

Type	Systemic insecticides
Controls	Kills insects that suck or chew plant material that has been treated.
Mode of Action	Works on the nervous system, causing insect paralysis and death.

**Thurston County Review Summary:**

Emamectin benzoate is a mixture of emamectin B1a (>90%) and emamectin B1b (<10%) CAS # 155569-91-8

Emamectin benzoate is rated high in hazard and products containing it fail Thurston County's pesticide review criteria. Emamectin benzoate is rated high in hazard due to the potential for increased susceptibility to infants and developing fetuses. Toxicity testing caused reproductive/developmental toxicity to offspring at dose concentrations that did not cause maternal toxicity (Reference 3). Foliar applications of emamectin benzoate insecticides can create concentrations on vegetation that is high in hazard to bees and other beneficial insects.

## MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	930	3	Moderate
Soil Sorption (Kd=mL/g)	219 to 2,037	3	Low
Organic Sorption (Koc=mL/g)	25,000 to 730,000	3	Low

**Mobility Summary:**

Emamectin benzoate binds well to all soil types. The hazard for it to move off the site of application with rain or irrigation water is rated low.

## PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.00000003	1	High
Biotic or Aerobic Half-life (days)	25 to 414	1	High
Photolysis Half-life (days)	2.5 (soil)	1	Low
Terrestrial Field Test Half-life (days)	6.2 (foliar)	3	Low
Hydrolysis Half-life (days)	Stable	3	High
Anaerobic Half-life (days)	1,281	3	High
Aquatic Field Test Half-life (days)	Value not found		

**Persistence Summary:**

The time it took emamectin benzoate to degrade to half of the original concentration in four different soil types varied from 25 to 414 days. In another test, it took 63 to 72 days for half of it to degrade. In sunlight, emamectin benzoate degrades to half of the applied concentration in a few days. Emamectin benzoate is expected to degrade to half of the applied concentration in about a week when it is on the surface of a plant, although it is unknown how long it takes to degrade when it is within a plant. Based on the soil half life, emamectin benzoate is rated high in hazard for persistence because it is likely to take more than 60 days to degrade to half of the applied concentration when it is not in sunlight. When injected into trees, emamectin benzoate can provide control of certain insects for over two years (which is considered highly persistent).

## BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	30	2	Low
Octanol/Water Partition Coefficient	log Kow = 5	2	High

**Bioaccumulation Summary:**

The octanol/water partition coefficient (log Kow = 5) indicates that emamectin benzoate may accumulate in fish or animals. Rats dosed with emamectin benzoate eliminated up to 90% in 5 days and 50% was elimination in about 1.5 days (Reference 2). The rapid elimination indicates a low potential to bioaccumulate in mammals. In a study with bluegill sunfish, a bioconcentration factor of 30 was calculated for edible tissue, which is considered to be a low potential for accumulation (Reference 2). The hazard for bioaccumulation potential is rated low.

# ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Toxicity Rating
Mammalian (LD50)	22 mg/kg and 53 mg/kg	2	High
Avian (LD50)	46 mg/kg bw	2	High
Honey bee or insect (LD50)	0.0035 ug/bee	2	Very high
Annelida -worms (LC50)	Value not found		
Fish (LC50)	180 ug/L	3	High
Crustacean (LC50)	1 ug/L	3	Very high
Mollusk (LC50)	490 ug/L	3	High
Amphibian (LD50 or LC50)	Value not found		

## Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that emamectin benzoate is highly or very highly toxic to all groups of organisms tested (Reference 1, 2 and 3).

A high risk to non-target arthropods and bees was identified in the EU risk assessment of emamectin benzoate applications made to grapes (Reference 1). There was substantial bee mortality noted following a foliar application to an alfalfa field at a rate of about 0.14 pounds of active ingredient per acre (Reference 2).

The EPA evaluated risk to non-target organisms from exposures to emamectin benzoate following spray applications (air blast, ground spray or aerial spray) to pome fruits (apples, pears, etc.) or tree nuts at a maximum application rate of 0.015 pounds of active ingredient per acre and found that the risk to birds and small mammals may exceed the level of concern for non-lethal toxicity (neurotoxicity) that could impair survival or reproductive success (Reference 3). The risk from potential short-term or long-term exposures to fish and other aquatic organisms following pome fruit or tree nut applications of emamectin benzoate at the maximum rate was below the EPA's calculated level of concern (Reference 3).

# ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Risk Rating
Injecting 160 trees (without gloves)	Dermal + inhalation	0.00025 mg/kg/day	0.00041 mg/kg/day	<1	3	High
Injecting 160 trees (with gloves)	Dermal + inhalation	0.00025 mg/kg/day	0.000013 mg/kg/day	19	3	Low
Child eating 1 gram of leaves from treated tree	Oral ingestion	0.00025 mg/kg/day	0.0002 mg/kg/day	1.25	3	High
Other short-term exposures were not evaluated						

## Acute Toxicity Risk Assessment Summary:

Acute toxicity risk assessments were compared to a dose of concern based on the "no effect" level of 0.075 mg/kg/day (neutotoxicity was observed at 0.1 mg/kg/day) and a safety factor of 300. Dermal absorption was determined to be 1% for concentrated products and 2% for the diluted products.

Risk from potential exposures to workers performing mixing and loading emamectin benzoate for 160 tree injections without gloves is rated high in hazard. If the worker wears chemical resistant gloves the resulting exposure would be rated low in hazard. The product label for tree injection requires that applicators wear chemically resistant gloves, so the risk assessment that includes chemically resistant gloves is more predictive of risk from potential exposures to applicators.

The highly conservative risk assessment calculated for a child eating leaves from a treated ash tree was derived from numerous assumptions about the distribution of emamectin benzoate throughout a tree. If the assumption about the chemical being distributed only to the leaves, then the risk to the child would be rated high in hazard. However, this is a very conservative estimate because it is very unlikely that the chemical will be sent to all the leaves with none of the chemical staying in the wood. The risk to a child is more likely moderate to low in hazard (but there is no data to support a lowering of the risk assessment).

Risk assessments that evaluate potential exposures to surface water were only performed for spills into small surface water bodies. Thurston County rates potential exposure hazards based on post-application risks, not from risk based on exposures from spills.

# CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	"Not likely to be carcinogenic to humans"	No evidence of carcinogenicity	1 and 2	Low
Mutagenicity	Value not found	No potential for genotoxicity	1	Low
Neurotoxicity - (NOAEL)	0.1 mg/kg/day	Neurotoxic effects	2	Rating based on risk
Endocrine Disruption	Value not found			
Developmental Toxicity (NOAEL)	2 mg/kg/day	Incomplete ossification	1	Low
Reproductive Toxicity (NOAEL)	0.6 mg/kg/day	Neurotoxic effects	1	High
Chronic Toxicity (NOAEL)	0.1 mg/kg/day	Neurotoxic effects	2	Rating based on risk

## Chronic Toxicity Hazard Summary:

Developmental/reproductive neurotoxicity was observed in offspring at doses that did not produce maternal toxicity (Reference 2). Fetal toxicity without maternal toxicity indicates an increased susceptibility to developing fetuses and is rated high in hazard by Thurston County's pesticide review criteria. Emamectin benzoate is not likely to be carcinogenic in humans and is not considered a chemical mutagen (References 1 and 2).

# CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Risk Rating
Long-term exposures are not expected						
Long-term exposures are not expected						
Long-term exposures are not expected						
Long-term exposures are not expected						

## Chronic Toxicity Risk Assessment Summary:

Ongoing lifelong exposures to insecticides containing emamectin benzoate are not expected from County or residential uses and were not evaluated or rated.

## Metabolites and Degradation Products:

In soil, amamectin benzoate degrades to 8a-OH MAB1a and N-nitroso MAB1a (Reference 1).

## Comments:

Technical grade emamectin benzoate is considered a severe eye irritant (EPA Toxicity Category I) but is not considered a skin sensitizer (Reference 3). Testing emamectin benzoate on skin produced severe irritation, slight irritation, and no irritation (Reference 3).

## References

1. European Food Safety Authority. Conclusion on the peer review of the pesticide risk assessment of the active substance emamectin. EFSA Journal 2012;10(11):2955.
2. SERA. SERA TR-052-23-03b. Emamectin benzoate Human Health and Ecological Risk Assessment FINAL REPORT. October 28, 2010.
3. USEPA. Environmental Fate and Effects Division (7507P). Section 3 Request for Additional Uses of Emamectin Benzoate (PC Code: 122806); Insecticide Product Proclaim @ (EPA Reg. No. 100-904) for Tree Nuts (Group 14) and Pistachios. DP Barcode: D345948. July 25, 2008.