siduron

Review Date: 04/16/2012
CAS #: 1982-49-6

Type	Terrestrial selective, systemic, pre-emergent herbicide.
Controls	Controls annual grasses, annual weeds, barnyard grass, bermuda grass, crabgrass, and foxtail.
Mode of Action	Root growth inhibitor that may also inhibit cell division (Reference 1).

Thurston County Review Summary:

Herbicide products containing siduron as an active ingredient are rated high in hazard and fail Thurston County's pesticide review criteria. Siduron is rated high in hazard due to the risk for toxicity to non-target organisms at expected environmental concentrations. It is also rated high in hazard for chemical persistence and the potential to move off the site of application (chemical mobility).

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	22.3	1	Moderate
Soil Sorption (Kd=mL/g)	1 - 6	1	High
Organic Sorption (Koc=mL/g)	175 - 268	1	High

Mobility Summary:

Siduron is moderately soluble in water and can be expected to bind poorly to all soil types. The hazard for siduron to leach into the soil or move off the site of application with rain or irrigation water is rated high.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.000000004	1	High
Biotic or Aerobic Half-life (days)	774	1	High
Abiotic Half-life (days)	Stable (photolysis - hydrolysis)	1	High
Terrestrial Field Test Half-life (days)	48 -64	1	Moderate - high
Hydrolysis Half-life (days)	Stable	1	High
Anaerobic Half-life (days)	365	1	High
Aquatic Field Test Half-life (days)	Value not found		

Persistence Summary:

Siduron is stable to degradation by the sun, water, and anaerobic conditions. Because it is likely to take more than 60 days to degrade to half of the applied concentration, siduron is rated high in hazard for chemical persistence.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	6.8 (edible) 33 (whole fish)	1	Low
Octanol/Water Partition Coefficient	log Kow = 0.431	1	Low

Bioaccumulation Summary:

The ocatnol/water partition coefficient of siduron indicates a low potential for accumulation in fish or animal tissue. In bioconcentration studies, fish accumulated siduron up to 6.8 times higher than the water concentration within in edible fish tissue and 33 times higher in the whole fish (which is considered low accumulation). When fish were exposed to siduron and then put into clean water, the accumulated siduron was 96 to 100% eliminated from the fish within 10 days (Reference 1). Siduron is rated low in hazard for bioaccumulation potential.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	>5,000 mg/kg	1	Low
Avian (LD50)	>2,250 mg/kg	1	Low
Honey bee or insect (LD50)	> 100 ug/bee	1	Low
Annelida -worms (LC50)	Value not found		
Fish (LC50)	8.1 mg/L	1	Moderate
Crustacean (LC50)	>13.7 mg/L	1	Moderate
Mollusk (LC50)	> 10.8 mg/L	1	Moderate
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that siduron is low in toxicity to animals, birds, and insects but moderately toxic to fish and other aquatic organisms.

Risk to non-target organisms (small animals, birds, insects, fish, etc.) following applications of siduron herbicides was evaluated by the EPA. The risk to small animals exceeds the level of concern for potential long-term exposures for all use scenarios and food categories (Reference 1). It is likely that the risk to mammals is overstated because the toxicity value used to evaluate the risk was not based on the toxicity of siduron (due to the lack of siduron toxicity data) but instead was derived from a rat study using a different phenylurea herbicide chemical's toxicity data. The level of concern is exceeded for long-term dietary exposures to birds that eat treated short grass as their sole diet (if the bird's diet includes other grasses, insects, berries, etc. the risk to birds is reduced). The lethal dose concentration (LD50) of siduron to honey bees indicates that it is low in toxicity to bees, but the expected environmental concentration after an application is higher than the lethal dose (so the risk to bees and other insects is high). The hazard to beneficial insects is rated high. Other animals of potential concern include: freshwater fish, aquatic invertebrates, and amphibians, and estuarine/marine fish and invertebrates, and reptiles (Reference 1). The risk to non-target wildlife from potential exposures to siduron following herbicidal use is rated high in hazard.

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Hand-to-mouth + object-to-mouth + soil ingestion	Incidental oral	1.5 mg/kg/day	0.22 mg/kg/day	6.7	2	Moderate
Adult applying granular product with belly grinder	Inhalation	1.5 mg/kg/day	0.00025 mg/kg/day	6,100	2	Low
Mix and apply wettable powder to 350 acres of turf	Dermal + Inhalation	1.5 mg/kg/day	0.52 mg/kg/day	2.9	2	Moderate
Other short-term exposures were not evaluated						

Acute Toxicity Risk Assessment Summary:

Risk assessments for post-application exposures to siduron were calculated for children's potential oral exposures through hand-to-mouth activities, object-to-mouth, and incidental soil ingestion following a turf grass application at the maximum application rate (12 lbs a.i./acre). The calculated exposure was at least 6 times less than the dose of concern and is rated moderate in hazard.

Risk of toxicity from post-application skin exposures to siduron were not evaluated because skin exposure testing with animals did not produce toxicity at any dose (up to 1,500 mg/kg/day).

Risk to occupational applicators that mix and apply wettable powder product for chemigation to 350 acres is calculated to be about one-third of the dose of concern and is rated moderate in hazard.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Not classified	Inadequate evidence to assess potential	2 and 3	N/A
Mutagenicity	Value not reported	"Negative"	2	Low
Neurotoxicity - (NOAEL)	Testing not required by EPA			
Endocrine Disruption	"Possible endocrine related action"	Avian reproductive toxicities	1	Moderate
Developmental Toxicity (NOAEL)	1,500 mg/kg-bw/day	No effects	1	Low
Reproductive Toxicity (NOAEL)	No studies for siduron			
Chronic Toxicity (NOAEL)	150 mg/kg/day	Decreased body weight gain	2	Check risk

Chronic Toxicity Hazard Summary:

The EPA evaluated bird reproductive toxicity studies and based on the weight of evidence determined that siduron has possible endocrine system related effects: "abnormal egg production, reductions in eggs laid, abnormal embryos of eggs set, and abnormal hatchlings of eggs set" (Reference 1). There were no signs of developmental toxicity observed in multi-generational rat studies but there were no reproductive toxicity tests performed for siduron. The mutagenicity studies reviewed by the EPA were negative for the in-vivo and in-vitro assays. Carcinogenicity studies are not required for EPA registration because siduron has no intended food uses. Although neurotoxicity studies were not performed for siduron, the EPA stated that there were no clinical signs of neurotoxicity in any of the acute, subchronic, or developmental toxicity tests (Reference 2).

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Long-term exposures were not evaluated						
Long-term exposures were not evaluated						
Long-term exposures were not evaluated						
Long-term exposures were not evaluated						

Chronic Toxicity Risk Assessment Summary:

Long-term risk assessments were not calculated for post-application exposures to siduron.

Metabolites and Degradation Products:

Siduron is within the phenylurea class of herbicides. In soil, siduron degraded very slowly to 2-methylcyclohexylamine and two unidentified compounds (Reference 1).

Comments:

Siduron is considered an eye irritant (EPA Toxicity Category III), a slight skin irritant (EPA Toxicity Category IV), but is not a dermal sensitizer (Reference 2).

References

1. USEPA. Environmental Fate and Effects Division. "Environmental Fate and Ecological Risk Assessment for the Reregistration of Siduron" August 31, 2007.
2. USEPA. Prevention, Pesticides and Toxic Substances. Reregistration Eligibility Decision for Siduron. EPA-HQ-OPP-2007-0973. May 2008.
3. International Agency for Research on Cancer. Agents Classified by the IARC Monographs, Volumes 1-102. (Accessed 4/16/2012). http://monographs.iarc.fr