

Type	Fungicide and antimicrobial (systemic with protective properties)
Controls	Propiconazole is used as a fungicide on vegetation or in wood preservative products. It is also used as an antimicrobial ingredient for use as a material coating or in products like paint, adhesive, etc.
Mode of Action	Inhibits the production of a fungal enzyme needed for cell wall formation.

Thurston County Review Summary:

Propiconazole products are rated high in hazard and fail Thurston County's pesticide review criteria. It is rated high in hazard because it is a developmental toxicant and considered a possible human carcinogen. The risk of toxicity to non-target mammals from post-application exposures to propiconazole is also rated high in hazard.

Propiconazole is rated high in hazard for persistence and moderate for the potential to move off the site of application. It is also rated moderate in hazard for bioaccumulation.

MOBILITY

Property	Value	Reference	Rating
Water Solubility (mg/L)	150	2	Moderate
Soil Sorption (Kd=mL/g)	31.5	2	Moderate
Organic Sorption (Koc=mL/g)	1,086	2	Moderate

Mobility Summary:

Propiconazole is soluble in water and adheres moderately to soil with and without organic matter. The hazard of moving off the site of application with rain or irrigation water is rated moderate.

PERSISTENCE

Property	Value	Reference	Rating
Vapor Pressure (mm Hg)	0.056 mPa	2	
Biotic or Aerobic Half-life (days)	90	2	High
Abiotic Half-life (days)	Not found		
Terrestrial Field Test Half-life (days)	214	2	High
Hydrolysis Half-life (days)	53.5	2	Moderate
Anaerobic Half-life (days)	636	2	High
Aquatic Field Test Half-life (days)	6	2	Low

Persistence Summary:

Propiconazole is expected to take from 90 days to over 200 days to degrade to half of the applied concentration on land but less than a week in water. Propiconazole degrades to 1,2,4-triazole, which has a half-life of about 500 days (Reference 1). The persistence hazard of propiconazole is rated high.

BIOACCUMULATION

Property	Value	Reference	Rating
Bioaccumulation Factor	Not found		
Bioconcentration Factor	116	2	Moderate
Octanol/Water Partition Coefficient	log Kow = 3.72	2	Moderate

Bioaccumulation Summary:

The octanol / water partition coefficient of propiconazole indicates that it has a moderate affinity to bind to fish or animal tissue. Bioaccumulation studies also show that some propiconazole accumulates in fish tissue. The hazard for bioaccumulation is rated moderate.

ACUTE TOXICITY HAZARD - ECOTOXICITY

Test Subject	Value	Reference	Rating
Mammalian (LD50)	958 mg/kg	2	Moderate
Avian (LD50)	2,825 mg ai/kg bw	1	Low
Honey bee or insect (LD50)	>100 ug/bee	2	Low
Annelida -worms (LC50)	686 mg/kg	2	Moderate
Fish (LC50)	0.85 mg/L	1	High
Crustacean (LC50)	4.8 mg/L	1	Moderate
Mollusk (LC50)	Not found		
Amphibian (LD50 or LC50)	Not found		

Acute Toxicity Testing and Ecotoxicity Summary:

The EPA evaluated risk to non-target mammals and birds from post application exposures to propiconazole. The calculated level of concern was exceeded for potential exposures to small mammals following applications to turf and ornamentals, groundcover, lawns, golf courses and sod farms. The assumption is that the exposure comes from eating treated short grass; tall grass; broadleaf plants and small insects. The EPA believes the risk to mammals is not great because the application rate used to assess risk is much higher than what is most commonly used. Other long-term exposures to mammals were also of concern for certain agricultural uses, but Thurston County does not evaluate pesticide use on crops. Risk to birds is considered moderate because there was only one instance where there was a potential exposure that reached the EPA's level of concern (short-term exposure to a bird that eats from an area that had been treated multiple times - lawn and ornamentals or groundcover). The risk of toxicity to non-target mammals from post-application exposures to propiconazole is rated high in hazard.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Rating
Adult using hose-end sprayed for home lawn	Dermal (skin) + inhalation	0.3 mg/kg/day	0.057 mg/kg/day	5.3	1	Moderate
Toddler interacting with treated lawn	Dermal + incidental oral	0.3 mg/kg/day	0.067 mg/kg/day	4.5	1	Moderate
Adult working in treated lawn	Dermal + oral	0.3 mg/kg/day	0.86 mg/kg/day	3.5	1	Moderate
Toddler playing on treated deck or playset	Dermal + oral	0.3 mg/kg/day	0.067 mg/kg/day	4.5	1	Moderate

Acute Toxicity Risk Assessment Summary:

Short-term risk assessments for residential uses of propiconazole included adult applicators using fungicide products as well as adults applying antimicrobial products to wooden structures (decks or playset). Residential risk assessments also included post-application exposures to toddlers interacting with treated vegetation and treated wood structures. The worst-case residential applicator scenario is for spraying a deck or playset, with an airless paint sprayer, and is rated high in hazard. The worst-case residential applicator exposure scenario for fungicide products is from a hose-end sprayer application to turf grass (rated moderate in hazard). Post-application exposures to toddlers either from playing in treated grass or on treated wood are also rated moderate in hazard. All other post-application exposures from residential uses (not from food or drinking water) are rated low in hazard.

CHRONIC TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	EPA group C	Possible human carcinogen	1	High
Mutagenicity	Unknown	Cell proliferation & hypertrophy	3	Moderate
Neurotoxicity - (NOAEL)	300 mg/kg/day	No neuropathology (behavior changes)	3	Check risk
Endocrine Disruption	1,2,4-triazole	Estrogen, androgen, and/or thyroid toxicity	1	High
Developmental Toxicity (NOAEL)		Incomplete skull ossification + other tox. Effects	3	High
Reproductive Toxicity (NOAEL)		Parental toxicity	3	Low
Chronic Toxicity (NOAEL)	10 mg/kg/day	Liver toxicity	1	Check risk

Chronic Toxicity Hazard Summary:

Propiconazole is rated high in hazard because the EPA has classified it as a possible human carcinogen and because it caused developmental toxicity without parental toxicity. Mutagenicity testing with propiconazole suggests that it induces cell proliferation followed by treatment-related hypertrophy (References 1 and 3). These effects may not cause mutagenicity but may increase the potential for mutagenicity or the effects from mutagenicity. Reproductive toxicity was only observed after maternal toxicity.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Rating
Toddler contacting treated deck or playset	Dermal (skin) + oral	0.10 mg/kg/day	0.077 mg/kg/day	1.3	1	High
Other lon-term exposures were not evaluated						
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Chronic Toxicity Risk Assessment Summary:

Available rat developmental toxicity and two-generation reproduction studies for metabolites triazole alanine and triazole acetic acid, showed an increased susceptibility to the offspring. EPA has retained an additional ten-times safety factor, for risk assessments, based on nervous system effects and database uncertainties, including data gaps for acute and developmental neurotoxicity studies. With this additional safety factor, risk assessments were calculated using an uncertainty factor of 1,000 (instead of the typical safety factor of 100). However, triazole and triazole acetic acid are formed inside plant tissue, so, contacting treated vegetation would not expose people to these chemicals. Risk to children from 1,2,4-triazole is evaluated in the long-term (chronic) risk assessment section due to its long half-life and potential for ongoing exposures.

The only post-application of concern (form residential uses) is the potential exposures to toddlers playing on a treated deck or playset. The exposure from skin contact and incidental ingestion from hand-to-mouth activities could result in an exposure that is more than half of the EPA's calculated dose of concern and is rated high in hazard.

Other long-term post-application exposures are either rated low in hazard or are from agricultural uses, which are not evaluated by Thurston County.

Metabolites and Degradation Products:

Propiconazole and other triazole fungicides are metabolized in animals and plants to form free triazole compounds, including 1,2,4-triazole, triazole alanine, and triazole acetic acid (Reference 1).

Comments:

Propiconazole is considered an eye irritant (EPA Toxicity Category III) but not a skin irritant (EPA Toxicity Category IV). Propiconazole is considered a skin sensitizer (Reference 1).

References

- USEPA. Reregistration Eligibility Decision (RED) for Propiconazole. EPA 738R-06-027. July 2006.
- International Union of Pure & Applied Chemistry. Pesticide Properties Database. propiconazole (Ref: CGA 64250). Accessed 6/16/11. <http://sitem.herts.ac.uk/aeru/iupac/>
- USEPA. Federal Register, Propiconazole; Pesticide Tolerances. 5/11/2011.