prodiamine

Review Date: 10/10/2014

CAS #: 29091-21-2

Type	Selective, pre-emergent terrestrial herbicide
Controls	Controls many types of grasses and broadleaf weeds.
Mode of Action	Inhibits root growth by blocking steps in plant cell division needed for chromosome separation and cell wall formation (Refrerence 1).

Thurston County Review Summary:

Prodiamine is a pre-emergent terrestrial herbicide which is rated high in hazard and pesticide products containing it fail Thurston County's pesticide review criteria. Prodiamine is rated high in hazard because the EPA classifies it as a possible human carcinogen.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	0.013	4	Low
Soil Sorption (Kd=mL/g)	20-399	5	Low
Organic Sorption (Koc=mL/g)	>5,000 to >19,000	4	Low

Mobility Summary:

Prodiamine is not very soluble in water and adheres strongly to all soil types. The hazard of prodiamine 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)	0.000000025	3	High
Biotic or Aerobic Half-life (days)	120	4	High
Photolysis Half-life (days)	5 (soil)	6	Low
Terrestrial Field Test Half-life (days)	69	4	High
Hydrolysis Half-life (days)	>6	5	High
Anaerobic Half-life (days)	32	6	Moderate
Aquatic Field Test Half-life (days)	Value not found		

Persistence Summary:

After a terrestrial application, prodiamine can be quickly degraded by sunlight however, field testing indicates that actual degradation is much slower (References 4 and 5). Based on field testing, the hazard for chemical persistence is rated high because it is expected to take over 60 days to degrade to half of the application concentration.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	1182	6	Moderate
Octanol/Water Partition Coefficient	log Kow = 4.1	4	Moderate

Bioaccumulation Summary:

The octanol/water coefficient (log Kow = 4.1) indicates a moderate potential for prodiamine to accumulate in fish or animal tissue.

In fish bioconcentration studies, prodiamine accumulated up to 1400 times in whole fish which was eliminated by 50% from the fish within 3 days, when they were put into clean water (Reference 6).

When rats were administered prodiamnie, it was quickly metabolised and eliminated (>98% in four days) with no evidence of bioaccumulation in repetitive-dose testing (Reference 6).

The hazard for bioaccumulation is rated low.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Toxicity Rating
Mammalian (LD50)	>5,000 mg/kg	1	Low
Avian (LD50)	>10,000 mg/kg	2	Low
Honey bee or insect (LD50)	>100 ug/bee	4	Low
Annelida -worms (LC50)	>1,000 mg/kg	4	Low
Fish (LC50)	0.83 mg/L	4	High
Crustacean (LC50)	0.66 mg/L	4	High
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that prodiamine is low in toxicity to mammals, birds, bees, and worms, but highly toxic to fish and other aquatic organisms (References 1, 2, and 4). Risk to birds and small mammals was considered acceptable when comparing expected prodiamine concentrations on turf, seed and insects after an application at the maximum rate to concentrations that caused adverse effects in the lab (Reference 6). Risk to fish and aquatic organisms exposed to runoff from a playing field turf application are expected to be acceptable, although higher than it is to birds and small mammals. Small spot-applications are expected to be low in risk to non-target organisms.

At the maximum application rate (0.75 lbs a.i./acre) to turf creates prodiamine concentrations ranging from 5 to 180 ppm (maximum) on potential food items (short and tall grasses, fruit, seeds, etc.) for birds and other small animals (Reference 7). This environmental concentration is 55 times lower than the lethal dose to bobwhite quail. Comparing the potential environmental concentration (5 to 180 ppm) to the dose that caused reproductive toxicity to birds (50 ppm for surrogate dinitroanaline chemical) indicates a risk of toxicity to birds at expected environmental concentrations following an application. This risk is lowered due to the toxic effect being a result of an ongoing diet of contaminated food. An actual diet of a bird would consist of treated and untreated food items with the prodiamine treated food items representing a small fraction of the total diet. Due to the use of surrogate chemical data used to assess the potential risk to birds, the risk to birds following a broadcast application of prodiamine is rated moderate in hazard. This hazard rating will be re-evaluated when sub-lethal bird toxicity data specifically for prodiamine is available. Risk to fish and aquatic organisms is considered low due to the very low water solubility of prodiamine (13 ppb).

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Risk Rating
50-Acre turf application (2 days)	Dermal + inhalation	Value not found	0.18 mg/kg/day	Unkown	3	Data gap
Mixing for a 50-Acre turf application	Dermal + inhalation	Value not found	1.46 mg/kg/day	Unknown	3	Data gap
Other short-term exposures were not evaluated						
Other short-term exposures were not evaluated						

Acute Toxicity Risk Assessment Summary:

A daily dose was calculated for occupatioanl exposures from mixing/loading a boom sprayer and applying to 50 acres. The risk from these potential exposures were used by the EPA to evaluate potential lifelong exposures but they did not calculate the risk from a single application. Therefore,not being able to evaluate the risk to appicators from a single application is considered a data gap.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	EPA Group C	Possible human carcinogen	1	High
Mutagenicity	Value not provided	Suggestive activity in 2 tests	1 and 6	Low
Neurotoxicity - (NOAEL)	291 mg/kg/day	No neurotoxicity	6	Low
Endocrine Disruption	16.8 mg/kg/day	Thyroid-related effects	6	Rating based on risk
Developmental Toxicity (NOAEL)	300 mg/kg/day	Malformed fetuses	2	Low
Reproductive Toxicity (NOAEL)	200 mg/kg/day	None observed	2	Low
Chronic Toxicity (NOAEL)	7.2 mg/kg/day	Increased liver weights	3	Check risk

Chronic Toxicity Hazard Summary:

The EPA classifies prodiamine as a Group C chemical (possible human carcinogen). Possible human carcinogens are considered high in hazard by Thurston County's pesticide review criteria. There was suggestive evidence of mutagenicity observed in initial testing with mouse lymphoma cells and in Salmonella but follow up tests, using currently accepted guidelines, were negative (References 2 and 6). It was concluded that the weight of evidence suggests that prodiamine is non-mutagenic (Reference 6). The EPA concluded that prodiamine was not a developmental toxicant because toxicity observed in the fetuses was at the same concentrations that caused maternal toxicity (Reference 2). There were no reproductive effects ofbserved at maternally toxic doses (Reference 6).

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Risk Rating
40 years of 50-acre turf application (twice/year)	Dermal + inhalation	0.072 mg/kg/day	0.00056 mg/kg/day	128	3	Low
40 years of mixing for 50-acre turf applications	Dermal + inhalation	0.072 mg/kg/day	0.0046 mg/kg/day	15.6	3	Low
40 years of mixing/applying to 50-acres of turf	Dermal + inhalation	0.072 mg/kg/day	0.0061 mg/kg/day	11.8	3	Low
Other long-term exposures were not evaluated						

Chronic Toxicity Risk Assessment Summary:

Occupational risk from 40 years of mixing/loading for an application to a 50-acre area of turf is rated low in hazard for both the applicator and for the person mixing and loading the application equipment. The risk assessment assumes that the applicator treats the 50-acre area at the maximum application rate every year for 40 years (Reference 3). The risk is also rated low in hazard when the exposures are combined and the same person mixes, loads and applies the herbicide to the 50-acre area for 40 years. The application method was calculated for a boom sprayer applying the annual maximum rate of 1.5 pounds of active ingredient per acre (1.5 ai/acre/yr).

Metabolites and Degradation Products:

The major degradation chemical of prodiamine is prodiamine benzimidazole (Reference 1).

Comments:

Prodiamine is considered minimally irritating to eyes (EPA Toxicity Category III), non-irritating to skin (EPA Toxicity Category IV) and is not a skin sensitizer, although some products containing prodiamine may be skin sensitizers (Reference 2).

References

1. USEPA. Prodiamine Summary Document, Registration Review: Initial Docket. Docket Number: EPA-HQ-OPP-2010-0920. December 2010.
2. USEPA. Office of Pesticides and Toxic Substances. Pesticide Fact Sheet. Prodiamine. Fact Sheet Number 231. 2/7/92.
3. USEPA. Office of Pesticides and Toxic Substances. MEMORANDUM: Exposure Assessment for New Chemical, Prodiamine, Using Surrogate Data (HED Project #2-0123, Intra Project # 0221). December 17, 1991.
4. International Union of Pure & Applied Chemistry. Pesticide Properties Database. Prodiamine (Ref: SAN 745H). Record updated July 31, 2014.
5. USEPA. Environmental Fate and Effects Division. MEMORANDUM From: Akiva Abramovitch, Section Head Environmental Fate Review Section #3 To: Susan Lewis, Project Manager, Registration Division (H7505C). Registration / File # 55947-UG. Prodiamine. Date Received 4/29/1991.
6. Austrailian Pesticides and Veterinary Medicines Authority. Public Release Summary on the Evaluation of the New Active PRODIAMINE in the Product BARRICADE TURF HERBICIDE. December 2010.
7. USEPA. Ecological Effects Branch. Addendum to the EEB Risk Assessment for Prodiamine on Turf and Lnadscape Ornamentals. (8/13/91).