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DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
BOARD OF PESTICIDES CONTROL
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Memorandum

To: Board of Pesticides Control
From: Pamela J. Bryer, Ph.D. | Pesticides Toxicologist
Subject: Callisto Special Local Need 24c Registration 2022 Review

December 2, 2022

Summary:

Mesotrione, the active ingredient in Callisto, is a low-toxicity herbicide that is unlikely to cause undue risk to people or the environment from the proposed uses in this Special Local Need 24c, registration.

Rationale:

Background: Mesotrione is a pre-emergent and post-emergent herbicide that controls broadleaf weeds. It works by inhibiting a biochemical pathway leading to the synthesis of components of vitamin E and photosynthesis. This product came onto the market in 2001.

Risk is a function of hazard and exposure and both elements must be considered to understand and predict potential effects. Mesotrione has generally low toxicity to organisms in acute exposure scenarios. Chronic exposure to mammals has the potential for toxic effects. Label rates and use patterns are crafted to prevent exposure at levels likely to cause toxic effects in mammals. The generally short half-life and frequency of allowed applications are how exposure is maintained at acceptable levels.

Toxicity:

Hazard Test System	Hazard Categorization	Measured Level of Toxic Effect
Mammals acute	LOW	>5,000 mg/kg
Mammals chronic	HIGH	0.3 mg/kg/day
Birds acute	LOW	>3,776 mg/kg
Birds chronic	MODERATE	20.6 mg/kg/day
Earthworms acute	LOW	>2,000 mg/kg
Earthworms chronic	MODERATE	10.9 mg/kg/day

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Honeybees contact	LOW	>100 ug/bee
Honeybees oral	MODERATE	>11 ug/bee
Fish acute	LOW	>120 mg/L
Fish chronic	LOW	12.4 mg/L
Aquatic invertebrates acute	LOW	>622 mg/L
Aquatic invertebrates chronic	LOW	180 mg/L
Sediment dwelling invertebrates	LOW	180 mg/L

The following is an excerpt from PubChem detailing a human exposure study that was performed with mesotrione roughly twenty years ago:

“... The mesotrione study was performed to determine the magnitude and duration of the effect on tyrosine catabolism. Additionally, the urinary excretion of unchanged mesotrione was measured to assess the importance of this route of clearance and to help develop a strategy for monitoring occupational exposure. /Three groups, each consisting of six male volunteers between 19 and 53 years, were given a single oral dose of either 0.1, 0.5 or 4 mg mesotrione/kg./ ... Plasma tyrosine concentrations were monitored and the urinary excretion of mesotrione and tyrosine metabolites was measured. ... Administration of mesotrione resulted in an increase in tyrosine concentrations, which reached a maximum of approximately 300 nmol/mL following a dose of 4 mg/kg body weight. Concentrations returned to those of background within 2 days of dosing. Urinary excretion of tyrosine metabolites was increased during the 24 hr immediately following a dose of 4 mg mesotrione/kg, but returned to background levels during the following 24 hr period.” (<https://pubchem.ncbi.nlm.nih.gov/compound/Mesotrione#section=Human-Toxicity-Excerpts>)

This excerpt is provided simply to demonstrate the relative non-toxic nature of mesotrione in mammals. In this study, humans were dosed at different levels and the concentration of a biomarker of effect were followed. The compound cleared from the body within 24 hours and the effect on amino acid metabolism was finished in 48 hours. Long-term exposures have the potential to negatively effect mammals based on a three-generation study in rats showing effects on food consumption, litter size, and litter viability. Rats but not mice showed these effects at fairly low daily doses.

Additionally, US EPA’s 2020 Cancer Classification for mesotrione is: Not Likely To Be Carcinogenic To Humans

Exposure:

Environmental fate and transfer metric	Categorization	Measured value describing movement in environment
Solubility	High	1,500 mg/L
Persistence as measured as half-life		
Lab soil half-life	Non-persistent	4 to 44 days
Field soil half-life	Non-persistent	3 to 7 days
On/In plant tissue half-life		3 to 4.5 days
Sunlit water half-life		81 to 89 days
Water half-life	Stable	Stable
Sediment half-life		5.2 days
Octanol-water partition coefficient (LogP)	Low	0.11
Soil horizon travel		Within top 6 inches
Bioconcentration factor	Low	Calculated ≤ 3
Volatility	Low (particulate only)	5.7×10^{-3} mPa

Mesotrione has a generally short residence in the environment. Field studies show the product breaks down and is eliminated from the environment over the course of a season under most situations. Mesotrione can be stable and not breakdown if it is in dark water while sunlit waters allow for slow breakdown. The presence of microorganisms predicts rapid degradation and removal from the environment. It is not expected to accumulate in the food chain due to the low bioconcentration factor. The vapor pressure is too low for mesotrione to liberate itself from a surface into the air following application. Mesotrione is considered to be moderately mobile in the environment which is largely based on the high solubility and low low octanol-water partition coefficient.

Maine use patterns:

- 1) There were 1,189 and 1,137 lbs used by commercial applicators for 2018 and 2019 respectively (label use rates state maximum use rate of 1 lbs/ A/ yr). For reference, Maine has 22.6 million acres.
- 2) There were 3.1 acres treated each year for 2020 and 2021 of school grounds statewide treated annually with mesotrione.

National use patterns:

Tolerances are set for mesotrione in a few commodities all at a single low concentration of 0.01 ppm. Nut trees, okra, oat, rhubarb, soybean, sugarcane, and sorghum are the only commodities with established tolerances (<https://www.ecfr.gov/current/title-40/chapter-I/subchapter-E/part-180/subpart-C/section-180.571>).

Mesotrione is commonly used in midwestern states on corn as can be seen in the figures from USGS below

(https://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=2018&map=MESOTRIONE&hilo=H).

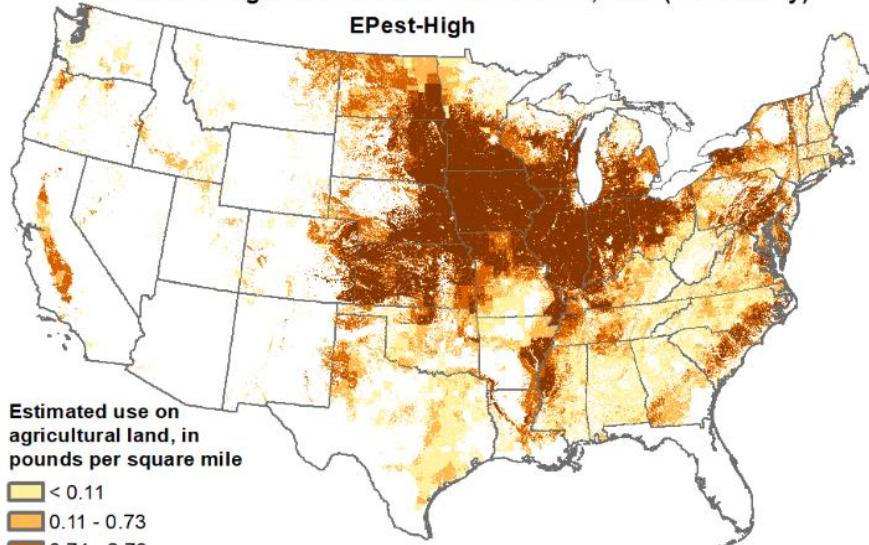
[Select another pesticide](#)

2018

● Epest-High
○ Epest-Low

Estimated Agricultural Use for Mesotrione , 2018 (Preliminary)

Epest-High



Use by Year and Crop

