imazapyr

Review Date: 4/13/2009

Type	Terrestrial or aquatic non-selective herbicide - systemic (absorbs into the plant and is circulated to kill entire plant).
Controls	Pre- and post-emergent control of terrestrial grasses, broadleaf weeds, brush, vines, and emergent aquatic weed species.
Mode of Action	Inhibits synthesis of three branched-chain amino acids which are essential for plant life.

Thurston County Review Summary:

Imazapyr is considered practically non-toxic to mammals, bees, fish, crustaceans, and only slightly toxic to birds. Like many herbicides, imazapyr can cause injury to non-target plant species if it is directly applied to desired plants or runs off the site of application to desired plants. Since imazapyr is very water soluble and does not adhere strongly to soil, it has the potential to move with water off the site of application. And, because sunlight plays a major role in degrading imazapyr, it is recommended to use imazapyr products when no rain is expected for several days.

Imazapyr products receive a conditional rating by Thurston County's review process for the potential hazard of chemical mobility and persistence.

MOBILITY

Property	Value	Reference	Rating
Solubility (mg/L)	1,110	2	High
Soil Sorption (Kd=mL/g)	0.64	2	High
Organic Sorption (Koc=mL/g)	142	1	High

Mobility Summary:

Imazapyr is considered very water soluble, adheres poorly to soil and organic matter, and has been found to leach into soils after terrestrial applications. Imazapyr is considered high in mobility hazard after terrestrial applications.

PERSISTENCE

Property	Value	Reference	Rating
Vapor Pressure (mm Hg)	0.0000002	2	Moderate
Biotic or Aerobic Half-life (days)	>365	1	High
Abiotic Half-life (days)	Not found		
Terrestrial Field Test Half-life (days)	up to 141	1	High
Hydrolysis Half-life (days)	negligible	1	High
Anaerobic Half-life (days)	insignificant	1	High
Aquatic Field Test Half-life (days)	14	1	Moderate

Persistence Summary:

The primary route of degradation of imazapyr is by photolysis. Light can break down this chemical in a few days but, if it is kept out of sunlight the chemical is broken down very slowly by microbial degradation. If imazapyr is applied to sandy soils and leaches down below 18 inches (where microbial activity is limited) the chemical can be expected to persist for more than a year.

In aquatic environments imazapyr is expected to be low to moderately persistent, likely due to dispersion and chemical breakdown by sunlight.

BIOACCUMULATION

Property	Value	Reference	Rating
Bioaccumulation Factor	Not found		
Bioconcentration Factor	Not found		
Octanol/Water Partition Coefficient	20	1	Low

Bioaccumulation Summary:

Imazapyr is very water soluble and has a low octanol/water partition coefficient making it unlikely to accumulate in tissue. Bioaccumulation hazard of imazapyr is considered low.

ACUTE TOXICITY

Test Subject	Value	Reference	Rating
Mammalian (LD50)	>5,000 mg/kg	1	Low
Avian (LD50)	>1,890 mg/kg	1	Low
Honey bee or insect (LD50)	>100 ug/bee	1	Low
Annelida -worms (LC50)	Not found		
Fish (LC50)	>100 mg/L	1	Low
Crustacean (LC50)	>189 mg/L	1	Low
Mollusk (LC50)	>132 mg/L	1	Low
Amphibian (LD50 or LC50)	Not found		

Acute Toxicity Summary:

In single dose testing, imazapyr is considered practically non-toxic to mammals, bees, fish, crustaceans, oysters, and only slightly toxic to some birds. Aquatic toxicity was tested on embryos and fry sac from rainbow trout and fathead minnows without any adverse effects on hatching or survival.

The worst-case exposure scenarios for a terrestrial application or aquatic application of imazapyr is to a toddler performing high contact activities in treated turf in a residential setting (which was considered moderate in hazard for toxicity). As of 2008, there are no imazapyr containing products registered for use in Washington State that allows it to be used on residential lawns. All other short-term exposure scenarios were 100 times less than the EPA's level of concern for acute toxicity.

The hazard for acute toxicity from the use of herbicides, with imazapyr as a sole active ingredient, is considered low.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Adult mixing and applying herbicide	2.5 mg/kg/day	0.01 mg/kg/day	250	Dermal & Oral	2	Low
Toddler swimming in treated water	2.5 mg/kg/day	0.0037 mg/kg/day	680	Ingestion - swim	2	Low
Post-application exposure #2 was not evaluated						
Toddler playing in treated vegetation	2.5 mg/kg/day	0.61 mg/kg/day	4.1	Dermal, oral, incidental	2	Moderate

Acute Toxicity Risk Assessment Summary

The worst-case exposure scenario for a terrestrial application of imazapyr is to a toddler performing high contact activities in treated turf in a residential setting. As of 2008, there are no products registered for use in Washington State that allows imazapyr products to be used on residential lawns. All other short-term exposure scenarios were 100 times less than the EPA's level of concern for acute toxicity.

The worst-case exposure scenario after an aquatic application was performed for a swimmer entering treated water on the day of application. The risk of toxicity due to incidental ingestion was 600 times less than the EPA's level of concern.

The worst-case scenario for an applicator is through the combined activities of mixing, loading, and applying an emulsifiable concentrate. The applicator exposure scenario has a safety factor 250 times the exposure of concern for acute toxicity.

The risk for toxicity from a short term exposure to imazapyr after herbicidal use is considered low in hazard.

CHRONIC TOXICITY

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	E	Evidence of non-carcinogenicity	1	Low
Mutagenicity	Negative	Negative	1	Low
Neurotoxicity - (NOAEL)	--	Negative	2	Low
Endocrine Disruption	--	Negative	2	Low
Developmental Toxicity (NOAEL)	300 mg/kg/day	Negative	1	Low
Reproductive Toxicity (NOAEL)	738 mg/kg/day	Negative	1	Low
Chronic Toxicity (NOAEL)	250 mg/kg/day	Skeletal muscle effects	2	Check risk

Chronic Toxicity Summary:

Developmental and reproductive toxicity testing did not illicit adverse affects up to the highest dose tested, although maternal toxicity was noted at 300 mg/kg/day (mid dose level). Imazapyr is classified as an EPA Group E chemical for no evidence of carcinogenicity. In toxicity testing, there was no evidence of neurotoxicity, mutagenicity or endocrine disruption (Reference 2).

In the chronic toxicity tests there were no compound-related effects in toxic signs, mortality, body weight, food consumption, hematology, clinical chemistry, urinalyses, gross pathology, organ weights, and non-neoplastic and neoplastic lesions. The NOAEL is >10,000 ppm (250 mg/kg/day). Skeletal muscle effects were seen with the chemical analog imazapic at 250 mg/kg/day.

The hazard for toxicity from the use of herbicides with imazapyr as a sole active ingredient is considered low.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Exposure to treated vegetation was not evaluated						
Agrregate exposure was not evaluated						
Adults or kids drinking water contining imazapyr	2.5 mg/kg/day	<0.0025 mg/kg/day	>1,000	Drinking water	2	Low
Children (1-2 yrs) eating treated food	2.5 mg/kg/day	0.00083 mg/kg/day	3,012	Ingestion	2	Low

Chronic Toxicity Risk Assessment Summary:

The chronic dietary analysis for imazapyr shows that the exposure for all population subgroups (eating treated food and water) does not exceed the EPA's calculated level of concern. All population subgroups are predicted to have exposures < 0.1% of the dose of concern (>1,000 times safer than required by EPA). The risk for chronic toxicity from the use of imazapyr containing herbicides is considered low.

DegradationProducts:

In aquatic testing, half-lives of imazapyr degradation products are less than or equal to 3 days. Breakdown products from metabolism of imazapyr are <3%.

Imazapyr is not known to have any common mode of toxicity with any other chemicals. Including imazethapyr, imazamethabenz-methyl, imazameth, or imazapic.

Comments:

The reason imazapyr is more toxic to plants is because it stops a plant's ability make an essential chemical (aliphatic three branched-chain amino acids) that birds and animals also require but do not make themselves (they eat plants that already contain them). So, that specific toxic affect can only happen in a plant, all other identified toxic affects occur at a much higher dose.

Irreversible eye damage can be caused by imazapyr (toxicity category I) - imazapyr is not irritating to skin and is not considered a skin sensitizer.

References

1. "Ecological Risk Assessment of the Proposed Use of the Herbicide Imazapyr to Control Invasive Cordgrass (Spartina spp.) in Estuarine Habitat of Washington State." Department of Agriculture, Olympia, WA 98504. Prepared by ENTRIX Inc., Olympia, Washington. Project No. 3000901, October 30, 2003.
2. Memorandum: "Imazapyr: Revised HED Chapter of the Reregistration Eligibility Document (RED). PC Code: 128821, CAS Reg 81334-34-1, Case #3078, DP Barcode D324106." December 8, 2005. USEPA Office of Prevention, Pesticides and Toxic Substances.