# dithiopyr

**Review Date:** 6/11/2009

| | |
|---|---|
| Type | Terrestrial - selective, systemic, pre-emergent and early post-emergent herbicide. |
| Controls | Control of listed annual grasses and broadleaf weeds in established lawns, sod farms, non-cropland and industrial sites, ornamental turf, container and field-grown nursery ornamentals. |
| Mode of Action | Shoot and root inhibitor. |

**Thurston County Review Summary:**

Dithiopyr is considered moderate in hazard for mobility, persistence, and bioaccumulation. Risk assessments calculate that there is the potential for exposures to children entering treated turf grass that Thurston County rates as moderate in hazard for toxicity. Herbicide products containing dithiopyr as a sole active ingredient are rated as conditional.

## MOBILITY

| Property | Value | Reference | Rating |
|---|---|---|---|
| Solubility (mg/L) | 1.38 | 3 | Low |
| Soil Sorption (Kd=mL/g) | 8 - 99 | 8 | Moderate |
| Organic Sorption (Koc=mL/g) | 1,175 - 2,482 | 8 | Moderate |

**Mobility Summary:**

The chemical dithiopyr is not very soluble in water and is expected to adhere moderately to soil containing organic matter and poorly to soil without organic matter. Dithiopyr is considered moderate in mobility hazard.

## PERSISTENCE

| Property | Value | Reference | Rating |
|---|---|---|---|
| Vapor Pressure (mm Hg) | 0.000004 | 3 | Moderate |
| Biotic or Aerobic Half-life (days) | 39 | 5 | Moderate |
| Abiotic Half-life (days) | 69 | 5 | High |
| Terrestrial Field Test Half-life (days) | 25 | 6 | Moderate |
| Hydrolysis Half-life (days) | Not found | | |
| Anaerobic Half-life (days) | Not found | | |
| Aquatic Field Test Half-life (days) | Not found | | |

**Persistence Summary:**

Liquid products of dithiopyr are likely to have some of it volatilize (evaporate) from the turf and the remainder of the chemical will be degraded by sunlight and soil microbes. Dithiopyr is expected to degrade to half of the applied concentration in less than 60 days which is rated as a moderate persistence hazard.

## BIOACCUMULATION

| Property | Value | Reference | Rating |
|---|---|---|---|
| Bioaccumulation Factor | Not found | | |
| Bioconcentration Factor | 100-3000 | 4 | Moderate |
| Octanol/Water Partition Coefficient | log Kow = 4.75 | 3 | Moderate |

**Bioaccumulation Summary:**

Dithiopyr has a stronger affinity to bind to organic solvents than to water (log Kow = 4.75), but the bioconcentration factor provided by one of the product manufacturers is in a range so large that the rating could be low or moderate in hazard. Studies with fish show that dithiopyr is 92-94% eliminated by depuration within 14 days. The hazard for bioaccumulation is rated as low to moderate.

# ACUTE TOXICITY

| Test Subject | Value | Reference | Rating |
|---|---|---|---|
| Mammalian (LD50) | >5,000 mg/kg | 3 | Low |
| Avian (LD50) | >2,250 mg/kg | 4 | Low |
| Honey bee or insect (LD50) | 81 ug/bee | 4 | Low |
| Annelida -worms (LC50) | >1,000 mg/kg | 4 | Low |
| Fish (LC50) | 0.46 mg/L | 4 | High |
| Crustacean (LC50) | 5.2 mg/L | 4 | Moderate |
| Mollusk (LC50) | Not found | | |
| Amphibian (LD50 or LC50) | Not found | | |

**Acute Toxicity Summary:**

Dithiopyr is considered low in acute toxicity hazard to mammals, birds, insects, and earthworms. Dithiopyr is considered highly toxic to fish and moderately toxic to crustaceans.

# ACUTE TOXICITY - Risk Assessment

| Subject and Scenario | Dose of Concern | Exposure | Margin of Safety | Route | Reference | Rating |
|---|---|---|---|---|---|---|
| Adult mixing and applying with a hand-held sprayer | 3.3 mg/kg/day | 0.017 mg/kg/day | 194 | Dermal (skin absorption) | 8 | Low |
| Adult mixing and applying with a backpack sprayer | 0.007 mg/kg/day | 0.0002 mg/kg/day | 35 | Inhalation | 8 | Low |
| Child playing in treated turf grass | 0.019 mg/kg/day | 0.002 mg/kg/day | 9.5 | Incidental ingestion | 8 | Moderate |
| Child playing in treated turfgrass | 0.007 mg/kg/day | 0.0035 mg/kg/day | 2 | Inhalation + ingestion | 8 | Moderate |

**Acute Toxicity Risk Assessment Summary**

Health Canada performed risk assessments for short-term exposures (exposures less than one week in duration) that were much more recent and complete than the USEPA.

The worst-case exposure for an adult mixing, loading, and applying herbicide is with a backpack sprayer. These exposures could result in a potential dose 35 times less than the calculated dose of concern and is considered low in hazard for toxicity.

The potential exposures to children playing in treated turf grass was calculated for pesticide inhalation, skin absorption, and incidental ingestion through hand-to-mouth activities. The largest potential exposure came from hand-to-mouth activities and resulted in an exposure about 9 times less than the dose of concern. The combination of all potential exposures (inhalation, drinking water ingestion, and hand-to-mouth activities) could result in an exposure that is half of the dose of concern. Thurston County rates these potential exposures as moderate in hazard for toxicity.

# CHRONIC TOXICITY

| Property | Value | Adverse Effect | Reference | Rating |
|---|---|---|---|---|
| Carcinogenicity | E | Evidence of non-carcinogenicity for humans | 2 | Low |
| Mutagenicity | Negative | - - | 3 | Low |
| Neurotoxicity - (NOAEL) | 5,000 mg/kg/day | None | 3 | Low |
| Endocrine Disruption | Not listed | | | Low |
| Developmental Toxicity (NOAEL) | 1,000 mg/kg/day | None | 3 | Low |
| Reproductive Toxicity (NOAEL) | 2,500 mg/kg/day | None | 3 | Low |
| Chronic Toxicity (NOAEL) | 0.36 mg/kg/day | Mild liver toxicity | 3 | Check risk |

**Chronic Toxicity Summary:**

Dithiopyr in rated as EPA cancer classification "E" (evidence of non-carcinogenicity for humans) and is not considered a mutagen. Maternal toxicity was reached before any developmental or reproductive toxicity was seen (Reference 3). There was no evidence of neurotoxicity, even at the highest dose level (5000 mg/kg). Long-term toxicity testing indicates that the first adverse effect is associated with liver toxicity.

# CHRONIC TOXICITY - Risk Assessment

| Subject and Scenario | Dose of Concern | Exposure | Margin of Safety | Route | Reference | Rating |
|---|---|---|---|---|---|---|
| Long-term exposure to treated turf not evaluated | | | | | | |
| Occupational mixer and applicator of dithiopyr | 0.0036 mg/kg/day | 0.0000033 mg/kg/day | 1,090 | Dermal (skin absoption) | 7 | Low |
| Infants drinking formula mixed with treated water | 0.004 mg/kg/day | 0.00085 mg/kg/day | 4.7 | Ingestion | 8 | Moderate |
| Dietary exposures were not evaluated | | | | | | |

**Chronic Toxicity Risk Assessment Summary:**

The only risk assessment performed by the EPA was for occupational exposures for adults mixing, loading, and spraying dithiopyr herbicide. Using the scenario of a mixer, loader, applicator using the maximum application rate; the daily exposure of active ingredient could be up to about 0.00004 mg/kg/day. The EPA calculated the mean daily exposure for an entire year would be 0.0000033 mg/kg/day (assuming the worker applied herbicide on 30 separate days). These potential exposures are 1,000 times less than the calculated dose of concern.

Health Canada performed a recent risk assessment for exposures to dithiopyr that the USEPA did not assess. Since there is a potential for dithiopyr to reach surface water Canada performed an assessment for drinking treated water. The potential long-term exposure to an infant drinking treated water is nearly 5 times less than the dose of concern and is rated as a moderate hazard for toxicity by Thurston County.

**DegradationProducts:**

The metabolites identified for dithiopyr are; "monoacid 1", "monoacid 2", dicarboxylic acid, and dicarbothioic acid.

**Comments:**

Dithiopyr shows no evidence of skin sensitization (Reference 3), but is considered a potential skin, eye, and respiratory tract irritant (Reference 1).

**References**


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2. USEPA. Science Information Management Branch, Health Effects Division, Office of Pesticide Programs. "Chemicals Evaluated for Carcinogenic Potential".
3. Ward, Dennis P. Toxicology Department, The Agricultural Group, A Unit of Monsanto Company. Summary of Toxicology Studies With Dithiopyr. February 20, 1993.
4. Dow AgroSciences LLC. Material Safety Data Sheet, Dimension EC Herbicide. MSDS: 007748. 11/24/03.
5. Hong, S. and Albert E. Smith , Department of Crop and Soil Sciences, University of Georgia. "Abiotic and Biotic Degradation of Dithiopyr in Golf Course Greens." 1996.
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8. Pest Management Regulatory Agency, Health Canada. Proposed Re-evaluation Decision - Dithiopyr (PRVD2009-01). January 15, 2009.