STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY
BOARD OF PESTICIDES CONTROL
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Memorandum

To: Board of Pesticides Control

From: Pamela J. Bryer, PhD, Toxicologist

Subject: Pesticides allowed for treatment of browntail moth near marine waters

Date: January 6, 2020

Introduction

At the April 19, 2019 meeting, the board agreed that the toxicologist should pursue updates to the list of current allowable active ingredients for treatment of browntail moth in the 50' to 250' marine shore zone.

There are several reasons to revisit the browntail moth allowable active ingredients list:

- Newer actives may appear in the marketplace and may be effective against browntail moth while also presenting a low risk profile.
- Risk assessment methodologies are constantly being refined and improved.
- Periodic reviews of the currently allowable active ingredients labeled for the management of browntail moth help to ensure implementation of appropriate protective efforts for Gulf of Maine marine organisms.

Process

Risk assessment is a multipart process and many of those components are herein summarized. Additional information may be obtained by contacting Pam Bryer.

This risk assessment evaluates the potential for harm to aquatic organisms living in the Gulf of Maine from the management of browntail moth infestations on coastal properties. Maine Forest Service provided BPC with information on their recommendations for selecting pesticides to be used to treatment for browntail moth. BPC then conducted a database search for pesticides matching those criteria and

collected the physical and chemical data on those pesticides. Using the labeled rates for the appropriate sites (ornamental, pome trees, etc) the expected concentration in the water was calculated. This predicted water concentration was then compared to estuarine and marine organisms' ability to tolerate those specific pesticides. Standard formulas and benchmarks for acceptable risk were used to establish a new list of potential chemicals for use in treating for browntail moth.

This document provides clarification of the risk assessment process in five sections:

1. Describes the formation of the initial list

2. Explains how the predicted water concentration is derived and how chemical data are selected

3. Covers the Risk Quotient calculation and how the toxicity data were selected

4. Describes how the EPA Level of Concern works

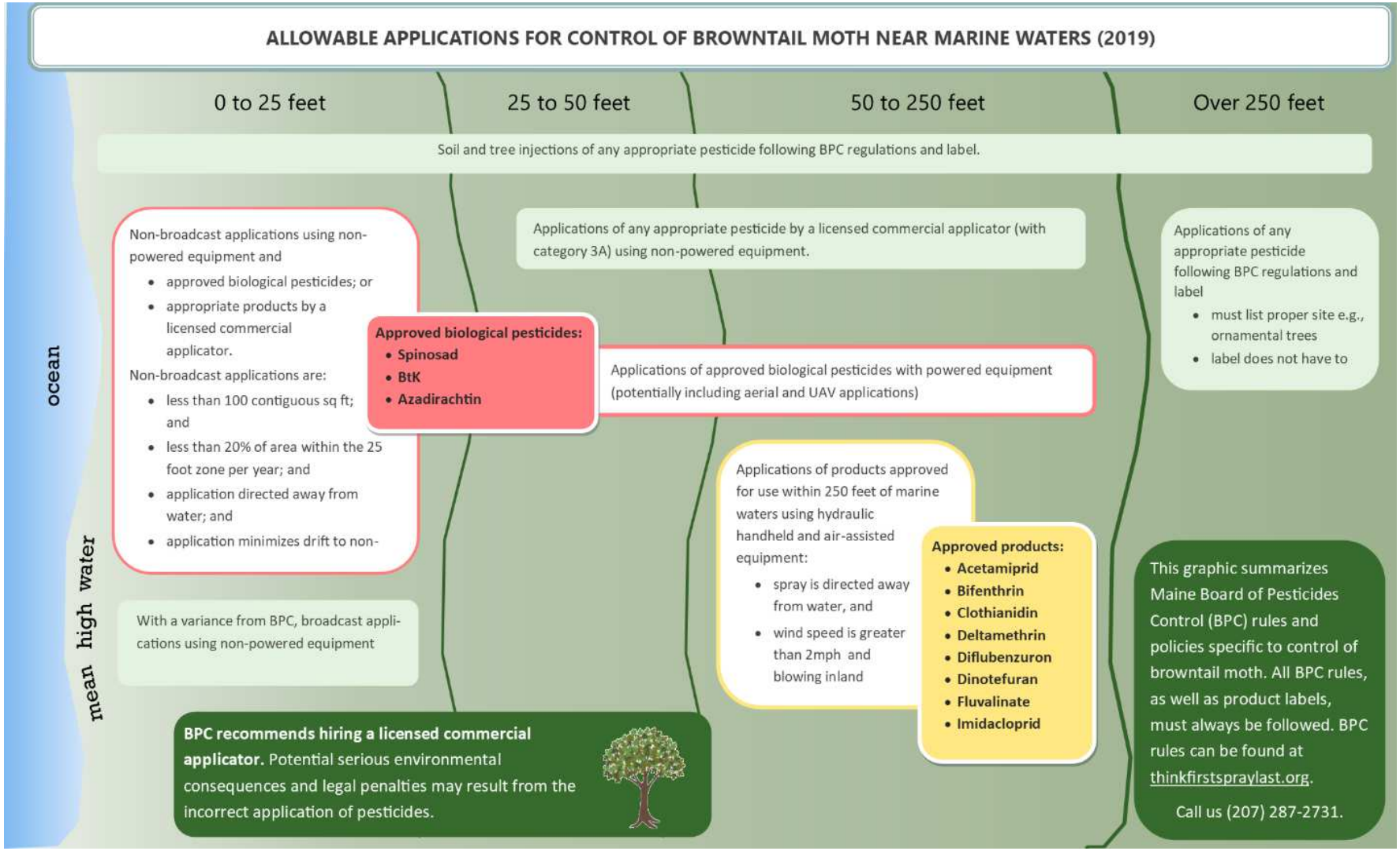
5. Describes the proposed list of active ingredients and other relevant information on those actives

Summary

- None of the previously approved active ingredients for the management of browntail moth between 50 to 250 feet from the marine highwater mark were included on the new list allowed for broadcast applications.
- Those pyrethroid insecticides assessed were deemed to have unacceptable risk, including some that were previously on the list of allowable pesticides.
- The proposed list contains six active ingredients for use with powered equipment in the area between 50 and 250 feet from the mean high-water mark. Pesticides applied by tree injection demonstrated consistently low risk profiles and represent the overall best method for avoiding off-target movement.

This ecological risk assessment only covers the potential effects on aquatic organisms (fish and invertebrates) that live in the estuarine/marine environment. Biological pesticides were not evaluated with this risk assessment.

Previous browntail moth guidance with list of approved products in the 50’ to 250’ zone.



Section 1 Initial List Development

The BPC does not make pesticide recommendations and relied on the Maine Forest Service to provide guidance on selecting active ingredients to consider for this risk assessment. There is little data available on efficacy and use of pesticides for the treatment of browntail moth. Relatively few pesticide labels indicate use on browntail moths.

The Maine pesticide registration database (NPIRS) was queried for all currently registered pesticides stating “gypsy moth” on their label. The list was further refined by restricting database returns by the year 2019, and the following sites: ornamental, fruit trees, forestry, cherry, and oak. Maine Forest Service suggested gypsy moth as a starting point for identifying potential pesticides to be used for browntail moth control because gypsy moths share several life history traits with browntail moths making them a good surrogate species. Maine Forest Service previously objected to the use of imidacloprid for browntail moth control (imidacloprid is not expected to be effective) so that chemical was eliminated from the potential list.

On October 10, 2019 Maine Forest Service and BPC participated in a Browntail Moth Roundtable Meeting. A goal of the roundtable was to provide an opportunity for status updates, as well as, to receive feedback and suggestions from applicators on the proposed list of allowed pesticides. Additionally,

applicators were surveyed by Maine Forest Service prior to the meeting to determine the most commonly used pesticides and which pesticides are considered effective.

The pesticide products database results were reduced to a list of active ingredients associated with products claiming efficacy against gypsy moths. After removing imidacloprid, as per Maine Forest Service, the list was reviewed and additional changes made. The following items were considered in shaping this initial list:

- Pesticides that are not insecticides were removed from the list.
- Pesticides that are not primarily used on ornamentals or on agricultural commodities were removed from the list. These were products that listed gypsy moth on the label but were not labeled for typical browntail moth applications, like agricultural fumigants.
    - For example, the methyl bromide label containing a gypsy moth usage listed farm equipment as the site for application.
- Pesticides that did not include the proper sites were removed from the list. Several pesticides, although labeled for gypsy moths did not include any of the following sites: outdoor ornamental; oaks; pome, stone, nut trees or cherries. This removal was practical because there was no way to calculate an Expected Environmental Concentration (EEC) without a label rate as the basis.

Label Review

For each remaining active ingredient, the label was reviewed to find the site-specific application rate and/or the site-specific maximum application rate.

This risk assessment is based on the scenario of a residential yard treatment with infested oaks. The assumption was for treatment to take place during a narrow window in early spring. When the label omitted ornamentals but included pome/stone/nut tree rates those rates were used.

When the label contained a maximum annual usage rate statement that rate was modeled. Frequently, that corresponded to the scenario of a single application. Additional usage rates were modeled when the maximum annual rate included many more applications than could be expected for a browntail moth treatment in spring. When there was no annual maximum usage statement and there were no restrictions on repeated applications one treatment a week for a month was modeled unless the label required a longer span between treatments.

The goal with selecting these rates was to push the modeled concentration to the maximum legal amount possible within the given scenario. The maximum legal amount possible exceeds the browntail moth treatment application rate most of the time.

Initial List of Considered Active Ingredients for Treatment of Browntail Moth Near Marine Waters (EPA Chem Code)
Abamectin (122804)
Acephate (103301)
Acetamiprid (99050)
Bifenthrin (128825)
Carbaryl (56801)
Chlorantraniliprole (90100)
Chlorpyrifos (59101)
Clothianidin (44309)
Cyantraniliprole (90098)
Cyfluthrin (128831)
Cyfluthrin-beta (118831)
Cyhalothrin-lambda (128897)
Cypermethrin (109702)
Cypermethrin-zeta (129064)
Deltamethrin (97805)
Diflubenzuron (108201)
Dinotefuran (44312)
Emamectin benzoate (122806)
Esfenvalerate (109303)
Fenpropathrin (127901)
Fluvalinate (109302)
Indoxacarb (67710)
Malathion (57701)
Methoxyfenozide (121027)
Naled (34401)
Novaluron (124002)
Oxydemeton-methyl (58702)
Permethrin (109701)
Phosmet (59201)
Piperonyl butoxide (67501)
Pyrethrins (69001)
Spinetoram (110008)
Tebufenozide (129026)

Section 2 EEC Calculation

Expected Environmental Concentration (EEC)

The primary driver of a risk assessment is the modeled concentration predicted to occur in the environment. How much of a hazardous compound that is found off-target, in the environment, underlies the potential for harm. In ecological risk assessments, the amount of active ingredient predicted/modeled to occur in the environmental is called the Expected Environmental Concentration or EEC.

EEC was calculated via the EPA's Pesticide in Water Calculator version 1.52. This newer model from EPA combines two different models (PRZM5 & VVWM) into one and improves the graphical user interface. The Pesticide in Water Calculator replaces the Surface Water Concentration Calculator.

The Pesticide in Water Calculator bases EEC on 1) pesticide specific chemical parameters; 2) a weather file representing local weather; 3) a standard commodity scenario; and 4) adjustable application variables including timing, frequency, boom height, application type, etc.

For this ecological risk assessment, the Pesticide in Water Calculator was set to run the "Standard EPA Pond" scenario. In this scenario, 100% of a 10-hectare plot is treated and all of the potential drift and runoff are directed to a 1-hectare pond. The model uses the local weather data with the pesticide application and chemical data to run 30 years of variable Expected Environmental Concentrations. The maximum or peak concentration produced by the model becomes the basis of the acute exposure Risk Quotient calculation. The model also calculates a 21-day average and a 60-day average, these averages become the basis for the

chronic exposure Risk Quotient calculations for invertebrates and fish respectively.

Model Input Selection

The chemical data needed for modeling are not always available so multiple sources were used. The source for each data point entered into the Pesticide in Water Calculator model for each active ingredient was recorded and is available upon request.

Preference was given to collecting data from EPA's pesticide registration risk assessment documents. For risk assessments done recently by EPA, data reported for the Pesticide in Water Calculator models used in registration documents were used directly. However, some of the older risk assessments were not modeled the same way and those cases data were not available in the most recent EPA registration risk assessment documents.

When EPA registration documents were not available, the next sources of chemical data searched were (in this order) PubChem, EPA's CompTox, University of Hertfordshire's Pesticide Properties Database (PPDB); links to these sites are in the table below.

Database Name	URL
EPA Pesticide Chemical Search	https://iaspub.epa.gov/apex/pesticides/f?p=CHEMICALSEARCH:1:0::NO:1::
PubChem	https://pubchem.ncbi.nlm.nih.gov/
CompTox	https://comptox.epa.gov/dashboard
PPDB	https://sitem.herts.ac.uk/aeru/ppdb/en/atoz.htm

Resolving Input Data Conflicts When Necessary

In an attempt to make this risk assessment as protective as possible, every chance for a conservative interpretation was taken. With chemical data this translates into resolving conflicting inputs with whichever value would allow the chemical to escape into and last the longest in the environment. For example, soil half-life is variable by nature, if a chemical's half-life data were reported as 10-14 days, 14 days would be the value chosen for use in the Pesticide in Water Calculator.

This practice of using the most conservative values is valuable in ecological risk assessments because of differences in how uncertainty is accounted for. In human health risk assessments, the risk equation is influenced by degrees of uncertainty that reflect the acknowledgement that there are missing or incomplete data (for example, studies that are done on rats will not always predict what will happen in people). Uncertainty and modifying factors are not used in ecological risk assessments, however, by selecting the most protective or conservative values possible the ecological risk assessment process attempts to ensure maximum protection.

Section 3 RQ Calculation & Toxicity Data

Risk Quotient (RQ)

Acute RQ = EEC / LD_{50}

Chronic RQ = EEC / NOAEL

The risk assessment equation compares the Expected Environmental Concentration to the lowest concentration that causes an effect in toxicity studies. The Risk Quotient, or RQ, is the variable produced and used for ecological risk characterizations. For acute studies, the toxicity study is an 'LD_{50}' study where the lethal dose to kill half of the study group is determined. For chronic studies, the toxicity study is typically a 'NOAEL' study where the highest administered concentration that causes no effect is found; NOAEL stands for No Observed Adverse Effect Level.

Toxicity Input Study Source

Where possible the toxicity data used for RQ calculations were taken from the pesticide registration documents published by the Office of Pesticide Programs at EPA. However, ideal data does not always exist and alternative data sources were required. The source of each toxicity value used was documented and those data are available upon request.

The focus of the browntail moth regulations is the protection of coastal habitats to conserve lobsters and other important marine organisms. No lobster-specific data were used in this study because there are very few published studies on lobster ecotoxicology. Toxicity data from marine and estuarine species were used, with a few exceptions when no marine or estuarine data could be located and freshwater toxicity studies were substituted. The table in Section 2 contains URLs to the data sources used for finding toxicity data.

Lowest Toxicity Value Selected

For the Risk Quotient (RQ) calculations, the lowest toxicity values were selected. The lowest value represents the highest concentration in a toxicity study where the organisms showed no effects to the pesticide, this ensures the most sensitive study organisms will be included. Unlike the simplistic acute studies and their LD_{50}s, NOAEL studies cover a broad range of toxic effects. Effects studied include growth, development, reproductive or fecundity effects, birth defects and morphology, endocrine disruption, nervous system effects, immune system factors and a suite of assays to understand the potential for cancer.

The lowest toxicity values were selected for the RQ calculation and were taken from either a fish or an invertebrate species. Although invertebrates and fish are quite different, by selecting one of two the most sensitive responses to the active ingredients under consideration the RQ calculation is made as conservative and protective as possible for the habitat as a whole. The chronic RQ calculation differs between invertebrates (21-d NOAEL study) and fish (60-d NOAEL study) to reflect the different lifespans of these organisms; and was taken into account for these calculations.

Calculated Acute & Chronic Risk Quotient (RQ) Values

Compound	Peak EEC (ppb)	21-day EEC (ppb)	60-day EEC (ppb)	Acute Aquatic LD50 (ppb)	Chronic Aquatic NOAEC (ppb)	Acute RQ	Chronic RQ
Abamectin	0	0	0	0.02	0.0029	**0**	**0**
Acephate Foliar	18.7	10.5	4.76	7300	580	**0.003**	**0.018**
Acephate Injection	0	0	0	7300	580	**0**	**0**
Acetamiprid Pome/Stone	5.14	4.64	4.08	66	2.5	**0.078**	**1.86**
Acetamiprid Nut Tree	6.17	5.56	4.89	66	2.5	**0.094**	**2.22**
Bifenthrin EPA RA	0.935	0.06.6	0.0626	0.004	0.004	**233.75**	**16.5**
Bifenthrin Ornamental Gypsy	0.374	0.0264	0.0225	0.004	0.004	**93.5**	**6.6**
Bifenthrin Ornamental Other	3.4	0.24	0.227	0.004	0.004	**850**	**60**
Carbaryl	77.4	30.3	11.8	5.7	1.5	**13.58**	**20.2**
Chlorantraniliprole	0.922	0.646	0.437	1150	695	**0.001**	**0.001**
Chlorpyrifos Apple	3.98	1.8	1.13	0.035	0.0046	**113.71**	**391.30**
Chlorpyrifos Ornamental	1.99	0.902	0.565	0.035	0.0046	**56.86**	**196.09**
Clothianidin	4.49	4.38	4.14	53	5.1	**0.085**	**0.859**
Cyantraniliprole	3.03	1.75	0.863	1200	386	**0.003**	**0.005**
Cyfluthrin	0.224	0.0161	0.0099	0.0024	0.00017	**93.33**	**94.71**
Cyfluthrin EPA RA	0.313	0.0223	0.014	0.0024	0.00017	**130.42**	**132.94**
Cyfluthrin-β	0.0028	0.0002	0.0001	0.0022	0.00007	**1.272**	**2.871**
Cyfluthrin-β a 4X Appl	0.215	0.0192	0.00993	0.0022	0.00007	**97.73**	**274.29**
Cyhalothrin-λ Pome	0.281	0.0663	0.0586	0.00491	0.0002	**57.23**	**313.5**
Cyhalothrin- λ Seed Orchard	0.704	0.157	0.147	0.00491	0.0002	**143.38**	**785**
Cyhalothrin- λ Ornamental	0.507	0.113	0.106	0.00491	0.0002	**103.26**	**565**
Cypermethrin	0.986	0.0603	0.0366	0.0054	0.000781	**182.59**	**77.21**
Cypermethrin EPA RA	0.448	0.0274	0.0166	0.0054	0.000781	**82.96**	**35.08**
Cypermethrin-zeta	0.348	0.0213	0.0129	0.04	0.01	**8.7**	**1.29**
Deltamethrin Low	0.111	0.0110	0.009	0.0037	0.024	**30**	**0.458**
Deltamethrin Mid	0.273	0.0272	0.0221	0.0037	0.024	**73.78**	**1.134**
Deltamethrin High	0.302	0.03	0.0244	0.0037	0.024	**81.62**	**1.25**
Dicrotophos	0	0	0	77	3.09	**0**	**0**
Diflubenzuron	0.126	0.0696	0.0410	0.64	0.045	**0.197**	**1.547**
Dinotefuran	0	0	0	790	6360	**0**	**0**
Emamectin benzoate	0	0	0	0.04	0.00017	**0**	**0**
Esfenvalerate	1.08	0.173	0.126	0.00466	0.012	**231.76**	**1017.65**
Fenpropathrin	2.68	0.515	0.426	0.021	16.9	**127.62**	**42.92**
Indoxacarb	0.793	0.416	0.257	54.2	25	**0.015**	**0.025**
Methoxyfenozide	5.98	5.48	5.22	1200	6.9	**0.005**	**0.219**
Naled	24.7	1.3	0.456	8.8	0.06	**2.807**	**0.188**
Novaluron	0.451	0.0535	0.0263	0.12	46	**3.758**	**0.892**
Oxydemeton-methyl	5.17	2.32	0.949	3	0.0024	**1.723**	**0.050**
Permethrin	5	0.629	0.464	0.018	0.69	**277.78**	**262.08**
Phosmet	3.79	0.0858	0.0304	2	2.1	**1.895**	**0.124**
Piperonyl butoxide	0.523	0.238	0.176	490	0.25	**0.001**	**0.113**
Pyrethrins	0.126	0.0310	0.0181	1.4	0.25	**0.09**	**0.124**
Spinetoram	0.399	0.119	0.098	2.05	38	**0.195**	**0.003**
Spinetoram Do Not Exceed	1.59	0.475	0.386	2.05	38	**0.776**	**0.013**
Tebufenozide	1.84	1.5	1.23	500	22	**0.004**	**0.068**

Section 4 Level of Concern

EPA's Level of Concern (LOC) Table

Table 2.3. Agency Risk Quotient (RQ) Metrics and Levels of Concern (LOC) Per Risk Class.

Risk Class	Risk Description	RQ	LOC
Aquatic Animals (fish and invertebrates)			
Acute	Potential for effects to non-listed animals from acute exposures	Peak EEC/LC_{50}[1]	0.5
Acute Restricted Use	Potential for effects to animals from acute exposures Risks may be mitigated through restricted use classification	Peak EEC/LC_{50}[1]	0.1
Acute Listed Species	Listed species may be potentially affected by acute exposures	Peak EEC/LC_{50}[1]	0.05
Chronic	Potential for effects to non-listed and listed animals from chronic exposures	60-day EEC/NOAEC (fish) 21-day EEC/NOAEC (invertebrates)	1
Aquatic Plants			
Non-Listed	Potential for effects to non-listed plants from exposures	Peak EEC/LC_{50}[1]	1
Listed	Potential for effects to listed plants from exposures	Peak EEC/NOAEC	1
Terrestrial Animals (mammals and birds)[2]			
Acute	Potential for effects to non-listed animals from acute exposures	EEC/LC_{50} (Dietary) EEC/LD_{50} (Dose)	0.5
Acute Restricted Use	Potential for effects to animals from acute exposures Risks may be mitigated through restricted use classification	EEC/LC_{50} (Dietary) EEC/LD_{50} (Dose)	0.2
Acute Listed Species	Listed species may be potentially affected by acute exposures	EEC/LC_{50} (Dietary) EEC/LD_{50} (Dose)	0.1
Chronic	Potential for effects to non-listed and listed animals from chronic exposures	EEC/NOAEC	1
Terrestrial and Semi-Aquatic Plants			
Non-Listed	Potential for effects to nontarget, non-listed plants from exposures	EEC/ EC_{25}	1
Listed Plant	Potential for effects to nontarget, listed plants from exposures	EEC/ NOAEC EEC/ EC_{05}	1

[1] LC_{50} or EC_{50}.
[2] EEC based on upper bound Kenaga nomogram values for foliar exposure.

When the calculated Risk Quotient (RQ) is higher than the established Level of Concern (LOC) there is unacceptable risk, and conversely when the RQ is lower than the LOC value, risk is deemed acceptable.

Risk Quotient > Level Of Concern --> Unacceptable Risk
Risk Quotient < Level Of Concern --> Acceptable Risk

For example, imagine a modeled application produced the following:

A 21-day average Expected Environmental Concentration, EEC, of 20 ppm
-and we know that-

The 14 speckled sand shrimp shows a toxicity response, NOAEL, (say, fewer than normal number of babies) when exposed to 7 ppm but not to 5 ppm.
-then we calculate-

RQ = EEC/NOAEL --> RQ = 20 ppm /5 ppm --> RQ = 4

We would compare this RQ = 4 to the LOC that is appropriate (LOC = 1) from the EPA LOC Table, as below.

Table 2.3. Agency Risk Quotient (RQ) Metrics and Levels of Concern (LOC) Per Risk Class.

Risk Class	Risk Description	RQ	LOC
Aquatic Animals (fish and invertebrates)			
Acute	Potential for effects to non-listed animals from acute exposures	Peak EEC/LC_{50}[1]	0.5
Acute Restricted Use	Potential for effects to animals from acute exposures Risks may be mitigated through restricted use classification	Peak EEC/LC_{50}[1]	0.1
Acute Listed Species	Listed species may be potentially affected by acute exposures	Peak EEC/LC_{50}[1]	0.05
Chronic	Potential for effects to non-listed and listed animals from chronic exposures	60-day EEC/NOAEC (fish) 21-day EEC/NOAEC (invertebrates)	1

In this scenario, we would say this active ingredient use poses unacceptable risk to the environment because RQ of 4 is greater than LOC of 1.

Higher RQ values indicate how many more times toxic the environment is over what is known to cause effects in the most sensitive organism. In the example here, the shrimp show toxic effects starting at 5 ppm. The environmental concentration is 4 times greater than that (20 ppm) and would very likely cause effects.

Selection of Listed Species Criteria

Under the acute exposure scenario EPA has established three risk classes: acute, acute restricted use, and acute listed species. With each level the acceptable risk threshold is lowered. In this risk assessment, only the 'Acute Listed Species' value was used.

Table 2.3. Agency Risk Quotient (RQ) Metrics and Levels of Concern (LOC

Risk Class	Risk Description
	Aquatic Animals (fish and invertebrates)
Acute	Potential for effects to non-listed animals from acute exposures
Acute Restricted Use	Potential for effects to animals from acute exposures Risks may be mitigated through restricted use classification
Acute Listed Species	Listed species may be potentially affected by acute exposures
Chronic	Potential for effects to non-listed and listed animals from chronic exposures

The 'Listed Species' risk class was selected not because lobsters and shellfish are currently federally or state listed but as a means to make this risk assessment as conservative as possible to protect this unique habitat. Very little toxicity testing has taken place on lobsters or other species of shellfish important to the Gulf of Maine ecosystem. Ecological risk assessments do not include uncertainty or modifying factors, like those used in human health risk assessments, to account for unknown variables in the available data so accepting the listed status level can help account for unknown species differences.

Acceptable Risk Indicated with Green Highlighting

Compound	Peak EEC (ppb)	21-day EEC (ppb)	60-day EEC (ppb)	Acute Aquatic LD_{50} (ppb)	Chronic Aquatic NOAEC (ppb)	**Acute RQ (LOC<0.05)**	**Chronic RQ (LOC<1)**
Abamectin	0	0	0	0.02	0.0029	**0**	**0**
Acephate Foliar	18.7	10.5	4.76	7300	580	**0.003**	**0.018**
Acephate Injection	0	0	0	7300	580	**0**	**0**
Acetamiprid Pome/Stone	5.14	4.64	4.08	66	2.5	**0.078**	**1.86**
Acetamiprid Nut Tree	6.17	5.56	4.89	66	2.5	**0.094**	**2.22**
Bifenthrin EPA RA	0.935	0.06.6	0.0626	0.004	0.004	**233.75**	**16.5**
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Bifenthrin Ornamental Other	3.4	0.24	0.227	0.004	0.004	**850**	**60**
Carbaryl	77.4	30.3	11.8	5.7	1.5	**13.58**	**20.2**
Chlorantraniliprole	0.922	0.646	0.437	1150	695	**0.001**	**0.001**
Chlorpyrifos Apple	3.98	1.8	1.13	0.035	0.0046	**113.71**	**391.30**
Chlorpyrifos Ornamental	1.99	0.902	0.565	0.035	0.0046	**56.86**	**196.09**
Clothianidin	4.49	4.38	4.14	53	5.1	**0.085**	**0.859**
Cyantraniliprole	3.03	1.75	0.863	1200	386	**0.003**	**0.005**
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Cyfluthrin-β	0.0028	0.0002	0.0001	0.0022	0.00007	**1.272**	**2.871**
Cyfluthrin-β a 4X Appl	0.215	0.0192	0.00993	0.0022	0.00007	**97.73**	**274.29**
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Cypermethrin	0.986	0.0603	0.0366	0.0054	0.000781	**182.59**	**77.21**
Cypermethrin EPA RA	0.448	0.0274	0.0166	0.0054	0.000781	**82.96**	**35.08**
Cypermethrin-zeta	0.348	0.0213	0.0129	0.04	0.01	**8.7**	**1.29**
Deltamethrin Low	0.111	0.0110	0.009	0.0037	0.024	**30**	**0.458**
Deltamethrin Mid	0.273	0.0272	0.0221	0.0037	0.024	**73.78**	**1.134**
Deltamethrin High	0.302	0.03	0.0244	0.0037	0.024	**81.62**	**1.25**
Dicrotophos	0	0	0	77	3.09	**0**	**0**
Diflubenzuron	0.126	0.0696	0.0410	0.64	0.045	**0.197**	**1.547**
Dinotefuran	0	0	0	790	6360	**0**	**0**
Emamectin benzoate	0	0	0	0.04	0.00017	**0**	**0**
Esfenvalerate	1.08	0.173	0.126	0.00466	0.012	**231.76**	**1017.65**
Fenpropathrin	2.68	0.515	0.426	0.021	16.9	**127.62**	**42.92**
Indoxacarb	0.793	0.416	0.257	54.2	25	**0.015**	**0.025**
Methoxyfenozide	5.98	5.48	5.22	1200	6.9	**0.005**	**0.219**
Naled	24.7	1.3	0.456	8.8	0.06	**2.807**	**0.188**
Novaluron	0.451	0.0535	0.0263	0.12	46	**3.758**	**0.892**
Oxydemeton-methyl	5.17	2.32	0.949	3	0.0024	**1.723**	**0.050**
Permethrin	5	0.629	0.464	0.018	0.69	**277.78**	**262.08**
Phosmet	3.79	0.0858	0.0304	2	2.1	**1.895**	**0.124**
Piperonyl butoxide	0.523	0.238	0.176	490	0.25	**0.001**	**0.113**
Pyrethrins	0.126	0.0310	0.0181	1.4	0.25	**0.09**	**0.124**
Spinetoram	0.399	0.119	0.098	2.05	38	**0.195**	**0.003**
Spinetoram Do Not Exceed	1.59	0.475	0.386	2.05	38	**0.776**	**0.013**
Tebufenozide	1.84	1.5	1.23	500	22	**0.004**	**0.068**

Section 5 List of Potential Pesticides

Proposed List of Active Ingredients Allowed for the Treatment of Browntail Moth Near Marine Waters*

Acephate
Chlorantraniliprole
Cyantraniliprole
Indoxacarb
Piperonyl butoxide
Tebufenozide

*within the 50' to 250' zone from the marine water edge using powered application equipment

Major Changes from Previous List

This proposed list represents a major change from the previous list. None of the chemicals available on the previous list are represented on this newer list for powered broadcast application. This change is likely a consequence of changing the assessment scenario and incorporating chronic exposures into the assessment framework. The scenario basis for the previous assessment originated from the

'worst case' scenario of a chemical spill into a pond. The current assessment is based on maximum legal use, as intended at the relevant sites, for both acute and chronic exposure levels.

The current method of determining Expected Environmental Concentration allows for the chemical specific details to be incorporated into the scenario. As an example, bifenthrin is a pyrethroid insecticide that has a relatively short half-life on the plant while exposed to sunlight, however, this changes once bifenthrin reaches the sediment. In sediment, the half-life of bifenthrin is roughly 18 times longer than the foliar half-life. Incorporation of more chemical-specific parameters into the environmental modelling allow us to better predict expected effects of the products as used.

After all active ingredient concentrations were modeled with the Pesticides in Water Calculator, the Expected Environmental Concentration was compared to a sensitive marker of toxicity and a Risk Quotient was established. Risk Quotients were compared to Level of Concern values to assess whether or not the potential risk is at acceptable levels. As a secondary check to this, the Expected Environmental Concentrations were compared to EPA's Aquatic Life Criteria. Specifically, the peak concentration was compared to the Aquatic Life Criteria. If the modeled concentration exceeded the Aquatic Life Criteria the pesticide was removed from the list of acceptable active ingredients. One active ingredient, methoxyfenozide, was removed from the list because of the Aquatic Life Criteria. Due to the work taken to establish Aquatic Life Criteria thresholds, if the Expected Environmental Concentration exceeds that threshold there is good reason to suspect there is a potential for unacceptable risk. It is not clear why there is this difference, though, methoxyfenozide is a newer chemistry and there were still outlying needs for additional data during registration review.

Biological Pesticides have not been included in this review. They will be reviewed for the next review cycle. The current list of allowed biologicals should remain the same until the next review.

A Note About Tree Injection Pesticides

The label search turned up 33 active ingredients that were evaluated for acceptable risk in the near marine zone. All 33 active ingredients were included in the risk assessment, however, some of the labels only allowed for tree injection. The risk assessment on these labels proceeded because of the information that could be learned from including them in the risk assessment.

There is no restriction on tree injection and as such these pesticides <u>did not need to be included</u> in this risk assessment.

As expected, all active ingredients used via tree injection were modeled to have acceptable risk in this risk assessment. Drift and surface runoff contribute to the majority of off-target movement of pesticides.

List of Tree-Injection Pesticides Included in Current Risk Assessment
Abamectin
Acephate
Dicrotophos
Dinotefuran
Emamectin benzoate

No Current Uses

There were a number of active ingredients that appeared during the initial pesticide database search but were not included in the risk assessment. The initial review searched for any pesticide that contained 'gypsy moth' on the label. Below is a table listing those chemistries that were not included in this risk assessment. The most common reason why they were not included is these pesticide products did not have the appropriate site listed to make their inclusion appropriate.

List of 'Gypsy Moth' Pesticides Not Included in Current Risk Assessment
d-Allethrin
Fluvalinate
Malathion
Mancozeb
Methyl bromide
Pyraclostrobin
Pyridalyl
Tetramethrin
Thiamethoxam

Additional aspects of consideration

Additional summary information for the assessed chemicals follows and includes carcinogenic potential, bioconcentration potential, mechanism of action, Aquatic Life Criteria concentrations, and groundwater concentrations over time are listed.

EPA Cancer Classification
(organized from highest hazard to lowest)

Likely To Be Carcinogenic To Humans.
-none-
Group B--Probable Human Carcinogen.
-none-
Group C--Possible Human Carcinogen.
Acephate
Piperonyl butoxide
Group D--Not Classifiable As To Human Carcinogenicity.
-none-
Suggestive Evidence Of Carcinogenicity, But Not Sufficient To Assess Human Carcinogenic Potential.
Dicrotophos
Not Likely To Be Carcinogenic To Humans: At Doses That Do Not Cause A Mitogenic Response In The Liver.
-none-
Not Likely To Be Carcinogenic To Humans.
Chlorantraniliprole
Cyantraniliprole
Dinotefuran
Emamectin benzoate
Indoxacarb
Methoxyfenozide
Group E--Evidence Of Non-Carcinogenicity For Humans.
Abamectin
Tebufenozide

Potential for Bioconcentration

Compound	Bioconcentration Factor	Potential for Bioconcentration[1]
Abamectin	18.9	Low
Acephate	8.55	Low
Chlorantraniliprole	166	Threshold for concern
Cyantraniliprole	251	Threshold for concern
Dicrotophos	3	Low
Dinotefuran	2	Low
Emamectin benzoate	71	Low
Indoxacarb	449,000	High
Methoxyfenozide	124	Threshold for concern
Piperonyl butoxide	249	Threshold for concern
Tebufenozide	277	Threshold for concern

[1] Rule of thumb used by EPA

General Chemistry and Mechanism of Action

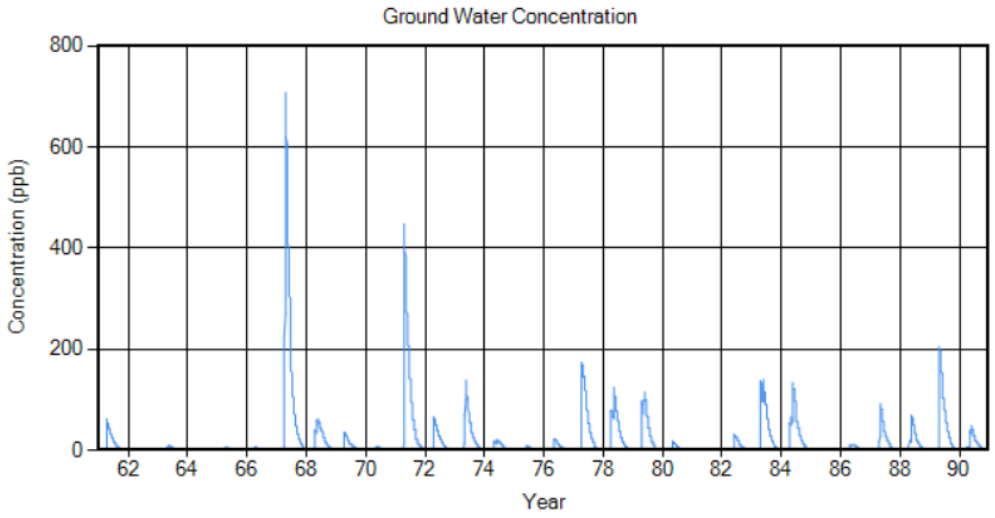
Compound	Specific BTM Efficacy	General Chemistry	Mechanism of Action
Abamectin	Yes	Mectins	Chloride channel activators
Acephate	Yes / On label	Organophosphate	Cholinesterase inhibition
Chlorantraniliprole	Unknown	Other	Ryanodine receptor modulators
Cyantraniliprole	Unknown	Other	Ryanodine receptor modulators
Dicrotophos	Unknown	Organophosphate	Cholinesterase inhibition
Dinotefuran	Yes	Neonicotinoid	nAChR activators
Emamectin benzoate	Yes	Mectins	Chloride channel activators
Indoxacarb	Unknown	Other	Sodium channel blocker
Methoxyfenozide	On label	IGR	Ecdysone agonist
Piperonyl butoxide	On label	Synergist	Modulates liver detox enzymes

EPA Aquatic Life Criteria Compared to Modeled Expected Environmental Concentrations (EEC)

	Fish		Invertebrates		Nonvascular Plants	Vascular Plants	Peak	21-day	60-day
	Acute	Chronic	Acute	Chronic	Acute	Acute	EEC	EEC	EEC
	all units ug/L (ppb)						*all units ug/L (ppb)*		
Abamectin	1.6	0.52	0.17		> 100,000	3,900	0	0	0
Acephate	416,000	5,760	550	150	> 50,000		18.7	10.5	4.76
Chlorantraniliprole	> 6,900	110	5.8	4.47	1,780	> 2,000	0.922	0.646	0.437
Cyantraniliprole	> 5,000	10,700	10.2	6.56	> 10,000	> 12,100	3.03	1.75	0.863
Dicrotophos	2,850	9,880	6.3	1.7	> 118,000	> 117,000	0	0	0
Dinotefuran	> 49,550	6,360	> 484,150	> 95,300	> 97,600	> 110,000	0	0	0
Emamectin benzoate							0	0	0
Indoxacarb	145	150	300	75	> 110	> 84	0.793	0.416	0.257
Methoxyfenozide	> 2,100	530	28.5	3.1	> 3,400		5.98	5.48	5.22
Piperonyl butoxide	950	40	255	30			0.523	0.238	0.176
Tebufenozide	1,500	51.1	1,900	29	> 740	> 940	1.84	1.5	1.23

Groundwater concentration profiles for the proposed allowable active ingredients.

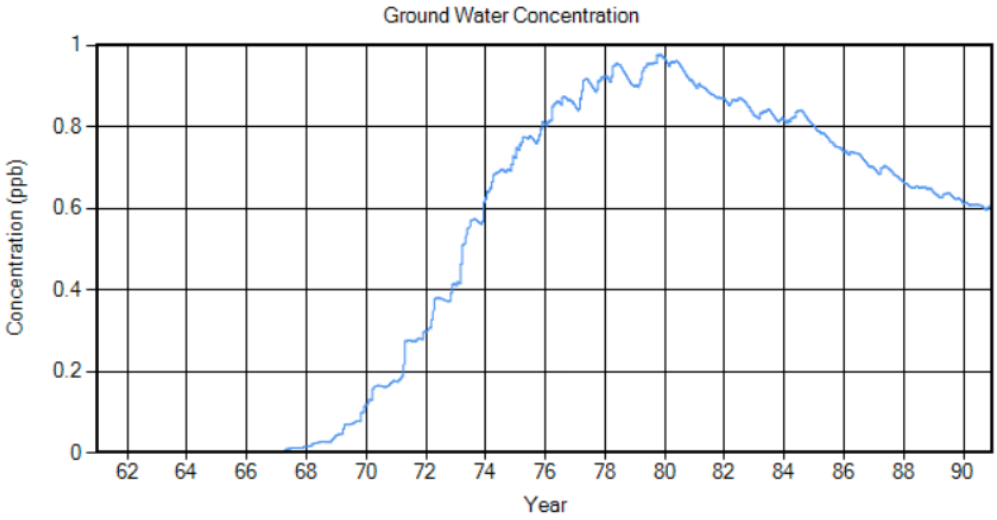
Acephate:



Copy Graph

	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	708.53	100.1435	109.413	17.30894	17.16519

Chlorantraniliprole:



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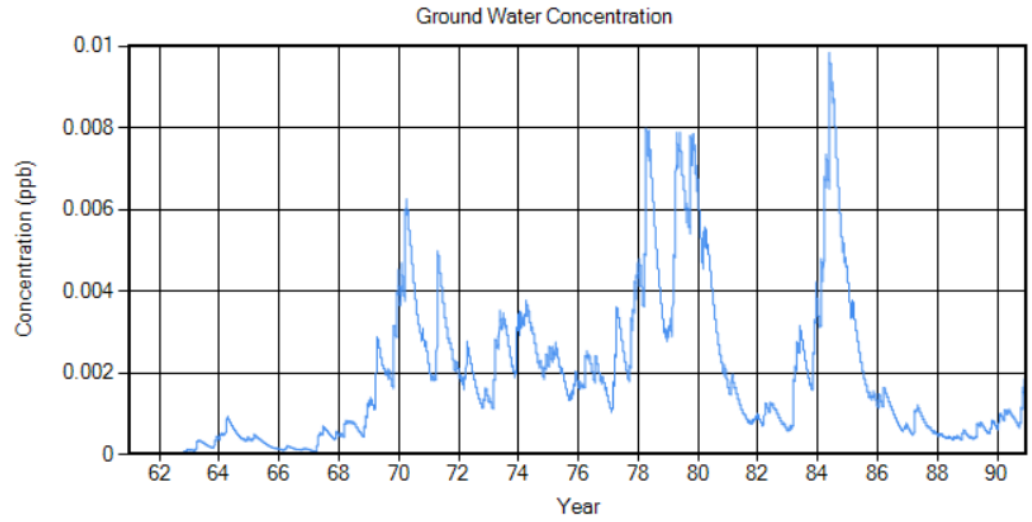
	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	0.97954	5796.991	1.890119	0.7981147	0.4963997

Cyantraniliprole:



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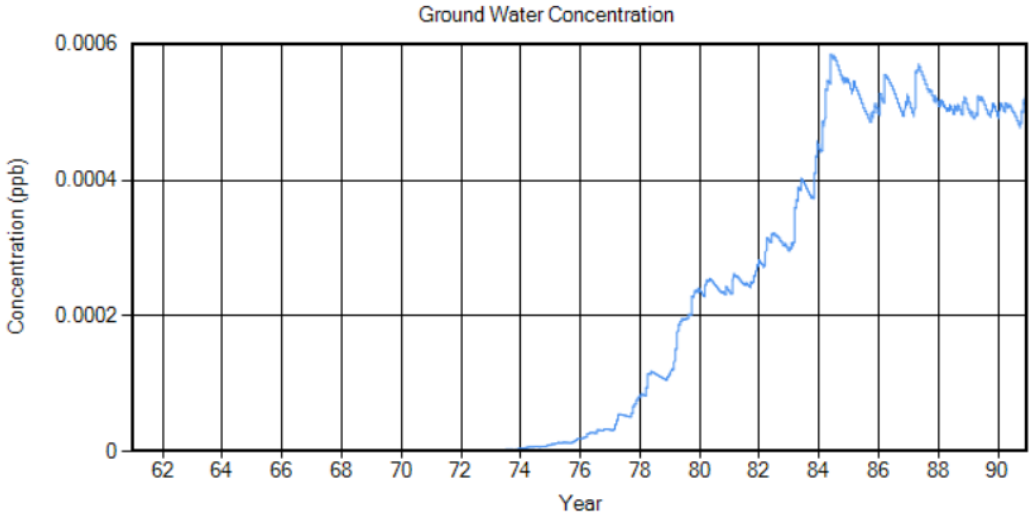
	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	0.009856	2557.705	4.283919	0.002467011	0.001875083

Indoxacarb:



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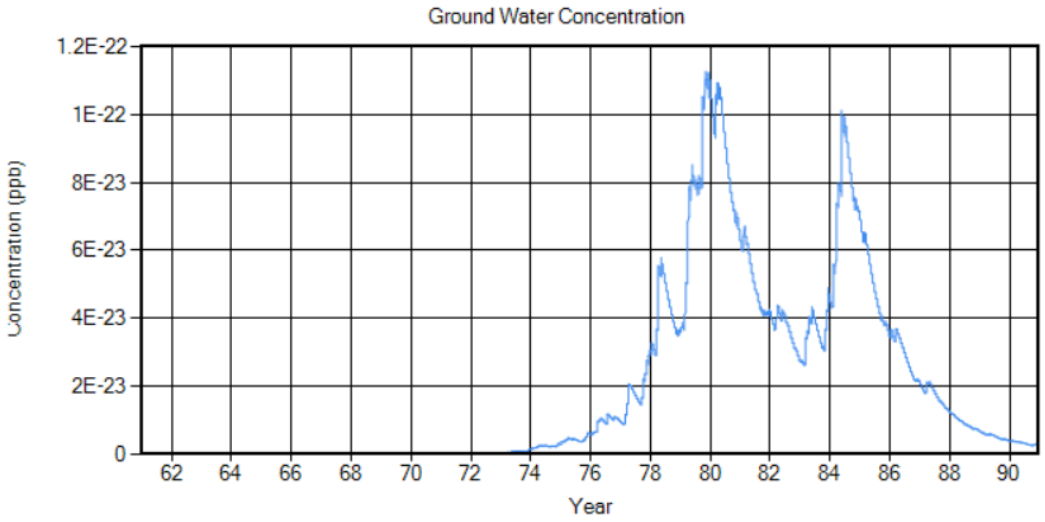
	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	0.00058643	-999999	0.5214787	-999999	0.0001730193

Piperonyl butoxide:



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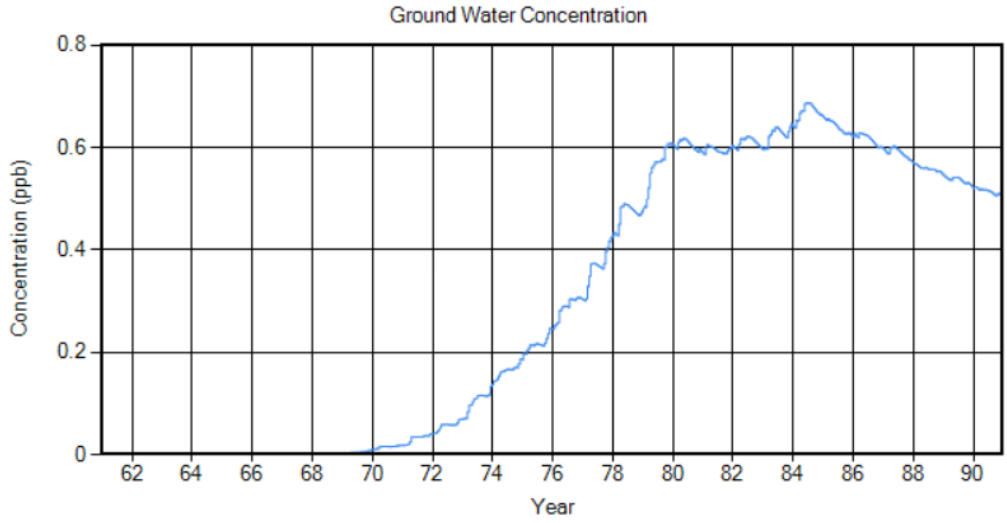
	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	1.1272E-22	-999999	0.248291	-999999	1.85458E-23

Tebufenozide:



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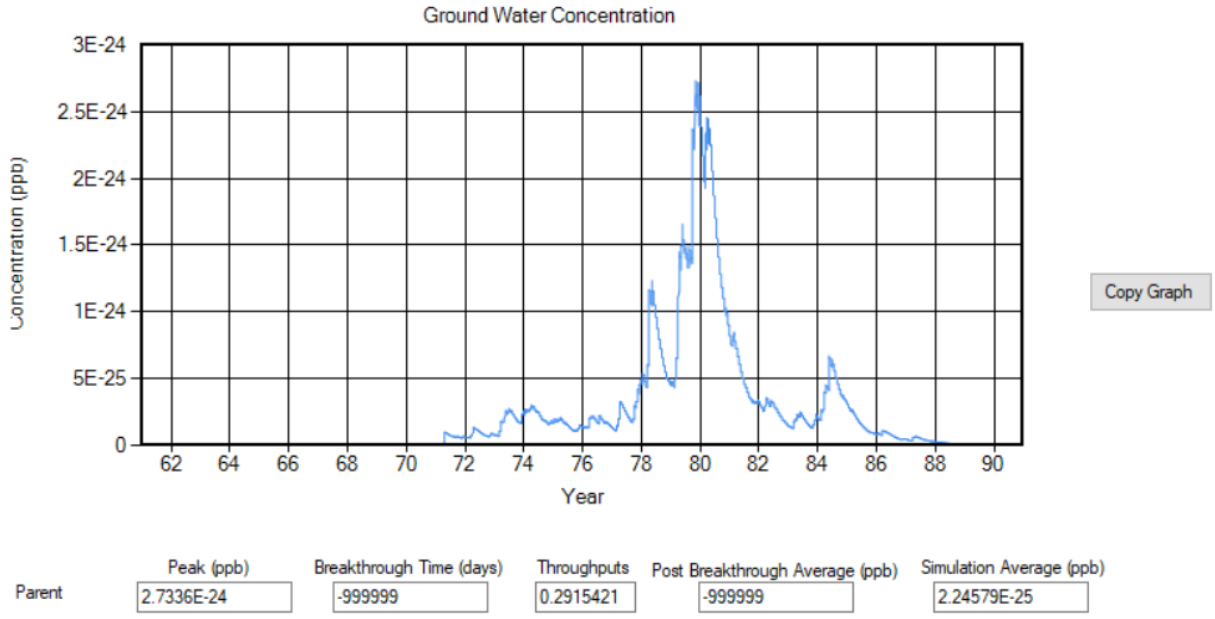
	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	0.68835	8668.021	1.264072	0.5893792	0.2942969

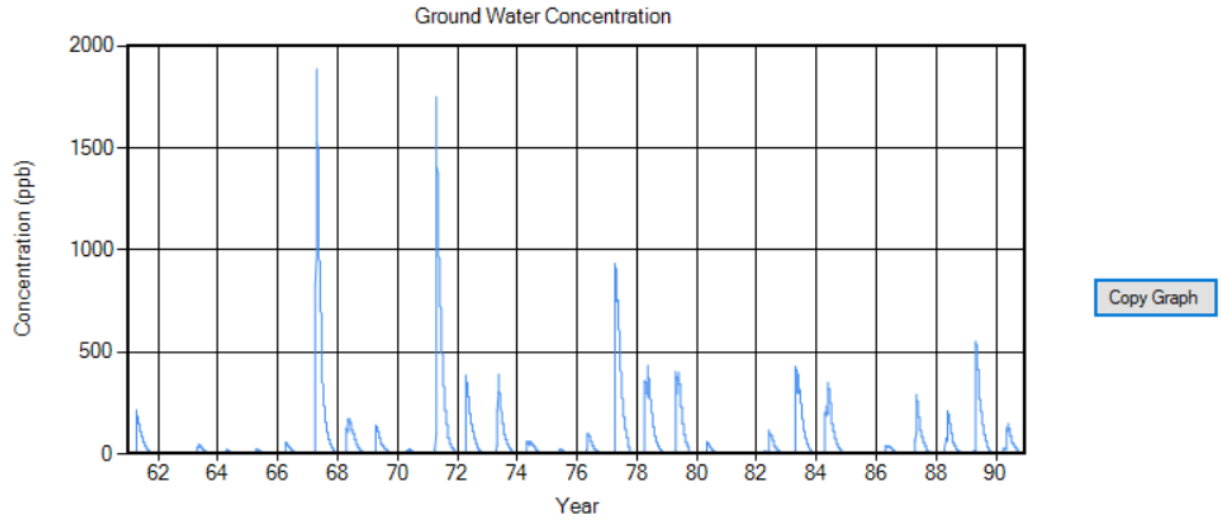
Groundwater concentration profiles for several tree-injection active ingredients.

Abamectin:



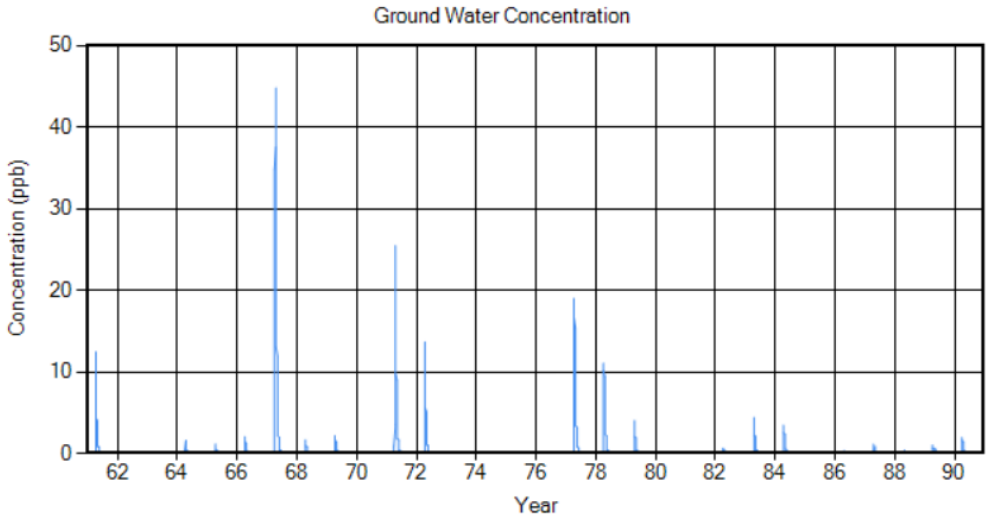
	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	2.7336E-24	-999999	0.2915421	-999999	2.24579E-25

Acephate:



	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	1889.1	100.1435	109.413	56.69709	56.22622

Dicrotophos:



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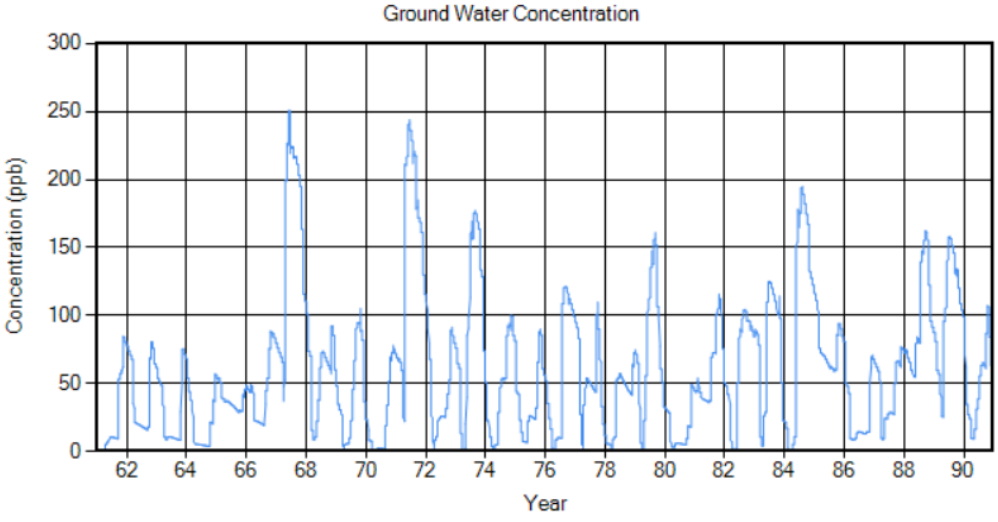
	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	44.846	90.86891	120.5803	0.2321686	0.2302615

Dinotefuran:



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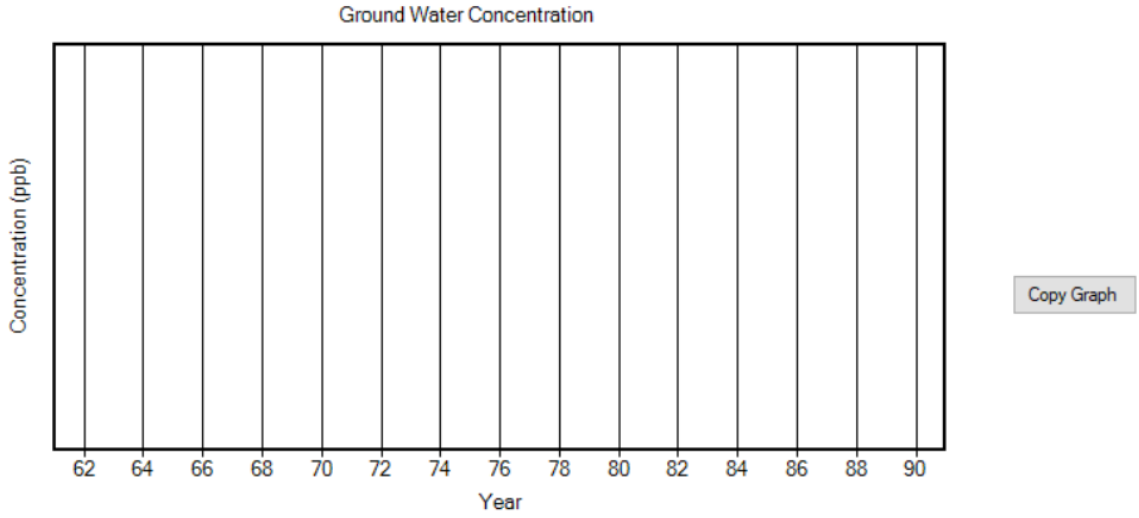
	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	250.8	164.0427	66.79359	61.2508	60.66385

Emamectin benzoate:



	Peak (ppb)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (ppb)	Simulation Average (ppb)
Parent	0	-999999	0.00604710	-999999	0