 | 6.17 | 6.167 | 6.154 | 6.124 | 6.098 | 5.938 |
| 1984 | 5.862 | 5.847 | 5.801 | 5.72 | 5.689 | 5.569 |
| 1985 | 5.71 | 5.694 | 5.664 | 5.565 | 5.548 | 5.349 |
| 1986 | 5.323 | 5.316 | 5.266 | 5.161 | 5.126 | 5.031 |
| 1987 | 5.378 | 5.363 | 5.31 | 5.187 | 5.143 | 4.936 |
| 1988 | 5.319 | 5.303 | 5.245 | 5.148 | 5.085 | 4.841 |
| 1989 | 5.71 | 5.692 | 5.622 | 5.497 | 5.417 | 4.979 |
| 1990 | 5.165 | 5.151 | 5.124 | 5.099 | 5.066 | 4.947 |

Sorted results

| Prob. | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 0.032258065 | 7.633 | 7.597 | 7.457 | 7.208 | 7.104 | 6.455 |
| 0.064516129 | 6.99 | 6.969 | 6.885 | 6.784 | 6.71 | 6.406 |
| 0.096774194 | 6.685 | 6.668 | 6.643 | 6.577 | 6.535 | 6.012 |
| 0.129032258 | 6.17 | 6.167 | 6.154 | 6.124 | 6.098 | 5.938 |
| 0.161290323 | 5.931 | 5.914 | 5.86 | 5.793 | 5.751 | 5.569 |
| 0.193548387 | 5.862 | 5.847 | 5.801 | 5.72 | 5.689 | 5.396 |
| 0.225806452 | 5.823 | 5.801 | 5.714 | 5.584 | 5.548 | 5.349 |
| 0.258064516 | 5.739 | 5.722 | 5.666 | 5.578 | 5.521 | 5.216 |
| 0.290322581 | 5.731 | 5.715 | 5.664 | 5.566 | 5.515 | 5.16 |
| 0.322580645 | 5.71 | 5.694 | 5.653 | 5.565 | 5.466 | 5.118 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.35483871 | 5.71 | 5.692 | 5.622 | 5.504 | 5.43 | 5.031 |
| 0.387096774 | 5.661 | 5.644 | 5.602 | 5.497 | 5.417 | 4.979 |
| 0.419354839 | 5.378 | 5.374 | 5.36 | 5.33 | 5.307 | 4.947 |
| 0.451612903 | 5.377 | 5.363 | 5.31 | 5.187 | 5.143 | 4.94 |
| 0.483870968 | 5.323 | 5.316 | 5.266 | 5.161 | 5.126 | 4.936 |
| 0.516129032 | 5.319 | 5.303 | 5.245 | 5.148 | 5.085 | 4.841 |
| 0.548387097 | 5.165 | 5.151 | 5.124 | 5.099 | 5.066 | 4.828 |
| 0.580645161 | 5.12 | 5.106 | 5.057 | 5.017 | 4.957 | 4.802 |
| 0.612903226 | 5.058 | 5.047 | 5.005 | 4.937 | 4.91 | 4.741 |
| 0.64516129 | 5.031 | 5.016 | 4.96 | 4.913 | 4.877 | 4.679 |
| 0.677419355 | 4.942 | 4.926 | 4.874 | 4.772 | 4.712 | 4.524 |
| 0.709677419 | 4.809 | 4.8 | 4.76 | 4.668 | 4.65 | 4.398 |
| 0.741935484 | 4.749 | 4.73 | 4.677 | 4.575 | 4.509 | 3.919 |
| 0.774193548 | 3.712 | 3.7 | 3.656 | 3.638 | 3.612 | 3.242 |
| 0.806451613 | 3.129 | 3.121 | 3.102 | 3.078 | 3.075 | 2.903 |
| 0.838709677 | 3.077 | 3.067 | 3.037 | 2.978 | 2.942 | 2.529 |
| 0.870967742 | 2.591 | 2.583 | 2.551 | 2.507 | 2.484 | 2.126 |
| 0.903225806 | 2.144 | 2.139 | 2.103 | 2.067 | 2.039 | 1.647 |
| 0.935483871 | 1.395 | 1.391 | 1.381 | 1.363 | 1.347 | 1.03 |
| 0.967741935 | 0.7159 | 0.7138 | 0.7077 | 0.6602 | 0.5821 | 0.2694 |
| **0.1** | **6.6335** | **6.6179** | **6.5941** | **6.5317** | **6.4913** | **6.0046** |

Average of yearly averages: 4.39768

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: Metsoyb1
Metfile: w13893.dvf
PRZM scenario: MSsoybeanC.txt
EXAMS environment file: pond298.exv
Chemical Name: Metconazole

| Description | Variable Name | Value | Units | Comments |
|---|---|---|---|---|
| Molecular weight | mwt | 319.8 | g/mol | |
| Henry's Law Const. | henry | 2.18E-12 | | atm-m^3/mol |
| Vapor Pressure | vapr | 1.58E-08 | torr | |
| Solubility | sol | 30.4 | mg/L | |
| Kd | Kd | 7.91 | mg/L | |
| Koc | Koc | | mg/L | |
| Photolysis half-life | kdp | 72.6 | days | Half-life |
| Aerobic Aquatic Metabolism | kbacw | 916.2 | days | Halfife |
| Anaerobic Aquatic Metabolism | kbacs | 990 | days | Halfife |
| Aerobic Soil Metabolism | asm | 458.1 | days | Halfife |
| Hydrolysis: | pH 7 | 0 | days | Half-life |
| Method: CAM | 2 | integer | See PRZM manual | |
| Incorporation Depth: | DEPI | 0 | cm | |
| Application Rate: | TAPP | 0.063 | kg/ha | |
| Application Efficiency: | APPEFF | 0.95 | fraction | |
| Spray Drift | DRFT | 0.05 | fraction of application rate applied to pond | |
| Application Date | Date | 6-Jan | dd/mm or dd/mmm or dd-mm or dd-mmm | |
| Interval 1 | interval | 7 | days | Set to 0 or delete line for single app. |
| Record 17: | FILTRA | | IPSCND | 1 UPTKF |
| Record 18: | PLVKRT | | PLDKRT | FEXTRC 0.5 |
| Flag for Index Res. Run | IR | Pond | | |
| Flag for runoff calc. | RUNOFF | none | "none, monthly or total(average of entire run)" | |

stored as Metsoyb2.out **"Two Ground Applications, 7 days interval"**
Chemical: Metconazole
PRZM environment: MSsoybeanC.txt "modified Satday, 12 October 2002 at 17:07:44"
EXAMS environment: pond298.exv "modified Thuday, 29 August 2002 at 16:33:30"
Metfile: w13893.dvf "modified Wedday, 3 July 2002 at 09:06:20"
Water segment concentrations (ppb)

| Year | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 1961 | 0.5609 | 0.5588 | 0.5527 | 0.5016 | 0.4185 | 0.1617 |
| 1962 | 1.098 | 1.094 | 1.086 | 1.069 | 1.056 | 0.7874 |
| 1963 | 1.678 | 1.674 | 1.646 | 1.628 | 1.61 | 1.293 |
| 1964 | 2.056 | 2.05 | 2.025 | 1.996 | 1.982 | 1.68 |
| 1965 | 2.526 | 2.517 | 2.491 | 2.438 | 2.406 | 2.007 |
| 1966 | 2.512 | 2.507 | 2.491 | 2.461 | 2.455 | 2.318 |
| 1967 | 2.984 | 2.976 | 2.947 | 2.933 | 2.919 | 2.602 |
| 1968 | 3.992 | 3.975 | 3.923 | 3.842 | 3.79 | 3.251 |
| 1969 | 4.218 | 4.204 | 4.155 | 4.063 | 4.01 | 3.708 |
| 1970 | 4.31 | 4.298 | 4.259 | 4.224 | 4.179 | 3.965 |
| 1971 | 3.998 | 3.99 | 3.958 | 3.881 | 3.841 | 3.775 |
| 1972 | 4.988 | 4.968 | 4.889 | 4.754 | 4.667 | 4.044 |
| 1973 | 4.936 | 4.92 | 4.858 | 4.798 | 4.75 | 4.395 |
| 1974 | 5.101 | 5.086 | 5.03 | 4.977 | 4.932 | 4.631 |
| 1975 | 4.628 | 4.625 | 4.613 | 4.588 | 4.568 | 4.324 |
| 1976 | 4.214 | 4.205 | 4.168 | 4.111 | 4.089 | 4.012 |
| 1977 | 4.136 | 4.124 | 4.077 | 4.001 | 3.992 | 3.917 |
| 1978 | 4.815 | 4.8 | 4.758 | 4.678 | 4.614 | 4.128 |
| 1979 | 4.789 | 4.776 | 4.744 | 4.683 | 4.629 | 4.41 |
| 1980 | 6.843 | 6.808 | 6.677 | 6.445 | 6.351 | 5.244 |
| 1981 | 5.95 | 5.94 | 5.921 | 5.872 | 5.842 | 5.72 |
| 1982 | 6.152 | 6.133 | 6.057 | 5.957 | 5.901 | 5.665 |
| 1983 | 5.448 | 5.446 | 5.434 | 5.408 | 5.384 | 5.173 |
| 1984 | 5.022 | 5.01 | 4.971 | 4.905 | 4.882 | 4.783 |
| 1985 | 4.84 | 4.828 | 4.807 | 4.726 | 4.677 | 4.549 |
| 1986 | 4.416 | 4.413 | 4.403 | 4.379 | 4.358 | 4.222 |
| 1987 | 4.433 | 4.421 | 4.377 | 4.281 | 4.257 | 4.127 |
| 1988 | 4.421 | 4.407 | 4.359 | 4.267 | 4.22 | 4.027 |
| 1989 | 4.806 | 4.791 | 4.728 | 4.625 | 4.554 | 4.167 |
| 1990 | 4.334 | 4.324 | 4.3 | 4.284 | 4.257 | 4.128 |

Sorted results

| Prob. | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 0.032258065 | 6.843 | 6.808 | 6.677 | 6.445 | 6.351 | 5.72 |
| 0.064516129 | 6.152 | 6.133 | 6.057 | 5.957 | 5.901 | 5.665 |
| 0.096774194 | 5.95 | 5.94 | 5.921 | 5.872 | 5.842 | 5.244 |
| 0.129032258 | 5.448 | 5.446 | 5.434 | 5.408 | 5.384 | 5.173 |
| 0.161290323 | 5.101 | 5.086 | 5.03 | 4.977 | 4.932 | 4.783 |
| 0.193548387 | 5.022 | 5.01 | 4.971 | 4.905 | 4.882 | 4.631 |
| 0.225806452 | 4.988 | 4.968 | 4.889 | 4.798 | 4.75 | 4.549 |
| 0.258064516 | 4.936 | 4.92 | 4.858 | 4.754 | 4.677 | 4.41 |
| 0.290322581 | 4.84 | 4.828 | 4.807 | 4.726 | 4.667 | 4.395 |
| 0.322580645 | 4.815 | 4.8 | 4.758 | 4.683 | 4.629 | 4.324 |
| 0.35483871 | 4.806 | 4.791 | 4.744 | 4.678 | 4.614 | 4.222 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.387096774 | 4.789 | 4.776 | 4.728 | 4.625 | 4.568 | 4.167 |
| 0.419354839 | 4.628 | 4.625 | 4.613 | 4.588 | 4.554 | 4.128 |
| 0.451612903 | 4.433 | 4.421 | 4.403 | 4.379 | 4.358 | 4.128 |
| 0.483870968 | 4.421 | 4.413 | 4.377 | 4.284 | 4.257 | 4.127 |
| 0.516129032 | 4.416 | 4.407 | 4.359 | 4.281 | 4.257 | 4.044 |
| 0.548387097 | 4.334 | 4.324 | 4.3 | 4.267 | 4.22 | 4.027 |
| 0.580645161 | 4.31 | 4.298 | 4.259 | 4.224 | 4.179 | 4.012 |
| 0.612903226 | 4.218 | 4.205 | 4.168 | 4.111 | 4.089 | 3.965 |
| 0.64516129 | 4.214 | 4.204 | 4.155 | 4.063 | 4.01 | 3.917 |
| 0.677419355 | 4.136 | 4.124 | 4.077 | 4.001 | 3.992 | 3.775 |
| 0.709677419 | 3.998 | 3.99 | 3.958 | 3.881 | 3.841 | 3.708 |
| 0.741935484 | 3.992 | 3.975 | 3.923 | 3.842 | 3.79 | 3.251 |
| 0.774193548 | 2.984 | 2.976 | 2.947 | 2.933 | 2.919 | 2.602 |
| 0.806451613 | 2.526 | 2.517 | 2.491 | 2.461 | 2.455 | 2.318 |
| 0.838709677 | 2.512 | 2.507 | 2.491 | 2.438 | 2.406 | 2.007 |
| 0.870967742 | 2.056 | 2.05 | 2.025 | 1.996 | 1.982 | 1.68 |
| 0.903225806 | 1.678 | 1.674 | 1.646 | 1.628 | 1.61 | 1.293 |
| 0.935483871 | 1.098 | 1.094 | 1.086 | 1.069 | 1.056 | 0.7874 |
| 0.967741935 | 0.5609 | 0.5588 | 0.5527 | 0.5016 | 0.4185 | 0.1617 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.1 | 5.8998 | 5.8906 | 5.8723 | 5.8256 | 5.7962 | 5.2369 |

Average of yearly averages: 3.707136667

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: Metsoyb2
Metfile: w13893.dvf
PRZM scenario: MSsoybeanC.txt
EXAMS environment file: pond298.exv
Chemical Name: Metconazole

| Description | Variable Name | Value | Units | Comments | |
|---|---|---|---|---|---|
| Molecular weight | mwt | 319.8 | g/mol | | |
| Henry's Law Const. | henry | 2.18E-12 | | atm-m^3/mol | |
| Vapor Pressure | vapr | 1.58E-08 | torr | | |
| Solubility | sol | 30.4 | mg/L | | |
| Kd Kd | 7.91 | mg/L | | | |
| Koc Koc | | mg/L | | | |
| Photolysis half-life | kdp | 72.6 | days | Half-life | |
| Aerobic Aquatic Metabolism | kbacw | 916.2 | days | Halfife | |
| Anaerobic Aquatic Metabolism | kbacs | 990 | days | Halfife | |
| Aerobic Soil Metabolism | asm | 458.1 | days | Halfife | |
| Hydrolysis: | pH 7 | 0 | days | Half-life | |
| Method: CAM | 2 | integer | See PRZM manual | | |
| Incorporation Depth: | DEPI | 0 | cm | | |
| Application Rate: | TAPP | 0.063 | kg/ha | | |
| Application Efficiency: | APPEFF | 0.99 | fraction | | |
| Spray Drift | DRFT | 0.01 | fraction of application rate applied to pond | | |
| Application Date | Date | 6-Jan | dd/mm or dd/mmm or dd-mm or dd-mmm | | |
| Interval 1 | interval | 7 | days | Set to 0 or delete line for single app. | |
| Record 17: | FILTRA | IPSCND | 1 | UPTKF | |
| Record 18: | PLVKRT | PLDKRT | | FEXTRC | 0.5 |
| Flag for Index Res. Run | IR | Pond | | | |
| Flag for runoff calc. | RUNOFF | none | "none, monthly or total (average of entire run)" | | |

stored as Metsoyb3.out "Two Aerial Applications, 14 days interval"
Chemical: Metconazole
PRZM environment: MSsoybeanC.txt "modified Satday, 12 October 2002 at 17:07:44"
EXAMS environment: pond298.exv "modified Thuday, 29 August 2002 at 16:33:30"
Metfile: w13893.dvf "modified Wedday, 3 July 2002 at 09:06:20"
Water segment concentrations (ppb)

| Year | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 1961 | 0.7687 | 0.7664 | 0.7594 | 0.7042 | 0.6169 | 0.2788 |
| 1962 | 1.471 | 1.466 | 1.456 | 1.436 | 1.419 | 1.086 |
| 1963 | 2.215 | 2.21 | 2.172 | 2.135 | 2.106 | 1.709 |
| 1964 | 2.689 | 2.68 | 2.647 | 2.602 | 2.578 | 2.198 |
| 1965 | 3.187 | 3.177 | 3.146 | 3.084 | 3.047 | 2.619 |
| 1966 | 3.236 | 3.227 | 3.208 | 3.183 | 3.18 | 3.001 |
| 1967 | 3.817 | 3.804 | 3.759 | 3.74 | 3.713 | 3.338 |
| 1968 | 4.85 | 4.83 | 4.776 | 4.672 | 4.605 | 4.008 |
| 1969 | 5.077 | 5.061 | 5.006 | 4.9 | 4.837 | 4.496 |
| 1970 | 5.288 | 5.274 | 5.224 | 5.181 | 5.122 | 4.822 |
| 1971 | 4.983 | 4.974 | 4.933 | 4.835 | 4.776 | 4.67 |
| 1972 | 6.003 | 5.98 | 5.891 | 5.739 | 5.636 | 4.958 |
| 1973 | 5.893 | 5.875 | 5.805 | 5.727 | 5.668 | 5.307 |
| 1974 | 6.073 | 6.055 | 5.99 | 5.928 | 5.874 | 5.525 |
| 1975 | 5.512 | 5.508 | 5.494 | 5.464 | 5.44 | 5.245 |
| 1976 | 5.184 | 5.173 | 5.129 | 5.06 | 5.033 | 4.954 |
| 1977 | 5.175 | 5.16 | 5.101 | 5.046 | 5.01 | 4.867 |
| 1978 | 5.803 | 5.786 | 5.742 | 5.641 | 5.566 | 5.073 |
| 1979 | 5.801 | 5.785 | 5.758 | 5.688 | 5.623 | 5.333 |
| 1980 | 7.762 | 7.725 | 7.583 | 7.33 | 7.226 | 6.121 |
| 1981 | 6.78 | 6.769 | 6.746 | 6.68 | 6.645 | 6.557 |
| 1982 | 7.116 | 7.094 | 7.008 | 6.903 | 6.83 | 6.511 |
| 1983 | 6.283 | 6.279 | 6.266 | 6.235 | 6.209 | 6.051 |
| 1984 | 6.014 | 5.999 | 5.951 | 5.867 | 5.833 | 5.705 |
| 1985 | 5.902 | 5.886 | 5.857 | 5.755 | 5.722 | 5.505 |
| 1986 | 5.452 | 5.439 | 5.387 | 5.328 | 5.302 | 5.208 |
| 1987 | 5.344 | 5.331 | 5.276 | 5.171 | 5.153 | 5.069 |
| 1988 | 5.45 | 5.434 | 5.374 | 5.275 | 5.21 | 4.963 |
| 1989 | 5.893 | 5.873 | 5.795 | 5.673 | 5.591 | 5.115 |
| 1990 | 5.346 | 5.332 | 5.298 | 5.272 | 5.238 | 5.121 |

Sorted results

| Prob. | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 0.032258065 | 7.762 | 7.725 | 7.583 | 7.33 | 7.226 | 6.557 |
| 0.064516129 | 7.116 | 7.094 | 7.008 | 6.903 | 6.83 | 6.511 |
| 0.096774194 | 6.78 | 6.769 | 6.746 | 6.68 | 6.645 | 6.121 |
| 0.129032258 | 6.283 | 6.279 | 6.266 | 6.235 | 6.209 | 6.051 |
| 0.161290323 | 6.073 | 6.055 | 5.99 | 5.928 | 5.874 | 5.705 |
| 0.193548387 | 6.014 | 5.999 | 5.951 | 5.867 | 5.833 | 5.525 |
| 0.225806452 | 6.003 | 5.98 | 5.891 | 5.755 | 5.722 | 5.505 |
| 0.258064516 | 5.902 | 5.886 | 5.857 | 5.739 | 5.668 | 5.333 |
| 0.290322581 | 5.893 | 5.875 | 5.805 | 5.727 | 5.636 | 5.307 |
| 0.322580645 | 5.893 | 5.873 | 5.795 | 5.688 | 5.623 | 5.245 |
| 0.35483871 | 5.803 | 5.786 | 5.758 | 5.673 | 5.591 | 5.208 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.387096774 | 5.801 | 5.785 | 5.742 | 5.641 | 5.566 | 5.121 |
| 0.419354839 | 5.512 | 5.508 | 5.494 | 5.464 | 5.44 | 5.115 |
| 0.451612903 | 5.452 | 5.439 | 5.387 | 5.328 | 5.302 | 5.073 |
| 0.483870968 | 5.45 | 5.434 | 5.374 | 5.275 | 5.238 | 5.069 |
| 0.516129032 | 5.346 | 5.332 | 5.298 | 5.272 | 5.21 | 4.963 |
| 0.548387097 | 5.344 | 5.331 | 5.276 | 5.181 | 5.153 | 4.958 |
| 0.580645161 | 5.288 | 5.274 | 5.224 | 5.171 | 5.122 | 4.954 |
| 0.612903226 | 5.184 | 5.173 | 5.129 | 5.06 | 5.033 | 4.867 |
| 0.64516129 | 5.175 | 5.16 | 5.101 | 5.046 | 5.01 | 4.822 |
| 0.677419355 | 5.077 | 5.061 | 5.006 | 4.9 | 4.837 | 4.67 |
| 0.709677419 | 4.983 | 4.974 | 4.933 | 4.835 | 4.776 | 4.496 |
| 0.741935484 | 4.85 | 4.83 | 4.776 | 4.672 | 4.605 | 4.008 |
| 0.774193548 | 3.817 | 3.804 | 3.759 | 3.74 | 3.713 | 3.338 |
| 0.806451613 | 3.236 | 3.227 | 3.208 | 3.183 | 3.18 | 3.001 |
| 0.838709677 | 3.187 | 3.177 | 3.146 | 3.084 | 3.047 | 2.619 |
| 0.870967742 | 2.689 | 2.68 | 2.647 | 2.602 | 2.578 | 2.198 |
| 0.903225806 | 2.215 | 2.21 | 2.172 | 2.135 | 2.106 | 1.709 |
| 0.935483871 | 1.471 | 1.466 | 1.456 | 1.436 | 1.419 | 1.086 |
| 0.967741935 | 0.7687 | 0.7664 | 0.7594 | 0.7042 | 0.6169 | 0.2788 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.1 | 6.7303 | 6.72 | 6.698 | 6.6355 | 6.6014 | 6.114 |

Average of yearly averages: 4.513793333

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: Metsoyb3
Metfile: w13893.dvf
PRZM scenario: MSsoybeanC.txt
EXAMS environment file: pond298.exv
Chemical Name: Metconazole

| Description | Variable Name | Value | Units | Comments |
|---|---|---|---|---|
| Molecular weight | mwt | 319.8 | g/mol | |
| Henry's Law Const. | henry | 2.18E-12 | | atm-m^3/mol |
| Vapor Pressure | vapr | 1.58E-08 | torr | |
| Solubility | sol | 30.4 | mg/L | |
| Kd | Kd | 7.91 | mg/L | |
| Koc | Koc | | mg/L | |
| Photolysis half-life | kdp | 72.6 | days | Half-life |
| Aerobic Aquatic Metabolism | kbacw | 916.2 | days | Halfife |
| Anaerobic Aquatic Metabolism | kbacs | 990 | days | Halfife |
| Aerobic Soil Metabolism | asm | 458.1 | days | Halfife |
| Hydrolysis: | pH 7 | 0 | days | Half-life |
| Method: CAM | 2 | integer | See PRZM manual | |
| Incorporation Depth: | DEPI | 0 | cm | |
| Application Rate: | TAPP | 0.063 | kg/ha | |
| Application Efficiency: | APPEFF | 0.95 | fraction | |
| Spray Drift | DRFT | 0.05 | fraction of application rate applied to pond | |
| Application Date | Date | 6-Jan | dd/mm or dd/mmm or dd-mm or dd-mmm | |
| Interval 1 | interval | 14 | days | Set to 0 or delete line for single app. |
| Record 17: | FILTRA | IPSCND | 1 | UPTKF |
| Record 18: | PLVKRT | PLDKRT | | FEXTRC 0.5 |
| Flag for Index Res. Run | IR | Pond | | |
| Flag for runoff calc. | RUNOFF | none | "none, monthly or total (average of entire run)" | |

stored as Metsoyb4.out "Two Ground Applications, 14 days interval"
Chemical: Metconazole
PRZM environment: MSsoybeanC.txt "modified Satday, 12 October 2002 at 17:07:44"

EXAMS environment: pond298.exv "modified Thuday, 29 August 2002 at 16:33:30"

Metfile: w13893.dvf "modified Wedday, 3 July 2002 at 09:06:20"
Water segment concentrations (ppb)

| Year | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 1961 | 0.6153 | 0.613 | 0.606 | 0.5468 | 0.454 | 0.1731 |
| 1962 | 1.175 | 1.172 | 1.162 | 1.144 | 1.13 | 0.8471 |
| 1963 | 1.747 | 1.743 | 1.714 | 1.695 | 1.676 | 1.359 |
| 1964 | 2.154 | 2.146 | 2.121 | 2.091 | 2.077 | 1.755 |
| 1965 | 2.639 | 2.629 | 2.602 | 2.546 | 2.513 | 2.1 |
| 1966 | 2.622 | 2.617 | 2.599 | 2.568 | 2.562 | 2.419 |
| 1967 | 3.086 | 3.078 | 3.048 | 3.035 | 3.02 | 2.702 |
| 1968 | 4.092 | 4.074 | 4.022 | 3.939 | 3.885 | 3.343 |
| 1969 | 4.356 | 4.341 | 4.29 | 4.194 | 4.138 | 3.809 |
| 1970 | 4.481 | 4.468 | 4.428 | 4.39 | 4.347 | 4.113 |
| 1971 | 4.174 | 4.167 | 4.134 | 4.052 | 4.006 | 3.927 |
| 1972 | 5.17 | 5.149 | 5.067 | 4.929 | 4.839 | 4.206 |
| 1973 | 5.091 | 5.075 | 5.012 | 4.949 | 4.9 | 4.547 |
| 1974 | 5.244 | 5.229 | 5.169 | 5.113 | 5.071 | 4.764 |
| 1975 | 4.765 | 4.762 | 4.75 | 4.723 | 4.703 | 4.456 |
| 1976 | 4.341 | 4.332 | 4.294 | 4.235 | 4.213 | 4.142 |
| 1977 | 4.28 | 4.268 | 4.219 | 4.134 | 4.135 | 4.047 |
| 1978 | 4.958 | 4.942 | 4.9 | 4.817 | 4.752 | 4.265 |
| 1979 | 4.913 | 4.899 | 4.857 | 4.801 | 4.746 | 4.531 |
| 1980 | 6.971 | 6.936 | 6.803 | 6.567 | 6.471 | 5.357 |
| 1981 | 6.055 | 6.044 | 6.025 | 5.984 | 5.953 | 5.825 |
| 1982 | 6.277 | 6.258 | 6.18 | 6.075 | 6.02 | 5.773 |
| 1983 | 5.562 | 5.559 | 5.547 | 5.52 | 5.496 | 5.289 |
| 1984 | 5.176 | 5.163 | 5.124 | 5.045 | 5.022 | 4.923 |
| 1985 | 5.041 | 5.028 | 5.004 | 4.92 | 4.866 | 4.711 |
| 1986 | 4.599 | 4.596 | 4.585 | 4.56 | 4.538 | 4.405 |
| 1987 | 4.442 | 4.438 | 4.425 | 4.396 | 4.373 | 4.264 |
| 1988 | 4.552 | 4.538 | 4.488 | 4.394 | 4.346 | 4.153 |
| 1989 | 4.991 | 4.974 | 4.906 | 4.803 | 4.735 | 4.306 |
| 1990 | 4.513 | 4.502 | 4.478 | 4.461 | 4.433 | 4.308 |

Sorted results

| Prob. | Peak | 96 hr | 21 Day | 60 Day | 90 Day | Yearly |
|---|---|---|---|---|---|---|
| 0.032258065 | 6.971 | 6.936 | 6.803 | 6.567 | 6.471 | 5.825 |
| 0.064516129 | 6.277 | 6.258 | 6.18 | 6.075 | 6.02 | 5.773 |
| 0.096774194 | 6.055 | 6.044 | 6.025 | 5.984 | 5.953 | 5.357 |
| 0.129032258 | 5.562 | 5.559 | 5.547 | 5.52 | 5.496 | 5.289 |
| 0.161290323 | 5.244 | 5.229 | 5.169 | 5.113 | 5.071 | 4.923 |
| 0.193548387 | 5.176 | 5.163 | 5.124 | 5.045 | 5.022 | 4.764 |
| 0.225806452 | 5.17 | 5.149 | 5.067 | 4.949 | 4.9 | 4.711 |
| 0.258064516 | 5.091 | 5.075 | 5.012 | 4.929 | 4.866 | 4.547 |
| 0.290322581 | 5.041 | 5.028 | 5.004 | 4.92 | 4.839 | 4.531 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.322580645 | 4.991 | 4.974 | 4.906 | 4.817 | 4.752 | 4.456 |
| 0.35483871 | 4.958 | 4.942 | 4.9 | 4.803 | 4.746 | 4.405 |
| 0.387096774 | 4.913 | 4.899 | 4.857 | 4.801 | 4.735 | 4.308 |
| 0.419354839 | 4.765 | 4.762 | 4.75 | 4.723 | 4.703 | 4.306 |
| 0.451612903 | 4.599 | 4.596 | 4.585 | 4.56 | 4.538 | 4.265 |
| 0.483870968 | 4.552 | 4.538 | 4.488 | 4.461 | 4.433 | 4.264 |
| 0.516129032 | 4.513 | 4.502 | 4.478 | 4.396 | 4.373 | 4.206 |
| 0.548387097 | 4.481 | 4.468 | 4.428 | 4.394 | 4.347 | 4.153 |
| 0.580645161 | 4.442 | 4.438 | 4.425 | 4.39 | 4.346 | 4.142 |
| 0.612903226 | 4.356 | 4.341 | 4.294 | 4.235 | 4.213 | 4.113 |
| 0.64516129 | 4.341 | 4.332 | 4.29 | 4.194 | 4.138 | 4.047 |
| 0.677419355 | 4.28 | 4.268 | 4.219 | 4.134 | 4.135 | 3.927 |
| 0.709677419 | 4.174 | 4.167 | 4.134 | 4.052 | 4.006 | 3.809 |
| 0.741935484 | 4.092 | 4.074 | 4.022 | 3.939 | 3.885 | 3.343 |
| 0.774193548 | 3.086 | 3.078 | 3.048 | 3.035 | 3.02 | 2.702 |
| 0.806451613 | 2.639 | 2.629 | 2.602 | 2.568 | 2.562 | 2.419 |
| 0.838709677 | 2.622 | 2.617 | 2.599 | 2.546 | 2.513 | 2.1 |
| 0.870967742 | 2.154 | 2.146 | 2.121 | 2.091 | 2.077 | 1.755 |
| 0.903225806 | 1.747 | 1.743 | 1.714 | 1.695 | 1.676 | 1.359 |
| 0.935483871 | 1.175 | 1.172 | 1.162 | 1.144 | 1.13 | 0.8471 |
| 0.967741935 | 0.6153 | 0.613 | 0.606 | 0.5468 | 0.454 | 0.1731 |
| 0.1 | 6.0057 | 5.9955 | 5.9772 | 5.9376 | 5.9073 | 5.3502 |

Average of yearly averages: 3.827306667

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: Metsoyb4
Metfile: w13893.dvf
PRZM scenario: MSsoybeanC.txt
EXAMS environment file: pond298.exv
Chemical Name: Metconazole

| Description | Variable Name | Value | Units | Comments |
|---|---|---|---|---|
| Molecular weight | mwt | 319.8 | g/mol | |
| Henry's Law Const. | henry | 2.18E-12 | | atm-m^3/mol |
| Vapor Pressure | vapr | 1.58E-08 | torr | |
| Solubility | sol | 30.4 | mg/L | |
| Kd Kd | 7.91 | mg/L | | |
| Koc Koc | | mg/L | | |
| Photolysis half-life | kdp | 72.6 | days | Half-life |
| Aerobic Aquatic Metabolism | kbacw | 916.2 | days | Halfife |
| Anaerobic Aquatic Metabolism | kbacs | 990 | days | Halfife |
| Aerobic Soil Metabolism | asm | 458.1 | days | Halfife |
| Hydrolysis: | pH 7 | 0 | days | Half-life |
| Method: CAM | 2 | integer | See PRZM manual | |
| Incorporation Depth: | DEPI | 0 | cm | |
| Application Rate: | TAPP | 0.063 | kg/ha | |
| Application Efficiency: | APPEFF | 0.99 | fraction | |
| Spray Drift | DRFT | 0.01 | fraction of application rate applied to pond | |
| Application Date | Date | 6-Jan | dd/mm or dd/mmm or dd-mm or dd-mmm | |
| Interval 1 | interval | 14 | days | Set to 0 or delete line for single app. |
| Record 17: | FILTRA | IPSCND | 1 | UPTKF |
| Record 18: | PLVKRT | PLDKRT | | FEXTRC 0.5 |
| Flag for Index Res. Run | IR | Pond | | |
| Flag for runoff calc. | RUNOFF | none | "none, monthly or total(average of entire run)" | |

# APPENDIX B

**Table B-1: Acute Toxicity of Metconazole to Fish**

| Species | % A.I. (cis:trans) | $LC_{50}$ | NOAEC | Test Type | Toxicity Classification | Reference | Status |
|---|---|---|---|---|---|---|---|
| **Freshwater Fish** | | | | | | | |
| Rainbow trout (*Salmo gairdneri*) | 96.3 (83:17) | 72-hr 2.1 mg/L | 0.53 mg/L | Mean Measured Semi Static | Moderately Toxic | Toy, 1990 | Acceptable |
| Fathead Minnow (*Pimephales promelas*) | 96.3 (83:17) | 96-hr 3.9 mg/L | 1.8 mg/L | Mean Measured Semi Static | Moderately Toxic | Toy, 1991 | Acceptable |
| Common Carp (*Cyprinus carpio*) | 97.9 (83.3:14.6) | 96-hr 3.99 mg/L | 0.814 mg/L | Mean Measured Flow-through | Moderately Toxic | Mitchell, 1996a | Acceptable |

**Table B-2: Chronic Toxicity (Early life stage) of Metconazole to Fish**

| Species | % A.I. (cis:trans) | 28-Day NOAEC/ LOAEC | Endpoint | Test Type | Reference | Status |
|---|---|---|---|---|---|---|
| **Freshwater Fish** | | | | | | |
| Rainbow trout (*Onchorrhynchus mykiss*) | 97.9 (83.3:14.6) | $LC_{50}$=1.69/ 1.14/ 2.5 mg/L | mortality | Mean Measured Flow-through | Mitchell, 1996b | Acceptable |
| | | 1.14/ 2.5 mg/L | sublethal effects | | | |

| Table B-3: Chronic Toxicity (90-day) of Metconazole to Freshwater Fish | | | | | | |
|---|---|---|---|---|---|---|
| Species | % AI | 90-day NOAEC/ LOAEC (mg/L) | Endpoint | Test Type | Reference | Status |
| Rainbow trout (*Onchorrhynchus mykiss*) | 97.4 (83.1% cis) | 0.32/ >0.32 | % Embryo survival (0-28d) of eggs set | Mean Measured/ Flow-through | Zok, 2001 | Acceptable |
| | | 0.32/ >0.32 | % Embryo/larval survival (28-37d) of 28d survivors | | | |
| | | 0.32/ >0.32 | % Embryo/larval survival (0-37d) of eggs set | | | |
| | | 0.32/ >0.32 | % Larval survival (37-62d) of 37d survivors | | | |
| | | 0.32/ >0.32 | % Larval survival (0-62d) of eggs set | | | |
| | | 0.00291/ 0.01 | % Young fish survival (62-95d) of 62 d survivors | | | |
| | | 0.00291/ 0.01 | % Survival at the end from eggs set | | | |
| | | 0.00291/ 0.01 | Wet Weight | | | |
| | | 0.00291/ 0.01 | Length | | | |

| Table B-4: Acute Toxicity of Metconazole to Freshwater Invertebrates | | | | | | | |
|---|---|---|---|---|---|---|---|
| Species | % AI (cis:trans) | Toxicity endpoint | NOAEC (mg/L) | Test Type | Toxicity Classification | Reference | Status |
| Waterflea (*Daphnia magna*) | 96.3 (83:17) | 48-hr $EC_{50}$ = 4.2 mg/L | 3.0 | Mean Measured/Static | Moderately Toxic | Toy, 1990 | Acceptable |

**Table B-5: Chronic Toxicity of Metconazole to Freshwater Invertebrates**

| Species | % A.I. | 21-day NOAEC/LOAEC | Endpoints Affected | Test Type | Reference | Status |
|---|---|---|---|---|---|---|
| Waterflea (*Daphnia magna*) | 97.4 | $EC_{50}$ = 0.078 mg/L | Mortality | Measured Semi Static | Jatzek, 2002 | Acceptable |
| | | 0.31/0.63 mg/L | First appearance of young (d) | | | |
| | | 0.078/ 0.16 mg/L | # living young per parent (21d) | | | |
| | | 0.16/ 0.31 mg/L | # dead young per parent (21d) | | | |
| | | 0.078/0.16 mg/L (estimated no stats provided) | # aborted subitane eggs per parent (21d) | | | |

**Table B-6: Chronic Toxicity of Metconazole to Sediment Chironomids**

| Species | % A.I. | 10-day Toxicity Results | Endpoints Affected | Test Type | Reference | Status |
|---|---|---|---|---|---|---|
| Midge larvae (*Chironomus riparius*) | 97.9 | $LC_{50}$ = 3.33 mg/L (10 day) | Based on survival/emergence | Measured Spiked sediment water (decreasing conc in water column was observed with corresponding increase conc in sediment | England, 1997 | Study established with artificial sediment containing 10% sphagnum instead of 5%. Sediment:vol ratio was 10:1 |
| | | NOAEC = 2.12 mg/L (10 day) | | | | |
| | | $LC_{50}$ = 3.41 mg/L (28 day) | | | | |
| | | NOAEC = 2.12 mg/L (28 day) | | | | |

**Table B-7: Toxicity of Metconazole to Aquatic Plants**

| Species | % AI (*cis:trans*) | Toxicity | Test Type | Reference | Study Classification |
|---|---|---|---|---|---|
| Algae (*Scenedesmus capricornutum*) Tier II | 96.3 *(83:17)* | $E_bC_{50}$ = 1.7 mg/L<br>$E_rC_{50}$ = 2.2 mg/L<br>NOEC = 0.38 mg/L | Static 72 h Test | Toy, 1990 | Acceptable |

**Table B-8. Bioaccumulation Potential of Metconazole in Fish**

| Species | % AI (cis:trans) | Toxicity | Test Type | Reference | Study Classification |
|---|---|---|---|---|---|
| Bluegill Sunfish (*Lepomis macrochirus*) | 99.44 *(77.4:22.6)* | max BCF = 124 depuration half-life < 1 d | 28 d exposure/ 14 d depuration | Kao, 1996 | Acceptable |
| Bluegill Sunfish (*Lepomis macrochirus*) | 97.2 | max BCF = 129.7 depuration half-life < 1 d | 28 d exposure/ 14 d depuration | Cenni, 2002 | Acceptable |

**Table B-9: Acute Toxicity of Metconazole Formulation**

| Species | Conc. of Metcon. | Toxicity | NOAEC | Test Type | Toxicity Classification | Reference | Status |
|---|---|---|---|---|---|---|---|
| **Freshwater Fish** | | | | | | | |
| Rainbow trout (*Salmo gairdneri*) | 60 g/L SL | **96-hr** $LC_{50}$ = 14.83 mg formulation/L | (72-hr) 5 mg formulation/L (96-hr) 10 mg formulation/L | Mean Measured Static | Slightly Toxic | Zok, 2001 | Acceptable |
| Rainbow trout (*Salmo gairdneri*) | 60 g/L SL | **28 d** $LC_{50}$ = 0.507 mg formulation/L | (28-d) 0.242 mg formulation/L | Mean Measured Flow through | Highly Toxic | Mitchell, 1996a | Acceptable |
| Waterflea (*Daphnia magna*) | 60 g/L SL | **21 d** $EC_{50}$ = 0.111 mg formulation/L | (21-d) 0.021 mg formulation/L | Mean Measured Static Renewal | Very Highly Toxic | Mitchell, 1996c | Acceptable (first young were born in controls after 12 d, which is late) |
| Waterflea (*Daphnia magna*) | 60 g/L SL | **48-hr** $EC_{50}$ = 0.365 mg formulation/L | (48-hr) 121 mg formulation/L | Mean Measured Static | Highly Toxic | Aufderheide & Mitchell, 1998 | Acceptable |
| Waterflea (*Daphnia magna*) | Blank Formulation | **48-hr** $LC_{50}$ = 0.14 mg test product/L | (48-hr) 0.1 mg test product/L | Mean Measured Static | Highly Toxic | Mitchell, 2001 | Acceptable |
| Waterflea (*Daphnia magna*) | 60 g/L SL | **48-hr** $LC_{50}$ = 0.42 mg formulation/L | (48-hr) 0.27 mg test product/L | Mean Measured Static | Highly Toxic | Mitchell, 1998 | Acceptable |
| Waterflea (*Daphnia magna*) | 99 g/L SL | **48-hr** $LC_{50}$ = 9.3 mg formulation/L or 0.82 mg ai/L | (48-hr) 6.04 mg/L formulation/L (0.53 mg ai/L) | Mean Measured Static | Highly Toxic | Olivieri, 2000 | Not determined |
| Algae (*Scenedesmus capricornutum*) | 60 g/L SL | **72-hr** $E_bC_{50}$ = 5.13 mg/L $E_rC_{50}$ = 8.38 mg formulation/L | (72-hr) 2.23 mg formulation/L | Mean Measured Static | Moderately Toxic | Mitchell, 1996b | Acceptable |

Table B-9: Acute Toxicity of Metconazole Formulation

| Species | Conc. of Metcon | Toxicity | NOAEC | Test Type | Toxicity Classification | Reference | Status |
|---|---|---|---|---|---|---|---|
| Algae (*Scenedesmus capricornutum*) | 90g/L SC | **72-hr** $E_bC_{50}$ = 3.94 mg/L formulation (0.348 mg ai/L) | 1.82 mg/L formulation (0.160 mg ai/L) | Mean Measured Static | Highly Toxic | Olivieri, 2000 | Not determined |

| Table B-10: Avian Acute Toxicity to Metconazole | | | | | | | |
|---|---|---|---|---|---|---|---|
| Species | % A.I. (cis:trans) | Toxicity Endpoint (Confidence Intervals) | NOAEL | Toxicity Classification | toxicity symptoms | Reference | Status |
| **Acute Single Oral Dose- 14-day** | | | | | | | |
| Northern bobwhite quail (*Colinus virginianus*) | 96.3 *(83:17)* | $LD_{50}$ = 787 mg ai/kg bw | 423 mg/kg bw based on mortality | Slightly Toxic | Decrease in body weight, subdued, unsteadiness | Hakin, 1992a | Acceptable |
| Northern bobwhite quail (*Colinus virginianus*) | *(84.2:13.7)* | $LD_{50}$ = 798 mg ai/kg bw | <450 mg/kg bw | Slightly Toxic | Decrease in body weight then recovery, subdued, unsteadiness | Johnson, 1998 | Acceptable |
| | *95% cis* | $LD_{50}$ = 875 mg ai/kg bw | <450 mg/kg bw | | | | |
| **Subacute Dietary- 5-day** | | | | | | | |
| Mallard duck (*Anas platyrhnchos*) | 95.3 *(83.7:16.3)* | $LC_{50}$ > 5200 ppm (4/10 birds died at 5200ppm) | 1300 ppm based on weight loss | Practically Non-Toxic | Weight loss, decrease food consumption | Hakin, 1991b | Acceptable |
| Bobwhite quail (*Colinus virginianus*) | 95.3 *(83.7:16.3)* | $LC_{50}$ = 1057 ppm | <163 ppm based on mortality | Slightly Toxic | Decrease in weight gain, black areas on liver, decrease food consumption | Hakin, 1991a | Acceptable |

| Table B-11. Avian Chronic Toxicity to Metconazole | | | | | |
|---|---|---|---|---|---|
| Species | % A.I. (cis:trans) | Toxicity Endpoint NOAEC/LOAEC | NOAEC Endpoints | Reference | Status |
| Mallard duck (*Anas platyrhnchos*) | *95.2% cis* | 60/400 ppm | Significant reduction in % cracked and broken eggs of eggs laid, % normal hatchlings of viable embryos, # of 14-day surviving chicks | Hakin, 1992c | Acceptable |
| Northern Bobwhite quail (*Colinus virginianus*) | *95.2% cis* | 60/400 ppm | Significant reduction in # eggs laid/female and %viable embryos of eggs set | Hakin, 1992b | **Not Acceptable**- control mortality >10%, Percent cracked eggs in control was high; cages too small |
| Northern Bobwhite quail (*Colinus virginianus*) | *(84.2:13.7)* | 60/120 ppm | Significant reduction in % normal hatchlings of viable embryos, # of 14-day surviving chicks, body weigh of chicks | Johnson & Ahmed, 1999 | Acceptable |

| Table B-12. Mammalian Acute Oral Toxicity to Metconazole | | | | | |
|---|---|---|---|---|---|
| Species | % A.I. (cis:trans) | $LD_{50}$ (mg/kg-bwt) | Toxicity Classification | Reference | Status |
| Laboratory rat (*Rattus norvegicus*) | 95.3 *(85:15)* | M: 727 F: 595 | Slightly Toxic | Gardner, 1990a | Acceptable |
| Laboratory mouse | 95.3 *(85:15)* | M: 718 F: 410 | Slightly Toxic Moderately Toxic | Gardner, 1990a | Acceptable |
| Laboratory rat (*Rattus norvegicus*) | 95.3 *(95:5)* | M: 1627 F: 1312 | Slightly Toxic | Gardner, 1991 | Acceptable |

| Table B-13. Mammalian Developmental and Chronic Toxicity to Metronazole | | | | | |
|---|---|---|---|---|---|
| Test type | % a.i. (cis:trans) | NOAEL/LOAEL (mg/kg bw/day) | Affected Endpoints | Reference | Status |
| 2-Generation reproduction laboratory rat (*Rattus norvegicus*) | 95.2 *(95:5)* | 8/32 | Parental (based on increased ovarian weights in $F_1$ females) | Willoughby, 1992 | Acceptable |
| | | 8/32 | Reproduction (increased gestation length in $F_1$ dams, decreased post-implantation survival and reduced litter size in $F_2$ pups) | | |
| | | 8/32 | Offspring (based on reduced body weight gain in $F_1$, decreased post-implantation survival) | | |

| Table B-14. Non-target Insect Acute Toxicity to Metronazole | | | | | | |
|---|---|---|---|---|---|---|
| Species | % ai (cis:trans) | Contact $LD_{50}$ | Oral $LD_{50}$ | Toxicity Classification based on Contact $LD_{50}$ | Reference | Study Classification |
| Honey bee (*Apis mellifera*) | 95.3 *(83.7: 16.3)* | **(96 h)** $LD_{50}$>100 NOAEC = 100 µg a.i./bee | **(72 h)** $LD_{50}$ = 85 NOAEC = 6 µg a.i./bee | practically non-toxic | Harrison & Hillaby, 1991 | Acceptable |
| Honey bee (*Apis mellifera*) | 60 g/L SL formulation | **(72 h)** $LD_{50}$>200 NOAEC = 200 µg formulation/bee | **(72 h)** $LD_{50}$ > 187 NOAEC = 12.5 µg formulation/bee | practically non-toxic | Engelhard, 1998 | Acceptable |
| Honey bee (*Apis mellifera*) | 60 g/L SL formulation | **(48 h)** $LD_{50}$>100 NOAEC = 50 µg formulation/bee | **(48 h)** $LD_{50}$ > 139.7 NOAEC = 139.7 µg formulation/bee | practically non-toxic | Schmitzer, 1999b | Acceptable |

**Table B-15: Acute Toxicity of Metconazole to Earthworms**

| Species | % A.I. (cis:trans) | Toxicity | Endpoints Affected | Test Duration | Reference | Status |
|---|---|---|---|---|---|---|
| Earthworms (*Eisenia foetida*) | *(95.2:0.1)* | $LC_{50}$ > 1000 mg ai/kg substrate<br>NOAEC = 1000 mg ai/kg substrate | no significant difference in % weight loss | 14 day | Hillaby& Harrison, 1991 | Acceptable |
| | 98.3 *(85:15)* | $LC_{50}$ > 1.8 mg ai/kg substrate<br>NOAEC = 1.8 mg ai/kg substrate | no significant difference in % biomass increase and reproduction | 56 day | Engelhard, 1998a | |
| | 60 g/L SL | $LC_{50}$ > 1000 mg formulation/kg substrate<br>NOAEC = 500 mg formulation/kg substrate | burrowing time in 1000ppm was longer than control, not sign diff in weight gain in the treatment | 14 day | Candolfi & Ott, 1996 | |

**Table B-16: Toxicity of Metconazole to Terrestrial Plants**

| Test Type | Species | Toxicity (g ai/ha) | Endpoints Affected | Reference | Status |
|---|---|---|---|---|---|
| Seedling Emergence 60 g/L SL formulation | Sugarbeet<br>Lettuce<br>Radish<br>Soybean<br>Onion<br>Oat | NOAEC = 96 | Emergence and survival | Aufderheide, 2000b | Acceptable |
| | | $EC_{50}$ > 96<br>NOAEC = 96 | Shoot length | | |
| | | $EC_{50}$ > 96<br>NOAEC = 96 | Plant dry weight | | |
| | | NOAEC = 96 | Phytotoxicity Ratings | | |
| Vegetative Vigor 60 g/L SL formulation | Sugarbeet | $EC_{50}$ > 95<br>NOAEC = 95 | Shoot length (most sensitive endpoint) | Aufderheide, 2000a | Acceptable |
| | Lettuce | $EC_{50}$ > 110<br>NOAEC = 110 | | | |
| | Radish | $EC_{50}$ > 110<br>NOAEC = 110 | | | |
| | Soybean | $EC_{50}$ > 110<br>**NOAEC = 27** | | | |
| | Onion | $EC_{50}$ > 95<br>NOAEC = 95 | | | |
| | Oat | $EC_{50}$ > 94<br>NOAEC = 94 | | | |



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## APPENDIX C: Risk Quotient Method

The Risk Quotient Method is the means used by EFED to integrate the results of exposure and ecotoxicity data. For this method, risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values (i.e., RQ = EXPOSURE/TOXICITY), both acute and chronic. These RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to non-target organisms and the need to consider regulatory action. EFED has defined LOCs for acute risk, potential restricted use classification, and for endangered species.

The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories:

(1) acute - there is a potential for acute risk; regulatory action may be warranted in addition to restricted use classification;
(2) acute restricted use - the potential for acute risk is high, but this may be mitigated through restricted use classification
(3) acute endangered species - the potential for acute risk to endangered species is high, regulatory action may be warranted, and
(4) chronic risk - the potential for chronic risk is high, regulatory action may be warranted.

Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to non-target insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from required studies. Examples of ecotoxicity values derived from short-term laboratory studies that assess acute effects are: (1) $LC_{50}$ (fish and birds), (2) $LD_{50}$ (birds and mammals), (3) $EC_{50}$ (aquatic plants and aquatic invertebrates), and (4) $EC_{25}$ (terrestrial plants). Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic effects are: (1) LOAEL (birds, fish, and aquatic invertebrates), and (2) NOAEL (birds, fish and aquatic invertebrates). The NOAEL is generally used as the ecotoxicity test value in assessing chronic effects.

Risk presumptions, along with the corresponding RQs and LOCs are summarized in Table C.

## Table C: Risk Presumptions and LOCs

| Risk Presumption | RQ | LOC |
|---|---|---|
| Birds[1] | | |
| Acute Risk | EEC/$LC_{50}$ or $LD_{50}$/sqft or $LD_{50}$/day | 0.5 |
| Acute Restricted Use | EEC/$LC_{50}$ or $LD_{50}$/sqft or $LD_{50}$/day (or $LD_{50}$ < 50 mg/kg) | 0.2 |
| Acute Endangered Species | EEC/$LC_{50}$ or $LD_{50}$/sqft or $LD_{50}$/day | 0.1 |
| Chronic Risk | EEC/NOAEC | 1 |
| Wild Mammals[1] | | |
| Acute Risk | EEC/$LC_{50}$ or $LD_{50}$/sqft or $LD_{50}$/day | 0.5 |
| Acute Restricted Use | EEC/$LC_{50}$ or $LD_{50}$/sqft or $LD_{50}$/day (or $LD_{50}$ < 50 mg/kg) | 0.2 |
| Acute Endangered Species | EEC/$LC_{50}$ or $LD_{50}$/sqft or $LD_{50}$/day | 0.1 |
| Chronic Risk | EEC/NOAEC | 1 |
| Aquatic Animals[2] | | |
| Acute Risk | EEC/$LC_{50}$ or $EC_{50}$ | 0.5 |
| Acute Restricted Use | EEC/$LC_{50}$ or $EC_{50}$ | 0.1 |
| Acute Endangered Species | EEC/$LC_{50}$ or $EC_{50}$ | 0.05 |
| Chronic Risk | EEC/NOAEC | 1 |
| Terrestrial and Semi-Aquatic Plants | | |
| Acute Risk | EEC/$EC_{25}$ | 1 |
| Acute Endangered Species | EEC/$EC_{05}$ or NOAEC | 1 |
| Aquatic Plants[2] | | |
| Acute Risk | EEC/$EC_{50}$ | 1 |
| Acute Endangered Species | EEC/$EC_{05}$ or NOAEC | 1 |

[1] $LD_{50}$/sqft = (mg/sqft) / ($LD_{50}$ * wt. of animal)
$LD_{50}$/day = (mg of toxicant consumed/day) / ($LD_{50}$ * wt. of animal)

[2] EEC = (ppb or ug/L) in water

## Appendix D

# *Species Listing by State*

No species were excluded
Minimum of 1 Acre.

*Soybeans for beans (acres)*

| ***Alabama*** | ( 4) species affected | | **Taxa** | Critical Habitat |
|---|---|---|---|---|
| BAT, GRAY *(Myotis grisescens)* | | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | | Endangered | Mammal | Yes |
| MOUSE, ALABAMA BEACH *(Peromyscus polionotus ammobates)* | | Endangered | Mammal | Yes |
| MOUSE, PERDIDO KEY BEACH *(Peromyscus polionotus trissyllepsis)* | | Endangered | Mammal | Yes |
| ***Arkansas*** | ( 1) species affected | | **Taxa** | Critical Habitat |
| BAT, GRAY *(Myotis grisescens)* | | Endangered | Mammal | No |
| ***Colorado*** | ( 1) species affected | | **Taxa** | Critical Habitat |
| MOUSE, PREBLE'S MEADOW JUMPING *(Zapus hudsonius preblei)* | | Threatened | Mammal | Yes |
| ***Connecticut*** | ( 2) species affected | | **Taxa** | Critical Habitat |
| BAT, INDIANA *(Myotis sodalis)* | | Endangered | Mammal | Yes |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | | Endangered | Mammal | Yes |
| ***Delaware*** | ( 2) species affected | | **Taxa** | Critical Habitat |
| SQUIRREL, DELMARVA PENINSULA FOX *(Sciurus niger cinereus)* | | Endangered | Mammal | No |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | | Endangered | Mammal | Yes |
| ***Florida*** | ( 5) species affected | | **Taxa** | Critical Habitat |
| BAT, GRAY *(Myotis grisescens)* | | Endangered | Mammal | No |

| | | | |
|---|---|---|---|
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| MANATEE, WEST INDIAN (FLORIDA) *(Trichechus manatus)* | Endangered | Mammal | Yes |
| MOUSE, PERDIDO KEY BEACH *(Peromyscus polionotus trissyllepsis)* | Endangered | Mammal | Yes |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | Endangered | Mammal | Yes |

***Georgia*** ( 4) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, GRAY *(Myotis grisescens)* | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| MANATEE, WEST INDIAN (FLORIDA) *(Trichechus manatus)* | Endangered | Mammal | Yes |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | Endangered | Mammal | Yes |

***Hawaii*** ( 2) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, HAWAIIAN HOARY *(Lasiurus cinereus semotus)* | Endangered | Mammal | No |
| SEAL, HAWAIIAN MONK *(Monachus schauinslandi)* | Endangered | Mammal | Yes |

***Illinois*** ( 2) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, GRAY *(Myotis grisescens)* | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |

***Indiana*** ( 2) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, GRAY *(Myotis grisescens)* | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |

***Iowa*** ( 1) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |

| | | | Taxa | Critical Habitat |
|---|---|---|---|---|
| ***Kansas*** | ( 2) species affected | | | |
| BAT, GRAY *(Myotis grisescens)* | | Endangered | Mammal | No |
| FERRET, BLACK-FOOTED *(Mustela nigripes)* | | Endangered | Mammal | No |
| ***Kentucky*** | ( 3) species affected | | **Taxa** | Critical Habitat |
| BAT, GRAY *(Myotis grisescens)* | | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | | Endangered | Mammal | Yes |
| BAT, VIRGINIA BIG-EARED *(Corynorhinus (=Plecotus) townsendii virginianus)* | | Endangered | Mammal | Yes |
| ***Louisiana*** | ( 2) species affected | | **Taxa** | Critical Habitat |
| BEAR, AMERICAN BLACK *(Ursus americanus)* | | Threatened | Mammal | No |
| BEAR, LOUISIANA BLACK *(Ursus americanus luteolus)* | | Threatened | Mammal | Yes |
| ***Maine*** | ( 2) species affected | | **Taxa** | Critical Habitat |
| LYNX, CANADA *(Lynx canadensis)* | | Threatened | Mammal | No |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | | Endangered | Mammal | Yes |
| ***Maryland*** | ( 3) species affected | | **Taxa** | Critical Habitat |
| BAT, INDIANA *(Myotis sodalis)* | | Endangered | Mammal | Yes |
| SQUIRREL, DELMARVA PENINSULA FOX *(Sciurus niger cinereus)* | | Endangered | Mammal | No |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | | Endangered | Mammal | Yes |
| ***Massachusetts*** | ( 2) species affected | | **Taxa** | Critical Habitat |
| BAT, INDIANA *(Myotis sodalis)* | | Endangered | Mammal | Yes |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | | Endangered | Mammal | Yes |
| ***Michigan*** | ( 2) species affected | | **Taxa** | Critical Habitat |

| | | | | |
|---|---|---|---|---|
| BAT, INDIANA *(Myotis sodalis)* | | Endangered | Mammal | Yes |
| WOLF, GRAY *(Canis lupus)* | | Threatened | Mammal | Yes |
| ***Minnesota*** | ( 1) species affected | | **Taxa** | Critical Habitat |
| WOLF, GRAY *(Canis lupus)* | | Threatened | Mammal | Yes |
| ***Mississippi*** | ( 1) species affected | | **Taxa** | Critical Habitat |
| BEAR, LOUISIANA BLACK *(Ursus americanus luteolus)* | | Threatened | Mammal | Yes |
| ***Missouri*** | ( 2) species affected | | **Taxa** | Critical Habitat |
| BAT, GRAY *(Myotis grisescens)* | | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | | Endangered | Mammal | Yes |
| ***Montana*** | ( 3) species affected | | **Taxa** | Critical Habitat |
| BEAR, GRIZZLY *(Ursus arctos horribilis)* | | Threatened | Mammal | No |
| FERRET, BLACK-FOOTED *(Mustela nigripes)* | | Endangered | Mammal | No |
| WOLF, GRAY *(Canis lupus)* | | Threatened | Mammal | Yes |
| ***Nebraska*** | ( 1) species affected | | **Taxa** | Critical Habitat |
| FERRET, BLACK-FOOTED *(Mustela nigripes)* | | Endangered | Mammal | No |
| ***New Jersey*** | ( 2) species affected | | **Taxa** | Critical Habitat |
| BAT, INDIANA *(Myotis sodalis)* | | Endangered | Mammal | Yes |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | | Endangered | Mammal | Yes |
| ***New Mexico*** | ( 1) species affected | | **Taxa** | Critical Habitat |
| FERRET, BLACK-FOOTED *(Mustela nigripes)* | | Endangered | Mammal | No |
| ***New York*** | ( 2) species affected | | **Taxa** | Critical Habitat |

| | | | |
|---|---|---|---|
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | Endangered | Mammal | Yes |

***North Carolina*** ( 5) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| MANATEE, WEST INDIAN (FLORIDA) *(Trichechus manatus)* | Endangered | Mammal | Yes |
| SQUIRREL, CAROLINA NORTHERN FLYING *(Glaucomys sabrinus coloratus)* | Endangered | Mammal | No |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | Endangered | Mammal | Yes |
| WOLF, RED *(Canis rufus)* | Endangered | Mammal | No |

***Ohio*** ( 1) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |

***Oklahoma*** ( 3) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, GRAY *(Myotis grisescens)* | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| BAT, OZARK BIG-EARED *(Corynorhinus (=Plecotus) townsendii ingens)* | Endangered | Mammal | No |

***Pennsylvania*** ( 2) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| SQUIRREL, DELMARVA PENINSULA FOX *(Sciurus niger cinereus)* | Endangered | Mammal | No |

***Rhode Island*** ( 1) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | Endangered | Mammal | Yes |

***South Carolina*** ( 2) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|

| | | | |
|---|---|---|---|
| MANATEE, WEST INDIAN (FLORIDA) *(Trichechus manatus)* | Endangered | Mammal | Yes |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | Endangered | Mammal | Yes |

***South Dakota*** ( 1) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| FERRET, BLACK-FOOTED *(Mustela nigripes)* | Endangered | Mammal | No |

***Tennessee*** ( 4) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, GRAY *(Myotis grisescens)* | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| SQUIRREL, CAROLINA NORTHERN FLYING *(Glaucomys sabrinus coloratus)* | Endangered | Mammal | No |
| WOLF, RED *(Canis rufus)* | Endangered | Mammal | No |

***Texas*** ( 4) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BEAR, LOUISIANA BLACK *(Ursus americanus luteolus)* | Threatened | Mammal | Yes |
| JAGUARUNDI, Gulf Coast *(Herpailurus (=Felis) yagouaroundi cacomitli)* | Endangered | Mammal | No |
| Jaguarundi, Sinaloan *(Herpailurus (=Felis) yagouaroundi tolteca)* | Endangered | Mammal | No |
| OCELOT *(Leopardus (=Felis) pardalis)* | Endangered | Mammal | No |

***Vermont*** ( 1) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |

***Virginia*** ( 6) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, GRAY *(Myotis grisescens)* | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| BAT, VIRGINIA BIG-EARED *(Corynorhinus (=Plecotus) townsendii virginianus)* | Endangered | Mammal | Yes |

| | | | |
|---|---|---|---|
| SQUIRREL, DELMARVA PENINSULA FOX *(Sciurus niger cinereus)* | Endangered | Mammal | No |
| SQUIRREL, VIRGINIA NORTHERN FLYING *(Glaucomys sabrinus fuscus)* | Endangered | Mammal | No |
| WHALE, NORTHERN RIGHT *(Eubalaena glacialis)* | Endangered | Mammal | Yes |

***West Virginia*** ( 4) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| BAT, GRAY *(Myotis grisescens)* | Endangered | Mammal | No |
| BAT, INDIANA *(Myotis sodalis)* | Endangered | Mammal | Yes |
| BAT, VIRGINIA BIG-EARED *(Corynorhinus (=Plecotus) townsendii virginianus)* | Endangered | Mammal | Yes |
| SQUIRREL, VIRGINIA NORTHERN FLYING *(Glaucomys sabrinus fuscus)* | Endangered | Mammal | No |

***Wisconsin*** ( 1) species affected

| | | Taxa | Critical Habitat |
|---|---|---|---|
| WOLF, GRAY *(Canis lupus)* | Threatened | Mammal | Yes |

**No species were excluded.**