UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Office of Chemical Safety and
Pollution Prevention

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MEMORANDUM

SUBJECT: Revised Assessment for Clothianidin Registration of Prosper T400 Seed Treatment on Mustard Seed (Oilseed and Condiment) and Poncho/Votivo Seed Treatment on Cotton.

FROM: Joseph DeCant, Ecologist Joseph P. DeCant
for Michael Barrett, Chemist Allen W. Vaughan 12/02/10
Environmental Risk Branch V
Environmental Fate and Effects Division (7507P)

THROUGH: Mah T. Shamim, Branch Chief MTShamim 12/3/10
Environmental Risk Branch V
Environmental Fate and Effects Division (7507P)

TO: Kable Davis, Risk Manager Reviewer
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Insecticide-Rodenticide Branch
Registration Division (7505P)

This revised memo summarizes the Environmental Fate and Effects Division's (EFED) attached revised screening-level Environmental Risk Assessment for clothianidin. This revised memo and risk assessment provide more information related to the reclassification of a bee field study (46907801/46907802) and how it impacts the conclusions of the assessment.

The registrant, Bayer CropScience, is submitting a request for registration of clothianidin to be used as a seed treatment on cotton and mustard (oilseed and condiment). The major risk concerns are with aquatic free-swimming and benthic invertebrates, terrestrial invertebrates, birds, and mammals.

The proposed use on cotton poses an acute and chronic risk to freshwater and estuarine/marine free-swimming invertebrates, but the risk in some cases depends on the incorporation method and the region of the U.S. where the crops are grown. The proposed use on mustard only shows a risk concern on a chronic basis to estuarine/marine free-swimming invertebrates with a low efficiency incorporation method. The proposed uses result in acute risk to freshwater and estuarine/marine benthic invertebrates, but incorporation and region have minimal impact on the risk conclusions. Chronic risk was only present for estuarine/marine benthic invertebrates but was independent of incorporation efficiency and region.

Clothianidin's major risk concern is to nontarget insects (that is, honey bees). Clothianidin is a neonicotinoid insecticide that is both persistent and systemic. Acute toxicity studies to honey bees show that clothianidin is highly toxic on both a contact and an oral basis. Although EFED does not conduct RQ based risk assessments on non-target insects, information from standard tests and field studies, as well as incident reports involving other neonicotinoids insecticides (e.g., imidacloprid) suggest the potential for long term toxic risk to honey bees and other beneficial insects. An incident in Germany already illustrated the toxicity of clothianidin to honeybees when allowed to drift off-site from treated seed during planting.

A previous field study (MRID 46907801/46907802) investigated the effects of clothianidin on whole hive parameters and was classified as acceptable. However, after another review of this field study in light of additional information, deficiencies were identified that render the study supplemental.

In this field study, control and treated plots were each 1 hectare in size and paired, so that 4 sites were established with a control plot paired with a treated plot. These plots were separated by a minimum of 250 m. The study author states, "Of 23 back-up control nectar samples, 2 (field E1C, July 7; field W3C, July 7) had detectable clothianidin residues, at a maximum of 0.922 ppb, suggesting that workers in control colonies may have foraged on clothianidin-treated canola. This may have occurred because the separation between some pairs of control and treated fields was insufficient or because the forage in some control fields was of lower quality..." The inverse may also have occurred. That is, bees placed on treated fields likely foraged on the control fields, which would have reduced the level of exposure to clothianidin residues due to a lack of separation between sites. Bees have been shown to forage up to 6 km (Visscher and Seeley, 1982) or even twice that in some instances when no competing forage is present (Ratnieks, 2000). The distance of 250 m is inadequate for this separation. The inadequacy is evident given contamination in some of the nectar samples taken from control hives.

Furthermore, the study authors state that, "Approximately 5 g of pollen was analyzed under a light microscope, which confirmed that bees foraged on canola, while the remainder...". This type of identification simply identifies that canola was present in the pollen samples, but does not quantify the proportion of canola pollen present in the sample. This type of pollen evaluation does not characterize the foraging of the bees. The bees in the treated fields could have foraged disproportionately on other uncontaminated sources relative to bees in the control fields. Furthermore, the study authors simply state that to their knowledge, no other forage was present with a radius of 1 km from the edge of the fields. However, given the ability of bees to forage long distances, this lack of data leaves uncertainty in the exposure and suggests that this study did not provide the worst case exposure scenario necessary for use in characterizing risk.

An addendum (MRID 46907802) was submitted later that presented the results of the overwintering part of the study, which revealed that the majority of the hives, including those exposed to clothianidin during the previous season, survived the overwintering period. However, the cross-contamination in the control hives prevents a comparison between the control hives and the treated hives as they relate to whole hive parameters in this addendum. Therefore, this study can only be used to provide a qualitative description of hive survival following the exposure to clothianidin at the levels that were described in the study.

It does not satisfy the guideline 850.3040, and another field study is needed to evaluate the effects of clothianidin on bees through contaminated pollen and nectar. Exposure through contaminated pollen and nectar and potential toxic effects therefore remain an uncertainty for pollinators.

EFED expects adverse effects to bees if clothianidin is allowed to drift from seed planting equipment. Because of this and the uncertainty surrounding the exposure and potential toxicity through contaminated pollen and nectar, EFED is recommending bee precautionary labeling.

The proposed application rates and uses also pose an acute and chronic risk to small birds and mammals when clothianidin treated seeds are applied with low efficiency or no incorporation methods.

Clothianidin does not appear to present risk to terrestrial plants (there were no significant effects in the studies submitted). In addition, it does not appear to present risk to aquatic vascular or nonvascular plants.

Both high and low efficiency incorporation resulted in acute risk to freshwater invertebrates in North Carolina and Mississippi cotton, whereas cotton in California and mustard in North Dakota did not result in an exceedence of the LOC. These results suggest that certain regions of the country are more vulnerable to run-off and exposure of the proposed application rates of clothianidin, and therefore to the potential for the toxic effects of clothianidin to freshwater invertebrates. The acute lethal toxicity to benthic invertebrates also suggests this conclusion. These organisms are an integral part of the freshwater trophic system and serve as both decomposers/predators that are important for nutrient cycling and a food source for larger predators (e.g., fish). The ecological integrity in these vulnerable areas in the U.S. could therefore be impacted by the use on cotton at the proposed application rate. A reduction in the cotton application rate together with maximum incorporation of the seeds into the ground could therefore limit the exposure of clothianidin to aquatic invertebrates through run-off.

Specific label language that clearly states a method of incorporation and incorporation depth would make a significant impact on other risk conclusions of the proposed new uses. Risk to estuarine/marine invertebrates on an acute basis could be effectively mitigated by this label language, as shown by the lack of LOC exceedences in the high efficiency incorporation scenario (section 5.1.1). In addition, label language that would specify more efficient incorporation methods, such as T-banded incorporation with a specified depth, would eliminate all risk to birds and mammals by burying the seeds into the ground and thereby limiting any foraging on these seeds.

Outstanding Data Requirements

Environmental Fate:

162-4 Aerobic Aquatic metabolism Study. Based on the additional information submitted by the registrant, EFED agreed to change the previously-reviewed aerobic aquatic metabolism study (MRID 45422324) from "unacceptable" to "supplemental". However, the aerobic aquatic metabolism data requirements are still not fulfilled, the registrant must submit a new aerobic aquatic metabolism study. Reasons are presented below:

1. The potential for clothianidin to move from the treated area to the nearby surface water body has been increased significantly since 2003 because the registrant has recently added new uses on the labels. According to the review completed on 2/20/2003 (Title - "EFED Risk Assessment for the Seed Treatment of Clothianidin 600FS on Corn and Canola", the Agency required the registrant to conduct a new aerobic aquatic metabolism study (162-4). This risk assessment was based on the maximum application rate for the seed treatment at 0.1 lb ai/A. However, according to the new uses reviewed by EFED (Turfgrass, Tobacco, Apples, Pears, and Ornamentals), this chemical can be directly applied to the soil surface/foliage at much higher application rate (0.4 lbs ai/A). As a result, the potential for clothianidin to move from the treated area to the nearby surface water body under the new uses is much greater than the use as a seed treatment. Therefore, there is a need for a better understanding of the fate of clothionidin in the aerobic aquatic environment.

2. The fate of the thiazolyl ring was not monitored in the previously-reviewed aerobic aquatic metabolism study (MRID 45422324) because the test substance was labeled on the nitroimino side chain. Therefore, the fate of the thiazolyl ring remains unknown. The fate guidelines recommend to use the ring-labeled test substance.

3. A well-designed new aerobic aquatic metabolism study is deemed critical for EPA to fully assess the risk of clothionidin in the aquatic environment.

166-1 Small-Scale Prospective Groundwater Monitoring Study. Due to direct soil and foliar applications of clothianidin and concerns about the chemical leaching into ground water (see below), the Agency will request the registrant to submit a small-scale prospective groundwater monitoring study.

> Source: EPA review "EFED Risk Assessment for the Seed Treatment of Clothianidin 600FS on Corn and Canola" dated February 20, 2003 (page 3):
>
> "Clothianidin has the properties of a chemical which could lead to widespread ground-water contamination, but no ground-water monitoring studies have been conducted to date. Should the registrant request field uses involving direct application of clothianidin

to the land surface, Prospective Ground-Water Monitoring Studies may be needed to evaluate fully the potential impact of such uses." Due to the extreme mobility and persistence of clothianidin in the environment, a small-scale prospective groundwater monitoring study will provide additional fate information on the better understanding of this chemical in the environment and improve the certainty of the risk assessment.

Seed Leaching Study: EFED believes that a seed leaching study would greatly increase certainty regarding a more realistic estimate of the amount of available clothianidin residues on the seed surface. This in turn would allow a refinement of exposure estimates and environmental concentration values (EECs). A study has been submitted to the Agency and is currently under review (MRID 47483002).

Ecological Effects:
The database available for clothianidin to support the assessment was largely complete. The following ecological studies for clothianidin are still outstanding and need to be submitted.

Honey Bee Toxicity of Residues on Foliage (850.3030): This study is required for chemicals that have outdoor terrestrial uses in which honeybees will be exposed and exhibit an LD50 < 11 µg a.i./bee. The study that was submitted to satisfy this guideline is supplemental but does not satisfy the guideline requirement. This study is not required for this assessment due to the lack of exposure to residues on foliage from the seed treatments. This study is placed in reserve pending future new uses.

Field Test for Pollinators (850.3040): The possibility of toxic exposure to nontarget pollinators through the translocation of clothianidin residues that result from seed treatments has prompted EFED to require field testing (850.3040) that can evaluate the possible chronic exposure to honey bee larvae and queen. In order to fully evaluate the possibility of this toxic effect, a field study should be conducted and the protocol submitted for review by the Agency prior to initiation. Another study had been submitted to satisfy this guideline requirement. While it had originally been classified as acceptable, after recent reevaluation it is classified as supplemental, and a field study is still being needed for a more refined risk assessment.

Algal Toxicity (850.5400): Data on four species of non-vascular plants is required. A study on only one species has been submitted to date on *Selenastrum capricornutum*.

EFED Label Recommendations

Label Recommendations

Manufacturing Use Product
Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing

prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

End Use Products

This product is toxic to aquatic invertebrates. Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high-water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Do not apply where runoff is likely to occur. Runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Apply this product only as specified on the label.

This chemical has properties and characteristics associated with chemicals detected in ground water. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground water contamination.

This compound is toxic to birds and mammals. Treated clothianidin seeds exposed on soil surface may be hazardous to birds and mammals. Cover or collect clothianidin seeds spilled during loading.

This compound is toxic to honey bees. The persistence of residues and potential residual toxicity of Clothianidin in nectar and pollen suggests the possibility of chronic toxic risk to honey bee larvae and the eventual instability of the hive.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Environmental Fate and Ecological Risk Assessmentfor the Registration of CLOTHIANIDIN for Use as a Seed Treatment on Mustard Seed (Oilseed and Condiment) and Cotton

Date: 12/02/10 Prepared by: Joseph DeCant, Ecologist Michael Barrett, Chemist Approved by: Mah T. Shamim, Chief Environmental Risk Branch V	United States Environmental Protection Agency Office of Pesticide Programs Environmental Fate and Effects Division Environmental Risk Branch V 1200 Pennsylvania Ave., NW Mail Code 7507P Washington, DC 20460

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1. Executive Summary

The Environmental Fate and Effects Division (EFED) has completed its ecological risk assessment in support of the proposed new uses of PONCHO/VOTiVO on cotton seed and Prosper T400 Insecticide and Fungicide Treatment on Mustard seed (oilseed and condiment) (Clothianidin as the active ingredient). The major risk concerns are with aquatic free-swimming and benthic invertebrates, terrestrial invertebrates, birds, and mammals.

1.1 Potential Risk to Non-Target Organisms

The proposed use on cotton poses an acute and chronic risk to freshwater and estuarine/marine free-swimming invertebrates, but the risk in some cases depends on the incorporation method and the region of the U.S. where the crops are grown. The proposed use on mustard only shows a risk concern on a chronic basis to estuarine/marine free-swimming invertebrates with a low efficiency incorporation method. While EFED does not currently have an established method of assessing risk to benthic freshwater and estuarine/marine invertebrates, there is the potential for risk when the EECs are compared with the toxicity endpoints for these taxa related to the proposed use on cotton. However, the potential risk only extends to threatened and endangered freshwater species for the mustard use.

Clothianidin's major risk concern is to nontarget insects (that is, honey bees). Clothianidin is a neonicotinoid insecticide that is both persistent and systemic. Acute toxicity studies to honey bees show that clothianidin is highly toxic on both a contact and an oral basis. Although EFED does not conduct RQ based risk assessments on non-target insects, information from standard tests and field studies, as well as incident reports involving other neonicotinoids insecticides (e.g., imidacloprid) suggest the potential for long term toxic risk to honey bees and other beneficial insects. An incident in Germany already illustrated the toxicity of clothianidin to honeybees when allowed to drift off-site from treated seed during planting.

A previous field study (MRID 46907801/46907802) investigated the effects of clothianidin on whole hive parameters and was classified as acceptable. However, after another review of this field study in light of additional information, deficiencies were identified that render the study supplemental. It does not satisfy the guideline 850.3040, and another field study is needed to evaluate the effects of clothianidin on bees through contaminated pollen and nectar. Exposure through contaminated pollen and nectar and potential toxic effects therefore remain an uncertainty for pollinators.

EFED expects adverse effects to bees if clothianidin is allowed to drift from seed planting equipment. Because of this and the uncertainty surrounding the exposure and potential toxicity through contaminated pollen and nectar, EFED is recommending bee precautionary labeling.

The proposed application rates and uses also pose an acute and chronic risk to small birds and mammals when clothianidin treated seeds are applied with low efficiency or no incorporation methods.

Clothianidin does not appear to present risk to terrestrial plants (there were no significant effects in the studies submitted). In addition, it does not appear to present risk to aquatic vascular or nonvascular plants.

Both high and low efficiency incorporation resulted in acute risk to freshwater invertebrates in North Carolina and Mississippi cotton, whereas cotton in California and mustard in North Dakota, regardless of incorporation method, did not result in an exceedence of the LOC. These results suggest that certain regions of the country are more vulnerable to run-off and exposure from the proposed application rates of clothianidin, and therefore to the potential for the toxic effects of clothianidin to freshwater invertebrates. These organisms are an integral part of the freshwater trophic system and serve as both decomposers/predators that are important for nutrient cycling and a food source for larger predators, such as fish. The ecological integrity in these vulnerable areas in the U.S. could therefore be impacted by the use on cotton at the proposed application rate. A reduction in the application rate together with maximum incorporation of the seeds into the ground could therefore limit the exposure of clothianidin to aquatic invertebrates through run-off.

Specific label language that clearly states a method of incorporation would make a significant impact on other risk conclusions of the proposed new uses. Acute risk to free-swimming estuarine/marine invertebrates on an acute basis could be effectively mitigated by this label language, as shown by the lack of LOC exceedences in the high efficiency incorporation scenario (section 5.1.1). In addition, label language that would specify certain high efficiency incorporation methods, such as T-banded incorporation, would eliminate all risk to birds and mammals by burying the seeds into the ground and thereby limiting any foraging on these seeds.

1.2 Exposure Characterization

Clothianidin appears to be a persistent compound under most field conditions. Based on analysis of the laboratory studies alone, the major route of dissipation for clothianidin would appear to be photolysis if exposure to sunlight occurs (e.g., the measured aqueous photolysis half-life was <1 day and aerobic half-lives were 148 to 1155 days). Although photolysis appears to be much more rapid than other avenues of degradation/dissipation of clothianidin in the laboratory studies, the very slow rate of dissipation that was observed in field studies suggests that photolysis probably is not significant under most actual-use conditions. Photolysis may be quite important in surface waters if residues have reached clear bodies of water and are in solution rather than bound to sediment. Clothianidin is stable to hydrolysis at environmental pHs and temperatures. Degradation is also relatively rapid under anaerobic aquatic conditions (overall half-life of 27 days); however, metabolic degradation occurs very slowly in aerobic soil. Clothianidin is mobile to highly mobile in the laboratory [soil organic carbon partition coefficients (Koc) values were 84 to 129 for all test soils except for a sandy loam soil which had a Koc value of 345], although only a modest amount of leaching was observed in the submitted field studies. Previous studies have confirmed that compounds with a similar combination of mobility and persistence characteristics have a potential to leach to ground water at some use sites. Volatilization is not expected to be a significant dissipation process.

1.3 Effects Characterization

The acute studies that were submitted that tested the parent compound showed that clothianidin is practically non-toxic to freshwater fish (LC_{50} >105.8 -117 ppm). Studies on degradates (TMG, MNG, and TZNG) indicated a similar practically non-toxic profile (LC_{50} >105 ppm). A chronic early life stage study conducted on the fathead minnow showed that exposure of 20 ppm has the potential to affect length and dry weight of freshwater fish. The data submitted for estuarine/marine fish on an acute basis showed that the LC_{50} = 93.6 ppm; therefore, clothianidin is categorized as slightly toxic. No study has been submitted on the chronic effects to estuarine/marine fish.

Available data that was submitted that tested the parent compound showed that clothianidin is practically non-toxic to Daphnia magna with an acute 48-hour EC_{50} value of >119 ppm, but that it is very highly toxic to Chironomus riparius with an acute 48-hour EC_{50} value of 0.022 ppm. Additional data (48-hour EC_{50}) on degradates (TZNG, MNG, and TMG) indicated a practically non-toxic to slightly toxic profile (EC_{50} = 64.0 to >115.2 ppm). The data showed that clothianidin significantly reduced survival of mysid shrimp at 0.051 ppm, categorizing the compound as very highly toxic. Clothianidin was categorized as practically non-toxic to Eastern oyster because adverse effects did not occur for this species up to concentrations of 129.1 ppm.

Regarding chronic toxicity to invertebrates, clothianidin has the potential for chronic toxicity to daphnids and possibly other freshwater invertebrates. Exposure to 0.12 ppm can result in reproductive effects, including the reduced number of juveniles produced per adult. The data submitted also indicate that clothianidin reduced the number of young per reproductive day at 9.7 ppb.

Two studies were submitted that assessed toxicity to sediment dwelling freshwater and estuarine/marine invertebrates. One study (MRID 46826902) assessed the toxicity to the midge (*Chironomus riparius*) during a 10-Day sediment exposure. This study revealed an LC_{50} of 11 ppb and a NOAEC of 1.1 ppb based on pore water concentrations. The other study (MRID 47199401) evaluated a 10-day whole sediment toxicity test with *Leptocheirus plumulosus* using spiked sediment This study revealed an LC_{50} of 20.4 ppb and a NOAEC of 11.6 ppb based on pore water concentrations. Therefore, clothianidin is very highly toxic to sediment dwelling aquatic invertebrates.

Studies submitted for two of the five recommended species showed that exposure to clothianidin at levels greater than or equal to 3.5 ppm reduced biomass of aquatic non-vascular plants and increased the incidence of necrotic fronds in aquatic vascular plants. Studies on degradates (TMG, MNG and TZNG) showed reductions in green algal cell density when exposed to levels >1.46 ppm

An extensive assessment of the potential exposure and risk to avian guideline species exposed to clothianidin by oral intubation or in the diet concluded that clothianidin was moderately toxic to bobwhite quail on an acute basis (LD50> 200 mg/kg) and non-toxic to the mallard duck and bobwhite quail on a sub-acute basis (5 day LC50 >5040 ppm and 5230 ppm), respectively. The submitted chronic toxicity data show that exposure of 525 ppm of clothianidin in the diet adversely affected eggshell thickness (MRID 45422421).

Likewise, an assessment of potential exposure and risk to small mammals exposed to clothianidin by the oral route suggests that clothianidin is moderately toxic to small mammals on an acute oral basis (mouse LD50 = 389 to 465 mg/kg/day). Reproduction studies in rats indicate that concentrations of 500 ppm clothianidin resulted in increased stillbirths and delayed sexual maturation in males. Developmental studies in rabbits indicate that concentrations of 75 mg/kg/day resulted in premature deliveries, decreased gravid uterine weights, and increased litter incidence of missing lung lobes/fetus.

Currently, EFED does not assess risk to nontarget insects or terrestrial invertebrates using the risk quotient method. However, it appears that clothianidin exposure to honeybees has the potential for high toxicity on both an acute contact and oral basis. Acute toxicity studies to honey bees show that clothianidin has the potential to be highly toxic on both a contact and an oral basis (contact LD50 = 0.044 μg/bee; oral LD50 = 0.0037 μg/bee), while its degradates (e.g.,, TMG, MNG, TZMU, and TZNG) are moderately to practically non-toxic on an oral basis (LD50 = 3.9 - >153 μg/bee). One honey bee field study (MRID 45422435) showed that mortality, pollen foraging activity, and honey yield were negatively affected by residues of clothianidin; however, residues were not quantified in this study. Another honey bee field study (MRID 45422440) showed that pollen treated with clothianidin at a measured concentration level up to 19.7 μg a.i./kg produced no significant adverse effects to mortality, foraging activity (including pollen and honey collection), comb production, honey storage behavior, population growth (including egg, larvae, pupae, and adult growth stages), and behavioral anomalies. However, only one replicate hive per treatment level was tested, therefore, statistical analysis of the data could not be performed.

Subchronic invertebrate toxicity studies showed that clothianidin adversely affected earthworm mortality and body weight (LC50 = 15.5 ppm) and its degradates reduced body weight (LC50 = 982.6 ppm). There were no apparent effects of clothianidin on earthworm reproduction or population dynamics.

For terrestrial plants, the studies that were submitted tested formulated products of clothianidin (49.3% TI-435 50% WDG). The results of these studies showed that exposure elicited no effect (that is, ≥ 25%) on non-target terrestrial plants.

1.4 Data Gaps and Uncertainties

Outstanding Data Requirements

Environmental Fate:

<u>162-4 Aerobic Aquatic metabolism Study</u>. Based on the additional information submitted by the registrant, EFED agreed to change the previously-reviewed aerobic aquatic metabolism study (MRID 45422324) from "unacceptable" to "supplemental". However, the aerobic aquatic metabolism data requirements are still not fulfilled, the registrant must submit a new aerobic aquatic metabolism study. Reasons are presented below:

1. The potential for clothianidin to move from the treated area to the nearby surface water body has been increased significantly since 2003 because the registrant has recently added new uses on the labels. According to the review completed on 2/20/2003 (Title - "EFED Risk Assessment for the Seed Treatment of Clothianidin 600FS on Corn and Canola", the Agency required the registrant to conduct a new aerobic aquatic metabolism study (162-4). This risk assessment was based on the maximum application rate for the seed treatment at 0.1 lb ai/A. However, according to the new uses reviewed by EFED (Turfgrass, Tobacco, Apples, Pears, and Ornamentals), this chemical can be directly applied to the soil surface/foliage at much higher application rate (0.4 lbs ai/A). As a result, the potential for clothianidin to move from the treated area to the nearby surface water body under the new uses is much greater than the use as a seed treatment. Therefore, there is a need for a better understanding of the fate of clothionidin in the aerobic aquatic environment.

2. The fate of the thiazolyl ring was not monitored in the previously-reviewed aerobic aquatic metabolism study (MRID 45422324) because the test substance was labeled on the nitroimino side chain. Therefore, the fate of the thiazolyl ring remains unknown. The fate guidelines recommend to use the ring-labeled test substance.

3. A well-designed new aerobic aquatic metabolism study is deemed critical for EPA to fully assess the risk of clothionidin in the aquatic environment.

<u>166-1 Small-Scale Prospective Groundwater Monitoring Study</u>. Due to direct soil and foliar applications of clothianidin and concerns about the chemical leaching into ground water (see below), the Agency will request the registrant to submit a small-scale prospective groundwater monitoring study.

> Source: EPA review "EFED Risk Assessment for the Seed Treatment of Clothianidin 600FS on Corn and Canola" dated February 20, 2003 (page 3):
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> "Clothianidin has the properties of a chemical which could lead to widespread ground-water contamination, but no ground-water monitoring studies have been conducted to date. Should the registrant request field uses involving direct application of clothianidin to the land surface, Prospective Ground-Water Monitoring Studies may be needed to evaluate fully the potential impact of such uses." Due to the extreme mobility and persistence of clothianidin in the environment, a small-scale prospective groundwater monitoring study will provide additional fate information on the better understanding of this chemical in the environment and improve the certainty of the risk assessment.

Seed Leaching Study: EFED believes that a seed leaching study would greatly increase certainty regarding a more realistic estimate of the amount of available clothianidin residues on the seed surface. This in turn would allow a refinement of exposure estimates and environmental concentration values (EECs). A study has been submitted to the Agency and is currently under review (MRID 47483002).

Ecological Effects:
The database available for clothianidin to support the assessment was largely complete. The following ecological studies for clothianidin are still outstanding and need to be submitted.

Honey Bee Toxicity of Residues on Foliage (850.3030): This study is required for chemicals that have outdoor terrestrial uses in which honeybees will be exposed and exhibit an LD50 < 11μg a.i./bee. The study that was submitted to satisfy this guideline is supplemental but does not satisfy the guideline requirement. This study is not required for this assessment due to the lack of exposure to residues on foliage from the seed treatments. This study is placed in reserve pending future new uses.

Field Test for Pollinators (850.3040): The possibility of toxic exposure to nontarget pollinators through the translocation of clothianidin residues that result from seed treatments has prompted EFED to require field testing (850.3040) that can evaluate the possible chronic exposure to honey bee larvae and queen. In order to fully evaluate the possibility of this toxic effect, a field study should be conducted and the protocol submitted for review by the Agency prior to initiation. Another study had been submitted to satisfy this guideline requirement. While it had originally been classified as acceptable, after recent reevaluation it is classified as supplemental, and a field study is still being needed for a more refined risk assessment.

Algal Toxicity (850.5400): Data on four species of non-vascular plants is required. A study on only one species has been submitted to date on *Selenastrum capricornutum*.

Uncertainties
The uncertainties associated with clothianidin exposure in the environment are mainly focused in these areas:

- Accumulation of clothianidin in soils after repeated uses and the potential for transport/migration to surface water bodies and potential risk to sensitive aquatic invertebrates (e.g., sediment-dwelling benthic organisms)
- Label language that specifies the method of incorporation
- Potential toxic risk to pollinators (e.g. honeybees) as the result of accumulation from seed treatments and/or foliar spray on plants/blooms from repeated uses in cotton and mustard
- Repeated or continuous exposure to soil invertebrates and small mammals to clothianidin accumulated in soils after repeated uses.
- Data Gaps: The data gaps that were outlined in Section 2.6.1 were either required or conditionally required for clothianidin and still have to be submitted. Acceptable data from these studies will aid in reducing some of the uncertainty associated with this assessment.

For terrestrial screening risk assessments, a generic bird or mammal is assumed to occupy either the treated field or adjacent areas receiving pesticide at a rate commensurate with the treatment rate on the field. The actual habitat requirements of any particular terrestrial species are not considered, and it is assumed that species exclusively and permanently occupy the treated area being modeled. This assumption leads to a maximum level of exposure in the risk assessment. In the absence of specific data, EFED assumes the most conservative scenario. Screening-level risk assessments for spray applications of pesticides usually consider dietary exposure alone.

2 Problem Formulation

The purpose of this problem formulation is to provide the foundation for the environmental fate and ecological effects risk assessment being conducted for the seed treatment insecticides with clothianidin. Additionally, this problem formulation is intended to identify data gaps, uncertainties, and potential assumptions to address those uncertainties relative to characterizing the risk associated with the registered uses of clothianidin, which is a neonicotinoid with current uses as a seed treatment application.

2.1 Nature of Regulatory Action

Under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Bayer CropSciences is seeking registration for the new uses of Clothianidin as a seed-treatment insecticide in cotton and mustard (oilseed and condiment).

2.2 Stressor Source and Distribution

2.2.1 Nature of the Chemical Stressor

A summary of selected physical and chemical parameters for clothianidin is presented in **Table 1**.

Table 1. Summary of physicochemical properties of clothianidin.

Physical-Chemical and Other Properties	
CAS Name	[C(E)]-N-[(2-chloro-5-thiazolyl)methyl]-N'-methyl-N''-nitroguanidine
IUPAC Name	(E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3-methyl-2-nitroguanidine
CAS No	210880-92-5 (previously 205510-53-8)
Empirical Formula	$C_6H_8ClN_5O_2S$
Molecular Weight	249.7
Common Name	Clothianidin
Pesticide Type	Insecticide
Chemical Family	Neonicotinoid

Physical-Chemical and Other Properties	
Color/Form	Clear and colorless/solid, powder
Odor	odorless
Melting Point	176.8°C
Flash Point	N/A
Relative Density	1.61 g/ml (at 20°C), 1.59 g/cm^3
Water Solubility	0.327g/L (at 20°C)
Solubility in other solvents	heptane <0.00104 g/L (at 25°C) xylene 0.0128 dichloromethane 1.32 methanol 6.26 octanol 0.938 acetone 15.2 ethyl acetate 2.03
Vapor Pressure	3.8 x10^{-11} Pa (at 20°C)
Henry's Law Constant	2.9 x 10^{-11} Pa x m3/mol
K_{OW}	1.12 (at pH 7)

Although nicotine has been used as a pesticide for over 200 years, it degraded too rapidly in the environment and lacked the selectivity to be very useful in large scale agricultural situations. However, in order to address this problem, the neonicotinoids (chloronicotinyl insecticides) were developed as a substitute of nicotine, targeting the same receptor site (AChR) and activating post-synaptic acetylcholine receptors but not inhibiting AChE. Clothianidin, like other neonicotinoids, is an agonist of acetylcholine, the neurotransmitter that stimulates the nAChR. In insects, neonicotinoids cause symptoms similar to that of nicotine. The symptoms appear rapidly as increased restlessness followed by violent convulsions and death. The advantage of clothianidin and other neonicotinoids over nicotine is that they are less likely to break down in the environment.

2.2.2 Overview of Clothianidin Usage

This assessment is intended to address the proposed new uses of clothianidin as a seed treatment for cotton and mustard (oilseed and condiment). The crop, target pests, and relevant application information are summarized in **Table 2**.

Table 2. Use information for the proposed use of clothianidin on seeds as an insecticide. Uses being evaluated for D377955 and D378994 are in bolded dark blue text.

Summary of Directions for Use of Clothianidin Seed Treatments.					
Applic. Timing, Type, and Equip.	Form. [EPA Reg. No.]	Application Rates [1]		Use Directions and Limitations [3]	
		g ai/1000 seeds	oz ai/1000 seeds	lb ai/A [2]	
Root Vegetables (Group 1) [4]					
Seed treatment using commercial seed treatment equipment only	56.25% WP [264-XXX]	Radish: 0.45 Carrot: 0.118	Radish: 0.01575 Carrot: 0.0042	Radish: 0.50-0.67 Carrot: 0.10-0.25	Do not use treated seed for food, feed or oil processing.
Bulb Vegetables (Group 3)					
Seed treatment using commercial seed treatment equipment only	56.25% WP [264-XXX]	Bulb onion: 0.18 Green onion: 0.106 Leek: 0.20	Bulb onion: 0.006 Green onion: 0.0037 Leek: 0.0071	Bulb onion: 0.06-0.19 Green onion: 0.23-0.42 Leek: 0.30-0.35	Do not use treated seed for food, feed or oil processing.
Leafy Green Vegetables (Subgroup 4A)					
Seed treatment using commercial seed treatment equipment only	56.25% WP [264-XXX]	Head Lettuce: 0.798 Leaf Lettuce: 0.64 Spinach: 0.16	Head Lettuce: 0.028 Leaf Lettuce: 0.0225 Spinach: 0.0055	Head Lettuce: 0.70-2.25 Leaf Lettuce: 0.68-2.26 Spinach: 0.09-0.21	Do not use treated seed for food, feed or oil processing.
Brassica Leafy Vegetables (Group 5)					
Seed treatment using commercial seed treatment equipment only	56.25% WP [264-XXX]	Cabbage: 1.193 Broccoli: 1.193 Mustard Greens: 0.0995	Cabbage: 0.0416 Broccoli: 0.0416 Mustard Greens: 0.0035	Cabbage: 0.06-0.44 Broccoli: 0.39-0.42 Mustard Greens: 0.03-0.16	Do not use treated seed for food, feed or oil processing.
Fruiting Vegetables (Group 8)					
Seed treatment using commercial seed treatment equipment only	56.25% WP [264-XXX]	Tomato: 0.099 Pepper: 0.495	Tomato: 0.0035 Pepper: 0.0174	Tomato: 0.02-0.06 Pepper: 0.04-0.21	Do not use treated seed for food, feed or oil processing.
Cucurbit Vegetables (Group 9)					
Seed treatment using commercial seed treatment equipment only	56.25% WP [264-XXX]	Squash: 0.995 Melon: 0.995 Cucumber: 995	Squash: 0.034 Melon: 0.034 Cucumber: 0.034	Squash: 0.04 Melon: 0.02-0.11 Cucumber: 0.04-0.16	Do not use treated seed for food, feed or oil processing.
Cereal Grains, except rice (Group 15)					

Summary of Directions for Use of Clothianidin Seed Treatments.					
Applic. Timing, Type, and Equip.	Form. [EPA Reg. No.]	Application Rates [1]		Use Directions and Limitations [3]	
		g ai/1000 seeds	oz ai/1000 seeds	lb ai/A [2]	
Seed treatment using commercial seed treatment equipment only	56.25% WP [264-XXX]	70 g ai/100 kg seed	1.125 oz ai/100 lbs seed	Corn: 0.007-0.011 Sorghum: 0.001-0.007 Millet: 0.011-0.025 Barley: 0.035-0.067 Oats: 0.034-0.090 Wheat: 0.021-0.105	Do not use treated seed for food, feed or oil processing.
Wheat, Barley and Triticale					
Seed treatment using on farm or commercial seed treatment equipment.	0.128 lb/gal FlC [264-XXX]	7.5 g ai/100 kg seed	0.12 oz ai/100 lb seed	Barley: 0.004-0.007 Wheat: 0.002-0.011	Do not use treated seed for food, feed or oil processing. Forage may be grazed or harvested 31 days after seeding.
Potato					
Seed treatment using commercial seed treatment equipment only	56.25% WP [264-XXX]	12.5 g ai/100 kg seed pieces	0.20 oz ai/100 lb seed pieces	potato: 0.163-0.325	Do not use treated seed for food, feed or oil processing.
Cotton					
Seed Treatment AE 1283742 imidacloprid / clothianidn mix	AE 1283742 Poncho 600	0.15 lb/100 lbs seed		0.02	
COTTON – NEW USE RATE – DP Barcode #378994					
Seed Treatment	**40.3% VOTiVO (unique formulation)**	**3.53 g ai/1000 seeds**	**0.078 oz ai/1000 seeds**	**Up to 0.063**	
MUSTARD SEED – NEW USE RATE – DP Barcode #378994					
Seed Treatment	**21.75% Prosper T400**	**0.215 fl oz/ 100 lbs seed or 0.004 lb ai/ 100 lbs seed**		**Up to 0.028**	

2.3 Receptors

2.3.1 Aquatic and Terrestrial Receptors and Effects

The receptor is a biological entity that is exposed to the stressor (US Environmental Protection Agency, 1998). As described in the risk assessment Overview Document (US EPA, 2004), this risk assessment uses a surrogate species approach in its evaluation of clothianidin. Toxicological data generated from surrogate test species, which are intended to be representative of broad taxonomic groups, are used to extrapolate the potential effects on a variety of species (receptors) included under these taxonomic groupings. For example, the mallard duck and bobwhite quail are the preferred species in avian toxicity tests (acute and chronic) to represent toxicity for the entire class of bird species.

Acute and chronic toxicity data from studies submitted by the registrant along with the available open literature are used to evaluate potential direct effects of pesticides to aquatic and terrestrial receptors. These data include toxicity studies on the technical grade active ingredient (TGAI). The open literature are indentified through EPA's ECOTOX database (http://cfpub.epa.gov/ecotox/), which employs a literature search engine for locating chemical toxicity data for aquatic and terrestrial floral and fauna. The evaluation of both sources of data provides insight into the direct and indirect effects of pesticides on biotic communities from the loss of species that are sensitive to the clothianidin, and changes in structural and functional characteristics of the affected communities. A search of the ECOTOX database did not yield any relevant studies additional to those submitted by the registrant that would support this action.

Table 3 provides examples of taxonomic groups and the surrogate species tested to help understand potential ecological effects of clothianidin on these non-target taxonomic groups.

Table 3. Test species evaluated for assessing potential ecological effects of clothianidin.

Taxonomic Group	Example(s) of Surrogate Species	Acute Toxicity Classification
Birds[1]	Mallard duck (*Anas platyrhynchos*) Bobwhite quail (*Colinus virginianus*)	Practically non-toxic on a dietary basis to moderately toxic on a dose basis
Mammals	Rat (*Rattus norvegicus*)	Moderately toxic
Freshwater Fish[2]	Bluegill sunfish (*Lepomis macrochirus*) Rainbow trout (*Oncorhynchus mykiss*)	Practically non-toxic
Freshwater Invertebrate	Midge (*Chironomus riparius*)	Very highly toxic
Freshwater Benthic Invertebrate	Midge (*Chironomus riparius*)	Very highly toxic
Estuarine/marine fish	Sheepshead minnow (*Cyprinodon variegates*)	Slightly toxic
Estuarine/marine invertebrates	Mysid shrimp (*Mysidopsis bahia*)	Very highly toxic
Estuarine Marine Benthic Invertebrate	*Leptocheirus plumulosus*	Very highly toxic

Taxonomic Group	Example(s) of Surrogate Species	Acute Toxicity Classification
Estuarine/marine mollusks	Eastern oyster (*Crassotrea virginica)*	Practically non-toxic
Terrestrial invertebrates	Honey bees (*Apis mellifera*)	Highly toxic

[1]Birds represent surrogates for terrestrial-phase amphibians and reptiles
[2]Freshwater fish serve as surrogates for aquatic-phase amphibians

2.3.2 Ecosystems Potentially at Risk

The ecosystems at risk from a stressor are often exclusive in scope, and as a result it may not be possible to identify specific ecosystems at the baseline level. However, in general terms, terrestrial ecosystems potentially at risk could include the treated field and areas immediately adjacent to the treated field that may receive drift or runoff. Areas adjacent to the treated field could include other cultivated fields, fencerows, hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats, and other uncultivated areas.

Aquatic ecosystems potentially at risk from a stressor include water bodies adjacent to, or down stream from the treated field and might include impounded bodies such as ponds, lakes, and reservoirs, or flowing waterways such as streams or rivers. For uses in coastal areas, aquatic habitat also includes marine ecosystems, including estuaries.

For clothianidin, the terrestrial ecosystem primarily at risk is the rhizosphere zone in which treated seeds are planted on the crop field, through contaminated nectar and/or pollen, or due to the seed left (accidental spillage or otherwise) on the soil surface at the time of planting. Seed-bound clothianidin may pose risk to aquatic ecosystems through leaching, runoff, or erosion from the crop field. It is noted that for soil incorporated chemicals, or seed treatments, drift is usually a minor component.

2.4 Assessment Endpoints

Assessment endpoints represent the actual environmental value that is to be protected, defined by an ecological entity (species, community, or other entity) and its attribute or characteristics (US Environmental Protection Agency 1998 and 2005). For clothianidin, the ecological entities include the following: birds, mammals, terrestrial plants, insects, freshwater fish and invertebrates, estuarine/marine fish and invertebrates, aquatic plants, and algae. The assessment endpoints for each of these entities include survival, growth, and/or reproduction. This assessment will use the most sensitive toxicity measures of effect from surrogate test species to estimate treatment-related direct effects on acute mortality and chronic reproductive, growth, and survival assessment endpoints.

2.5 Conceptual Model

For a pesticide to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a pesticide moves in the environment from a source to an ecological receptor. For an ecological pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure.

A conceptual model is intended to provide a written description and visual representation of the predicted relationships between the stressor, potential routes of exposure, and the predicted effects for the assessment endpoint. A conceptual model consists of two major components: the risk hypothesis and the conceptual diagram (US Environmental Protection Agency 1998 and 2005).

2.5.1 Risk Hypothesis

Risk hypotheses are specific assumptions about potential adverse effects and may be based on theory and logic, empirical data, and mathematical models. For this assessment, the risk is stressor initiated where the stressor is the release of clothianidin into the environment. Relative to the proposed use of clothianidin, EFED initially had concerns for risk to aquatic organisms due to high persistence and potential mobility of clothianidin to surface waters. In the case of this assessment, EFED relied on the clothianidin toxicity studies which considers standard single chemical toxicity testing (acute and chronic endpoints) submitted by the registrant and reviewed by the Agency. EFED used this information for selection of the most sensitive species tested in order to generate RQ values. Effects data are included under the section "Characterization of Ecological Effects," and represent registrant submitted data. The effects database is mostly complete for freshwater and estuarine/marine aquatic organisms and thus is suitable for a screening level risk assessment. The major endpoints related to aquatic environments at issue are:

(a). Direct effects to aquatic invertebrates in the water column via acute toxicity.
(b). Direct effects to benthic aquatic organisms dwelling in the sediment and/or pore water via acute and/or chronic toxicity.

In addition to the concern for aquatic ecosystems, EFED is also concerned with potential impacts to terrestrial species and functional groups, including pollinators; nectar and fruit eating birds, mammals, and insects; and soil-inhabiting invertebrates and mammals (i.e. earthworms, burrowing mammals). Available effects data are included under the section "Characterization of Ecological Effects," and represent registrant submitted data. Although EFED does not conduct RQ based risk assessments on beneficial insects, there is potential for direct toxic effects to honey bees as suggested by the toxicity data. The terrestrial effects database for these species and functional groups is incomplete and thus recommendations are made for additional studies or assessments to fill data gaps needed for a suitable screening level risk assessment. The major endpoints related to terrestrial environments at issue are:

(a). Direct effects to mammals, birds, insects, and soil invertebrates via acute toxicity.
(b). Direct effects on reproduction to birds (eggshell thinning), mammals (endocrine disruption), and insects via chronic toxicity.
(d). Direct effects to foraging activity of pollinators

Therefore, the following risk hypothesis is presumed for this screening-level assessment:

The proposed new use of clothianidin on cotton and mustard (oilseed and condiment) will likely involve situations where terrestrial animals and aquatic plants and animals will be exposed to the chemical and or its transformation products. Based on information on environmental fate, mode of action, direct toxicity, and potential indirect effects, EFED assumes that clothianidin may have the potential to cause reduced survival, growth, and reproduction to terrestrial and aquatic animals and aquatic plants as a result of the proposed uses of the pesticide. However, due to the low toxicity of clothianidin to terrestrial plants and the limited exposure from the seed treatment, clothianidin is not likely to reduce the survival, growth, and reproduction of terrestrial plants based on the proposed uses.

2.5.2 Conceptual Diagram

The potential exposure pathways and effects of clothianidin on terrestrial and aquatic environments are depicted in **Figure 1**. Solid arrows represent the most likely routes of exposure and effects for clothianidin.

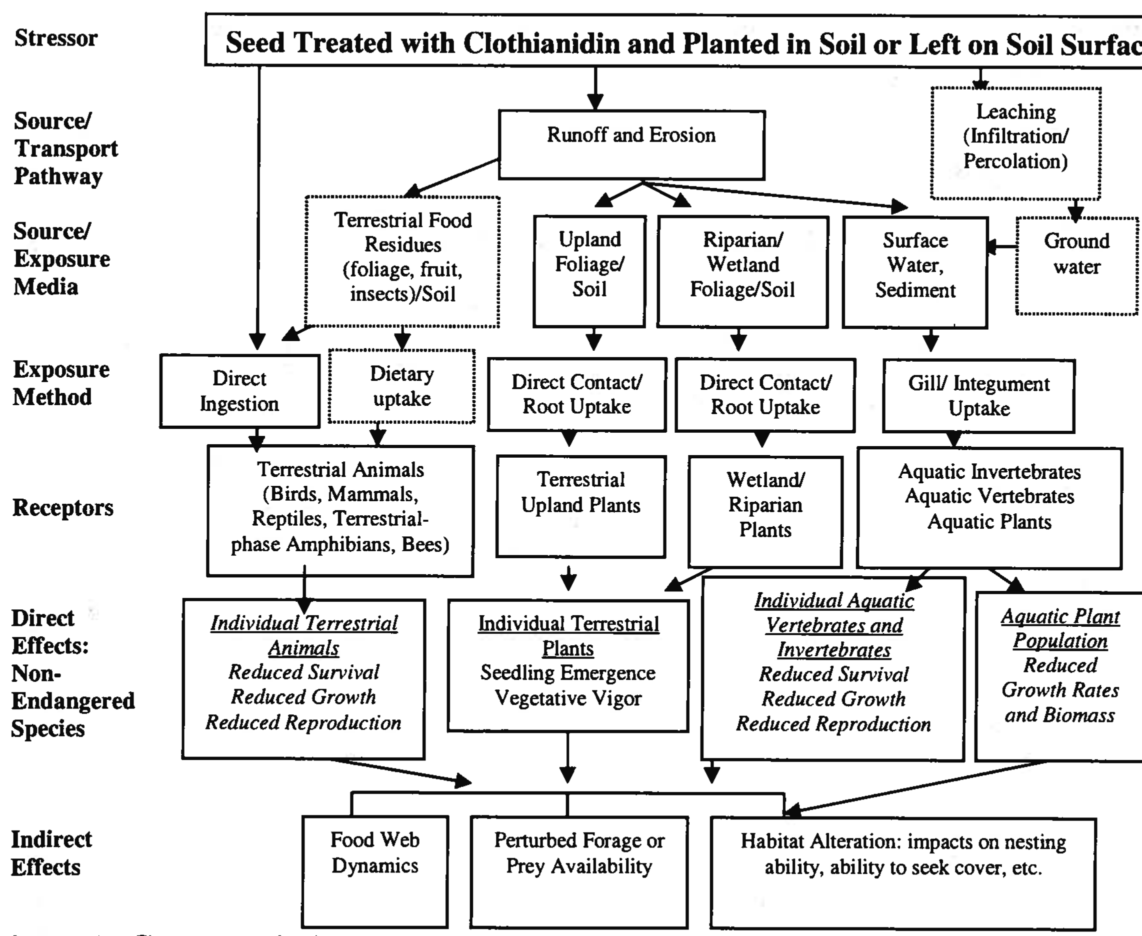

Figure 1. Conceptual diagram depicting potential risks to terrestrial and aquatic animals from the use of clothianidin as a seed-treatment insecticide. Italicized groups of taxa are identified as the taxa of concern based on toxicity and results from previous assessments.

2.6 Analysis Plan

2.6.1 Methods of Conducting Ecological Risk Assessment and Identification of Data Gaps

This document characterizes the environmental fate and effects of clothianidin to assess whether the proposed label new use of the compound results in risk to non-target organisms at levels above the Agency's LOCs. The primary method used to assess risk in this screening-level assessment is the risk quotient (RQ). The RQ is the result of comparing measures of exposure to measures of effect. A commonly used measure of exposure is the estimated exposure concentration (EEC) and commonly used measures of effect include toxicity values such as LD_{50} or NOAEC. The resulting RQ is then compared to a specified level of concern (LOC), which represents a point of departure for concern, i.e. if the RQ exceeds the LOC, then risks are triggered. Although not necessarily a true estimate of risk since there is no estimated probability of effect, in general, the higher the RQ, the more certain the potential risks.

Table 4 summarizes the environmental fate data requirements for clothianidin according to 40 CFR Part 158 Subpart N. Studies that have been received or not yet received will be noted as such in the table.

Table 4. Environmental fate data requirements for clothianidin.

Table of Environmental Fate Data Requirements				
Guide-line #	**Data Requirement**	**MRID #**	**Study Classification**	**Is more data needed?**
161-1	Hydrolysis	45422317	Core	no
161-2	Photodegradation in Water	45422318 45422319 45422320 45422321 45422322	Core Supplemental Core Supplemental Core	no
161-3	Photodegradation on Soil	45422323	Core	no
161-4	Photodegradation in Air		Waived	no
162-1	Aerobic Soil Metabolism	45422325 45422326 45422327 45422328	Core Core Supplemental Supplemental	no
162-2	Anaerobic Soil Metabolism	N/A	N/A	no

Table of Environmental Fate Data Requirements				
Guide-line #	**Data Requirement**	**MRID #**	**Study Classification**	**Is more data needed?**
162-3	Anaerobic Aquatic Metabolism	45422330	Core	no
162-4	Aerobic Aquatic Metabolism	46826903 45422324 45422329	Core Supplemental Supplemental	no
163-1	Leaching-Adsorption/Desorption	45422311 45422312 45422313 45422314 45422315 45422316	Core Ancillary Supplemental Supplemental Supplemental Supplemental	no
163-2	Laboratory Volatility	N/A	N/A	Waived
163-3	Field Volatility	N/A	N/A	Waived
164-1	Terrestrial Field Dissipation	45490703 45490704 45490705 45422331 45422332 45422333 45422334 45422335 45422336 45422508 45422604 45422612	Core Core Core Supplemental Core Core Core Core Core Supplemental Ancillary Ancillary	no
164-2	Aquatic Field Dissipation	N/A	N/A	Reserved
165-4	Accumulation in Fish	N/A	N/A	Waived
165-5	Accumulation-aquatic non-target	N/A	N/A	Reserved
166-1	Ground Water- small prospective	N/A	N/A	Yes
201-1	Droplet Size Spectrum	45490701	Supplemental (upgradable)	Reserved

Table of Environmental Fate Data Requirements				
Guide-line #	**Data Requirement**	**MRID #**	**Study Classification**	**Is more data needed?**
202-1	Drift Field Evaluation	N/A		Reserved

Table 5 summarizes the data requirements for clothianidin according to 40 CFR Part 158 Subpart G. Studies that have been received or not yet received will be noted as such in the table.

Table 5. Ecological effects data requirements for clothianidin.

Table of Ecological Toxicity Data Requirements				
Guideline #	**Data Requirement**	**MRID #**	**Classification**	**Is more data needed?**
850.2100	Avian acute oral LD_{50}			
	(mallard duck)	45422417	Core	
	(japanese quail)	45422418	Supplemental	No
850.2200	Avian subacute dietary LC_{50}			
	(bobwhite quai)l	45422419	Core	
	(mallard duck)	45422420	Core	No
850.2300	Avian reproduction			
	(bobwhite quail)	45422421	Core	No
	(mallard duck)	45422422	Supplemental	
850.1075	Freshwater fish acute LC_{500}			
	(rainbow trout)			
	TGAI	45422406	Supplemental	
	DEG	45422408	Supplemental	
	DEG	45422409	Supplemental	
	DEG	45422410	Supplemental	
	(bluegill sunfish)	45422407	Core	
	TGAI			No
850.1010	Freshwater invertebrate acute EC_{50} (daphnia)			
	TGAI	45422338	Core	
	DEG	45422401	Core	
	DEG	45422340	Core	
	DEG	45422339	Supplemental	
	(chironomid)			
	TGAI	45422414	Supplemental	No

Table of Ecological Toxicity Data Requirements				
Guideline #	**Data Requirement**	**MRID #**	**Classification**	**Is more data needed?**
850.1075	Estuarine/marine fish acute LC_{50} (sheepshead minnow)	45422411	Supplemental	No
850.1025 850.1035 850.1045 850.1055 850.1075	Estuarine/marine invertebrate acute EC_{50} (eastern oyster) (mysid)	 45422404 45422403	 Core Core	No
850.1400	Freshwater fish early life stage (fathead minnow)	45422413	Supplemental	No
850.1300	Freshwater invertebrate life cycle (daphnia)	45422412	Supplemental	No
850.1350	Estuarine/marine life cycle (mysid)	45422405	Core	No
850.1735	Acute Freshwater Invertebrate Sediment Toxicity TGAI	468269-02	Supplemental	No
850.1740	Acute Estuarine/Marine Invertebrate Sediment Toxicity TGAI	471994-01	Supplemental	No
850.1950	Aquatic Field Study	NA	NA	No
870..1100	Acute mammalian oral LD_{50} (rat) (mouse)	 45422621 45422622	 Core Core	No
870.4100	Mammalian Chronic (rat) (rat) (rabbit)	 45422714-16 45422825 -26 45422712-13	 Core Core Core	No
850.4100	Seedling Emergence - Tier I	45422501	Core	No
850.4150	Vegetative Vigor - Tier I	45422502	Core	No
850.5400	Aquatic plant algae TGAI DEG DEG DEG	 45422504 45422505 45422506 45422507	 Core Core Core Core	Yes[1]
850.4400	Aquatic plant acute EC_{50}	45422503	Core	No

Table of Ecological Toxicity Data Requirements				
Guideline #	Data Requirement	MRID #	Classification	Is more data needed?
850.3020	Acute honey bee contact LD_{50}	45422426	Core	No
Non-guideline	Acute honey bee oral LD_{50}			
	TGAI	45422426	Supplemental	
	DEG	45422427	Supplemental	
	DEG	45422428	Supplemental	
	DEG	45422429	Supplemental	No
	DEG	45422430	Supplemental	
850.3030	Honey Bee Residue on Foliage	45490702	Supplemental	Yes
850.3040	Honey Bee Field Testing for Pollinators	45422431	Supplemental	
		45422432	Supplemental	
		45422433	Supplemental	
		45422435	Supplemental	
		45422436	Supplemental	
		45422437	Supplemental	
		45422440	Supplemental	
		46907801/46907802	Supplemental	Yes
850.6200	Earthworm Subchronic			
	TGAI	45422511	Core	
	DEG	45422512	Core	No
	DEG	45422513	Core	
Non-guideline	Earthworm Chronic			
		45422525	Supplemental	No
		45422526	Supplemental	

[1]EFED needs 3 more Tier I or Tier II Core clothianidin studies for the nonvascular surrogate species, marine diatom (Skeletonema costatum), blue-green algae (Anabaena flos-aquae), and a freshwater diatom.

2.6.2 Outstanding Data Requirements

Environmental Fate:

<u>162-4 Aerobic Aquatic metabolism Study</u>. Based on the additional information submitted by the registrant, EFED agreed to change the previously-reviewed aerobic aquatic metabolism study (MRID 45422324) from "unacceptable" to "supplemental". However, the aerobic aquatic metabolism data requirements are still not fulfilled, the registrant must submit a new aerobic aquatic metabolism study. Reasons are presented below:

1. The potential for clothianidin to move from the treated area to the nearby surface water body has been increased significantly since 2003 because the registrant has recently added new uses on the labels. According to the review completed on 2/20/2003 (Title - "EFED Risk

Assessment for the Seed Treatment of Clothianidin 600FS on Corn and Canola", the Agency required the registrant to conduct a new aerobic aquatic metabolism study (162-4). This risk assessment was based on the maximum application rate for the seed treatment at 0.1 lb ai/A. However, according to the new uses reviewed by EFED (Turfgrass, Tobacco, Apples, Pears, and Ornamentals), this chemical can be directly applied to the soil surface/foliage at much higher application rate (0.4 lbs ai/A). As a result, the potential for clothianidin to move from the treated area to the nearby surface water body under the new uses is much greater than the use as a seed treatment. Therefore, there is a need for a better understanding of the fate of clothionidin in the aerobic aquatic environment.

2. The fate of the thiazolyl ring was not monitored in the previously-reviewed aerobic aquatic metabolism study (MRID 45422324) because the test substance was labeled on the nitroimino side chain. Therefore, the fate of the thiazolyl ring remains unknown. The fate guidelines recommend to use the ring-labeled test substance.

3. A well-designed new aerobic aquatic metabolism study is deemed critical for EPA to fully assess the risk of clothionidin in the aquatic environment.

<u>166-1 Small-Scale Prospective Groundwater Monitoring Study</u>. Due to direct soil and foliar applications of clothianidin and concerns about the chemical leaching into ground water (see below), the Agency will request the registrant to submit a small-scale prospective groundwater monitoring study.

> Source: EPA review "EFED Risk Assessment for the Seed Treatment of Clothianidin 600FS on Corn and Canola" dated February 20, 2003 (page 3):
>
> "Clothianidin has the properties of a chemical which could lead to widespread ground-water contamination, but no ground-water monitoring studies have been conducted to date. Should the registrant request field uses involving direct application of clothianidin to the land surface, Prospective Ground-Water Monitoring Studies may be needed to evaluate fully the potential impact of such uses." Due to the extreme mobility and persistence of clothianidin in the environment, a small-scale prospective groundwater monitoring study will provide additional fate information on the better understanding of this chemical in the environment and improve the certainty of the risk assessment.

Seed Leaching Study: EFED believes that a seed leaching study would greatly increase certainty regarding a more realistic estimate of the amount of available clothianidin residues on the seed surface. This in turn would allow a refinement of exposure estimates and environmental concentration values (EECs). A study has been submitted and is currently under review (MRID 47483002).

Ecological Effects:
The database available for clothianidin to support the assessment was largely complete. The following ecological studies for clothianidin are still outstanding and need to be submitted.

Honey Bee Toxicity of Residues on Foliage (850.3030): This study is required for chemicals that have outdoor terrestrial uses in which honeybees will be exposed and exhibit an LD50 < 11μg a.i./bee. The study that was submitted to satisfy this guideline is supplemental but does not satisfy the guideline requirement. This study is not required for this assessment due to the lack of exposure to residues on foliage from the seed treatments. This study is placed in reserve pending future new uses.

Field Test for Pollinators (850.3040): The possibility of toxic exposure to non-target pollinators through the translocation of clothianidin residues that result from seed treatments has prompted EFED to require field testing (850.3040) that can evaluate the possible chronic exposure to honey bee larvae and queen. In order to fully evaluate the possibility of this toxic effect, a field study should be conducted and the protocol submitted for review by the Agency prior to initiation. Another study had been submitted to satisfy this guideline requirement. While it had originally been classified as acceptable, after recent reevaluation it is classified as supplemental, and a field study is still being needed for a more refined risk assessment.

Algal Toxicity (850.5400): Data on four species of non-vascular plants is required. A study on only one species has been submitted to date on *Pseudokirchneriella subcapitata*, formerly known as *Selenastrum capricornutum.*

2.6.3 Measures of Effect and Exposure

Table 6 lists the measures of environmental exposure and ecological effects used to assess the potential risks of clothianidin to non-target organisms in this assessment based on the concerns in the problem formulation. The methods used to assess the risk are consistent with those outlined in the document "Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs." (2004)

Table 6. Measures of effect and exposure for clothianidin.

Assessment Endpoint		Surrogate Species and Measures of Ecological Effect[1]	Measures of Exposure
Birds[2]	Survival	- Mallard duck acute oral LD_{50} - Bobwhite quail and mallard duck subacute dietary LC_{50}	Maximum residues on seed and soil
	Reproduction and growth	Mallard duck and bobwhite quail chronic reproduction NOAEL	
Mammals	Survival	Laboratory rat acute oral LD_{50}	
	Reproduction and growth	Laboratory rat chronic reproduction NOAEL	
Freshwater Fish[3]	Survival	Rainbow trout and bluegill sunfish acute LC_{50}	Peak EEC[4]
	Reproduction and growth	Fathead minnow chronic (early life stage) NOAEC and LOAEC	60-day average EEC[4]
Freshwater Invertebrates	Survival	Water flea acute LC_{50}	Peak EEC[4]
	Reproduction and growth	Water flea NOAEC and LOAEC	21-day average EEC[4]
Estuarine/marine	Survival	Sheepshead minnow acute LC_{50}	Peak EEC[4]

Assessment Endpoint		Surrogate Species and Measures of Ecological Effect[1]	Measures of Exposure
fish	Reproduction and growth	No study submitted	60-day average EEC[4]
Estuarine/marine invertebrates	Survival	Mysid shrimp acute LC_{50}	Peak EEC[4]
	Reproduction and growth	No study submitted	21-day average EEC[4]

[1]If species listed in this table represent most commonly encountered species from registrant-submitted studies, risk assessment guidance indicates most sensitive tested within taxonomic group are to be used for baseline risk assessments
[2]Birds represent surrogates for terrestrial phase amphibians and reptiles
[3]Freshwater fish may be surrogates for amphibians (aquatic phase)
[4]One in 10-year frequency

3 Exposure Assessment

Summary
Clothianidin appears to be a persistent compound under most field conditions. Based on analysis of the laboratory studies alone, the major route of dissipation for clothianidin would appear to be photolysis if exposure to sunlight occurs (e.g., the measured aqueous photolysis half-life was <1 day and aerobic half-lives were 148 to 1155 days). Although photolysis appears to be much more rapid than other avenues of degradation/dissipation of clothianidin in the laboratory studies, the very slow rate of dissipation that was observed in field studies suggests that photolysis probably is not significant under most actual-use conditions. Photolysis may be quite important in surface waters if residues have reached clear bodies of water and are in solution rather than bound to sediment. Clothianidin is stable to hydrolysis at environmental pHs and temperatures. Degradation is also relatively rapid under anaerobic aquatic conditions (overall half-life of 27 days); however, metabolic degradation occurs very slowly in aerobic soil. Clothianidin is mobile to highly mobile in the laboratory [soil organic carbon partition coefficients (Koc) values were 84 to 129 for all test soils except for a sandy loam soil which had a Koc value of 345], although only a modest amount of leaching was observed in the submitted field studies. Previous studies have confirmed that compounds with a similar combination of mobility and persistence characteristics have a potential to leach to ground water at some use sites. Volatilization is not expected to be a significant dissipation process.

Degradation and Metabolism
Metabolism in aerobic soil occurred very slowly. At 20°C, clothianidin degraded in two soils with a first-order half-life of 148 and 239 days (Hofchen and Laacher soil series), in seven soils ranging in texture from sand to silt loam with half-lives of 495 to 1,155 days (BBA 2.2, Quincy, Sparta, Crosby, Susan, Elder, and Howe soil series), and in a tenth soil with a half-life that was nominally calculated to be 6,931 days (Fugay soil series). Degradation was too little in the Fugay soil study to accurately calculate the degradation rate over the 1-year study period ($r2$ = 0.05). A total system half-life of 187 days was estimated from a 120-day aerobic aquatic metabolism study (MRID 46826903).

Under anaerobic aquatic conditions, metabolic degradation occurred relatively quickly (half-life of 14 days in water; 37 days in sediment; 27 days overall). Clothianidin was <1% of the applied in the water at and after 120 days and was <2.0% in the silt loam sediment at and after 183 days. No major degradates were isolated; clothianidin was converted primarily to soil-bound residues.

Clothianidin photodegraded with half-lives of <1 day in sterile buffer solution in the laboratory and in natural water outdoors, and approximately 34 days in soil in the laboratory. The range of values (1 to 34 days) given for surface water-source drinking water represents uncertainty with regard to the importance of photodegradation in the long-term fate of clothianidin in natural waters. In the laboratory, clothianidin photodegraded in sterile aqueous pH 7 buffer solutions with a half-life of 6.2-6.8 hours, based on a 12-hour light/12-hour dark cycle. Major degradates were *N*-(2-clorothiazol-5-ylmethyl)-*N*'-methylurea (TMZU), methylurea (MU), methylguanidine (MG), 4-hydroxy-2-methylamino-2-imidazolin-5-one (HMIO), 7-methylamino-4H-imidazo[5,1-b][1,2,5]thiadiazin-4-one (MIT), formamide (FA), and CO_2. Outdoors, clothianidin degraded in nonsterile river water with a half-life of 25.1 to 27.7 hours under a cycle of approximately 9 hours sunlight/15 hours darkness. Major transformation products were MG, HMIO, MU, Urea, TMG, 3-methylamino-1*H*-imidazo [1,5-*c*]imidazole (MAI), 2-chlorothiazol-5-ylmethanol (CTCA), and CO_2. There was no degradation in the control samples held in the dark, which is consistent with clothianidin's observed stability to hydrolysis.

On moist soil, clothianidin photodegraded with a half-life of 8.2 days based on continuous irradiation (estimated to be equivalent to 34.2 solar summer days in Phoenix, AZ); degradation was not significant in the dark. At study termination (equivalent to 71 days solar summer days in Phoenix, AZ), 22.3% of the clothianidin remained undegraded. No degradates accumulated to significant levels during the study.

Soil sorption and mobility

In laboratory batch equilibrium studies, clothianidin had medium mobility in a US sandy loam soil and high mobility in US loamy sand and clay loam and German sand and sandy loam soils. In batch equilibrium studies using the same soils and similar conditions, MNG was very highly mobile, TZMU was highly to very highly mobile, TZNG was moderately mobile, and TMG was immobile or had low mobility. The mobility of clothianidin appeared to decrease as the length of time clothianidin was in contact with the soil increased; the longer clothianidin was aged in treated soil, the less likely it was to desorb from that soil.

Field dissipation

Clothianidin is expected to dissipate very slowly under terrestrial field conditions, based on the results of five bare ground field experiments conducted in the US and Canada. Half-lives of clothianidin, based on residues in the 0-15 cm soil depth, were 277 days (Wisconsin sand soil, incorporated), 315 days (Ohio silt loam soil, not incorporated), 365 days (Ontario silt loam soil, incorporated), and 1,386 days (North Dakota clay loam soil, not incorporated), and could not be determined at a fifth site due to limited dissipation during the 25-month study (Saskatchewan silty clay loam soil, incorporated). Incorporation did not appear to be a significant factor in determining the rate of dissipation. Clothianidin was generally not detected below the 45 cm soil depth except at one site, where it moved into the 45-60 cm depth. No degradates were detected at >10% of the applied, and degradates were generally only detected in the 0-15 cm soil layer. However, in many cases most of the parent remained untransformed at the close of the study; further accumulation of degradates could have occurred. Degradates that were increasing in concentration or at least continuing to persist towards the close of one or more field dissipation studies were: MNG (MRID 45422336) TZNG (MRID 45422335, 45422333), and TZMU (MRID 45422335).

Two studies were conducted to investigate leaching of clothianidin under field conditions (MRIDS 45422331 and 45422508). These studies were conducted in the Federal Republic of Germany and were apparently designed to fulfill certain European regulatory requirements. In these monolith lysimeter studies, 42 to 59% of the applied remained in the soil approximately 3 to 4 years following the first of two applications, and residues were primarily undegraded clothianidin. The loss of radioactivity was attributed by the authors to mineralization of clothianidin, since ≤1% of the total residues were detected in the leachate. Clothianidin was not detected in the leachate. There was also a significant amount of TZNG and/ or MNG that remained in monolith lysimeters at the close of multi-year studies. In one study (MRID 45422331), analysis of the soil in the lysimeter three years after the original application of clothianidin revealed TZNG was present as about 5% of the applied clothianidin. When the soil was analyzed more than 4 years after application in another lysimeter study (MRID 45422508) about 3% of the applied was present as MNG and 2% was present as TZNG. The substantial amount of clothianidin parent remaining in the soil profile at the close of these studies indicates that further leaching of clothianidin may occur in following years if sufficient precipitation occurs.

3.1 Aquatic Exposure Estimates

The aquatic exposure estimates presented in this assessment were based on the use of models as limited surface and ground water monitoring data are available for clothianidin[1]. To simulate the most conservative surface water exposure for the ecological risk assessment, the Tier II PRZM/EXAMS model was used.

PRZM-EXAMS Model Inputs and Scenarios for Clothianidin

The Pesticide Root Zone Model, (PRZM, Carsel *et al.*, 1997) and the Exposure Analysis Modeling System (EXAMS, Burns, 1997) were used in tandem to generate aquatic estimated environmental concentrations (EECs). PRZM (3.12 beta dated May 24, 2001) simulates fate and transport on the agricultural field whereas EXAMS (2.98.04, dated July 18, 2002) simulates the fate and resulting daily concentrations in the water body. Simulations are carried out with the

1 The primary but indirect exception to this are two Small-Scale Prospective Ground-Water Monitoring Studies for the related pesticide Thiamethoxam (thiamethoxam degrades readily to clothianidin).
MRID 473797-01 A Small-Scale Prospective Groundwater Monitoring Study for Thiamethoxam Insecticide (Platinum™) in Macon County, Georgia. Report dated 1/16/2008.
MRID 474882-01. A Small-Scale Prospective Groundwater Monitoring Study for Platinum" 2SC (Thiamethoxam, CGA-293343) in St. Joseph County, Michigan. Report dated 6/6/2008.

linkage program shell, EXPRESS (1.03.02, dated July 20, 2007). Simulations are run for multiple (usually 30) years, and the EECs represent peak values that are expected once every ten years based on the thirty years of daily values generated during the simulation. Additional information on these models can be found at:
http://www.epa.gov/oppefed1/models/water/index.htm
and at:
http://www.epa.gov/ceampubl/swater/index.html

The aquatic exposure is estimated for the maximum application pattern to a 10-ha field bordering a 1-ha pond, 2-m deep (20,000 m^3) with no outlet. Exposure estimates generated using this standard pond are intended to represent a wide variety of vulnerable water bodies that occur at the top of watersheds including prairie pot holes, playa lakes, wetlands, vernal pools, man-made and natural ponds, and intermittent and first-order streams. As a group, there are factors that make these water bodies more or less vulnerable than the standard surrogate pond. Static water bodies that have larger ratios of pesticide-treated drainage area to water body volume would be expected to have higher peak EECs than the standard pond. These water bodies will be either smaller in size or have large drainage areas. Smaller water bodies have limited storage capacity and thus may overflow and carry pesticide in the discharge, whereas the standard pond has no discharge. As watershed size increases beyond 10-ha, it becomes increasingly unlikely that the entire watershed is planted with a non-major single crop that is all treated simultaneously with the pesticide. For major crops like cereal grains, however, this may not be the case. Headwater streams can also have peak concentrations higher than the standard pond, but they likely persist for only short periods of time and are then carried and dissipated downstream.

OPP standard PRZM crop scenarios, which consist of location-specific soils, weather, and cropping practices, were used in the simulations to represent proposed labeled uses of Clothianidin. These scenarios were developed to represent high-end exposure sites in terms of vulnerability to runoff and erosion and subsequent off-site transport of pesticide. Model input parameters representing the proposed mustard and cotton seed treatment uses are provided in **Table 7** (further details on model input and output are provided in the Appendix).

Table 7. Input parameters for PRZM/EXAMS for the calculation of aquatic and benthic EECs of clothianidin.

Parameter (units)	Value(s)	Sources	Comments
Output File Name	CLOTHIANIDIN	---	---
Chemical Name	Clothianidin	Label	
Crop Names	Mustard seed treatment Cotton seed treatment	Label	Cotton seed treatment is higher rate than previously registered for this type of use. Mustard seed treatment is an entirely new use.

Parameter (units)	Value(s)	Sources	Comments
Application Rate	**lb a.i./a** Mustard (ND Canola scenario) = 0.028 lb ai/A Cotton (NC, MS, & CA scenarios) = 0.0633 lb ai/A	Proposed Labels	
Day of Application (mm-dd)	CA Cotton = 04-24 MS Cotton = 04-24 NC Cotton = 05-25 ND Canola = 05-09		Regionally specific typical planting dates.
Number of Applications Allowed at the Maximum Application Rate	1	Label	
Minimum Interval between Applications (days)	N/A	Label	
CAM (Chemical application method)	5 or 8	Label	CAM 8 represents efficient uniform planting at the nominal depth. CAM 5 allows for some of the seed to be distributed above the target planting depth.
IPSCND (Flag indicating the disposition of pesticide remaining on foliage after harvest)	N/A	---	Applies only if CAM = 2 or 3
DEPI = Incorporation Depth (cm)	Cotton = 1.27 cm Mustard = 1.27 cm	Label	Typical minimum recommended planting depth
K_{OC} (mL/g)	160	MRID 45422311	The average K_{OC} value (of 129, 345, 123, 84 and 119), as per EFED guidance (1). The K_{OC} value represents better the mobility of clothianidin (relative standard deviation is smaller).
Aerobic Soil Metabolism (days)	745	MRIDs 45422325 and 45422326	Represents the 90th percentile of the upper confidence bound on the mean of 9 half-life values. $t_{1/2}$ = 148, 239, 578, 1155, 533, 533, 693, 990, and 495 days. Mean = 596 days, Std. dev. 321 days, $t_{90,\ n-1}$ = 1.397 for n=9. The Fugay soil was excluded because too little degradation occurred to accurately calculate a half-life.
Method of Application	Broadcast	Label	Proposed label
Buffer Zone (ft.)	N/A	Label	Proposed label
Application Efficiency (fraction)	1	---	For seed treatment, the application efficiency is assumed to be 100%.
Spray Drift (fraction)	0	---	For seed treatment, the spray drift value is assumed to be 0%.

Parameter (units)	Value(s)	Sources	Comments
Solubility in Water (ppm)	3270 mg/L	(3)	10X the actual solubility as per EFED guidance (1). Highest available value.
Aerobic Aquatic Metabolism (days)	562	MRID 46826903	3x single measured value
Anaerobic Aquatic Metabolism (days)	81	MRID 45422330	Determined by multiplying the available half-life (27 days) by 3 to account for the uncertainty associated with using a single value.
Hydrolysis at pH 7 half-life (days)	Stable	MRID 45422317	EFED guidance (1).
Aqueous Photolysis (days)	34	MRID 45422323 (soil); 45422318, 45222320, 45422322, 45422319, 45422321 (water)	Longest half-life of 34 days used instead of aqueous photolysis half-life because of demonstrated persistence in water and on soil surface exposed to sunlight. Lower value of ~1 day from natural water photolysis study was not used in the modeling for this assessment.
Molecular Weight (g/mole)	249.7	MRID 45422317	---
Vapor Pressure (torr or mmHg)	3.8×10^{-11} Pa = 2.9×10^{-13} mmHg	(3)	At 20°C
Henry's Law Constant (Atm-m^3/mol)	2.9e-16 Atm-m3/mole	Calculated	At 20°C (Not used for model input)
Environment	pond298.exv	---	Default for pond scenario, as opposed to index reservoir.
Field Size	EPA Pond	---	
Runoff	None	---	---
FEXTRC, Foliar extraction	0.5	---	EFED guidance (1)
PLDKRT, Decay rate on foliage	0	---	EFED guidance (1)
PLVKRT, Volatilization rate from foliage	0	---	EFED guidance (1)
UPTKF, Uptake factor	0	---	EFED guidance (1)
1. All values were selected according to the EFED guidance on input parameters for PRZM/EXAMS (version 2.1.) dated 10/22/09, available at http://www.epa.gov/oppefed1/models/water/input_parameter_guidance.htm 2. Sources for seeding rates and dates of application: Label directions andOPP internal compilations. 3. European Commission Health & Consumer Protection Directorate document, Clothianidin SANCO/10533/05, Jan 2005			

Aquatic EEC values derived from PRZM/EXAMS for each of the modeled crop scenarios are summarized in Table 8 and the benthic (soil pore-water) concentrations are provided in Table 9. Both high- and low-efficiency seedings were simulated: in the high efficiency simulation all of the seed is assumed to have been planted at the target depth (1.27 cm for both uses) whereas in the low efficiency application seed density is highest at 1.27 cm but a lesser concentration of seed is assumed to settle in the soil at a lesser depth.[2] Acute aquatic exposure was estimated to be up to 3.0 ug/L for the cotton seed use and 0.49 ug/L for the mustard seed use. The acute

[2] Refer to the PRZM user manual (http://www.epa.gov/athens/publications/reports/Suarez600R05111PRZM3.pdf) for further details.

concentration in the pore water was estimated to be up to 1.90 ug/L for the cotton seed use and 0.33 ug/L for the mustard seed use. Chronic exposure estimates were only marginally lower in both surface water and benthic pore water (consistent with the high environmental persistence of clothianidin observed in laboratory and field studies).

Table 8. Estimated Environmental Concentrations for Clothianidin in Surface Water.

Scenarios	Peak	21-day Average	60-day Average
	EEC (μg/L)		
Seed Treatment (high incorp. efficiency)			
CA Cotton	0.14	0.14	0.14
MS Cotton	1.47	1.42	1.36
NC Cotton	1.57	1.53	1.48
ND Canola (mustard seed)	0.26	0.25	0.24
Seed Treatment (low incorp. efficiency)			
CA Cotton	0.31	0.31	0.30
MS Cotton	2.80	2.74	2.62
NC Cotton	3.00	2.91	2.82
ND Canola (mustard seed)	0.49	0.48	0.46

Table 9. Estimated Environmental Concentrations for Clothianidin in Benthic (soil-pore) Water.

Scenarios	Peak	21-day Average	60-day Average
	EEC (μg/L)		
Seed Treatment (high incorp. efficiency)			
CA Cotton	0.11	0.11	0.11
MS Cotton	0.81	0.81	0.80
NC Cotton	1.00	1.00	1.00
ND Canola (mustard seed)	0.17	0.17	0.17
Seed Treatment (low incorp. efficiency)			
CA Cotton	0.22	0.22	0.21
MS Cotton	1.58	1.58	1.56
NC Cotton	1.90	1.89	1.88
ND Canola (mustard seed)	0.33	0.33	0.33

We also estimated exposure to organisms ingesting residues from sediment. Peak exposures for both application efficiency level assumptions ranged from 0.74 to 12.83 ug / g of sediment (again, chronic exposure levels were not significantly lower) – see Table 10. Sediment residues normalized for organic carbon content ranged from 0.5 to 8.35 ug / g of sediment (peak or chronic exposure) - see Table 11.

Table 10. Estimated bound sediment concentrations for clothianidin.

Scenarios	Peak	21-day Average	60-day Average
Seed Treatment: Pond Sediment Bound 1/10 year EECs (low incorp. efficiency) --- ng/g (ppb) ---			
CA Cotton	1.47	1.46	1.45
MS Cotton	10.69	10.66	10.57
NC Cotton	12.83	12.80	12.73
ND Canola (mustard seed)	2.25	2.25	2.24
Seed Treatment: Pond Sediment Bound 1/10 year EECs (high incorp. efficiency) --- ng/g (ppb) ---			
CA Cotton	0.74	0.74	0.74
MS Cotton	5.48	5.47	5.43
NC Cotton	6.77	6.77	6.75
ND Canola (mustard seed)	1.18	1.18	1.17

Table 11. Top soil / sediment organic carbon fraction by PRZM/EXAMS scenario.

Scenarios	Organic Carbon (Percent)	Organic Carbon (Fraction)	
Seed Treatment: Pond Sediment Organic Carbon Levels, Cotton and Canola Scenarios[3]			
CA Cotton	0.29%	0.0029	
MS Cotton	1.28%	0.0128	
NC Cotton	2.32%	0.0232	
ND Canola	2.36%	0.0236	

Table 12. Bound Sediment Concentrations for Clothianidin normalized to Organic Carbon content.

Scenarios	Peak	21-day Average	60-day Average
Seed Treatment: Pond Sediment Bound 1/10 year EECs (low incorp. efficiency) --- ng/g (ppb) ---			
CA Cotton	507	503	500

[3] Pond sediment Organic carbon fraction assumed to be equal to the fraction of organic carbon in horizon 1 for the associated PRZM scenario.

MS Cotton	835	833	826
NC Cotton	553	552	549
ND Canola (mustard seed)	95	95	95
Seed Treatment: Pond Sediment Bound 1/10 year EECs (high incorp. efficiency) --- ng/g (ppb) ---			
CA Cotton	255	255	255
MS Cotton	428	427	424
NC Cotton	292	292	291
ND Canola (mustard seed)	50	50	50

3.2 Terrestrial Exposure Estimates

Consumption of clothianidin-treated seed is the most likely exposure route for terrestrial animals. The Terrestrial Exposure Model (Version 1.4.1), was used to estimate the dietary exposure to terrestrial birds and mammals. Because of the differences in foliar application and seed treatment uses of pesticides, the seed treatment worksheet of TREX was used as a "stand-alone" tool for estimating the avian and mammalian exposure concentrations for various crops.

The seed treatment worksheet of TREX assesses dietary exposure in two different ways. The first approach estimates the dietary dose assuming that an organism has been eating only treated seed. Using this assumption, the seed treatment worksheet calculates the food consumed by birds and mammals using Nagy's allometric food consumption equations. Food consumption is calculated for the smallest avian (20-gram weight) and mammalian (15-gram weight) species (**Appendix A**). Using a scaling factor approach, which adjusts food intake and toxicity values to account for the differences in the size of the animal assessed compared with the size of the animal used in the toxicity tests, daily doses or Nagy doses are calculated. Avian and mammalian Nagy doses for clothianidin were calculated using the equation – (daily food intake g/day * 0.001 kg/g * maximum seed application rate mg/kg-seed) / body weight of animal (kg).

The second method calculates the available concentration of pesticide on the basis of pesticide applied per square foot. Maximum clothianidin application for each crop is converted to mg a.i./sq ft in order to derive an estimate of the pesticide exposure per square foot.

Typical input values (for foliar treatments) for TREX include application rate, time interval between two applications, total number of applications and foliar half-life periods. All seeding rate information was obtained from U.S. EPA, 2004b. Since clothianidin is a seed-treatment insecticide, terrestrial EECs were derived using 1 application for the maximum proposed use rates for each crop—The TREX model assumes a default density of 8.33 lb/gal. This density was therefore used in the TREX model. Also, as clothianidin is a seed-treatment, foliar half-life periods are irrelevant for this analysis.

4 Ecological Effects Assessment

The short-term and long-term exposure effects of clothianidin on aquatic and terrestrial organisms were characterized based on the studies submitted by the registrant only as the ECOTOX database review did not reveal any open literature studies for clothianidin that were relevant. Toxicity studies available for this risk-assessment and the measurement endpoints selected for each taxonomic group are included in **Appendix B** of this document.

4.1 Aquatic Effects Summary

4.1.1 Freshwater and Marine Fish

Two freshwater fish toxicity studies using the TGAI are required to establish the acute toxicity of clothianidin to fish. The preferred test species are rainbow trout (a coldwater fish) and bluegill sunfish (a warmwater fish). The acute studies that were submitted that tested the parent compound showed that clothianidin is practically non-toxic to freshwater fish (LC_{50} >105.8 -117 ppm). Studies on degradates (TMG, MNG, and TZNG) indicated a similar practically non-toxic profile (LC_{50} >105 ppm). EFED will use the worst case value (LC_{50} >105.8 ppm) for evaluating acute toxic exposure to freshwater fish.

A freshwater fish early life-stage test using the TGAI is required for clothianidin because the end-use product may be transported to water from the intended use site, and the following conditions are met: (1) clothianidin is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity; (2) studies on aquatic invertebrates showed reproductive effects (daphnid 21-day LOAEC = 0.12 ppm) and (3) clothianidin is persistent in water (e.g., half-life of 744 days aerobic soil metabolism).

A chronic early life stage study conducted on the fathead minnow showed that exposure of 20 ppm has the potential to affect length and dry weight of freshwater fish. The NOAEC of 9.7 ppm will be used for risk assessment purposes.

The preferred test species is sheepshead minnow. The data submitted showed that the LC_{50} = 93.6 ppm; therefore, clothianidin is categorized as slightly toxic to estuarine/marine fish on an acute basis.

4.1.2 Freshwater and Marine Invertebrates

A freshwater aquatic invertebrate toxicity test using the TGAI is required to establish the toxicity of clothianidin to aquatic invertebrates. The preferred test species is Daphnia magna. The data that was submitted that tested the parent compound showed that clothianidin is practically non-toxic to Daphnia magna with an acute 48-hour EC_{50} value of >119 ppm, but that it is very highly toxic to Chironomus riparius with an acute 48-hour EC_{50} value of 0.022 ppm. EFED will use the worst case value (EC_{50}= 0.022 ppm) for evaluating acute toxic exposure to freshwater invertebrates. Additional data (48-hour EC_{50}) on degradates (TZNG, MNG, and TMG) indicated a practically non-toxic to slightly toxic profile (EC_{50} = 64.0 to >115.2 ppm).

Acute toxicity testing with estuarine/marine invertebrates using the TGAI is required for clothianidin because the end-use product is expected to reach this environment due to its potential use on crops with significant acreage in coastal counties. The preferred test species are mysid shrimp and eastern oyster. The data showed that clothianidin significantly reduced survival of mysid shrimp at 0.051 ppm, categorizing the compound as very highly toxic. Clothianidin was categorized as practically non-toxic to Eastern oyster because adverse effects did not occur for this species up to concentrations of 129.1 ppm. EFED will use the worst case value, LC_{50} = 0.051 ppm, for evaluating acute toxic exposure to estuarine/marine invertebrates.

A freshwater aquatic invertebrate life-cycle test using the TGAI is required for clothianidin because the end-use product may be transported to water from the intended use site, and the following conditions are met: (1) the presence of clothianidin in water is likely to be continuous or recurrent and (2) aquatic acute LC_{50} or EC_{50} values are less than 1 ppm (i.e., 0.022 ppm), and (3) physicochemical properties indicate that clothianidin is persistent in the aquatic environment (e.g., half-life of 744 days aerobic soil metabolism).

The preferred test is a 21-day life cycle on Daphnia magna. The data that were submitted show that clothianidin has the potential for chronic toxicity to daphnids and possibly other freshwater invertebrates. Exposure to 0.12 ppm can result in reproductive effects, including the reduced number of juveniles produced per adult. The NOAEC of 0.042 ppm will be used in assessing risk.

An estuarine/marine invertebrate life-cycle toxicity test using the TGAI is required for clothianidin because the end-use product is expected to transport to an estuarine/marine environment from the intended use site, and the following conditions are met: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity, (2) an aquatic acute LC_{50} or EC_{50} is less than 1 ppm (e.g., mysid LC_{50} = 0.051 ppm), and (3) studies of other organisms indicate that the reproductive physiology of fish and/or invertebrates may be affected, physicochemical properties indicate cumulative effects, or the pesticide is persistent in water (e.g., half-life of 744 days aerobic soil metabolism).

The preferred test species is mysid shrimp. The data submitted indicate that clothianidin reduced the number of young per reproductive day at 9.7 ppb. The NOAEC of 5.1 ppb will be used in assessing risk.

Two studies were submitted that assessed toxicity to sediment dwelling freshwater and estuarine/marine invertebrates. One study (MRID 46826902) assessed the toxicity to the midge (*Chironomus riparius*) during a 10-Day sediment exposure. This study revealed an LC_{50} of 11 ppb and a NOAEC of 1.1 ppb based on pore water concentrations. It also showed an LC_{50} based on mean-measured sediment concentrations (OC normalized) of 12.91 mg/kg TOC and a NOAEC of 1.65 mg ai/kg TOC. The other study (MRID 47199401) evaluated a 10-day whole sediment toxicity test with *Leptocheirus plumulosus* using spiked sediment. This study revealed an LC_{50} of 20.4 ppb and a NOAEC of 11.6 ppb based on pore water concentrations. It also revealed an LC_{50} of 315 µg ai/kg TOC and a NOAEC of 204 µg ai/kg TOC based on mean-measured sediment concentrations (OC normalized). Therefore, clothianidin is very highly toxic to sediment dwelling aquatic invertebrates.

Calculations for sediment exposure to benthic organisms followed the equilibrium partitioning model as noted in Appendix D and applied in a previous risk assessment for cypermethrin (DP289427). The pore water based endpoints were measured in the studies, however the sediment based endpoints (OC normalized) are a function of the whole sediment LC50 divided by the proportion of organic carbon in the sediment. PRZM-EXMS provides both pore water and sediment concentrations (which were also adjusted based on the sediment concentration divided by the proportion of organic carbon in the sediment), so these values provided a direct comparison to the endpoints derived from the studies noted above.

Chronic toxicity studies in benthic organisms were not submitted. To assess chronic risk to benthic organisms, chronic toxicity values were derived for both sediment and pore water. The chronic NOAEC estimated for benthic organisms in terms of µg a.i./kg sediment is based on the acute-to-chronic ratio method, determined by the following mathematical relationships:

> Freshwater invertebrate LC_{50} (22 µg a.i./L) / Freshwater invertebrate NOAEC (42 µg a.i./L) = Benthic LC_{50} in sediment 12.91 mg a.i./kg sediment (OC normalized) / X (estimated benthic NOAEC value in sediment), where X = 24,600 µg a.i./kg TOC.
>
> Estuarine/marine invertebrate LC_{50} (51 µg a.i./L) / Estuarine/marine invertebrate NOAEC (5.1 µg a.i./L) = Estuarine/marine Benthic LC_{50} in sediment 315µg a.i./kg sediment(oc normalized) / X (estimated benthic NOAEC value in sediment-oc normalized), where X = 31.5 µg a.i./kg TOC.

The chronic NOAEC estimated for benthic organisms in units of µg a.i./kg pore water is based on the acute-to-chronic ratio method, determined by the following mathematical relationships:

> Freshwater invertebrate LC_{50} (22 µg a.i./L) / Freshwater invertebrate NOAEC (42 µg a.i./L) = Benthic LC_{50} in pore water (11 µg a.i./L) / X (estimated benthic NOAEC value in pore water), where X = 21 µg a.i./L pore water.
>
> Estuarine/marine invertebrate LC_{50} (51 µg a.i./L) / Estuarine/marine invertebrate NOAEC (5.1 µg a.i./L) = Benthic LC_{50} in pore water (20.4 µg a.i./L) / X (estimated benthic NOAEC value in pore water), where X = 2.4 µg a.i./L pore water.

No chronic toxicity tests on clothianidin formulations or clothianidin degradates in freshwater or estuarine/marine benthic organisms were submitted.

4.1.3 Aquatic Plants

Several aquatic plant toxicity studies using the TGAI are required to establish the toxicity of clothianidin to non-target aquatic plants. The recommendation is for testing on five species: freshwater green alga (Selenastrum capricornutum), duckweed (Lemna gibba), marine diatom (Skeletonema costatum), blue-green algae (Anabaena flos-aquae), and a freshwater diatom. Studies submitted for two of the five recommended species showed that exposure to clothianidin at levels greater than or equal to 3.5 ppm reduced biomass of aquatic non-vascular plants and increased the incidence of necrotic fronds in aquatic vascular plants. Studies on degradates (TMG, MNG and TZNG) showed reductions in green algal cell density when exposed to levels >1.46 ppm. The EC_{50} of 64 ppm will be used for evaluating acute toxic exposure to non-target aquatic plants. EFED needs 3 more Core clothianidin studies for the nonvascular surrogate species, marine diatom (*Skeletonema costatum*), blue-green algae (*Anabaena flosaquae*), and a freshwater diatom.

4.2 Terrestrial Effects Summary

4.2.1 Toxicity Effects on Terrestrial animals

An extensive assessment of the potential exposure and risk to avian guideline species exposed to clothianidin by oral intubation or in the diet concluded that clothianidin was moderately toxic to bobwhite quail on an acute basis (LD50> 200 mg/kg) and non-toxic to the mallard duck and bobwhite quail on a sub-acute basis (5 day LC50 >5040 ppm and 5230 ppm), respectively. The submitted chronic toxicity data show that exposure of 525 ppm of clothianidin in the diet adversely affected eggshell thickness (MRID 45422421).

Likewise, an assessment of potential exposure and risk to small mammals exposed to clothianidin by the oral route suggests that clothianidin is moderately toxic to small mammals on an acute oral basis (mouse LD50 = 389 to 465 mg/kg/day). Reproduction studies in rats indicate that concentrations of 500 ppm clothianidin resulted in increased stillbirths and delayed sexual maturation in males. Developmental studies in rabbits indicate that concentrations of 75 mg/kg/day resulted in premature deliveries, decreased gravid uterine weights, and increased litter incidence of missing lung lobes/fetus.

4.2.2 Toxicity Effects on Invertebrates

Currently, EFED does not assess risk to nontarget insects or terrestrial invertebrates using the risk quotient method. However, it appears that clothianidin exposure to honeybees has the potential for high toxicity on both an acute contact and oral basis. Acute toxicity studies to honey bees show that clothianidin has the potential to be highly toxic on both a contact and an oral basis (contact LD50 = 0.044 μg/bee; oral LD50 = 0.0037 μg/bee), while its degradates (e.g.,, TMG, MNG, TZMU, and TZNG) are moderately to practically non-toxic on an oral basis (LD50 = 3.9 - >153 μg/bee). One honey bee field study (MRID # 45422435) showed that mortality, pollen foraging activity, and honey yield were negatively affected by residues of clothianidin; however, residues were not quantified in this study. Another honey bee field study (MRID 45422440) showed that pollen treated with clothianidin at a measured concentration level up to 19.7 μg a.i./kg produced no significant adverse effects to mortality, foraging activity (including pollen and honey collection), comb production, honey storage behavior, population growth (including egg, larvae, pupae, and adult growth stages), and behavioral anomalies. However, only one replicate hive per treatment level was tested, therefore, statistical analysis of the data could not be performed.

Subchronic invertebrate toxicity studies showed that clothianidin adversely affected earthworm mortality and body weight (LC50 = 15.5 ppm) and its degradates reduced body weight (LC50 = 982.6 ppm). There were no apparent effects of clothianidin on earthworm reproduction or population dynamics.

4.2.3 Toxicity Effects on Terrestrial Plants

Terrestrial Tier II studies are required for all low dose pesticides (those with the maximum use rate of 0.5 lbs a.i./A or less) and for any pesticide showing a negative response equal to or greater than 25% in Tier I studies. Two Tier I terrestrial plant toxicity studies were conducted to establish the toxicity of clothianidin to non-target terrestrial plants. The recommendations for seedling emergence and vegetative vigor studies are for testing of (1) six species of at least four dicotyledonous families, one species of which is soybean (Glycine max) and the second of which is a root crop, and (2) four species of at least two monocotyledonous families, one of which is corn (Zea mays). The studies that were submitted tested formulated products of clothianidin (49.3% TI-435 50% WDG). The results of these studies showed that exposure elicited no effect (that is, ≥ 25%) on non-target terrestrial plants, so Tier II tests were not necessary.

4.3 Incident Database Review

One incident was report in the EIIS, which was related to toxic effects to terrestrial invertebrates. The incident (I019743-001) involved hundreds of thousands of honeybees and was listed as highly probable, indicating that exposure to clothianidin was the likely cause of death. According to a press release by a German government agency (BVL) and various news reports, beekeepers in Baden-Wurttemberg region of Germany had reported that two-thirds of their bees died in May 2008 following the application of a pesticide called clothianidin. Tests on dead bees showed that almost all of those examined had a build-up of clothianidin. The chemical, produced by Bayer CropScience, is sold in Europe under the trade name Poncho. The seeds were treated in advance of being planted or were sprayed while in the field. The company said an application error by the seed company, which failed to use the glue like substance ("stickers") that sticks the pesticide to the seed, led to the chemical being dispersed into the air. Clothianidin is a systemic chemical that works its way through a plant and attacks the nervous system of any insect it comes into contact with and it is highly toxic to honeybees. The German Office for Consumer Protection and Food Safety has ordered the immediate suspension of the approval for eight seed treatment products including clothianidin as well as the related neonicotinoid ingredients imidacloprid and thiamethoxam, and the carbamate methiocarb. Germany temporarily pulled the registration for these seed treatments because of these incidents and the result of their studies. Investigations of bee kills determined that use of a particular type of pneumatic drilling equipment with treated seeds was causing a high exposure to bees. It appears that poorly applied corn seed treatments, together with physical abrasion of the treated seed by the pneumatic planters, led to dust clouds of pesticides being formed. These dust clouds drifted onto neighboring crops where bees were foraging.

5 Risk Characterization

Risk characterization is the integration of exposure and effects to determine the ecological risk from the use of such stressors as clothianidin. The risk characterization provides estimations and descriptions of the risk; articulates risk assessment assumptions, limitations, and uncertainties; synthesizes an overall conclusion; and provides the risk managers with information to make regulatory decisions.

5.1 Risk Estimation

The risk quotient (RQ) method was used to provide a metric for potential adverse ecological risks from the proposed uses of clothianidin. The risk quotient, a comparison of exposure estimates and toxicity endpoints, is estimated by dividing exposure concentrations by acute or chronic toxicity values (**Appendix C**). The resulting unitless RQs are compared to the Agency's levels of concern (LOC) to determine the need for regulatory action.

These LOCs are criteria used by OPP to indicate potential risk to non-target organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on non-target organisms. LOCs currently address the following risk presumption categories: (1) **acute** – potential for acute risk is high, regulatory action may be warranted in addition to restricted use classification (2) **acute restricted use** - 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 high, regulatory action may be warranted. Currently, EFED does not perform assessment for chronic risk to plants, acute or chronic risks to non-target insects or chronic risks 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 the results of required studies. Examples of ecotoxicity values derived from results of 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). An example of a toxicity test effect level derived from the results of a long-term laboratory study that assesses chronic effects is (1) NOAEC (birds, fish, and aquatic invertebrates). Risk presumptions, along with corresponding RQs and LOCs are tabulated in

Appendix B.

5.1.1 Aquatic Risk Quotients

The proposed seed treatments did not appear to pose an acute or chronic risk to either freshwater or saltwater/estuarine fish (**Table 10**). However, chronic risk to saltwater/estuarine fish could not be evaluated due to a lack of data on these taxa. In two of the scenarios, Mississippi and North Carolina cotton, the new uses pose acute risk to threatened and endangered freshwater invertebrates for both low efficiency and high efficiency incorporation applications. Only the low efficiency incorporation scenario with Mississippi and North Carolina cotton pose acute risk to threatened and endangered estuarine/marine invertebrates. Regarding chronic risk to aquatic invertebrates, only two scenarios showed risk in the high efficiency incorporation scenarios: the Mississippi and North Carolina cotton scenarios with risk to estuarine/marine invertebrates. However, with low efficiency incorporation there was risk in all scenarios to estuarine/marine invertebrates and risk to freshwater invertebrates in the North Carolina and Mississippi cotton scenarios.

Table 13. Summary of aquatic risk quotients for fish and aquatic invertebrates based on surface water EECs. LOC exceedances are in bold.

Crop	Acute Aquatic Risk Quotients			
High Efficiency Incorporation	**Freshwater Fish**	**Freshwater Invertebrates**	**Estuarine/Marine Fish**	**Estuarine/Marine Invertebrates**
CA Cotton	1.32E-06	0.00636	1.49E-06	0.00274
MS Cotton	1.39E-05	**0.0668**[3]	1.57E-05	0.0288
NC Cotton	1.48E-05	**0.0714**[3]	1.68E-05	0.0308
ND Canola (mustard)	2.46E-06	0.0118	2.78E-06	0.00510
Low Efficiency Incorporation	**Freshwater Fish**	**Freshwater Invertebrates**	**Estuarine/Marine Fish**	**Estuarine/Marine Invertebrates**
CA Cotton	2.93E-06	0.0141	3.31E-06	0.00608
MS Cotton	2.65E-05	**0.127**[3]	2.99E-05	**0.0549**[3]
NC Cotton	2.83E-05	**0.136**[3]	3.20E-05	**0.0588**[3]
ND Canola (mustard)	4.63E-06	0.0223	5.23E-06	0.00961
Crop	**Chronic Aquatic Risk Quotients**			
High Efficiency Incorporation	**Freshwater Fish**	**Freshwater Invertebrates**	**Estuarine/Marine Fish**	**Estuarine/Marine Invertebrates**
CA Cotton	1.44E-05	0.00333	N/A	0.0274
MS Cotton	0.000140	0.0338	N/A	**0.278**[3]
NC Cotton	0.000152	0.0364	N/A	**0.300**[3]
ND Canola (mustard)	2.47E-05	0.00595	N/A	0.0490
Low Efficiency Incorporation	**Freshwater Fish**	**Freshwater Invertebrates**	**Estuarine/Marine Fish**	**Estuarine/Marine Invertebrates**
CA Cotton	3.09E-05	0.00738	N/A	**0.0608**[3]
MS Cotton	0.000270	**0.0652**[3]	N/A	**0.537**[3]
NC Cotton	0.000291	**0.0693**[3]	N/A	**0.570**[3]

ND Canola (mustard)	4.74E-05	0.0114	N/A	**0.0941[3]**

[1]Acute RQs are based on the peak EEC
[2]Chronic RQs are based on the 21-day average EEC for invertebrates and the 60-day average EEC for fish
[3]RQ's exceed the threatened and endangered aquatic invertebrate LOC of 0.05

Risk to sediment dwelling freshwater and estuarine/marine invertebrates was assessed using the methods established for cypermethrin (DP289427) and described in section 4.1.2. Acute risk is a function of the peak pore water and organic carbon normalized sediment concentrations from PRZM-EXMS and the corresponding LC_{50} identified in the studies. Chronic risk is a function of the average 21 day OC normalized sediment bound concentration and the corresponding estimated chronic LC_{50} values also described in section 4.1.2.

The proposed uses result in acute risk to aquatic benthic invertebrates through exposure to both pore water and sediment bound OC normalized concentrations of clothianidin for cotton and mustard (**Tables 11** and **12**). Risk was present for both low efficiency and high efficiency application scenarios. However, chronic risk was only found for estuarine/marine invertebrates exposed to sediment bound residues, but risk was present for all application scenarios (**Table 13**).

Table 14. Summary of aquatic acute risk quotients for benthic aquatic invertebrates based on pore water EECs. Potential LOC exceedances are in bold.

Crop	Benthic Aquatic Invertebrate Risk Quotients[1]			
High Efficiency Incorporation	**Acute RQs for Freshwater Invertebrates**	**Sublethal RQs for Freshwater Invertebrates**	**Acute RQs for Estuarine/Marine Invertebrates**	**Sublethal RQs for Estuarine/Marine Invertebrates**
CA Cotton	0.02	**0.2[2]**	0.0108	0.0190
MS Cotton	**0.144[2]**	**1.44[3]**	**0.0774[2]**	**0.136[2]**
NC Cotton	**0.173[2]**	**1.73[3]**	**0.0931[2]**	**0.164[2]**
ND Canola (mustard)	0.03	**0.3[2]**	0.0162	0.0284
Low Efficiency Incorporation	**Acute RQs for Freshwater Invertebrates**	**Sublethal RQs for Freshwater Invertebrates**	**Acute RQs for Estuarine/Marine Invertebrates**	**Sublethal RQs for Estuarine/Marine Invertebrates**
CA Cotton	0.0222	**0.222[2]**	0.0119	0.0210
MS Cotton	**0.197[2]**	**1.97[3]**	**0.106[2]**	**0.187[2]**
NC Cotton	**0.225[2]**	**2.25[3]**	**0.121[2]**	**0.214[2]**
ND Canola (mustard)	0.0374	**0.374[2]**	0.0201	0.0354

[1]Acute RQs are based on the peak pore-water EEC and the LC_{50}. Sublethal RQs are based on the peak pore-water EEC for invertebrates and the NOAEC.
[2]RQs exceed the threatened and endangered aquatic invertebrate LOC of 0.05
[3]RQs exceed the acute risk LOC of 0.5 and the endangered species LOC of 0.05

Table 15. Summary of aquatic acute risk quotients for benthic aquatic invertebrates based on sediment bound (organic carbon normalized) EECs. Potential LOC exceedances are in bold.

Crop	Benthic Aquatic Invertebrate Risk Quotients[1]			
High Efficiency	**Acute RQs for**	**Sublethal RQs for**	**Acute RQs for**	**Sublethal RQs for**

Incorporation	Freshwater Invertebrates	Freshwater Invertebrates	Estuarine/Marine Invertebrates	Estuarine/Marine Invertebrates
CA Cotton	0.0198	**0.155**[2]	**0.810**[3]	**1.25**[3]
MS Cotton	0.0332	**0.259**[2]	**1.36**[3]	**2.10**[3]
NC Cotton	0.0226	**0.177**[2]	**0.926**[3]	**1.43**[3]
ND Canola (mustard)	0.00387	0.0303	**0.159**[2]	**0.245**[2]
Low Efficiency Incorporation	**Acute RQs for Freshwater Invertebrates**	**Sublethal RQs for Freshwater Invertebrates**	**Acute RQs for Estuarine/Marine Invertebrates**	**Sublethal RQs for Estuarine/Marine Invertebrates**
CA Cotton	0.0393	**0.307**[2]	**1.61**[3]	**2.48**[3]
MS Cotton	**0.0647**[2]	**0.506**[3]	**2.65**[3]	**4.09**[3]
NC Cotton	0.0428	**0.335**[2]	**1.75**[3]	**2.71**[3]
ND Canola (mustard)	0.00738	**0.0578**[2]	**0.303**[2]	**0.467**[2]

[1]Acute RQs are based on the peak OC normalized sediment bound EEC and the OC normalized LC_{50}. Sublethal RQs are based on the peak OC normalized sediment bound EEC for invertebrates and the OC normalized NOAEC.
[2]RQs exceed the threatened and endangered aquatic invertebrate LOC of 0.05
[3]RQs exceed the acute risk LOC of 0.5 and the endangered species LOC of 0.05

Table 16. Summary of aquatic chronic risk quotients for benthic aquatic invertebrates based on sediment bound (organic carbon normalized) EECs. Potential LOC exceedances are in bold.

Crop	**Benthic Aquatic Invertebrate Risk Quotients**[1]			
High Efficiency Incorporation	**Freshwater Invertebrates – Pore Water**	**Freshwater Invertebrates – Sediment Bound**	**Estuarine/Marine Invertebrates – Pore Water**	**Estuarine/Marine Invertebrates – Sediment Bound**
CA Cotton	0.00524	0.0104	0.0458	**8.10**[2]
MS Cotton	0.0386	0.0174	0.337	**13.6**[2]
NC Cotton	0.0476	0.0119	0.417	**9.26**[2]
ND Canola (mustard)	0.00809	0.00203	0.0708	**1.59**[2]
Low Efficiency Incorporation	**Freshwater Invertebrates – Pore Water**	**Freshwater Invertebrates – Sediment Bound**	**Estuarine/Marine Invertebrates – Pore Water**	**Estuarine/Marine Invertebrates – Sediment Bound**
CA Cotton	0.0105	0.0205	0.0917	**16.0**[2]
MS Cotton	0.0752	0.0338	0.658	**26.4**[2]
NC Cotton	0.0900	0.0224	0.787	**17.5**[2]
ND Canola (mustard)	0.0157	0.00387	0.137	**3.03**[2]

[1]RQs are based on the 21 day pore-water and OC normalized sediment bound residue EEC and the estimated chronic EC_{50}.
[2]RQs exceed the chronic LOC of 1

Risk to vascular and non-vascular plants was negligible. Using data on *Lemna gibba* and the most sensitive algal species, *Selenastrum capricornutum*, RQ's ranged from 0.00205 for listed non-vascular plants and 5.08E-05 for listed vascular plants in the most conservative scenario for low efficiency incorporation applications. Neither of these values, which represents the maximum RQ's that can be expected, exceeds the endangered aquatic plant LOC of 1.

5.1.2 Terrestrial Risk Quotients

Table 14 summarizes the acute and chronic avian and mammalian RQs. Two scenarios were modeled for birds and mammals. The first scenario is based on the lack of a specific method of incorporation in the label language. In this scenario, 100% availability of the treated seed was assumed based on a broadcast application without incorporation or minimal incorporation. In this scenario, maximum avian acute RQ's ranged from 2.67 to 3.06 for cotton and mustard, respectively, and chronic RQ's ranged from 17.07 to 19.51. These RQ's result in risk to listed on non-listed birds. Maximum mammalian acute RQ's ranged from 1.64 to 1.87 for cotton and mustard, respectively, and chronic RQ's ranged from 23.33 to 26.67. These RQ's also result in risk to listed and non-listed mammals. However, under the second scenario in which an incorporation method is specified (i.e. T-Banded – covered with specified amount of soil, In-furrow, drill, or shanked-in) the resulting RQ's showed a maximum value of 0.03 for acute risk and 0.27 for chronic risk, neither of which result in risk to listed or non-listed birds or mammals.

Currently, EFED does not assess risk to non-target insects. Results of acceptable studies are used for recommending appropriate label precautions. Available registrant submitted studies for the honey bee indicated that clothianidin is highly toxic to bees. While bees will generally not be exposed to clothianidin residues through direct contact due to the seed treatment, exposure to contaminated pollen and nectar could not be evaluated. Therefore, EFED cannot predict risk in any capacity towards insects.

Table 17. Summary of Terrestrial Acute and Chronic Risk Quotients. Values in bold represent an exceedence of the respective LOC.

Crop	Acute Dose-Based RQs				Chronic RQs[3]	
	Avian RQs		Mammalian RQs		Avian RQs	Mammalian RQs
	RQ1[1]	RQ2[2]	RQ1[1]	RQ2[2]		
Cotton[4]	**2.67**	**0.1**	**1.64**	**0.1**	**17.07**	**23.33**
Cotton[5]	0.03	0.00	0.02	0.00	0.17	0.23
Mustard[4] (condiment, oilseed)	**3.06**	0.04	**1.87**	0.04	**19.51**	**26.67**
Mustard[5] (condiment, oilseed)	0.03	0.00	0.02	0.00	0.02	0.27

[1]Acute RQs for birds and mammals are determined by dividing the estimated dietary intakes (mg/kg-bw/day) by a body weight adjusted avian LD_{50} of 1333 mg/kg-bw for mallard duck and a body weight adjusted mammalian LD_{50} of 5000 mg/kg-bw for the rat.
[2]Acute RQs were based on pesticide applied per square foot (mg a.i./ft^2/LD_{50}*bw)
[3]Chronic RQs were based on clothianidin seed application rate (mg a.i./kg seed) divided by a dietary-based NOAEC (550 mg/kg-diet for the mallard duck and a 200 mg/kg-diet for the rat).
[4]RQ's based on broadcast application with 100% availability of application rate on seeds.
[5]RQ's based on specified incorporation method and 1% availability of application rate on seeds.

5.2 Risk Description

The results of this baseline risk assessment show that the proposed new uses may pose acute risk to both freshwater and saltwater invertebrates. The results also indicate that the proposed uses for clothianidin may pose risk to both non-listed and listed mammalian and avian taxa, depending on the presence or absence of protective label language. Therefore, the hypothesis is supported that clothianidin has the potential to compromise survival and cause sub-lethal effects in non-target species. Risk to non-target beneficial insects cannot be assessed, but will be qualitatively discussed in the following sections.

5.2.1 Risk to Aquatic Organisms

The available data on clothianidin show that the compound is relatively persistent to very persistent under most circumstances. Clothianidin is stable to hydrolysis at all pH's at environmental temperatures, moderately to highly stable under aerobic soil metabolism conditions (half-lives range from 148-6,900 days), and shows moderate stability under anaerobic aquatic metabolism (half-life of 27 days for the overall system). Laboratory data suggests that photolysis appears to play a role in the dissipation of the chemical (half-life of 14.4 hours in sterile water, 25.4 hours in natural water, and 34 days on soil). Clothianidin has medium to very high mobility in soils. The fact that the KOC's of four of the five soils were of similar order of magnitude (range 84-129) indicates that there may be a correlation of the mobility with the organic carbon content of the soil. Certain degradates appeared to accumulate in some soils under some conditions [e.g., TZNG MNG, NTG, (aerobic) and TMG (anaerobic)]; over the very long term significant contamination of soil and water with these products might occur. The terrestrial field dissipation studies confirm the findings in the laboratory studies. Clothianidin was found to be persistent in the field (half-lives of 277 days, 1,400 days, and too high to calculate). Based on the overall picture that the laboratory and field studies provided, EFED concluded that there is a very high likelihood that clothianidin would persist and accumulate from year to year after repeated uses.

The potential impact to water quality from the use of clothianidin appears to be most likely due to the parent compound. The laboratory studies indicate that clothianidin is initially labile and then relatively persistent under most environmental conditions. This makes the chemical available for lengthy periods of time for runoff and exposure to aquatic environments. The impact of clothianidin to aquatic environments will also be affected by its mobility. The available studies indicated that clothianidin is persistent and mobile, stable to hydrolysis and has potential to leach to ground water and be transported via runoff to surface water, and will accumulate and persist in soils.

Non-target aquatic organisms (freshwater and estuarine/marine fish and invertebrates) can be exposed to clothianidin from the proposed uses mainly by runoff into surface water. EFED's risk assessment suggests that toxic risk to freshwater and estuarine/marine fish appears low. Acute, restricted use, and endangered species acute and chronic levels of concern for freshwater and estuarine/marine fish were not exceeded for the application rates and uses evaluated. Chronic risk to estuarine/marine fish could not be evaluated in this assessment due to the lack of data on this taxa. Given the low level of chronic toxicity of freshwater fish as well as the low acute toxicity of estuarine/marine fish, as well as the resulting very low RQ values to these taxa, it appears unlikely that the proposed uses of clothianidin would pose a chronic risk to estuarine and marine fish.

The proposed uses for mustard did not result in acute or chronic risk to either freshwater or estuarine/marine free-swimming invertebrates, except in the low efficiency incorporation where chronic risk was found for estuarine/marine invertebrates. However, the proposed cotton use in two of the scenarios, North Carolina and Mississippi, posed acute risk to freshwater invertebrates in both the low efficiency and high efficiency incorporation methods. Only the low efficiency incorporation method posed acute risk in the same scenarios to estuarine and marine invertebrates, suggesting that the method of incorporation is important in determining risk to these taxa. Chronic risk to free-swimming estuarine/marine invertebrates was present in all of the cotton scenarios with low incorporation efficiency, but only in North Carolina and Mississippi with high incorporation efficiency. High incorporation efficiency eliminated chronic risk to freshwater free-swimming invertebrates.

The clothianidin toxicity threshold is low for freshwater benthic invertebrates on an acute basis, so their vulnerability represents acute potential risk from accumulations of clothiandin in sediments. A comparison of peak EECs, both pore water and sediment bound residues, with the LC_{50} (mortality) and the NOAEC (sublethal) reveals that the proposed uses have the possibility of acute toxic risk to non-endangered and endangered freshwater and estuarine/marine benthic invertebrates, via runoff especially if repeated uses occur (**Table 12**). The acute risk, based on both lethal and sublethal effects, to estuarine/marine benthic invertebrates was independent of the region and the incorporation efficiency when exposure occurs via sediment bound concentrations. Chronic risk to this taxa also shows a similar result. This conclusion suggests that the application rates would need to be amended or other mitigation options that would reduce run-off are required to refine the risk any further.

5.2.2 Risk to Terrestrial Organisms

EFED's risk characterization of terrestrial animals focused on the potential for acute and chronic toxic risk from exposure to residual clothianidin after application. Based on proposed application rates and uses, acute risks is possible to terrestrial small birds and mammals. Results from exposure modeling of representative species indicates that acute (small birds and mammals) and chronic (birds and mammals) RQs exceed LOCs.

The exceedences and thus the risk are only present when no label language specifies the incorporation method. Given no incorporation or only minimal incorporation, the proposed uses for mustard and cotton pose an acute and chronic risk to birds and mammals. Incorporation of the treated seeds into the soil by certain methods as modeled in TREX eliminated all of the risk to both birds and mammals in the risk picture. According to current modeling approaches in EFED using TREX, the modeling assumptions for the various incorporation methods are as follows in terms of percent a.i. still available on the seeds that could be forage:

- T-Banded – covered with specified amount of soil: 1%
- In-furrow, drill, or shanked-in: 1%
- Side-dress, banded, mix, or lightly incorporate with soil: 15%
- Broadcast, mix, or lightly incorporated: 15%
- Side-dress, banded, unincorporated: 100%
- Broadcast, aerial broadcast, unincorporated: 100%

These modeling assumptions illustrate the typical types of seed incorporation that can best mitigate any risk to birds and mammals.

Another source of potential concern is the uncertainty surrounding clothianidin's possible role as an endocrine disrupter as noted from mammalian developmental and reproductive effects. This issue is compounded by the fact that clothianidin is an analog of nicotine and that studies in the published literature suggest that nicotine, when administered, causes developmental toxicity, including functional deficits, in animals and/or humans that are exposed in utero. Mammalian data shows that exposure to clothianidin can result in developmental effects (rabbit) that include premature deliveries, decreased gravid uterine weights, and increase incidence of missing lung lobe in fetus. The mammalian data also suggests that chronic toxicity in mammals can be manifested as systemic effects that can include decreased body weight gains and delayed sexual maturation (males only); decreased absolute thymus weight in F1 pups (both sexes), and increased stillbirths (F1 and F2 litters). Reproductive effects were also noted for adult rats that included decreased sperm motility and increased number of sperm with detached heads. Although these effects did not reduce rat fecundity, they do raise an uncertainty as to possible reproductive effects to other species that may have a more limited (less frequent) reproductive capability.

Accumulation of clothianidin in soils as the result of multiple applications and repeated or continuous exposure may adversely affect soil invertebrates. Subchronic invertebrate toxicity studies showed that clothianidin adversely affected earthworm mortality and body weight (LC_{50} = 15.5 ppm) and its degradates reduced body weight (LC_{50} = 982.6 ppm). Additional testing (chronic study) or modeling may be needed to determine if soil invertebrates are at risk from repeated uses of clothianidin.

Although EFED does not do a risk assessment on non target insects, information from standard tests and field studies, as well as incident reports involving other neonicotinoid insecticides (e.g., imidacloprid) also suggest the potential for long term toxic risk to honey bees and other beneficial insects. Other neonicotinoid compounds like imidacloprid (e.g., sunflower seed treatment) have resulted in incidents to honey bees. The National Union of French Beekeepers had concerns regarding imidacolprid (GAUCHO) seed treatment to sunflowers after beekeepers noted that honey bees were showing modifications of behavior that were reflected in foraging and orientation that eventually resulted in a drastic change in hive conditions and bee survival. Further research by the Le Centre Technique Interprofessional des Oleagineux (CETIOM) confirmed imidacloprid toxic residue levels in the sunflower nectar. This action has prompted France to ban the use of imidacloprid for sunflower seed treatment. Since clothianidin has a similar toxicity profile as imidacloprid and is a member of the same family of compounds, there is uncertainty regarding the toxic risk to honey bee development and foraging behavior, as well as the welfare of the queen from long term exposure to clothianidin residues that can be stored in the hive in honey and/or pollen.

A previous field study (MRID 46907801/46907802) investigated the effects of clothianidin used as a seed treatment on whole hive parameters and was classified as acceptable. However, after another review of this field study in light of additional information, deficiencies were identified that render the study supplemental.

In this field study, control and treated plots were each 1 hectare in size and paired, so that 4 sites were established with a control plot paired with a treated plot. These plots were separated by a minimum of 250 m. The study author states, "Of 23 back-up control nectar samples, 2 (field E1C, July 7; field W3C, July 7) had detectable clothianidin residues, at a maximum of 0.922 ppb, suggesting that workers in control colonies may have foraged on clothianidin-treated canola. This may have occurred because the separation between some pairs of control and treated fields was insufficient or because the forage in some control fields was of lower quality…" The inverse may also have occurred. That is, bees placed on treated fields likely foraged on the control fields, which would have reduced the level of exposure to clothianidin residues due to a lack of separation between sites. Bees have been shown to forage up to 6 km (Visscher and Seeley, 1982) or even twice that in some instances when no competing forage is present (Ratnieks, 2000). The distance of 250 m is inadequate for this separation. The inadequacy is evident given contamination in some of the nectar samples taken from control hives.

Furthermore, the study authors state that, "Approximately 5 g of pollen was analyzed under a light microscope, which confirmed that bees foraged on canola, while the remainder…". This type of identification simply identifies that canola was present in the pollen samples, but does not quantify the proportion of canola pollen present in the sample. This type of pollen evaluation does not characterize the foraging of the bees. The bees in the treated fields could have foraged disproportionately on other uncontaminated sources relative to bees in the control fields. Furthermore, the study authors simply state that to their knowledge, no other forage was present with a radius of 1 km from the edge of the fields. However, given the ability of bees to forage long distances, this lack of data leaves uncertainty in the exposure and suggests that this study did not provide the worst case exposure scenario necessary for use in characterizing risk.

An addendum (MRID 46907802) was submitted later that presented the results of the overwintering part of the study, which revealed that the majority of the hives, including those exposed to clothianidin during the previous season, survived the overwintering period. However, the cross-contamination in the control hives prevents a comparison between the control hives and the treated hives as they relate to whole hive parameters in this addendum. Therefore, this study can only be used to provide a qualitative description of hive survival following the exposure to clothianidin at the levels that were described in the study.

It does not satisfy the guideline 850.3040, and another field study is needed to evaluate the effects of clothianidin on bees through contaminated pollen and nectar. Exposure through contaminated pollen and nectar and potential toxic effects therefore remain an uncertainty for pollinators. Further studies are needed to determine the toxicity to honeybees from seed treatment applications.

Bayer has submitted an interim report (MRID 477987-01) on a study they are conducting in Austria. According to the report, the objective of the study was to investigate the frequency at which maize seedlings exude guttation fluid and to assess the relevance of guttation fluid to honeybees. Although not specifically mentioned in the text of the report, the study material appears to be clothianidin (based on one of the report figures). Over the two study areas, roughly 83% of the maize seedlings exuded guttation liquid. According to the report 16% of the assessment days at which guttation fluid was observed, honeybees were present when no alternative water supply was available; however, when alternative water was available, the honeybee visitation rate was 4%. Clothianidin residue levels in bees were greater than the level of quantification up to 14 days after seedling emergence; in bees without alternative water supply, honeybee mortality appeared to be correlated with clothianidin residues; however, the number of bees for which this relationship existed is uncertain. The study authors state that despite an increased bee mortality in some hives for 1 - 3 days during the survey, the overall development of the hives was not adversely affected by guttation fluid even under realistic, worst case exposure conditions.

This is an interim report and it does not contain sufficient detail or raw data with which to understand the study. The methods section does not describe the placement of colonies with and without water, nor is it possible to determine what bees were actually foraging on during the study period. It appears from the study that at least some of the bees did take advantage of the guttation liquid and that they were exposed to clothianidin. In some cases, bees exhibited behavioral effects and increased incidence of mortality that appeared to be associated with elevated clothianidin residues.

Clothianidin is a neonicotinoid insecticide that is relatively persistent in the environment; the compound is intended to be systemic in plants and the extent to which residues may be present in various plant tissues from seed treatments is uncertain. Clothianidin is highly toxic to bees on both an acute contact and oral exposure basis. A concern from the current seed treatment uses may be to beneficial insects (pollinators) that forage on crops grown from treated seed where exposure may occur through ingestion of residues in pollen and nectar as well as through guttation water produced by developing seedlings. Seed treatments are normally considered a lower exposure element to bees due to possible full ground incorporation of the seeds as well as a low drift component of the application to adjacent areas where bees may forage. However, recent incidents in Europe resulting from seed treatments where appropriate stickers were not utilized, indicate that dust-off drift can also have a significant impact on pollinators foraging in the vicinity of recently seeded fields under some environmental conditions. As such, there is uncertainty regarding the extent to which seed treatments may represent a route of exposure due to the compound's systemic and persistent nature.

5.2.3 Risk Refinement

Both high and low efficiency incorporation resulted in acute risk to freshwater invertebrates in North Carolina and Mississippi cotton, whereas cotton in California and mustard in North Dakota did not result in an exceedence of the LOC. These results suggests that certain regions of the country are more vulnerable to run-off and exposure of the proposed application rates of clothianidin, and therefore to the potential for the toxic effects of clothianidin to freshwater invertebrates. The acute lethal toxicity to benthic invertebrates also suggests this conclusion.

These organisms are an integral part of the freshwater trophic system and serve as both decomposers/predators that are important for nutrient cycling and a food source for larger predators (e.g., fish). The ecological integrity in these vulnerable areas in the U.S. could therefore be impacted by the use on cotton at the proposed application rate. A reduction in the cotton application rate together with maximum incorporation of the seeds into the ground could therefore limit the exposure of clothianidin to aquatic invertebrates through run-off.

Specific label language that clearly states a method of incorporation and incorporation depth would make a significant impact on other risk conclusions of the proposed new uses. Risk to estuarine/marine invertebrates on an acute basis could be effectively mitigated by this label language, as shown by the lack of LOC exceedences in the high efficiency incorporation scenario (section 5.1.1). In addition, label language that would specify more efficient incorporation methods, such as T-banded incorporation with a specified depth, would eliminate all risk to birds and mammals by burying the seeds into the ground and thereby limiting any foraging on these seeds.

5.3 Uncertainties

5.3.1 Exposure and Effects Assessment

- Accumulation of clothianidin in soils after repeated uses and the potential for transport/migration to surface water bodies and potential risk to sensitive aquatic invertebrates (e.g., sediment-dwelling benthic organisms)
- Potential toxic risk to pollinators (e.g. honeybees) as the result of accumulation from seed treatments and/or foliar spray on plants/blooms from repeated uses in cotton and mustard
- Repeated or continuous exposure to soil invertebrates and small mammals to clothianidin accumulated in soils after repeated uses.
- Data Gaps: The data gaps that were outlined in Section 2.6.1 were either required or conditionally required for clothianidin and still have to be submitted. Acceptable data from these studies will aid in reducing some of the uncertainty associated with this assessment.

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Appendix A. REX Methodology to Calculated Nagy Doses (EECs) and Risk Quotients for Birds and Mammals

The seed treatment worksheet of TREX calculates the avian and mammalian doses or exposure concentrations using two approaches: Nagy doses (mg a.i./kg-bw day^{-1}) and pesticide available on unit soil surface area (mg a.i. ft^2). Nagy doses are used in the calculation of both acute and chronic RQs for birds and mammals. Only acute RQs are calculated using the pesticide available on unit soil area.

Nagy doses for seed treatment applications are calculated using the scaling factor approach for a 20-gram bird and 15-gram mammal. The scaling factor approach adjusts the food intake and toxicity values to account for the differences in the size of the animal assessed compared with the size of the animal used in the toxicity tests. The Agency calculates the avian and mammalian Nagy doses using the equation below:

Avian and Mammalian Nagy Doses (mg a.i./kg-bw) = (daily food intake g/day *0.001 kg/g * maximum seed application (mg/kg-seed) / (body weight of animal (kg)

In the second approach, the amount of pesticide available on unit soil surface area is calculated by converting the maximum application rate from lb $acre^{-1}$ to mg a.i./ft^2. The equation used for this calculation is presented below:

Available a.i.(mg a.i./ft^2) = (Maximum application rate (lbs/Acre) * 10^6 mg/kg) / (43,560 square feet/acre * 2.2 lb/kg)

Calculation of Risk Quotients (RQs) for Seed Treatment Applications

Acute risk quotients are calculated using the adjusted LD_{50} value for the smallest weight class of animal (20g for birds and 15g for mammals). Acute RQs are calculated using the two methods:

Method 1 or EEC/LD_{50} method

Acute RQ = mg a.i./kg^{-1} day^{-1}/adjusted LD_{50}

Method 2 or EEC/LD_{50} ft^{-2} method

Acute RQ = mg/kg^{-1} a.i. ft^2 / (adjusted LD_{50} * body weight (kg)

Chronic RQs, which are not adjusted to different weight classes of birds or mammals, are calculated using the following equation:

Appendix B. Summary of Ecotoxicity Data

Toxicity to Terrestrial Animals

Birds, Acute and Subacute
An oral toxicity study using the technical grade of the active ingredient (TGAI) is required to establish the acute toxicity of clothianidin to birds. The preferred guideline test species is either mallard duck (a waterfowl) or bobwhite quail (an upland gamebird). The data that were submitted show that the 14-day oral LD_{50} is >2,000 mg/kg for bobwhite quail. The NOAEL is 500 mg/kg with observed effects including reduced mean body weights, mortality and clinical effects (subdued birds) in the 1,000 and 2,000 mg/kg test groups. A study conducted on a non-guideline species, Japanese quail, showed that the 14-day oral LD_{50} is 423 mg/kg. The NOAEL is 12.5 mg/kg bw based on clinical signs of toxicity (lethargy and ruffled appearanced) at the 25 mg/kg treatment level. Based on these results, clothianidin is categorized as ranging from practically non-toxic to moderately toxic to avian species on an acute oral basis; the guideline (71-1) is fulfilled (MRID #45422417).

Avian Acute Oral Toxicity

Species	% ai	LD50 (mg/kg)	Toxicity Category	MRID No. Author, Year	Study Classification
Northern bobwhite quail (Colinus virginianus)	96.0	>2,000	Practically non-toxic	45422417 Johnson, 1998	Core
Japanese Quail (Coturnix coturnix japonica)	97.6	423	Moderately toxic	45422418 Gallagher et al., 2000	Supplemental

Two dietary studies using the TGAI are required to establish the subacute toxicity of clothianidin to birds. The preferred test species are mallard duck and bobwhite quail. The data that were submitted show that the 8-day acute dietary LC_{50} is >5,000 ppm; therefore, clothianidin is categorized as practically non-toxic to avian species on a subacute dietary basis. The 8-day NOAEC's for each species based on sublethal effects (reduced body weight gain) were 309 ppm for the quail and 646 ppm for the mallard. The guideline (71-2) is fulfilled (MRID #45422419; MRID #45422420).

Avian Subacute Dietary Studies

Species	% ai	5-Day LC50 (ppm)[1]	Toxicity Category	MRID No. Author, Year	Study Classification
Northern bobwhite quail (Colinus virginianus)	96	>5,230	Practically non-toxic	45422419 Johnson, 1998	Core
Mallard duck (Anas platyrhynchos)	96	>5,040	Practically non-toxic	45422420 Johnson, 1998	Core

Birds, Chronic
Avian reproduction studies using the TGAI are required for clothianidin because birds may be subject to repeated or continuous exposure to the pesticide, especially preceding or during the breeding season. The preferred test species are mallard duck and bobwhite quail. The submitted data show that clothianidin exposure of 525 ppm adversely

affected eggshell thickness for bobwhite quail, but did not result in chronic effects during reproduction for mallard duck; the guideline (71-4) is fulfilled (MRID #45422421; MRID #45422422).

Avian Reproduction

Species	% ai	NOAEC/LOAEC (ppm)	LOAEC Endpoints	MRID. No. Author, Year	Study Classification
Northern bobwhite quail (Colinus virginianus)	97.6	205/525	Eggshell thickness	45422421 Gallagher et al., 2000	Core
Mallard duck (Anas platyrhynchos)	97.6	525/>525	No effect on reproduction	45422422 Gallagher et al.., 2000	Supplemental

Mammals, Acute and Chronic

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, rat or mouse toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. These toxicity values are reported below.

Mammalian Acute and Chronic Toxicity

Species	% a.i.	Test Type	Toxicity	Affected Endpoints	MRID No. Author, Year
Rat (Rattus norvegicus)	96	Acute	LD_{50} =5,000 mg/kg/day	Mortality	45422621 Gardner, 1997
Mouse (Mus musculus)	96	Acute	LD_{50} = 389-465 mg/kg/day	Mortality	45422622 Gardner, 1997
Rat (Rattus norvegicus)	96	2-Generation Reproduction	NOAEL (M/F) = 9.8/11.5 mg/kg/day (150/500 ppm)[5] LOAEL (M/F) = 31.2/36.8 mg/kg/day (500/500 ppm)[5] NOAEL (M) = 31.2 mg/kg/day (500 ppm0)[5] LOAEL (M)= 163.4 mg/kg/day (2500 ppm)[5]	Offspring systemic[1] Reproduction[2]	4522714-16 and 45422825-26, 2000 and 2001
Rabbit (Sylvilagus sp.)	96	Developmental	NOAEL/LOAEL = 25/75 mg/kg/day (825/2,475 ppm)[4]	Development[3]	45422712 and -13, 1998

[1]Decreased body weight gains and delayed sexual maturation (males only); decreased absolute thymus weight in F1 pups (both sexes), and increased stillbirths (F1 and F2 litters).
[2]Decreased sperm mobility and increased number of sperm with detatched heads (F1 and F2 litters).
[3]Premature deliveries, decreased gravid uterine weights, and increased litter incidence of missing lobe of the lung

Species	% a.i.	Test Type	Toxicity	Affected Endpoints	MRID No. Author, Year
per fetus. [4]ppm conversion based on: 1 mg/kg/day = 20 ppm in adult rats, 10 ppm in younger rats, 7 ppm in mice and 33 ppm in rabbits. (Nelson, 1975) [5]ppm value determined from study.					

The results indicate that clothianidin is categorized as practically non-toxic to small mammals on an acute oral basis (LD_{50} = 389->5,000 mg/kg/day).

In the 2-generation rat reproduction study, offspring systemic toxicity was detected for males and females at 500 ppm and reproductive toxicity was detected in males at 2500 ppm. The NOAEL for offspring systemic toxicity was 150 and 500 ppm for males and females, respectively, and the NOAEL for reproduction was 500 ppm. In the rabbit developmental study, toxicity was observed at 75 mg/kg/day; the NOAEL was 25 mg/kg/day.

Insects, Acute Contact and Oral

A honey bee acute contact study using the TGAI is required for clothianidin because its foliar application treatment use will result in honey bee exposure. The acute contact LD_{50}, using the honey bee, Apis mellifera, is an acute contact, single-dose laboratory study designed to estimate the quantity of toxicant required to cause 50% mortality in a test population of bees. The acute contact LD_{50} for clothianidin is 0.0439 µg a.i./bee and it is, therefore, classified as highly toxic to bees on a contact exposure basis [LD_{50} < 2 µg a.i./bee, based on toxicity categories in Atkins (1981)]. The guideline (141-1) is fulfilled (MRID No. 45422426).

Five acute oral toxicity studies are available for clothianidin and its metabolites; however, they are categorized as supplemental because the submission of honey bee acute oral toxicity studies is not a guideline requirement. The Office of Pesticide Programs (OPP) does not have a categorization scheme for acute oral toxicity to honey bees. However, based on the ICBB (1985) acute oral toxicity categorization scheme, clothianidin would be considered highly toxic to the honey bee by the oral route. With the exception of TZNG, the clothianidin metabolites TMG, MNG, and TZMU would be virtually non-toxic to honey bees. TZNG would be moderately toxic.

Nontarget Insect Acute Contact and Oral Toxicity

Species/Study Duration	% ai	LD50 (µg ai/bee)	Toxicity Category	MRID No. Author, Year	Study Classification
Honey bee Acute Contact Toxicity - Clothianidin					
Honey bee (Apis mellifera) 48 hour	96	0.0439	highly toxic	45422426 Weyman, 1998	Core
Honey bee Acute Oral Toxicity - Clothianidin					
Honey bee (Apis mellifera) 48 hour	96	0.0037	not applicable	45422426 Weyman, 1998	Supplemental
Honey bee Acute Oral Toxicity - Clothianidin Metabolite -TMG					
Honey bee (Apis mellifera) 48 hour	96	≥152	not applicable	45422427 Wilkins, 2000	Supplemental
Honey bee Acute Oral Toxicity - Clothianidin Metabolite - MNG					
Honey bee	99.2	>153	not applicable	45422428	Supplemental

Species/Study Duration	% ai	LD50 (µg ai/bee)	Toxicity Category	MRID No. Author, Year	Study Classification
(Apis mellifera) 48 hour				Wilkins, 2000	
Honey bee Acute Oral Toxicity - Clothianidin Metabolite - TZMU					
Honey bee (Apis mellifera) 48 hour	98.8	>113	not applicable	45422429 Wilkins, 2000	Supplemental
Honey bee Acute Oral Toxicity - Clothianidin Metabolite - TZNG					
Honey bee (Apis mellifera) 48 hour	98.6	3.95	not applicable	45422430 Wilkins, 2000	Supplemental

Insects, Mortality, Reproduction, and Feeding Capacity

Two studies were submitted to show acute effects of corn (MRID 45422520) and summer rape (MRID 45422521) seeds treated with TI 435 FS600 (formulated product) on carabid beetles (Poecilus cupreus) under extended laboratory test conditions. The goal of these studies was to evaluate whether or not exposing carabid beetles to clothianidin treated corn or rape seeds increased mortality or decreased feeding rate compared to the controls. About one third of the adult carabid beetles exposed to the treated corn seeds at a seed treatment rate of 0.45 lb ai/A showed abnormalities (undescribed signs of intoxication). Rape seed treated with clothianidin at an application rate of 0.095 lb ai/A caused behavioral impacts (intoxication) to 63 % of adult carabid beetles in the treatment group. The feeding rate of beetles in the treatment group was significantly reduced. There was also a significant difference in mortality (13.3 %) of the treatment group compared to the control. These studies were scientifically sound and classified as Supplemental.

Three studies (MRID Nos. 45422524, 45422522, & 45422523) were submitted to show effects of clothianidin on the life cycle of rove beetles (Aleochara bilineata) under extended laboratory conditions. The first study (MRID No. 45422524) was designed to evaluate the effects clothianidin would have on the beneficial ground beetles exposed to the pesticide in treated soil. Study endpoints were adult mortality and reproduction (total number of progeny produced). In this study, there were no significant differences observed between the control and clothianidin treatment groups for adult mortality. Reproductive performance (as indicated by decreased number of progeny) was affected in the two highest clothianidin treatment groups (200 and 250 µg a.i./kg soil). The goal of final two (2) rove beetle studies was to evaluate whether or not exposure of rove beetles to corn seeds (MRID No. 45422522) treated at a rate of 0.55 lb ai/A and to rape seeds (MRID No. 45422523) treated at a rate of 0.095 lb ai/A (10 g a.i./kg TI 435 FS 600) would result in significantly increased mortality of parent beetles and whether or not the offspring production rate would be adversely affected. The beetles exposed to the treated corn seed experienced a significant increase in mortality (55%) but no significant reproductive difference when compared to the controls. The reproductive performance of the rove beetles was determined by counting the number of rove beetles which emerged from the host pupae between days 39 and 77 after treatment. Rove beetles exposed to the treated rape seed experienced an increase in mortality and a reduced parasitization capacity. The number of offspring that emerged (reproductive performance) in the rape seed treated test groups was not significantly lower than the control group. These studies were scientifically sound and classified as Supplemental.

Insects, Residual Contact

A honey bee toxicity of residues on foliage study is required on an end-use product for any pesticide intended for outdoor application when the proposed use pattern indicates that honey bees may be exposed to the pesticide and when the formulation contains one or more active ingredients having an acute contact honey bee LD_{50} which falls in the moderately toxic or highly toxic range. The purpose of this guideline study is to develop data on the residual toxicity to honey bees. Bee mortality determinations are made from bees exposed to treated foliage harvested at various time periods after treatment. Clothianidin, as indicated in the acute toxicity test (MRID 45422426), is highly toxic to honey bees on a contact basis. Pesticides toxic to honey bees require bee precautionary labeling on all end-use formulations and registrants are required to submit data in accordance with Guideline 141-2 - Honey Bee Toxicity of Residues on Foliage. A scientifically-sound study was performed.

Alfalfa foliage was sprayed with Clothianidin, as V-10066, at application rates of 30, 60, and 90 g a.i./acre. Honey bees, three replicates/rate, were exposed in the lab to the weathered foliage at varying times until the mortality of bees exposed to residues was lower than 25%. Sublethal observations were also made. The RT_{25} for V-10066 at 30, 60, and 90 g a.i./acre were 111.68, 179.51, and 512.39 hours, respectively. EFED expects clothianidin's residue on treated foliage to remain toxic to bees for days after clothianidin is applied. Results indicate that clothianidin, as V-10066, should not be applied to blooming pollen-shedding or nectar-producing parts of plants.

Non-target Insects - Toxicity of Residues on Foliage

Species	g a.i./acre	RT_{25} (hours)[1]	MRID No. Author/Year	Study Classification
Honey Bee (Apis mellifera)	30 (0.07 lb ai/A)	111.68 (4.7 days)	45490702 Mayer, 2000	Supplemental
Honey Bee (Apis mellifera)	60 (0.13 lb ai/A)	179.51 (7.5 days)	45490702 Mayer, 2000	Supplemental
Honey Bee (Apis mellifera)	90 0.21 (lb ai/A)	512.39 (21.3 days)	45490702 Mayer, 2000	Supplemental

[1] RT_{25} is the residual time required to reduce the activity of the test material and bring bee mortality down to 25% in cage test exposures to field-weathered spray deposits (Mayer and Johansen, 1990). The time period determined by this toxicity value is considered to be time that the test material is expected to remain toxic to bees in the field from the residual exposure of the test material on vegetation at an expressed rate of application (lb ai/A).

Insects, Field Testing for Pollinators

Six honey bee field studies were undertaken in various locations (Sweden, United Kingdom, France, Canada, United States, and Germany) to determine the residue levels of clothianidin in various parts of summer rape plants grown from seeds treated at various application rates (8.62 lb ai/1000 lb seed or 0.038 lb ai/acre; 10.4 lb ai/1000 lb seed or 0.046 lb ai/acre; 6 lb ai/1000 lb seed or 0.04 lb ai/acre; and 1 lb ai/100 lb seed or 0.025 lb ai/acre). Residue levels in the honey bees that foraged on the plants grown from the treated seeds were also determined. These studies were considered scientifically sound; however, they do not fulfill the requirements for a pollinator field test (OPPs Guideline 141-5) because the protocol was not approved by EPA. They are classified as Supplemental. An approved protocol would have required that the studies be conducted in the United States, longer duration of honey bee activity observations, and the use of replications in the treatments and controls for statistical analyses. Field exposure to the test substance and the bee observation period were too brief (< 30 days) to fully evaluate the impact the exposure levels of clothianidin would have had on the bee colonies tested. The complete life cycle for an individual worker bee during the time period tested would be approximately 63 days.

These field studies evaluated the effects to small honey bee colonies hived on clothianidin rape seed treated and untreated (control) plots. Colonies were placed on the treated and untreated plots during the rape bloom stage approximately two months after the rape crops were planted. Bees were monitored for short periods of time to determine if they were being adversely affected by the clothianidin exposure as a result of the systemic activity demonstrated by clothianidin. Residues of clothianidin in the nectar from rape flowers ranged from 1.0 to 7.2 µg ai/kg. Nectar sampled from beehives ranged from 0.9 to 3.7µg ai/kg and nectar sampled from forage bees honey stomachs contained 8.6 µg ai/kg clothianidin. Residues of clothianidin were also found in forage bees (1.4 µg ai/kg), rape flowers (3.3 - 4.1 µg ai/kg), pollen taken from foraging bees (1.7 - 2.5 µg ai/kg), and pollen from beehives (1.6 - 3.0 µg ai/kg). These residues were a result of the clothianidin seed treatments performed approximately 60 days prior to sampling the commodities. Two (2) studies (MRID 45422436 & 45422437) also tested for the clothianidin metabolites, TZMU and TZNG, but residues of these metabolites were not found in the nectar and pollen samples analyzed. With the exception of one study (MRID 45422435), none of the studies reported mortality or adverse effects to the foraging activity of the bees. However, the residue levels in the nectar taken from the bees, 8.6 µg ai/kg, exceeds the honey bee acute oral LD_{50} of 3.7µg ai/kg (MRID 45422426). One honey bee field study (MRID # 45422435) showed that mortality, pollen foraging activity, and honey yield were negatively affected by residues of clothianidin; however, residues were not quantified in this study.

Non-target Insect Field Studies						
MRID #	**Study Classification**	**Study Location & Plant Date of Treated Seed**	**Chemical Application Rate**	**Sample Date(s)**	**Commodity Sampled**	**Clothianidin Residues Found (µg ai/kg)**
45422431	Supplemental	Borlunda-Skelinge, Sweden 4/28/98	Clothianidin 8.6 g a.i./kg seed or 8.62 lb ai/1000 lb seed or 0.038 lb ai/acre	1st week of July '98	forage bees	1.4
				1st week of July '98	nectar in bees	8.6
				7/3/98 and 7/2/98	nectar from rape flowers	1.2 and 7.2
				1st week of July '98	rape flowers	4.1
45422432	Supplemental	Elm Farm., United Kingdom 3/28/98	Clothianidin 10.4 lb ai/1000 lb seed or 0.046 lb ai/acre	6/22-6/24/98	rape flowers	3.3
				6/22-6/24/98	forage bees	none detected
45422433	Supplemental	Conches in Northern France 3/19/98	Clothianidin 10.4 lb ai/1000 lb seed or 0.046 lb ai/acre	6/15-6/18/98	pollen taken from forage bees	1.7
45422435	Supplemental	Ontario, Canada 5/3/00	Clothianidin 6 lb ai/1,000 lb seed or 0.04 lb ai /A	6/26-7/20/00	pollen from bee hives	3.0 (61 days after application) 1.6 (68 days after application)
					nectar from bee hives	3.7 (61 days after application) 0.9 * (68 days after application)
		Minnesota, US 5/16/00		6/28-7/28/00	pollen from bee hives	2.3 (50 days after application) 2.8 (57 days after application)

Non-target Insect Field Studies						
MRID #	**Study Classification**	**Study Location & Plant Date of Treated Seed**	**Chemical Application Rate**	**Sample Date(s)**	**Commodity Sampled**	**Clothianidin Residues Found (µg ai/kg)**
					nectar from bee hives	1.1 (50 days after application) 1.0 (57 days after application
45422436	Supplemental	Monheim, Germany 5/2/00	Clothianidin 1056 g a.i./100 kg seed or 1 lb ai/100 lb seed or 0.025 lb ai/A	7/6/00 and 7/7/00	nectar from rape flowers	2.8 and 3.0
45422437	Supplemental	Burscheid, Germany 4/28/00	Clothianidin 1056 g a.i./100 kg seed or 1 lb ai/100 lb seed or 0.025 lb ai/A	6/30/00 and 7/6/00 combs sampled 7/12/00; forage bees sampled on 7/2 and 7/18/00	nectar from rape flowers pollen from combs/forage bees	5.4 and 1.0 1.9 to 2.5
* <Level of Quantification (LOQ) =1.0 µg/kg and Level of Detection (LOD) = 0.3 µg/kg						

A seventh honey bee field study (MRID No. 45422440), reviewed under guideline 141-5, evaluated the effects of clothianidin treated pollen on the development of small honey bee colonies and on the behavior and mortality of honey bees. Three treatment levels and two controls were tested. One small beehive (about 500 bees) per treatment and control was tented on oat plots in cages and fed treated maize pollen. Pollen treated with clothianidin at a measured concentration level up to 19.7 µg ai/kg produced no significant adverse effects to the parameters measured in this study based upon the visual inspection of the data. The parameters measured included mortality, foraging activity (including honey and pollen collection), comb production, honey storage behavior, population growth (including egg, larvae, pupae, and adult growth stages) and behavioral anomalies. Since there was only one replicate hive per treatment level, a statistical analysis could not be made of the data provided. MRID No. 45422440 was determined to be scientifically sound and classified as Supplemental.

An eight honey bee field study (MRID 46907801/46907802) evaluated the long-term effects of clothianidin treated canola seed on whole hive parameters. This study was classified as scientifically sound and satisfied the guideline requirements for a field toxicity test with honeybees (OPP Gdln. No. 141-5; OPPTS 850.3040). Overall, there was no difference between colonies from clothianidin-treated and control fields. Although sporadic treatment or site differences were found on various dates, essentially no differences in worker or drone mortality, worker longevity, or brood development occurred during the study. Colonies in treated fields had similar weight gains and honey yields as those in control fields. Qualitative assessments, made the following spring by experienced bee researchers, confirmed that colonies from clothianidin-treated fields were as strong and healthy as those from control fields. It was concluded that honey bees that forage on clothianidin seed-treated canola will be exposed to clothianidin residues in pollen, nectar, and honey; however, exposure concentrations are below those required to elicit acute and sublethal effects. This study has recently been re-reviewed and found to contain deficiencies that limit its ability to determine the effects of clothianidin treated seed on honeybees. It is classified Supplemental due to cross contamination of the control hives that foraged in treated fields.

Spider, Mortality and Feeding Capacity
Two extended laboratory studies (MRID Nos. 45422518 & 45422519) evaluated the effects of clothianidin treated seed on the wolf spider, Pardosa spp. (Araneae, Lycosidae). The goal of these studies was to evaluate whether or not exposing wolf spiders to treated corn and rape seeds increased mortality or decreased feeding rate compared to the controls. The seed treatment rate for the corn seeds was 48.8 g a.i./Unit (1 Unit = 50,000 seed) with 2 corn seeds per 1170 cm^2 test box equivalent to 0.15 lb ai/A. The seed treatment rate for the rape seeds was 10 g a.i./kg TI 435 FS 600 with 4 rape seeds per 178 cm^2 test box equivalent to 0.06 lb ai/A. The studies' results indicated that the wolf spider mortality and feeding capacity in the clothianidin treatments were not significantly different from the controls. These studies were scientifically sound and classified as Supplemental.

Earthworm, Acute and Chronic
Five acute/chronic earthworm studies were reviewed for clothianidin and its metabolite/transformation products. These studies were conducted in compliance with the Organization for Economic Cooperation and Development (OECD) guidelines for testing of chemicals and were reviewed, by EFED, under EPA Ecological Effects Test Guidelines (U.S. EPA Ecological Effects Test Guidelines, April, 1996). EFED does not have a toxicity categorization for earthworms. The clothianidin earthworm LC_{50} (conc. in soil) was determined to be 15.5 mg/kg (MRID No. 45422511) with the metabolite, MNG, and transformation product, TZNG, being less toxic to earthworms than the parent compound. EPA does not presently require reproductive or population toxicity testing with earthworms for pesticide registration; however, two studies indicate that clothianidin exhibits no apparent effect to earthworm reproduction at application rates equal to or greater than 0.054 lb ai/A (MRID 45422525) or population density/biomass at application rates equal to or greater than 0.08 lb ai/A (MRID 45422526).

Earthworm Acute and Chronic Toxicity

Species/Study Duration	% ai	LC50/ EC50 (mg/kg in dry soil or lb ai/A)	NOAEC/ LOAEC (mg/kg in dry soil or lb ai/A)	Endpoints	MRID# Author/Year	Study Classification
Eisenia foetida 14 days	96	15.5 mg/kg (nominal)	< 10.0 mg/kg (nominal)	mortality	45422511 Weyman, 1998	Acceptable
Eisenia fetida 56 days	48	> 0.054 lb ai/A[1] (nominal)	≥ 0.054 lb ai/A[1] (nominal)	no significant treatment-related effects on mortality, body weight, or # offspring/ surviving adult	45422525 Meisner, 2000	Supplemental
Lumbricus terrestris, L.rubellus, L. castaneus, Apporrectodea caliginosa, A. terrestris longa	47.8	> 0.08 lb ai/A[2] (measured)	≥ 0.08 lb ai/A[2] (measured)	no significant treatment-related effect on number and biomass of earthworms	45422526 Heimbach, 2000	Supplemental

Earthworm Acute and Chronic Toxicity						
Species/Study Duration	% ai	LC50/ EC50 (mg/kg in dry soil or lb ai/A)	NOAEC/ LOAEC (mg/kg in dry soil or lb ai/A)	Endpoints	MRID# Author/Year	Study Classification
Allolobophora chlorotica 1 year						
Clothianidin Metabolite - MNG						
Eisenia fetida 14 days	99.2	> 1,000 mg/kg (nominal)	320 mg/kg (nominal)	reduction in body weights	45422512 Noack, 2000	Acceptable
Clothianidin Transformation Product - TZNG						
Eisenia fetida 14 days	99	982 mg/kg (nominal)	125 mg/kg (nominal) 63 mg/kg (nominal)	mortality reduction in body weight	45422513 Noack, 2000	Acceptable

[1] Equivalent to >500,000 clothianidin dressed corn seeds/ha
[2] Equivalent to > 91.4 g a.i./ha

Toxicity to Aquatic Organisms

Freshwater Fish, Acute
Two freshwater fish toxicity studies using the TGAI are required to establish the acute toxicity of clothianidin to fish. The preferred test species are rainbow trout (a coldwater fish) and bluegill sunfish (a warmwater fish). The acute studies that were submitted that tested the parent compound showed that clothianidin is practically non-toxic to freshwater fish (LC_{50} >105.8 -117 ppm). Studies on degradates (TMG, MNG, and TZNG) indicated a similar practically non-toxic profile (LC_{50} >105 ppm). EFED will use the worst case value (LC_{50} >105.8 ppm) for evaluating acute toxic exposure to freshwater fish. The guideline (72-1) is fulfilled (MRID 45422407; MRID 45422406).

Freshwater Fish Acute Toxicity					
Species	% ai	96-hour LC50 (ppm) (nominal)	Toxicity Category	MRID No. Author/Year	Study Classification
Bluegill sunfish (Lepomis macrochirus)	97.6	>117	Practically non-toxic	45422407 Palmer et al., 2000	Core
Rainbow trout (Oncorhynchus mykiss)	96	>105.8	Practically non-toxic	45422406 Wilhelmy et al., 1998	Supplemental
Rainbow trout (Oncorhynchus mykiss)	95.1 TMG	>110	Practically non-toxic	45422408 Dorgerloh, 2000	Supplemental
Rainbow trout	99.0	>105	Practically non-	45422409	Supplemental

Freshwater Fish Acute Toxicity					
Species	**% ai**	**96-hour LC50 (ppm) (nominal)**	**Toxicity Category**	**MRID No. Author/Year**	**Study Classification**
(Oncorhynchus mykiss)	MNG		toxic	Dorgerloh, 2000	
Rainbow trout (Oncorhynchus mykiss)	99.0 TZNG	>116	Practically non-toxic	45422410 Dorgerloh, 2000	Supplemental

Freshwater Fish, Chronic

A freshwater fish early life-stage test using the TGAI is required for clothianidin because the end-use product may be transported to water from the intended use site, and the following conditions are met: (1) clothianidin is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity; (2) studies on aquatic invertebrates showed reproductive effects (daphnid 21-day LOAEC = 0.12 ppm) and (3) clothianidin is persistent in water (e.g., half-life of 744 days aerobic soil metabolism).

A chronic early life stage study conducted on the fathead minnow showed that exposure of 20 ppm has the potential to affect length and dry weight of freshwater fish. The NOAEC of 9.7 ppm will be used for risk assessment purposes. The guideline (72-4) is satisfied (MRID #45422413).

Freshwater Fish Early Life-Stage Toxicity Under Flow-Through Conditions					
Species	**% ai**	**NOAEC/LOAEC (ppm)**	**Endpoints Affected**	**MRID No. Author/Year**	**Study Classification**
Fathead Minnow (Pimephales promelas)	97.6	9.7/20	Length and dry weight	45422413 Drottar et al., 2000	Supplemental

Freshwater Invertebrate Acute Toxicity for Clothianidin

Species	% ai	48-hour EC_{50} (ppm)	Toxicity category	MRID No. Author/Year	Study Classification
Waterflea (Daphnia magna)	99	>119	Practically non-toxic	45422338 Palmer, 2000	Core
Midge (Chironomus riparius)	97.6	0.022*	Very highly toxic	45422414 Mattock, 2001	Supplemental
Waterflea (Daphnia magna)	99.0 TZNG	64	Slightly toxic	45422401 Hendel, 2000	Core
Waterflea (Daphnia magna)	99.0 MNG	>100.8	Practically non-toxic	45422340 Hendel, 2000	Core
Waterflea (Daphnia magna)	95.1 TMG	>115.2	Practically non-toxic	45422339 Hendel, 2000	Supplemental
Midge (Chironomus riparius)	>99	LC_{50} = 11ppb NOAEC 1.1ppb	Very highly toxic	468269-02 Putt, A.E. 2006	Supplemental

* The EC_{50} value for exposure to Clothianidin TI-435 was the most sensitive; EC_{50} values for TZMU, MU, and TZNG were >102 ppm, >83.6 ppm, and 0.386 ppm, respectively.

Freshwater Invertebrates, Acute
A freshwater aquatic invertebrate toxicity test using the TGAI is required to establish the toxicity of clothianidin to aquatic invertebrates. The preferred test species is Daphnia magna. The data that was submitted that tested the parent compound showed that clothianidin is practically non-toxic to Daphnia magna with an acute 48-hour EC_{50} value of >119 ppm, but that it is very highly toxic to Chironomus riparius with an acute 48-hour EC_{50} value of 0.022 ppm. EFED will use the worst case value (EC_{50}= 0.022 ppm) for evaluating acute toxic exposure to freshwater invertebrates. Additional data (48-hour EC_{50}) on degradates (TZNG, MNG, and TMG) indicated a practically non-toxic to slightly toxic profile (EC_{50} = 64.0 to >115.2 ppm). Another study (MRID 46826902) assessed the toxicity to the midge (*Chironomus riparius*) during a 10-Day sediment exposure. This study revealed an LC_{50} of 11 ppb and a NOAEC of 1.1 ppb based on pore water concentrations. The guideline requirements (72-2) for acute invertebrate toxicity are fulfilled (MRID 45422338; MRID 45422414).

Freshwater Invertebrate, Chronic
A freshwater aquatic invertebrate life-cycle test using the TGAI is required for clothianidin because the end-use product may be transported to water from the intended use site, and the following conditions are met: (1) the presence of clothianidin in water is likely to be continuous or recurrent and (2) aquatic acute LC_{50} or EC_{50} values are less than 1 ppm (i.e., 0.022 ppm), and (3) physicochemical properties indicate that clothianidin is persistent in the aquatic environment (e.g., half-life of 744 days aerobic soil metabolism).

The preferred test is a 21-day life cycle on Daphnia magna. The data that were submitted show that clothianidin has the potential for chronic toxicity to daphnids and possibly other freshwater invertebrates. Exposure to 0.12 ppm can result in reproductive effects, including the reduced number of juveniles produced per adult. The NOAEC of 0.042 ppm will be used in assessing risk. The guideline (72-4) is fulfilled (MRID 45422412).

Freshwater Aquatic Invertebrate Chronic Toxicity

Species/ Static Renewal	% ai	21-day NOAEC/LOAEC (ppm)	MATC[1] (ppm)	Endpoints Affected	MRID No. Author/Year	Study Classification
Waterflea (Daphnia magna) Static Renewal	96	0.042/0.12	ND	Reproduction	45422412 Noack et al., 1998	Supplemental

Freshwater Field Studies
No data submitted.

Estuarine and Marine Fish, Acute
The preferred test species is sheepshead minnow. The data submitted showed that the LC_{50} = 93.6 ppm; therefore, clothianidin is categorized as slightly toxic to estuarine/marine fish on an acute basis. The guideline (72-3) is fulfilled (MRID 45422411).

Estuarine/Marine Fish Acute Toxicity

Species/Static	% ai	96-hour LC50 (ppm) (nominal)	Toxicity Category	MRID No. Author/Year	Study Classification
Sheepshead minnow	97.6	>93.6	Slightly toxic	45422411	Supplemental

Estuarine/Marine Fish Acute Toxicity					
Species/Static	% ai	96-hour LC50 (ppm) (nominal)	Toxicity Category	MRID No. Author/Year	Study Classification
(Cyprinodon variegatus)				Scheerbaum, 1999	

Estuarine and Marine Fish, Chronic
No data submitted.

Estuarine and Marine Invertebrates, Acute
Acute toxicity testing with estuarine/marine invertebrates using the TGAI is required for clothianidin because the end-use product is expected to reach this environment due to its potential use on crops with significant acreage in coastal counties. The preferred test species are mysid shrimp and eastern oyster. The data showed that clothianidin significantly reduced survival of mysid shrimp at 0.051 ppm, categorizing the compound as very highly toxic. Clothianidin was categorized as practically non-toxic to Eastern oyster because adverse effects did not occur for this species up to concentrations of 129.1 ppm. EFED will use the worst case value, LC_{50} = 0.051 ppm, for evaluating acute toxic exposure to estuarine/marine invertebrates. A 10-day whole sediment toxicity test with *Leptocheirus plumulosus* using spiked sediment was submitted to the Agency. This study is classified as supplemental, and shows that clothianidin is very highly toxic to benthic estuarine/marine invertebrates with an LC50 of 20.4 µg/L and a NOAEC of 11.6 µg/L based on pore water concentrations. The data requirements (72-3b) are fulfilled (MRID 45422404; MRID 45422403).

Estuarine/Marine Invertebrate Acute Toxicity					
Species/Static or Flow-through	% ai.	96-hour LC50 (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
Eastern oyster (Crassostrea virginica)	97.6	EC_{50}>129.1	Practically non-toxic	45422404 Scheerbaum, 1999	Core
Mysid (Americamysis bahia)	97.6	LC_{50}=0.051	Very highly toxic	45422403 Drottar et al., 2000	Core
Leptocheirus plumulosus	99.4	LC50 = 20.4 ppb NOAEC = 11.6 ppb	Very highly toxic	471994-01 Thomas et al., 2007	Supplemental

Estuarine and Marine Invertebrate, Chronic
An estuarine/marine invertebrate life-cycle toxicity test using the TGAI is required for clothianidin because the end-use product is expected to transport to an estuarine/marine environment from the intended use site, and the following conditions are met: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity, (2) an aquatic acute LC_{50} or EC_{50} is less than 1 ppm (e.g., mysid LC_{50} = 0.051 ppm), and (3) studies of other organisms indicate that the reproductive physiology of fish and/or invertebrates may be affected, physicochemical properties indicate cumulative effects, or the pesticide is persistent in water (e.g., half-life of 744 days aerobic soil metabolism).

The preferred test species is mysid shrimp. The data submitted indicate that clothianidin reduced the number of young per reproductive day at 9.7 ppb. The NOAEC of 5.1 ppb will be used in assessing risk. The guidelines (72-4c) have been fulfilled (MRID 45422405).

Estuarine/Marine Invertebrate Life-Cycle Toxicity					
Species	% ai	39-day	Endpoints	MRID No.	Study

Estuarine/Marine Invertebrate Life-Cycle Toxicity		NOAEC/LOAEC (ppb)	Affected	Author/Year	Classification
Mysid (Mysidopis bahia)	97.6	5.1/9.7	Reproduction	45422405 Drottar et al., 2000	Core

Estuarine and Marine Field Studies
No data submitted.

Aquatic Plants
Several aquatic plant toxicity studies using the TGAI are required to establish the toxicity of clothianidin to non-target aquatic plants. The recommendation is for testing on five species: freshwater green alga (Selenastrum capricornutum), duckweed (Lemna gibba), marine diatom (Skeletonema costatum), blue-green algae (Anabaena flos-aquae), and a freshwater diatom. Studies submitted for two of the five recommended species showed that exposure to clothianidin at levels greater than or equal to 3.5 ppm reduced biomass of aquatic non-vascular plants and increased the incidence of necrotic fronds in aquatic vascular plants. Studies on degradates (TMG, MNG and TZNG) showed reductions in green algal cell density when exposed to levels >1.46 ppm. The EC_{50} of 64 ppm will be used for evaluating acute toxic exposure to non-target aquatic plants. The guideline requirements (122-2 and 123-2) are fulfilled (MRID 45422503; MRID 45422504) for two of the five required species. EFED needs 3 more Core clothianidin studies for the nonvascular surrogate species, marine diatom (*Skeletonema costatum*), blue-green algae (*Anabaena flosaquae*), and a freshwater diatom.

Non-target Aquatic Plant Toxicity

Species [Study Type]	% a.i.	EC_{50}/NOAEC (ppm)	Endpoints Affected	MRID No. Author, Year	Study Classification
Duckweed (Lemna gibba) [Tier 2]	97.6	>121/59	Necrotic fronds	45422503 Palmer et al., 2000	Core
Green Algae (Selenastrum capricornutum) [Tier 2]	97.6	64/3.5	Biomass	45422504 Sutherland et al., 2000	Core
Green Algae (Selenastrum capricornutum) [Tier 2]	95.1 TMG	10/1.46	Cell density	45422505 Dorgerloh, 2000	Core
Green Algae (Selenastrum capricornutum) [Tier 1]	99.0 MNG	>100.6/100.6	None	45422506 Dorgerloh, 2000	Core
Green Algae (Selenastrum capricornutum) [Tier 1]	99.0 TZNG	>103/<103	Cell density	45422507 Dorgerloh, 2000	Core

Terrestrial Plants
Terrestrial Tier II studies are required for all low dose pesticides (those with the maximum use rate of 0.5 lbs a.i./A or less) and for any pesticide showing a negative response equal to or greater than 25% in Tier I studies. Two Tier I terrestrial plant toxicity studies were conducted to establish the toxicity of clothianidin to non-target terrestrial plants. The recommendations for seedling emergence and vegetative vigor studies are for testing of (1) six species

of at least four dicotyledonous families, one species of which is soybean (Glycine max) and the second of which is a root crop, and (2) four species of at least two monocotyledonous families, one of which is corn (Zea mays). The studies that were submitted tested formulated products of clothianidin (49.3% TI-435 50% WDG). The results of these studies showed that exposure elicited no effect (that is, ≥ 25%) on non-target terrestrial plants, so Tier II tests were not necessary. The guidelines (122-1a and 122-1b) are fulfilled (MRID 45422501; MRID 45422502).

Non-target Terrestrial Plant Toxicity

Species [Study Type]	% a.i.	Application Rate (lb ai/A)	Endpoints Affected	MRID No. Author, Year	Study Classification
Dicots: Soybean (Glycine max), Pinto bean (Phaseolus vulgaris), Radish (Raphanus sativus), Cabbage (Brassica oleracea), Lettuce (Lactuca sativa), Tomato (Lycopersicon esculentum) Monocots: Corn (Zea mays), Wheat (Triticum aestivum), Ryegrass (Lolium perenne), Onion (Allium cepa) [Tier I Seedling Emergence]	49.3 TI-435 50% WDG	0.2	No significant effect on seedling emergence	45422501 Brignole et al., 2000	Core
Dicots: Soybean (Glycine max), Pinto bean (Phaseolus vulgaris), Radish (Raphanus sativus), Cabbage (Brassica oleracea), Lettuce (Lactuca sativa), Tomato (Lycopersicon esculentum) Monocots: Corn (Zea mays), Wheat (Triticum aestivum), Ryegrass (Lolium perenne), Onion (Allium cepa) [Tier 1 Vegetative Vigor]	49.3	0.2	No significant reduction in height or shoot weight	45422502 Brignole et al., 2000	Core

Appendix C. The Risk Quotient Method and Levels of Concern

The Risk Quotient Method is the means by which the Environmental Fate and Effects Division (EFED) integrates the results of exposure and ecotoxicity data. In this method, both acute and chronic risk quotients (RQs) are calculated by dividing exposure estimates by the most sensitive ecotoxicity values or toxicity endpoints derived from the studies. Calculated RQs are then compared to OPP's levels of concern (LOCs). The LOCs are the 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, and for endangered species. Risk presumptions, along with the corresponding RQs and LOCs are summarized in the table below.

Risk Presumption	RQ	LOC
Birds		
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
Mammals		
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		
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		
Acute Risk	EEC/EC_{50}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1

Appendix D: Equilibrium Partitioning and Concentration in the Sediment

In general, pyrethroid insecticides are lipophilic compounds that can adsorb readily to particulate and sediment, thus possibly limiting its exposure to aquatic life in the water column but increasing toxic exposure in the benthos. Sediment can act as a reservoir for lipophilic persistent compounds. The sediment and particulate likely adsorb a high percentage of pyrethrin, as indicated by its high KO,. Therefore, coupled with cypermethrin's expected persistence in anaerobic environments, sediment bound cypermethrin could present a toxicity risk for benthic aquatic life and aquatic ecosystems in general. Exposure to this sediment can result in a direct impact to aquatic life through respiration, ingestion, dermal contact, as well as indirect impact through alterations of the food chain. Pesticide compounds that bind readily to particulate and organic carbon in the water column can eventually settle onto the benthos. This increase in particulatebound pesticides can result in an accumulation of compounds in or on the sediment that may have the potential for toxic impact to benthic and epibenthic aquatic organisms (e.g., early life stage of many invertebrates and fish, as well as crabs and shrimp). However, evaluating the risk to aquatic life fiom this exposure becomes problematic given the lack of adequate sediment toxicity and exposure data.

Therefore, in order to assess this potential for pesticide risk to aquatic benthic systems, EFED has adopted the method used by the USEPA Office of Water (OW) that relies on equilibrium partitioning (EqP) of chemicals. Th EqP theory is based on the hydrophobicity and concentrations of the chemical normalized to organic carbon (OC) in sediment (De Toro *et al.*, 1991) and holds that a nonionic chemical in sediment partitions between sediment organic carbon, interstitial (pore) water and benthic organisms. At equilibrium, if the concentration in any phase is known, then the concentration in the other phases can be predicted. A key component to this theory is the chemicals organic carbon coefficient (Koc), which is constant for every chemical and represents the ratio of the chemical concentration in water to the concentration in organic carbon. The document, " Technical Basis for the Derivation of Equilibrium Partitioning Sediment Guidelines (ESG) for the Protection of Benthic Organisms: Nonionic Organics" (USEPA, 2000a), demonstrates that biological responses of benthic organisms to nonionic organic chemicals in sediments are different when the sediment concentrations are expressed on a dry weight basis, but similar when expressed on a ug chemicallg organic carbon basis (uglg,,). Similar responses were also observed across sediments when interstitial water concentrations were used to normalize biological availability. The Technical Basis Document further demonstrates that if the toxic effect concentration in water is known (e.g., LC,,), the effect concentration in sediment on a uglg,, basis can be predicted by multiplying the effect concentration in water by the chemical Koc.

(LC50 ug/L x Koc L/kgoc x 1 kgoc/1000goc = LC50 µg/goc)

Since EFED uses a deterministic method for its screening level risk assessment, the calculation of risk quotient values (RQ) is important for assessing possible risk. The RQ values are calculated by taking the ratio of the estimated exposure concentrations (EEC) to the toxicity effect value (e.g., LC,,, NOAEC). The EEC values are model generated (e.g., PRZW EXAMS) and reflect peer evaluated and approved scenarios for assessing pesticide exposure to an aquatic environment. However, the PRZMI EXAMS output produces water column EEC values, as well as sediment and porewater EEC values. Therefore, in order to assess possible toxic pesticide exposure to aquatic organisms from sediments, EFED uses the PRZMI EXAMS model, which incorporates the principles of the equilibrium partitioning theory, in order to generate EECs from sediment and pore water. By relying on sediment andlor porewater output values, EFED uses two methods to calculate RQ values for sediments by using porewater exposure values and bulk sediment values.

Risk calculations that rely on pore water concentrations can be calculated by dividing the PRZMI EXAMS output value for pore water by the dissolved concentrations in the water column that cause toxicity in bioassays (e.g., LC_{50}). EEC pore water ug/L 1 LC50 ugL

If sediment effects data are available (LC50 uglkg,), RQs can be produced by using the PRZMI EXAMS sediment output value for sediment.

EEC sediment ug/ugoc / LC50 ugkgoc

The following three principle observations underlie the equilibrium partitioning (EqP) approach:

- The concentrations of nonionic organic chemicals in sediments (expressed on an organic carbon basis) and in interstitial waters correlate with observed biological effects on sediment-dwelling organisms across a range of sediments.
- Partitioning models can relate sediment concentrations for nonionic organic chemicals on an organic carbon basis to freely-dissolved concentrations in interstitial water.
- The distribution of sensitivities of benthic organisms is similar to that of water column species.

Appendix E: Aquatic Exposure Model Input and Output

MASTER INPUT COMPILATION (Project File) for EXPRESS PRZM-EXAMS Modeling Interface
(includes scenarios for several other crops that were run at the same time). CAM = 5 for cotton and mustard seed treatment simulations.

```
Master Project File Created: 2010-10-07 at 10:56:07
Express     v. 1.03.02    (2007-07-20)
Parent Compound: Clothianidin
         Scenario Group File:   1  1STDEFED.GRP
               Scenario Type:  3
          PRZM Crop Selector:
0000000000000000000000000000000000000010000110000
          PRZM Crop Selector:
0000000100011000011000000111001001010000100001100 0
          PRZM Crop Selector:
0000000101010000000000000000001000000000000000000 00
          PRZM Crop Selector:
0010001011100000100000000000000000000000000000000 00
Chemical Input Data Controls:  1 1 0 1 0
    Express Operational Mode: OPP
Chemical Name(s):  Clothianidin         |
            Molecular Weight:   249.7
         Plant Uptake Factor:   0.000
Partition Coefficient Method:            1          1
 Partition Coefficient Value:   160.0      160.0
              Vapor Pressure:  0.2900E-12
              Solubility    :   3270.
  Soil Degradation Half-Life:   745.0
          % Degradate formed:   0.000      0.000      0.000
            Foliar Half-Life:   0.000
  Foliar Washoff Coefficient:  0.5000
   Air Diffusion Coefficient:   4300.
    Enthalpy of Vaporization:   20.00
 Application DataSets Number: 27
     Application Parameters:   1  2  1  2  1  0  0    87.00  0
  Days Relative/Absolute    :            0
             Month          :            0
             CAM            :            1
             Depi  (cm)     :   4.000
             Rate           :  0.2000
        Drift Farm Pond % :   1.000
    Drift Index Reservoir % :   6.400
             Efficiency % :   99.00
     Application Parameters:   1  4  1  2  1  0  0    87.00  0
  Days Relative/Absolute    :            0
             Month          :            0
             CAM            :            5
             Depi  (cm)     :   1.270
             Rate           :  0.2800E-01
        Drift Farm Pond % :   0.000
```

```
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    87.00  0
Days Relative/Absolute     :              0
             Month         :              0
             CAM           :              1
             Depi (cm)     :   4.000
             Rate          :  0.2000
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    46.00  0
Days Relative/Absolute     :              0
             Month         :              0
             CAM           :              5
             Depi (cm)     :   3.800
             Rate          :  0.1100E-01
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    46.00  0
Days Relative/Absolute     :              0
             Month         :              0
             CAM           :              5
             Depi (cm)     :   3.800
             Rate          :  0.1100E-01
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    46.00  0
Days Relative/Absolute     :              0
             Month         :              0
             CAM           :              5
             Depi (cm)     :   3.800
             Rate          :  0.1100E-01
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    46.00  0
Days Relative/Absolute     :              0
             Month         :              0
             CAM           :              5
             Depi (cm)     :   3.800
             Rate          :  0.1100E-01
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    46.00  0
Days Relative/Absolute     :              0
             Month         :              0
             CAM           :              5
             Depi (cm)     :   3.800
             Rate          :  0.1100E-01
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    20.00  0
```

```
Days Relative/Absolute     :              0
              Month        :              0
              CAM          :              5
              Depi (cm)    :   1.270
              Rate         :  0.6330E-01
         Drift Farm Pond % :   0.000
   Drift Index Reservoir % :   0.000
              Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    20.00  0
Days Relative/Absolute     :              0
              Month        :              0
              CAM          :              5
              Depi (cm)    :   1.270
              Rate         :  0.6330E-01
         Drift Farm Pond % :   0.000
   Drift Index Reservoir % :   0.000
              Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    20.00  0
Days Relative/Absolute     :              0
              Month        :              0
              CAM          :              5
              Depi (cm)    :   1.270
              Rate         :  0.6330E-01
         Drift Farm Pond % :   0.000
   Drift Index Reservoir % :   0.000
              Efficiency % :   100.0
    Application Parameters:   1  2  2  2  1  0  0    87.00  0
Days Relative/Absolute     :             10
              Month        :              0
              CAM          :              1
              Depi (cm)    :   4.000
              Rate         :  0.2000
         Drift Farm Pond % :   1.000
   Drift Index Reservoir % :   6.400
              Efficiency % :   99.00
    Application Parameters:   1  2  2  2  1  0  0    87.00  0
Days Relative/Absolute     :             10
              Month        :              0
              CAM          :              1
              Depi (cm)    :   4.000
              Rate         :  0.2000
         Drift Farm Pond % :   1.000
   Drift Index Reservoir % :   6.400
              Efficiency % :   99.00
    Application Parameters:   1  2  2  2  1  0  0    87.00  0
Days Relative/Absolute     :             10
              Month        :              0
              CAM          :              1
              Depi (cm)    :   4.000
              Rate         :  0.2000
         Drift Farm Pond % :   1.000
   Drift Index Reservoir % :   6.400
              Efficiency % :   99.00
    Application Parameters:   1  2  2  2  1  0  0    87.00  0
Days Relative/Absolute     :             10
              Month        :              0
              CAM          :              1
```

```
               Depi (cm)     :   4.000
               Rate          :  0.2000
          Drift Farm Pond % :   1.000
    Drift Index Reservoir % :   6.400
               Efficiency % :   99.00
      Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute     :            0
               Month         :            0
               CAM           :            5
               Depi (cm)     :   1.270
               Rate          :  0.2000
          Drift Farm Pond % :   0.000
    Drift Index Reservoir % :   0.000
               Efficiency % :   100.0
      Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute     :            0
               Month         :            0
               CAM           :            5
               Depi (cm)     :   1.270
               Rate          :  0.4840
          Drift Farm Pond % :   0.000
    Drift Index Reservoir % :   0.000
               Efficiency % :   100.0
      Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute     :            0
               Month         :            0
               CAM           :            5
               Depi (cm)     :   1.270
               Rate          :  0.2100
          Drift Farm Pond % :   0.000
    Drift Index Reservoir % :   0.000
               Efficiency % :   100.0
      Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute     :            0
               Month         :            0
               CAM           :            5
               Depi (cm)     :   6.350
               Rate          :  0.2000
          Drift Farm Pond % :   0.000
    Drift Index Reservoir % :   0.000
               Efficiency % :   100.0
      Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute     :            0
               Month         :            0
               CAM           :            5
               Depi (cm)     :   6.350
               Rate          :  0.2000
          Drift Farm Pond % :   0.000
    Drift Index Reservoir % :   0.000
               Efficiency % :   100.0
      Application Parameters:   1  4  1  2  1  0  0    41.00  0
 Days Relative/Absolute     :            0
               Month         :            0
               CAM           :            5
               Depi (cm)     :   3.170
               Rate          :  0.5000E-01
          Drift Farm Pond % :   0.000
```

```
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   3  2  2  2  1  0  0    87.00  0
Days Relative/Absolute    :             14          21          28
             Month        :              0           0           0
             CAM          :              2           2           2
             Depi (cm)    :   4.000      4.000      4.000
             Rate         :  0.1000     0.5000E-01 0.5000E-01
       Drift Farm Pond %  :   1.000      1.000      1.000
  Drift Index Reservoir % :   6.400      6.400      6.400
             Efficiency % :   99.00      99.00      99.00
    Application Parameters:   1  4  1  2  1  0  0    87.00  0
Days Relative/Absolute    :              0
             Month        :              0
             CAM          :              5
             Depi (cm)    :   1.590
             Rate         :  0.6000E-01
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  4  1  2  1  0  0    87.00  0
Days Relative/Absolute    :              0
             Month        :              0
             CAM          :              5
             Depi (cm)    :   1.590
             Rate         :  0.6000E-01
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
    Application Parameters:   1  1  2  2  1  0  0    87.00  0
Days Relative/Absolute    :             30
             Month        :              0
             CAM          :              2
             Depi (cm)    :   4.000
             Rate         :  0.4000
       Drift Farm Pond %  :   5.000
  Drift Index Reservoir % :   16.00
             Efficiency % :   95.00
    Application Parameters:   1  1  2  2  1  0  0    87.00  0
Days Relative/Absolute    :             30
             Month        :              0
             CAM          :              2
             Depi (cm)    :   4.000
             Rate         :  0.4000
       Drift Farm Pond %  :   5.000
  Drift Index Reservoir % :   16.00
             Efficiency % :   95.00
    Application Parameters:   1  4  1  2  1  0  0    56.00  0
Days Relative/Absolute    :              0
             Month        :              0
             CAM          :              5
             Depi (cm)    :   2.860
             Rate         :  0.1050
       Drift Farm Pond %  :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
Product chem./hydr. status:  1 1 1
```

```
 Aerobic Dissipation (days) :   562.0
       Q10 Base Temperature :   25.00
       Q10 Limnetic         :   2.000
 Anaerobic Dissipation(days):   81.00
        Q10 Base temperature:   25.00
        Q10 Benthic         :   2.000
 Photolysis Half-Life (days):   34.00
   Number of Hydrolysis Obs.:           3
     Hydrolysis Temperatures:   25.00
  Hydrolysis C1:  0.000E+00 0.000E+00 0.000E+00
  pH Hydrol. C1:       5.00      7.00      9.00
               Melting Point:  -99.00
```

MASTER INPUT COMPILATION (Project File) for EXPRESS PRZM-EXAMS Modeling Interface (includes scenarios for several other crops that were run at the same time). CAM = 8 for cotton and mustard seed treatment simulations.

```
Master Project File Created: 2010-10-07 at 12:27:57
Express     v. 1.03.02    (2007-07-20)
Parent Compound: Clothianidin
         Scenario Group File:   1  1STDEFED.GRP
               Scenario Type:  3
          PRZM Crop Selector:
00000000000000000000000000000000000000010000110000
          PRZM Crop Selector:
00000001000110000110000001110010010100001000011000
          PRZM Crop Selector:
00000001010100000000000000000100000000000000000000
          PRZM Crop Selector:
00100010111000001000000000000000000000000000000000
Chemical Input Data Controls:  1 1 0 1 0
    Express Operational Mode: OPP
Chemical Name(s):  Clothianidin        |
            Molecular Weight:   249.7
         Plant Uptake Factor:   0.000
Partition Coefficient Method:          1          1
 Partition Coefficient Value:   160.0      160.0
              Vapor Pressure:  0.2900E-12
              Solubility    :   3270.
  Soil Degradation Half-Life:   745.0
          % Degradate formed:   0.000      0.000      0.000
            Foliar Half-Life:   0.000
  Foliar Washoff Coefficient:  0.5000
   Air Diffusion Coefficient:   4300.
    Enthalpy of Vaporization:   20.00
 Application DataSets Number: 27
      Application Parameters:   1  2  1  2  1  0  0    87.00  0
  Days Relative/Absolute    :           0
               Month        :           0
               CAM          :           1
               Depi (cm)    :   4.000
               Rate         :  0.2000
          Drift Farm Pond % :   1.000
    Drift Index Reservoir % :   6.400
               Efficiency % :   99.00
```

```
     Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute     :           0
              Month         :           0
              CAM           :           8
              Depi  (cm)    :  1.270
              Rate          : 0.2800E-01
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
     Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute     :           0
              Month         :           0
              CAM           :           1
              Depi  (cm)    :  4.000
              Rate          : 0.2000
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
     Application Parameters:   1  4  1  2  1  0  0    46.00  0
 Days Relative/Absolute     :           0
              Month         :           0
              CAM           :           8
              Depi  (cm)    :  3.800
              Rate          : 0.1100E-01
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
     Application Parameters:   1  4  1  2  1  0  0    46.00  0
 Days Relative/Absolute     :           0
              Month         :           0
              CAM           :           8
              Depi  (cm)    :  3.800
              Rate          : 0.1100E-01
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
     Application Parameters:   1  4  1  2  1  0  0    46.00  0
 Days Relative/Absolute     :           0
              Month         :           0
              CAM           :           8
              Depi  (cm)    :  3.800
              Rate          : 0.1100E-01
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
     Application Parameters:   1  4  1  2  1  0  0    46.00  0
 Days Relative/Absolute     :           0
              Month         :           0
              CAM           :           8
              Depi  (cm)    :  3.800
              Rate          : 0.1100E-01
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
     Application Parameters:   1  4  1  2  1  0  0    46.00  0
 Days Relative/Absolute     :           0
              Month         :           0
```

```
                CAM            :            8
                Depi (cm)      :   3.800
                Rate           :  0.1100E-01
           Drift Farm Pond % :   0.000
     Drift Index Reservoir % :   0.000
                Efficiency % :   100.0
       Application Parameters:   1   4   1   2   1   0   0    20.00   0
   Days Relative/Absolute      :            0
                Month          :            0
                CAM            :            8
                Depi (cm)      :   1.270
                Rate           :  0.6330E-01
           Drift Farm Pond % :   0.000
     Drift Index Reservoir % :   0.000
                Efficiency % :   100.0
       Application Parameters:   1   4   1   2   1   0   0    20.00   0
   Days Relative/Absolute      :            0
                Month          :            0
                CAM            :            8
                Depi (cm)      :   1.270
                Rate           :  0.6330E-01
           Drift Farm Pond % :   0.000
     Drift Index Reservoir % :   0.000
                Efficiency % :   100.0
       Application Parameters:   1   4   1   2   1   0   0    20.00   0
   Days Relative/Absolute      :            0
                Month          :            0
                CAM            :            8
                Depi (cm)      :   1.270
                Rate           :  0.6330E-01
           Drift Farm Pond % :   0.000
     Drift Index Reservoir % :   0.000
                Efficiency % :   100.0
       Application Parameters:   1   2   2   2   1   0   0    87.00   0
   Days Relative/Absolute      :           10
                Month          :            0
                CAM            :            1
                Depi (cm)      :   4.000
                Rate           :  0.2000
           Drift Farm Pond % :   1.000
     Drift Index Reservoir % :   6.400
                Efficiency % :   99.00
       Application Parameters:   1   2   2   2   1   0   0    87.00   0
   Days Relative/Absolute      :           10
                Month          :            0
                CAM            :            1
                Depi (cm)      :   4.000
                Rate           :  0.2000
           Drift Farm Pond % :   1.000
     Drift Index Reservoir % :   6.400
                Efficiency % :   99.00
       Application Parameters:   1   2   2   2   1   0   0    87.00   0
   Days Relative/Absolute      :           10
                Month          :            0
                CAM            :            1
                Depi (cm)      :   4.000
                Rate           :  0.2000
```

```
        Drift Farm Pond % :   1.000
  Drift Index Reservoir % :   6.400
             Efficiency % :   99.00
   Application Parameters:   1  2  2  2  1  0  0    87.00  0
Days Relative/Absolute    :              10
             Month        :               0
             CAM          :               1
             Depi (cm)    :   4.000
             Rate         :  0.2000
        Drift Farm Pond % :   1.000
  Drift Index Reservoir % :   6.400
             Efficiency % :   99.00
   Application Parameters:   1  4  1  2  1  0  0    87.00  0
Days Relative/Absolute    :               0
             Month        :               0
             CAM          :               8
             Depi (cm)    :   1.270
             Rate         :  0.2000
        Drift Farm Pond % :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
   Application Parameters:   1  4  1  2  1  0  0    87.00  0
Days Relative/Absolute    :               0
             Month        :               0
             CAM          :               8
             Depi (cm)    :   1.270
             Rate         :  0.4840
        Drift Farm Pond % :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
   Application Parameters:   1  4  1  2  1  0  0    87.00  0
Days Relative/Absolute    :               0
             Month        :               0
             CAM          :               8
             Depi (cm)    :   1.270
             Rate         :  0.2100
        Drift Farm Pond % :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
   Application Parameters:   1  4  1  2  1  0  0    87.00  0
Days Relative/Absolute    :               0
             Month        :               0
             CAM          :               8
             Depi (cm)    :   6.350
             Rate         :  0.2000
        Drift Farm Pond % :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
   Application Parameters:   1  4  1  2  1  0  0    87.00  0
Days Relative/Absolute    :               0
             Month        :               0
             CAM          :               8
             Depi (cm)    :   6.350
             Rate         :  0.2000
        Drift Farm Pond % :   0.000
  Drift Index Reservoir % :   0.000
             Efficiency % :   100.0
```

```
    Application Parameters:   1  4  1  2  1  0  0    41.00  0
 Days Relative/Absolute    :           0
              Month        :           0
              CAM          :           8
              Depi  (cm)   :  3.170
              Rate         : 0.5000E-01
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
    Application Parameters:   3  2  2  2  1  0  0    87.00  0
 Days Relative/Absolute    :          14          21        28
              Month        :           0           0         0
              CAM          :           2           2         2
              Depi  (cm)   :  4.000      4.000      4.000
              Rate         : 0.1000      0.5000E-01 0.5000E-01
         Drift Farm Pond % :  1.000      1.000      1.000
   Drift Index Reservoir % :  6.400      6.400      6.400
              Efficiency % :  99.00      99.00      99.00
    Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute    :           0
              Month        :           0
              CAM          :           8
              Depi  (cm)   :  1.590
              Rate         : 0.6000E-01
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
    Application Parameters:   1  4  1  2  1  0  0    87.00  0
 Days Relative/Absolute    :           0
              Month        :           0
              CAM          :           8
              Depi  (cm)   :  1.590
              Rate         : 0.6000E-01
         Drift Farm Pond % :  0.000
   Drift Index Reservoir % :  0.000
              Efficiency % :  100.0
    Application Parameters:   1  1  2  2  1  0  0    87.00  0
 Days Relative/Absolute    :          30
              Month        :           0
              CAM          :           2
              Depi  (cm)   :  4.000
              Rate         : 0.4000
         Drift Farm Pond % :  5.000
   Drift Index Reservoir % :  16.00
              Efficiency % :  95.00
    Application Parameters:   1  1  2  2  1  0  0    87.00  0
 Days Relative/Absolute    :          30
              Month        :           0
              CAM          :           2
              Depi  (cm)   :  4.000
              Rate         : 0.4000
         Drift Farm Pond % :  5.000
   Drift Index Reservoir % :  16.00
              Efficiency % :  95.00
    Application Parameters:   1  4  1  2  1  0  0    56.00  0
 Days Relative/Absolute    :           0
              Month        :           0
```

```
               CAM          :           8
               Depi (cm)    :   2.860
               Rate         :  0.1050
          Drift Farm Pond % :   0.000
     Drift Index Reservoir % :   0.000
               Efficiency % :   100.0
  Product chem./hydr. status:  1 1 1
 Aerobic Dissipation (days) :   562.0
       Q10 Base Temperature :   25.00
       Q10 Limnetic         :   2.000
 Anaerobic Dissipation(days):   81.00
        Q10 Base temperature:   25.00
        Q10 Benthic         :   2.000
 Photolysis Half-Life (days):   34.00
   Number of Hydrolysis Obs.:           3
     Hydrolysis Temperatures:   25.00
  Hydrolysis C1:  0.000E+00 0.000E+00 0.000E+00
  pH Hydrol. C1:       5.00      7.00      9.00
               Melting Point:  -99.00
```

****

Sample PRZM Input Files

MISSISSIPPI COTTON SCENARIO, CAM 5

FILE NAME = MS1Ctt-P.INP

```
*** Record 1: (A78), TITLE - label for simulation title
Express     v. 1.03.02    (2007-07-20)
*** MS Cotton; 8/13/2001 Title of input file  Existing
***____________
*** Record 2: (A78), HTITLE - Hydrology Information Title
"Yazoo County; MLRA 134; Metfile: W03940.dvf (old: Met13
***____________
*** Record 3: (2F8.0,I8,F8.0,2I8,5I4) PFAC,SFAC,IPEIND,ANETD,INICRP,ISCOND
***PFAC SFAC    IPEIND  ANETD   INICRP  ISCOND     (WDM data sets not used)
7.50E-013.60E-01       02.50E+01       1       1
***____________
*** Record 6: (I8) ERFLAG: Flag to calculate erosion
       4
***____________
*** Record 7: (4F8.0,8X,I8,2F8.0) USLEK,USLELS,USLEP,AFIELD,IREG,SLP,HL
***USLEKUSLELS  USLEP   AFIELD          IREG     SLP      HL
4.90E-011.34E+005.00E-011.00E+01               3    6.00  356.80
***____________
*** Record 8: (I8) NDC - Number of different crops simulated; FLITNUM
       1 0
***____________
*** Record 9 for Crop 1: (I8,3F8.0,I8,3(1X,I3),2F8.0)
ICNCN,CINTCP,AMXDR,COVMAX,ICNAH,(3)CN,WFMAX,HTMAX
***ICNCNCINTCP  AMXDR   COVMAX  ICNAH    CN1 CN2 CN3WFMAX   HTMAX
       12.00E-016.50E+011.00E+02       3  89  86  870.00E+001.22E+02
***____________
*** Record 9A (2I8): CROPNO,NUSLEC - Crop, Number of USLE C (cover management) factors
       1      26
*** Record 9B: (16(I2,I2,1X) GDUSLEC,GMUSLEC for each USLEC
***M DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM
```

```
0105 1605 0106 1606 0107 1607 0108 1608 0109 1609 2209 0110 1610 0111 1611 0112
*** Record 9C: (16(F4.0,1X)) - USLEC (USLE Cover management factors)
.718 .699 .620 .496 .354 .303 .305 .289 .343 .359 .359 .223 .327 .376 .425 .465
*** Record 9D: (16(F4.0,1X)) - MNGN - Manning's N for each USLEC
.014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014
*** Record 9E: (16(I4,1X)) - CN(II) for each USLEC
  86   86   86   86   86   86   86   86   86   86   86   89   89   89   89   89
***____________
*** Continuation of Records 9B,9C,9D,9E for USLEC 17-26
***M DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM
1612 0101 1601 0102 1602 0103 1603 0104 1604 2504
.494 .500 .517 .532 .549 .567 .591 .617 .667 .705
.014 .014 .014 .014 .014 .014 .014 .014 .014 .014
  89   89   89   89   89   89   89   89   89   89
***____________
*** Record 10: (I8) NCPDS - number of cropping periods
      30
***____________
*** Record(s) 11: (2X,3I2,2X,3I2,3X,3I2,I8) - dates of crop EMergence, MAturation, and
HArvest
*** EMD,EMM,IYREM,MAD,MAM,IYRMAT,HAD,HAM,IYRHAR,INCROP
***EMerge MAture  HArvest
***DMMYY  DDMMYY  DDMMYY   Crop No.
  010561  070961  220961        1
  010562  070962  220962        1
  010563  070963  220963        1
  010564  070964  220964        1
  010565  070965  220965        1
  010566  070966  220966        1
  010567  070967  220967        1
  010568  070968  220968        1
  010569  070969  220969        1
  010570  070970  220970        1
  010571  070971  220971        1
  010572  070972  220972        1
  010573  070973  220973        1
  010574  070974  220974        1
  010575  070975  220975        1
  010576  070976  220976        1
  010577  070977  220977        1
  010578  070978  220978        1
  010579  070979  220979        1
  010580  070980  220980        1
  010581  070981  220981        1
  010582  070982  220982        1
  010583  070983  220983        1
  010584  070984  220984        1
  010585  070985  220985        1
  010586  070986  220986        1
  010587  070987  220987        1
  010588  070988  220988        1
  010589  070989  220989        1
  010590  070990  220990        1
***____________
*** Record 12: (A78) PTITLE - Label for pesticide
Chemical Input Data:
***____________
*** Record 13: (4I8) NAPS,NCHEM,FRMFLG,DK2FLG
*** NAPS    NCHEM  FRMFLG  DK2FLG
      30       1       0       0
***____________
*** Record 15: (3A20) Name(s) of pesticides for output titles
Clothianidin
```

```
***
*** Record(s) 16: (2X,3I2,I3,3(I2,F5.0,F6.0,F5.0,F5.0)) - application data
***   including the application date (APD,APM,IAPYR), WINDAY, and
(1)(CAM,DEPI,TAPP,APPEFF,DRFT)
***DMMYYWinCmDepi Tapp  Eff  Drft CmDepi Tapp  Eff  Drft CmDepi Tapp  Eff  Drft
  240461  0 5 1.270.07091.000.0000
  240462  0 5 1.270.07091.000.0000
  240463  0 5 1.270.07091.000.0000
  240464  0 5 1.270.07091.000.0000
  240465  0 5 1.270.07091.000.0000
  240466  0 5 1.270.07091.000.0000
  240467  0 5 1.270.07091.000.0000
  240468  0 5 1.270.07091.000.0000
  240469  0 5 1.270.07091.000.0000
  240470  0 5 1.270.07091.000.0000
  240471  0 5 1.270.07091.000.0000
  240472  0 5 1.270.07091.000.0000
  240473  0 5 1.270.07091.000.0000
  240474  0 5 1.270.07091.000.0000
  240475  0 5 1.270.07091.000.0000
  240476  0 5 1.270.07091.000.0000
  240477  0 5 1.270.07091.000.0000
  240478  0 5 1.270.07091.000.0000
  240479  0 5 1.270.07091.000.0000
  240480  0 5 1.270.07091.000.0000
  240481  0 5 1.270.07091.000.0000
  240482  0 5 1.270.07091.000.0000
  240483  0 5 1.270.07091.000.0000
  240484  0 5 1.270.07091.000.0000
  240485  0 5 1.270.07091.000.0000
  240486  0 5 1.270.07091.000.0000
  240487  0 5 1.270.07091.000.0000
  240488  0 5 1.270.07091.000.0000
  240489  0 5 1.270.07091.000.0000
  240490  0 5 1.270.07091.000.0000
***
*** Record 17: (includes data for each chemical) (F8.0,3(I8,F8.0)) FILTRA,
(1)(IPSCND,UPTKF)
***FILT IPSCND1 UPTKF1  IPSCND2 UPTKF2  IPSCND3 UPTKF3
0.00E+00       10.00E+00
***
*** Record 19: (A78) STITLE - label for soil properties
Loring Silt Loam; HYDG: C   Brief description of soil pr
***
*** Record 20: (F8.0,8X,9I4)
CORED,BDFLAG,THFLAG,KDFLAG,HSWZT,MOC,IRFLAG,ITFLAG,IDFLAG,BIOFLG
***CORED (cm)       BD  TH  KD  HS MOC  IR  IT  ID BIO
1.55E+02             0   0   0   0   0   0   0   0   0
***
*** Record 26: (9F8.0) (1)DAIR, (1)HENRYK, (1)ENPY
4.30E+031.19E-152.00E+01
***
*** Record 33:  (I8) NHORIZ (total number of soil horizons)
       6
***
*** Record 34 for Horizon 1: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       11.30E+011.40E+003.85E-010.00E+000.00E+000.00E+00
***
*** Record 36 for Horizon 1: (8X,9F8.0)   (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***
*** Record 37 for Horizon 1: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        1.00E-013.85E-011.51E-011.28E+002.05E+00
```

```
***______________
*** Record 34 for Horizon 2: (I8,8F8.0) HORIZN,THKNS,BD,THET0,AD,(1)DISP,ADL
       22.30E+011.40E+003.70E-010.00E+000.00E+000.00E+00
***______________
*** Record 36 for Horizon 2: (8X,9F8.0)   (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***______________
*** Record 37 for Horizon 2: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        1.00E+003.70E-011.46E-014.90E-017.84E-01
***______________
*** Record 34 for Horizon 3: (I8,8F8.0) HORIZN,THKNS,BD,THET0,AD,(1)DISP,ADL
       33.30E+011.40E+003.70E-010.00E+000.00E+000.00E+00
***______________
*** Record 36 for Horizon 3: (8X,9F8.0)   (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***______________
*** Record 37 for Horizon 3: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        3.00E+003.70E-011.46E-011.60E-012.56E-01
***______________
*** Record 34 for Horizon 4: (I8,8F8.0) HORIZN,THKNS,BD,THET0,AD,(1)DISP,ADL
       43.00E+011.45E+003.40E-010.00E+000.00E+000.00E+00
***______________
*** Record 36 for Horizon 4: (8X,9F8.0)   (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***______________
*** Record 37 for Horizon 4: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        5.00E+003.40E-011.25E-011.20E-011.92E-01
***______________
*** Record 34 for Horizon 5: (I8,8F8.0) HORIZN,THKNS,BD,THET0,AD,(1)DISP,ADL
       52.30E+011.49E+003.35E-010.00E+000.00E+000.00E+00
***______________
*** Record 36 for Horizon 5: (8X,9F8.0)   (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***______________
*** Record 37 for Horizon 5: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        1.00E+003.35E-011.37E-017.00E-021.12E-01
***______________
*** Record 34 for Horizon 6: (I8,8F8.0) HORIZN,THKNS,BD,THET0,AD,(1)DISP,ADL
       63.30E+011.51E+003.43E-010.00E+000.00E+000.00E+00
***______________
*** Record 36 for Horizon 6: (8X,9F8.0)   (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***______________
*** Record 37 for Horizon 6: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        3.00E+003.43E-011.47E-016.00E-029.60E-02
***______________
*** Record 40: (2I8) ILP; CFLAG (blank if ILP=0)
       0
***______________
*** Record 42: (3(4X,A4,4X,A4,I8),I4)
ITEM1,STEP1,LFREQ1,ITEM2,STEP2,LFREQ2,ITEM3,STEP3,LFREQ3,EXMFLG
    WATR    YEAR      10    PEST    YEAR      10    CONC    YEAR      10   1
***______________
*** Record 43: (I8) EXMENV
      99
***______________
*** Record 44 for Chemical 1: EXMCHM,CAS Number,NPROC,RFORM,YIELD
       1    CASSNO: -999       1       10.00E+00
***______________
*** Record 45: NPLOTS (number of time series variables,STEP4
       0    YEAR
***______________
*** Records 46: Plotting variables
```

NORTH CAROLINA COTTON SCENARIO, CAM 5

FILE NAME = NC1Ctt-P.INP

```
*** Record 1: (A78), TITLE - label for simulation title
Express     v. 1.03.02    (2007-07-20)
*** NCcottonTitle of input file                Develope
***
*** Record 2: (A78), HTITLE - Hydrology Information Title
"MLRA 133A; Metfile: W13722.dvf (old: Met133A.met)," Sh
***
*** Record 3: (2F8.0,I8,F8.0,2I8,5I4) PFAC,SFAC,IPEIND,ANETD,INICRP,ISCOND
***PFAC SFAC    IPEIND  ANETD    INICRP  ISCOND     (WDM data sets not used)
7.50E-013.60E-01       01.75E+01       1       1
***
*** Record 6: (I8) ERFLAG: Flag to calculate erosion
       4
***
*** Record 7: (4F8.0,8X,I8,2F8.0) USLEK,USLELS,USLEP,AFIELD,IREG,SLP,HL
***USLEKUSLELS  USLEP   AFIELD          IREG     SLP     HL
3.40E-011.34E+001.00E+001.00E+01               3    6.00  356.80
***
*** Record 8: (I8) NDC - Number of different crops simulated; FLITNUM
       1 0
***
*** Record 9 for Crop 1: (I8,3F8.0,I8,3(1X,I3),2F8.0)
ICNCN,CINTCP,AMXDR,COVMAX,ICNAH,(3)CN,WFMAX,HTMAX
***ICNCNCINTCP  AMXDR   COVMAX  ICNAH    CN1 CN2 CN3WFMAX    HTMAX
       12.00E-016.50E+011.00E+02       3  92  89  900.00E+001.22E+02
***
*** Record 9A (2I8): CROPNO,NUSLEC - Crop, Number of USLE C (cover management) factors
       1      25
*** Record 9B: (16(I2,I2,1X) GDUSLEC,GMUSLEC for each USLEC
***M DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM
0106 1606 0107 1607 0108 1608 0109 1609 0110 1610 0111 1611 0112 1612 0101 1601
*** Record 9C: (16(F4.0,1X)) - USLEC (USLE Cover management factors)
.640 .511 .364 .311 .314 .299 .359 .376 .228 .326 .362 .396 .427 .460 .474 .504
*** Record 9D: (16(F4.0,1X)) - MNGN - Manning's N for each USLEC
.014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014
*** Record 9E: (16(I4,1X)) - CN(II) for each USLEC
  89   89   89   89   89   89   89   89   89   89   92   92   92   92   92   92
***
*** Continuation of Records 9B,9C,9D,9E for USLEC 17-25
***M DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM
0102 1602 0103 1603 0104 1604 2504 0105 1605
.532 .557 .584 .615 .645 .707 .741 .748 .720
.014 .014 .014 .014 .014 .014 .014 .014 .014
  92   92   92   92   92   92   92   92   92
***
*** Record 10: (I8) NCPDS - number of cropping periods
      30
***
*** Record(s) 11: (2X,3I2,2X,3I2,3X,3I2,I8) - dates of crop EMergence, MAturation, and
HArvest
*** EMD,EMM,IYREM,MAD,MAM,IYRMAT,HAD,HAM,IYRHAR,INCROP
***EMerge MAture  HArvest
***DMMYY  DDMMYY  DDMMYY   Crop No.
  010661  010861  011161       1
  010662  010862  011162       1
  010663  010863  011163       1
  010664  010864  011164       1
```

```
  010665  010865  011165        1
  010666  010866  011166        1
  010667  010867  011167        1
  010668  010868  011168        1
  010669  010869  011169        1
  010670  010870  011170        1
  010671  010871  011171        1
  010672  010872  011172        1
  010673  010873  011173        1
  010674  010874  011174        1
  010675  010875  011175        1
  010676  010876  011176        1
  010677  010877  011177        1
  010678  010878  011178        1
  010679  010879  011179        1
  010680  010880  011180        1
  010681  010881  011181        1
  010682  010882  011182        1
  010683  010883  011183        1
  010684  010884  011184        1
  010685  010885  011185        1
  010686  010886  011186        1
  010687  010887  011187        1
  010688  010888  011188        1
  010689  010889  011189        1
  010690  010890  011190        1
***____________
*** Record 12: (A78) PTITLE - Label for pesticide
Chemical Input Data:
***____________
*** Record 13: (4I8) NAPS,NCHEM,FRMFLG,DK2FLG
*** NAPS   NCHEM  FRMFLG  DK2FLG
      30       1       0       0
***____________
*** Record 15: (3A20) Name(s) of pesticides for output titles
Clothianidin
***____________
*** Record(s) 16: (2X,3I2,I3,3(I2,F5.0,F6.0,F5.0,F5.0)) - application data
***   including the application date (APD,APM,IAPYR), WINDAY, and
(1)(CAM,DEPI,TAPP,APPEFF,DRFT)
***DMMYYWinCmDepi Tapp  Eff  Drft CmDepi Tapp  Eff  Drft CmDepi Tapp  Eff  Drft
  250561  0 5 1.270.07091.000.0000
  250562  0 5 1.270.07091.000.0000
  250563  0 5 1.270.07091.000.0000
  250564  0 5 1.270.07091.000.0000
  250565  0 5 1.270.07091.000.0000
  250566  0 5 1.270.07091.000.0000
  250567  0 5 1.270.07091.000.0000
  250568  0 5 1.270.07091.000.0000
  250569  0 5 1.270.07091.000.0000
  250570  0 5 1.270.07091.000.0000
  250571  0 5 1.270.07091.000.0000
  250572  0 5 1.270.07091.000.0000
  250573  0 5 1.270.07091.000.0000
  250574  0 5 1.270.07091.000.0000
  250575  0 5 1.270.07091.000.0000
  250576  0 5 1.270.07091.000.0000
  250577  0 5 1.270.07091.000.0000
  250578  0 5 1.270.07091.000.0000
  250579  0 5 1.270.07091.000.0000
  250580  0 5 1.270.07091.000.0000
  250581  0 5 1.270.07091.000.0000
  250582  0 5 1.270.07091.000.0000
```

```
  250583  0 5 1.270.07091.000.0000
  250584  0 5 1.270.07091.000.0000
  250585  0 5 1.270.07091.000.0000
  250586  0 5 1.270.07091.000.0000
  250587  0 5 1.270.07091.000.0000
  250588  0 5 1.270.07091.000.0000
  250589  0 5 1.270.07091.000.0000
  250590  0 5 1.270.07091.000.0000
***_____________
*** Record 17: (includes data for each chemical) (F8.0,3(I8,F8.0)) FILTRA,
(1)(IPSCND,UPTKF)
***FILT IPSCND1 UPTKF1  IPSCND2 UPTKF2  IPSCND3 UPTKF3
0.00E+00       10.00E+00
***_____________
*** Record 19: (A78) STITLE - label for soil properties
"Boswell, sandy loam,  HYDG: D"   Brief description of s
***_____________
*** Record 20: (F8.0,8X,9I4)
CORED,BDFLAG,THFLAG,KDFLAG,HSWZT,MOC,IRFLAG,ITFLAG,IDFLAG,BIOFLG
***CORED (cm)      BD  TH  KD  HS MOC  IR  IT  ID BIO
1.00E+02            0   0   0   0   0   0   0   0   0
***_____________
*** Record 26: (9F8.0) (1)DAIR, (1)HENRYK, (1)ENPY
4.30E+031.19E-152.00E+01
***_____________
*** Record 33:  (I8) NHORIZ (total number of soil horizons)
       3
***_____________
*** Record 34 for Horizon 1: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       11.00E+011.80E+002.13E-010.00E+000.00E+000.00E+00
***_____________
*** Record 36 for Horizon 1: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***_____________
*** Record 37 for Horizon 1: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        1.00E-012.13E-016.30E-022.32E+003.71E+00
***_____________
*** Record 34 for Horizon 2: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       22.00E+001.80E+002.13E-010.00E+000.00E+000.00E+00
***_____________
*** Record 36 for Horizon 2: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***_____________
*** Record 37 for Horizon 2: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        2.00E+002.13E-016.30E-022.32E+003.71E+00
***_____________
*** Record 34 for Horizon 3: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       38.80E+011.70E+003.54E-010.00E+000.00E+000.00E+00
***_____________
*** Record 36 for Horizon 3: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***_____________
*** Record 37 for Horizon 3: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        4.00E+003.54E-012.13E-012.90E-014.64E-01
***_____________
*** Record 40: (2I8) ILP; CFLAG (blank if ILP=0)
       0
***_____________
*** Record 42: (3(4X,A4,4X,A4,I8),I4)
ITEM1,STEP1,LFREQ1,ITEM2,STEP2,LFREQ2,ITEM3,STEP3,LFREQ3,EXMFLG
    WATR    YEAR       10    PEST    YEAR       10    CONC    YEAR       10   1
***_____________
*** Record 43: (I8) EXMENV
```

```
      99
***____________
*** Record 44 for Chemical 1: EXMCHM,CAS Number,NPROC,RFORM,YIELD
       1    CASSNO: -999       1        10.00E+00
***____________
*** Record 45: NPLOTS (number of time series variables,STEP4
       0    YEAR
***____________
*** Records 46: Plotting variables
```

NORTH DAKOTA CANOLA SCENARIO, CAM 5
FILE NAME = ND1Cno-P.INP

```
*** Record 1: (A78), TITLE - label for simulation title
Express     v. 1.03.02     (2007-07-20)
*** NDCanolaTitle of input file                "Existin
***____________
*** Record 2: (A78), HTITLE - Hydrology Information Title
"Cavalier County, ND MLRA 55a; Metfile: W24013.dvf (Old
***____________
*** Record 3: (2F8.0,I8,F8.0,2I8,5I4) PFAC,SFAC,IPEIND,ANETD,INICRP,ISCOND
***PFAC SFAC    IPEIND  ANETD   INICRP  ISCOND     (WDM data sets not used)
7.60E-013.60E-01       01.25E+01       1       1
***____________
*** Record 6: (I8) ERFLAG: Flag to calculate erosion
       4
***____________
*** Record 7: (4F8.0,8X,I8,2F8.0) USLEK,USLELS,USLEP,AFIELD,IREG,SLP,HL
***USLEKUSLELS  USLEP   AFIELD          IREG    SLP     HL
2.80E-012.50E-011.00E+001.00E+01               3    1.50  356.80
***____________
*** Record 8: (I8) NDC - Number of different crops simulated; FLITNUM
       1 0
***____________
*** Record 9 for Crop 1: (I8,3F8.0,I8,3(1X,I3),2F8.0)
ICNCN,CINTCP,AMXDR,COVMAX,ICNAH,(3)CN,WFMAX,HTMAX
***ICNCNCINTCP  AMXDR   COVMAX  ICNAH   CN1 CN2 CN3WFMAX   HTMAX
       11.00E-011.20E+021.00E+02       3  87  82  830.00E+001.25E+02
***____________
*** Record 9A (2I8): CROPNO,NUSLEC - Crop, Number of USLE C (cover management) factors
       1      29
*** Record 9B: (16(I2,I2,1X) GDUSLEC,GMUSLEC for each USLEC
***M DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM
1605 0106 1606 0107 1607 0108 0508 1008 1608 2508 0109 1609 0110 1610 0111 1611
*** Record 9C: (16(F4.0,1X)) - USLEC (USLE Cover management factors)
.562 .468 .268 .092 .064 .065 .036 .098 .110 .110 .126 .139 .152 .162 .168 .170
*** Record 9D: (16(F4.0,1X)) - MNGN - Manning's N for each USLEC
.014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014
*** Record 9E: (16(I4,1X)) - CN(II) for each USLEC
  82   82   82   82   82   82   82   82   82   82   87   87   87   87   87   87
***____________
*** Continuation of Records 9B,9C,9D,9E for USLEC 17-29
***M DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM
0112 1612 0101 1601 0102 1602 0103 1603 0104 1604 2004 0105 0505
.171 .171 .583 .581 .579 .577 .574 .574 .575 .575 .611 .617 .610
.014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014 .014
  87   87   87   87   87   87   87   87   87   87   87   87   87
***____________
*** Record 10: (I8) NCPDS - number of cropping periods
      28
***____________
```

```
*** Record(s) 11: (2X,3I2,2X,3I2,3X,3I2,I8) - dates of crop EMergence, MAturation, and
HArvest
*** EMD,EMM,IYREM,MAD,MAM,IYRMAT,HAD,HAM,IYRHAR,INCROP
***EMerge MAture  HArvest
***DMMYY  DDMMYY  DDMMYY   Crop No.
  160561  150861  250861       1
  160562  150862  250862       1
  160563  150863  250863       1
  160564  150864  250864       1
  160565  150865  250865       1
  160566  150866  250866       1
  160567  150867  250867       1
  160568  150868  250868       1
  160569  150869  250869       1
  160570  150870  250870       1
  160571  150871  250871       1
  160572  150872  250872       1
  160573  150873  250873       1
  160574  150874  250874       1
  160575  150875  250875       1
  160576  150876  250876       1
  160577  150877  250877       1
  160578  150878  250878       1
  160579  150879  250879       1
  160580  150880  250880       1
  160581  150881  250881       1
  160582  150882  250882       1
  160583  150883  250883       1
  160584  150884  250884       1
  160585  150885  250885       1
  160586  150886  250886       1
  160587  150887  250887       1
  160588  150888  250888       1
***____________
*** Record 12: (A78) PTITLE - Label for pesticide
Chemical Input Data:
***____________
*** Record 13: (4I8) NAPS,NCHEM,FRMFLG,DK2FLG
*** NAPS    NCHEM  FRMFLG  DK2FLG
      28       1       0       0
***____________
*** Record 15: (3A20) Name(s) of pesticides for output titles
Clothianidin
***____________
*** Record(s) 16: (2X,3I2,I3,3(I2,F5.0,F6.0,F5.0,F5.0)) - application data
***   including the application date (APD,APM,IAPYR), WINDAY, and
(1)(CAM,DEPI,TAPP,APPEFF,DRFT)
***DMMYYWinCmDepi Tapp  Eff  Drft CmDepi Tapp  Eff  Drft CmDepi Tapp  Eff  Drft
  090561  0 5 1.270.03141.000.0000
  090562  0 5 1.270.03141.000.0000
  090563  0 5 1.270.03141.000.0000
  090564  0 5 1.270.03141.000.0000
  090565  0 5 1.270.03141.000.0000
  090566  0 5 1.270.03141.000.0000
  090567  0 5 1.270.03141.000.0000
  090568  0 5 1.270.03141.000.0000
  090569  0 5 1.270.03141.000.0000
  090570  0 5 1.270.03141.000.0000
  090571  0 5 1.270.03141.000.0000
  090572  0 5 1.270.03141.000.0000
  090573  0 5 1.270.03141.000.0000
  090574  0 5 1.270.03141.000.0000
  090575  0 5 1.270.03141.000.0000
```

```
  090576  0 5 1.270.03141.000.0000
  090577  0 5 1.270.03141.000.0000
  090578  0 5 1.270.03141.000.0000
  090579  0 5 1.270.03141.000.0000
  090580  0 5 1.270.03141.000.0000
  090581  0 5 1.270.03141.000.0000
  090582  0 5 1.270.03141.000.0000
  090583  0 5 1.270.03141.000.0000
  090584  0 5 1.270.03141.000.0000
  090585  0 5 1.270.03141.000.0000
  090586  0 5 1.270.03141.000.0000
  090587  0 5 1.270.03141.000.0000
  090588  0 5 1.270.03141.000.0000
***____________
*** Record 17: (includes data for each chemical) (F8.0,3(I8,F8.0)) FILTRA,
(1)(IPSCND,UPTKF)
***FILT IPSCND1 UPTKF1  IPSCND2 UPTKF2  IPSCND3 UPTKF3
0.00E+00       10.00E+00
***____________
*** Record 19: (A78) STITLE - label for soil properties
Hamerly loam; HYDG: C   Brief description of soil proper
***____________
*** Record 20: (F8.0,8X,9I4)
CORED,BDFLAG,THFLAG,KDFLAG,HSWZT,MOC,IRFLAG,ITFLAG,IDFLAG,BIOFLG
***CORED (cm)      BD  TH  KD  HS MOC  IR  IT  ID BIO
1.50E+02            0   0   0   0   0   0   0   0   0
***____________
*** Record 26: (9F8.0) (1)DAIR, (1)HENRYK, (1)ENPY
4.30E+031.19E-152.00E+01
***____________
*** Record 33:  (I8) NHORIZ (total number of soil horizons)
       4
***____________
*** Record 34 for Horizon 1: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       11.00E+011.48E+002.24E-010.00E+000.00E+000.00E+00
***____________
*** Record 36 for Horizon 1: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***____________
*** Record 37 for Horizon 1: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        1.00E-012.24E-011.08E-012.36E+003.78E+00
***____________
*** Record 34 for Horizon 2: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       21.50E+011.48E+002.24E-010.00E+000.00E+000.00E+00
***____________
*** Record 36 for Horizon 2: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***____________
*** Record 37 for Horizon 2: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        5.00E+002.24E-011.08E-012.36E+003.78E+00
***____________
*** Record 34 for Horizon 3: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       32.50E+011.48E+002.24E-010.00E+000.00E+000.00E+00
***____________
*** Record 36 for Horizon 3: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***____________
*** Record 37 for Horizon 3: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        5.00E+002.24E-011.08E-018.20E-011.31E+00
***____________
*** Record 34 for Horizon 4: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       41.00E+021.48E+002.28E-010.00E+000.00E+000.00E+00
***____________
```

```
*** Record 36 for Horizon 4: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***_____________
*** Record 37 for Horizon 4: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        5.00E+002.28E-011.10E-012.50E-014.00E-01
***_____________
*** Record 40: (2I8) ILP; CFLAG (blank if ILP=0)
       0
***_____________
*** Record 42: (3(4X,A4,4X,A4,I8),I4)
ITEM1,STEP1,LFREQ1,ITEM2,STEP2,LFREQ2,ITEM3,STEP3,LFREQ3,EXMFLG
    WATR    YEAR      10     PEST    YEAR      10     CONC    YEAR      10   1
***_____________
*** Record 43: (I8) EXMENV
      99
***_____________
*** Record 44 for Chemical 1: EXMCHM,CAS Number,NPROC,RFORM,YIELD
       1    CASSNO: -999       1       10.00E+00
***_____________
*** Record 45: NPLOTS (number of time series variables,STEP4
       0    YEAR
***_____________
*** Records 46: Plotting variables
```

CALIFORNIA COTTON SCENARIO, CAM 5
FILE NAME = CA1Ctt-P.INP

```
*** Record 1: (A78), TITLE - label for simulation title
Express     v. 1.03.02    (2007-07-20)
*** "CaCotton.xls - Created August 6, 2001" Title of i
***_____________
*** Record 2: (A78), HTITLE - Hydrology Information Title
"Fresno County, CA - MLRA 17, Metfile: W93193.dvf (old:
***_____________
*** Record 3: (2F8.0,I8,F8.0,2I8,5I4) PFAC,SFAC,IPEIND,ANETD,INICRP,ISCOND
***PFAC SFAC    IPEIND  ANETD   INICRP  ISCOND     (WDM data sets not used)
7.30E-010.00E+00       01.75E+01       1       1
***_____________
*** Record 6: (I8) ERFLAG: Flag to calculate erosion
       4
***_____________
*** Record 7: (4F8.0,8X,I8,2F8.0) USLEK,USLELS,USLEP,AFIELD,IREG,SLP,HL
***USLEKUSLELS  USLEP   AFIELD          IREG    SLP     HL
2.10E-013.70E-011.00E+001.00E+01               1    2.50  356.80
***_____________
*** Record 8: (I8) NDC - Number of different crops simulated; FLITNUM
       1 0
***_____________
*** Record 9 for Crop 1: (I8,3F8.0,I8,3(1X,I3),2F8.0)
ICNCN,CINTCP,AMXDR,COVMAX,ICNAH,(3)CN,WFMAX,HTMAX
***ICNCNCINTCP  AMXDR   COVMAX  ICNAH    CN1 CN2 CN3WFMAX   HTMAX
       12.00E-016.50E+011.00E+02       3  89  86  870.00E+001.22E+02
***_____________
*** Record 9A (2I8): CROPNO,NUSLEC - Crop, Number of USLE C (cover management) factors
       1      26
*** Record 9B: (16(I2,I2,1X) GDUSLEC,GMUSLEC for each USLEC
***M DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM
0105 1605 0106 1606 0107 1607 0108 1608 0109 1609 0110 1610 0111 1111 1611 0112
*** Record 9C: (16(F4.0,1X)) - USLEC (USLE Cover management factors)
```

```
.161 .085 .062 .062 .062 .054 .054 .054 .054 .054 .055 .091 .098 .098 .108 .123
*** Record 9D: (16(F4.0,1X)) - MNGN - Manning's N for each USLEC
.023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023
*** Record 9E: (16(I4,1X)) - CN(II) for each USLEC
  86   86   86   86   86   86   86   86   86   86   86   86   86   86   89   89
***____________
*** Continuation of Records 9B,9C,9D,9E for USLEC 17-26
***M DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM DDMM
1612 0101 1601 0102 1602 2502 0103 1603 0104 1604
.137 .157 .175 .196 .351 .395 .412 .392 .337 .259
.023 .023 .023 .023 .023 .023 .023 .023 .023 .023
  89   89   89   89   89   89   89   89   89   89
***____________
*** Record 10: (I8) NCPDS - number of cropping periods
      30
***____________
*** Record(s) 11: (2X,3I2,2X,3I2,3X,3I2,I8) - dates of crop EMergence, MAturation, and
HArvest
*** EMD,EMM,IYREM,MAD,MAM,IYRMAT,HAD,HAM,IYRHAR,INCROP
***EMerge MAture  HArvest
***DMMYY  DDMMYY  DDMMYY   Crop No.
  010561  200961  111161       1
  010562  200962  111162       1
  010563  200963  111163       1
  010564  200964  111164       1
  010565  200965  111165       1
  010566  200966  111166       1
  010567  200967  111167       1
  010568  200968  111168       1
  010569  200969  111169       1
  010570  200970  111170       1
  010571  200971  111171       1
  010572  200972  111172       1
  010573  200973  111173       1
  010574  200974  111174       1
  010575  200975  111175       1
  010576  200976  111176       1
  010577  200977  111177       1
  010578  200978  111178       1
  010579  200979  111179       1
  010580  200980  111180       1
  010581  200981  111181       1
  010582  200982  111182       1
  010583  200983  111183       1
  010584  200984  111184       1
  010585  200985  111185       1
  010586  200986  111186       1
  010587  200987  111187       1
  010588  200988  111188       1
  010589  200989  111189       1
  010590  200990  111190       1
***____________
*** Record 12: (A78) PTITLE - Label for pesticide
Chemical Input Data:
***____________
*** Record 13: (4I8) NAPS,NCHEM,FRMFLG,DK2FLG
*** NAPS    NCHEM   FRMFLG  DK2FLG
      30       1       0       0
***____________
*** Record 15: (3A20) Name(s) of pesticides for output titles
Clothianidin
***____________
*** Record(s) 16: (2X,3I2,I3,3(I2,F5.0,F6.0,F5.0,F5.0)) - application data
```

```
***   including the application date (APD,APM,IAPYR), WINDAY, and
(1)(CAM,DEPI,TAPP,APPEFF,DRFT)
***DMMYYWinCmDepi Tapp  Eff  Drft CmDepi Tapp  Eff  Drft CmDepi Tapp  Eff  Drft
  240461  0 5 1.270.07091.000.0000
  240462  0 5 1.270.07091.000.0000
  240463  0 5 1.270.07091.000.0000
  240464  0 5 1.270.07091.000.0000
  240465  0 5 1.270.07091.000.0000
  240466  0 5 1.270.07091.000.0000
  240467  0 5 1.270.07091.000.0000
  240468  0 5 1.270.07091.000.0000
  240469  0 5 1.270.07091.000.0000
  240470  0 5 1.270.07091.000.0000
  240471  0 5 1.270.07091.000.0000
  240472  0 5 1.270.07091.000.0000
  240473  0 5 1.270.07091.000.0000
  240474  0 5 1.270.07091.000.0000
  240475  0 5 1.270.07091.000.0000
  240476  0 5 1.270.07091.000.0000
  240477  0 5 1.270.07091.000.0000
  240478  0 5 1.270.07091.000.0000
  240479  0 5 1.270.07091.000.0000
  240480  0 5 1.270.07091.000.0000
  240481  0 5 1.270.07091.000.0000
  240482  0 5 1.270.07091.000.0000
  240483  0 5 1.270.07091.000.0000
  240484  0 5 1.270.07091.000.0000
  240485  0 5 1.270.07091.000.0000
  240486  0 5 1.270.07091.000.0000
  240487  0 5 1.270.07091.000.0000
  240488  0 5 1.270.07091.000.0000
  240489  0 5 1.270.07091.000.0000
  240490  0 5 1.270.07091.000.0000
***____________
*** Record 17: (includes data for each chemical) (F8.0,3(I8,F8.0)) FILTRA,
(1)(IPSCND,UPTKF)
***FILT IPSCND1 UPTKF1  IPSCND2 UPTKF2  IPSCND3 UPTKF3
0.00E+00       10.00E+00
***____________
*** Record 19: (A78) STITLE - label for soil properties
Twisselman Clay - Hydg: C   Brief description of soil pr
***____________
*** Record 20: (F8.0,8X,9I4)
CORED,BDFLAG,THFLAG,KDFLAG,HSWZT,MOC,IRFLAG,ITFLAG,IDFLAG,BIOFLG
***CORED (cm)      BD  TH  KD  HS MOC  IR  IT  ID BIO
1.00E+02            0   0   0   0   0   2   0   0   0
***____________
*** Record 26: (9F8.0) (1)DAIR, (1)HENRYK, (1)ENPY
4.30E+031.19E-152.00E+01
***____________
*** Record 27 (I8,3F8.0) IRTYP,FLEACH,PCDEPL,RATEAP - irrigation specifications
***IRTYPFLEACH  PCDEPL  RATEAP
       41.00E-015.50E-017.40E-02
***____________
*** Record 33:  (I8) NHORIZ (total number of soil horizons)
       3
***____________
*** Record 34 for Horizon 1: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       11.00E+011.45E+003.60E-010.00E+000.00E+000.00E+00
***____________
*** Record 36 for Horizon 1: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***____________
```

```
*** Record 37 for Horizon 1: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        1.00E-013.60E-012.20E-012.90E-014.64E-01
***____________
*** Record 34 for Horizon 2: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       22.60E+011.50E+003.60E-010.00E+000.00E+000.00E+00
***____________
*** Record 36 for Horizon 2: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***____________
*** Record 37 for Horizon 2: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        2.00E+003.60E-012.20E-012.90E-014.64E-01
***____________
*** Record 34 for Horizon 3: (I8,8F8.0) HORIZN,THKNS,BD,THETO,AD,(1)DISP,ADL
       36.40E+011.60E+003.17E-010.00E+000.00E+000.00E+00
***____________
*** Record 36 for Horizon 3: (8X,9F8.0)  (1)DWRATE,(1)DSRATE,(1)DGRATE
        9.30E-049.30E-040.00E+00
***____________
*** Record 37 for Horizon 3: (8X,7F8.0) DPN,THEFC,THEWP,OC,(1)KDs
        4.00E+003.17E-011.97E-011.74E-012.78E-01
***____________
*** Record 40: (2I8) ILP; CFLAG (blank if ILP=0)
       0
***____________
*** Record 42: (3(4X,A4,4X,A4,I8),I4)
ITEM1,STEP1,LFREQ1,ITEM2,STEP2,LFREQ2,ITEM3,STEP3,LFREQ3,EXMFLG
    WATR    YEAR      10    PEST    YEAR      10    CONC    YEAR      10   1
***____________
*** Record 43: (I8) EXMENV
      99
***____________
*** Record 44 for Chemical 1: EXMCHM,CAS Number,NPROC,RFORM,YIELD
       1    CASSNO: -999       1       10.00E+00
***____________
*** Record 45: NPLOTS (number of time series variables,STEP4
       0    YEAR
***____________
*** Records 46: Plotting variables


**********************************************************************
```

Table of Estimated Environmental Concentrations from PRZM-EXAMS

CAM = 5 for Seed Treatments, CAM = 1 or 2 for surface applications (pond water EECs):

Upper 10th Percentile Limnetic EECs in Farm Pond

Chemical - Clothianidin

Scenarios	Instantaneous	96-Hour	21-Day	60-Day	90-Day	Annual
RUN ID: GA1Oni-P	31.4	31.2	30.6	29.3	27.9	18.6
RUN ID: FL1Car-P	17.4	17.2	16.8	15.9	14.4	9.15
RUN ID: FL1Cuc-P	10.8	10.8	10.6	10.2	8.85	6.13
RUN ID: FL1Pep-P	10.6	10.6	10.4	9.85	9.44	6.06
RUN ID: CA1Let-P	7.33	7.30	7.15	6.86	6.67	5.26
RUN ID: FL1Cbb-P	5.58	5.54	5.43	5.22	4.82	3.42
RUN ID: PA1Tur-P	4.47	4.46	4.39	4.28	4.14	3.41
RUN ID: FL1Tur-P	3.05	3.04	2.97	2.85	2.76	2.17
RUN ID: NC1Ctt-P	3.00	2.98	2.91	2.82	2.76	2.18
RUN ID: MS1Ctt-P	2.80	2.78	2.74	2.62	2.53	1.85
RUN ID: NY2Gra-P	2.26	2.25	2.23	2.16	2.13	1.65
RUN ID: FL1Tma-P	1.15	1.14	1.11	1.07	1.06	0.829
RUN ID: CA1Gra-P	1.11	1.10	1.08	1.02	0.993	0.701
RUN ID: MS1Syb-P	1.07	1.07	1.05	1.01	0.976	0.708
RUN ID: CA1Oni-P	1.07	1.06	1.04	0.997	0.967	0.729
RUN ID: PA1Tma-P	0.998	0.998	0.978	0.943	0.916	0.759
RUN ID: NC1Tba-P	0.983	0.977	0.955	0.935	0.916	0.693
RUN ID: ND1Whe-P	0.796	0.793	0.782	0.770	0.757	0.629
RUN ID: ND1Cno-P	0.491	0.488	0.480	0.462	0.450	0.367
RUN ID: CA1Ctt-P	0.310	0.309	0.306	0.300	0.296	0.224
RUN ID: ME1Pot-P	0.265	0.265	0.264	0.260	0.258	0.214
RUN ID: MS1Cor-P	0.152	0.151	0.148	0.141	0.137	0.106
RUN ID: IL1Cor-P	0.672E-01	0.668E-01	0.663E-01	0.641E-01	0.623E-01	0.508E-01
RUN ID: OH1Cor-P	0.556E-01	0.553E-01	0.539E-01	0.524E-01	0.510E-01	0.438E-01
RUN ID: PA1Cor-P	0.369E-01	0.367E-01	0.362E-01	0.351E-01	0.344E-01	0.302E-01
RUN ID: ID1Pot-P	0.313E-01	0.312E-01	0.311E-01	0.306E-01	0.303E-01	0.226E-01
RUN ID: NC1Cor-P	0.305E-01	0.304E-01	0.302E-01	0.296E-01	0.292E-01	0.224E-01

Express u. 1.03.02 (2007-07-20) - Exams 2.98.04.06 with PRZM 3.12.2(+8)

CAM = 8 for Seed Treatments, CAM = 1 or 2 for surface applications (pond water EECs):

Upper 10th Percentile Limnetic EECs in Farm Pond

Chemical - Clothianidin

Scenarios	Instantaneous	96-Hour	21-Day	60-Day	90-Day	Annual
RUN ID: FL1Car-P	17.4	17.2	16.8	15.9	14.4	9.15
RUN ID: GA1Oni-P	16.7	16.7	16.5	16.1	15.8	10.8
RUN ID: FL1Cuc-P	10.8	10.8	10.6	10.2	8.85	6.13
RUN ID: CA1Let-P	7.33	7.30	7.15	6.86	6.67	5.26
RUN ID: FL1Pep-P	5.79	5.75	5.62	5.30	5.11	3.41
RUN ID: FL1Cbb-P	5.58	5.54	5.43	5.22	4.82	3.42
RUN ID: PA1Tur-P	4.47	4.46	4.39	4.28	4.14	3.41
RUN ID: FL1Tur-P	3.05	3.04	2.97	2.85	2.76	2.17
RUN ID: NY2Gra-P	2.26	2.25	2.23	2.16	2.13	1.65
RUN ID: NC1Ctt-P	1.57	1.55	1.53	1.48	1.45	1.15
RUN ID: MS1Ctt-P	1.47	1.46	1.42	1.36	1.31	0.958
RUN ID: CA1Gra-P	1.11	1.10	1.08	1.02	0.993	0.701
RUN ID: NC1Tba-P	0.983	0.977	0.955	0.935	0.916	0.693
RUN ID: CA1Oni-P	0.529	0.526	0.515	0.492	0.478	0.360
RUN ID: FL1Tma-P	0.525	0.521	0.505	0.483	0.472	0.339
RUN ID: PA1Tma-P	0.399	0.397	0.389	0.375	0.364	0.302
RUN ID: ND1Cno-P	0.259	0.258	0.254	0.244	0.238	0.191
RUN ID: CA1Ctt-P	0.143	0.143	0.142	0.139	0.137	0.112
RUN ID: IL1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: MS1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: NC1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: OH1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: PA1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: ID1Pot-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: ME1Pot-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: MS1Syb-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: ND1Whe-P	0.00	0.00	0.00	0.00	0.00	0.00

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CAM = 8 for Seed Treatments, CAM = 1 or 2 for surface applications (benthic pore water EECs):

Upper 10th Percentile Benthic EECs in Farm Pond

Chemical - Clothianidin

Scenarios	Instantaneous	96-Hour	21-Day	60-Day	90-Day	Annual
RUN ID: GA1Oni-P	11.8	11.8	11.8	11.1	9.97	7.30
RUN ID: FL1Car-P	9.47	9.46	9.38	9.14	8.81	6.46
RUN ID: FL1Cuc-P	6.05	6.03	5.77	5.48	5.42	4.21
RUN ID: CA1Let-P	4.67	4.67	4.66	4.64	4.62	3.96
RUN ID: FL1Cbb-P	3.45	3.45	3.44	3.14	2.80	2.22
RUN ID: FL1Pep-P	3.12	3.12	3.11	3.05	2.98	2.11
RUN ID: PA1Tur-P	2.85	2.85	2.84	2.81	2.77	2.62
RUN ID: NY2Gra-P	1.89	1.87	1.80	1.65	1.60	1.38
RUN ID: FL1Tur-P	1.82	1.82	1.82	1.80	1.77	1.47
RUN ID: NC1Ctt-P	0.999	0.999	0.999	0.997	0.988	0.844
RUN ID: MS1Ctt-P	0.810	0.810	0.808	0.801	0.791	0.694
RUN ID: CA1Gra-P	0.600	0.600	0.600	0.591	0.578	0.443
RUN ID: NC1Tba-P	0.584	0.584	0.584	0.582	0.578	0.510
RUN ID: CA1Oni-P	0.323	0.323	0.322	0.318	0.315	0.241
RUN ID: FL1Tma-P	0.288	0.288	0.287	0.283	0.279	0.216
RUN ID: PA1Tma-P	0.284	0.284	0.284	0.282	0.278	0.221
RUN ID: ND1Cno-P	0.173	0.173	0.173	0.172	0.171	0.152
RUN ID: CA1Ctt-P	0.109	0.109	0.109	0.109	0.107	0.710E-01
RUN ID: IL1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: MS1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: NC1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: OH1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: PA1Cor-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: ID1Pot-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: ME1Pot-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: MS1Syb-P	0.00	0.00	0.00	0.00	0.00	0.00
RUN ID: ND1Whe-P	0.00	0.00	0.00	0.00	0.00	0.00

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