metsulfuron methyl

Review Date: 10/30/2009
CAS #: 74223-64-6

Type	Terrestrial systemic herbicide with pre-emergent and post-emergent control.
Controls	Selective control of broadleaf species and some annual grasses.
Mode of Action	Inhibits acetolactate synthase (which assists in amino acid synthesis) stops cell division and results in plant death.

Thurston County Review Summary:

The herbicide active ingredient metsulfuron methyl is rated as high in hazard for the potential to move off the site of application with rain or irrigation water, but it is considered moderate in persistence (likely to reach half of the applied concentration within 60 days), and low in hazard for bioaccumulation. It is considered low in toxicity to non-target organisms and low in risk to humans contacting or eating contaminated vegetation or foods. Metsulfuron methyl is very toxic to plants and contact with runoff is likely to injure or kill broadleaf plants or aquatic vegetation.

Herbicides with metsulfuron methyl as a sole active ingredient pass Thurston County's review process.

MOBILITY

Property	Value	Reference	Rating
Solubility (mg/L)	2,790	2	High
Soil Sorption (Kd=mL/g)	Not found		
Organic Sorption (Koc=mL/g)	39.5	2	High

Mobility Summary:

Metsulfuron methyl is soluble and adheres poorly to soil which indicates that it is high in hazard for moving off the site of application with rain or irrigation water.

PERSISTENCE

Property	Value	Reference	Rating
Vapor Pressure (mm Hg)	2.5 E-12	5	Low
Biotic or Aerobic Half-life (days)	14-180 (average = 30)	5	Moderate to high
Abiotic Half-life (days)	Not found		
Terrestrial Field Test Half-life (days)	4-15	2	Low to moderate
Hydrolysis Half-life (days)	"Stable"	2	High
Anaerobic Half-life (days)	140	2	High
Aquatic Field Test Half-life (days)	29 to >84	5	High

Persistence Summary:

Persistence testing of metsulfuron methyl has produced a wide range of values indicating that the length of time for this chemical to degrade to half of the applied concentration is very dependent on the site conditions where it is used. Factors like soil moisture, pH, and temperature highly influence chemical degradation. Since this is a terrestrial herbicide chemical the rating is biased on land degradation and since the range of values for persistence covers the low to high range - the rating is selected to reflect the conserative end of the field dissipation studies and the average of the biotic half-life studies. The persitence hazard of metsufuron methyl is rated as moderate.

BIOACCUMULATION

Property	Value	Reference	Rating
Bioaccumulation Factor	Not found		
Bioconcentration Factor	1	2	Low
Octanol/Water Partition Coefficient	log Kow = -1.74	6	Low

Bioaccumulation Summary:

Bioaccumulation testing in rats indicate that metsulfuron methyl is rapidly metabolized and 50% eliminated from the body within one day (primarily in the urine). The octanol water partition coefficient also suggests that this chemical does not want to bind with fats or oils and is therefore considered low in hazard for bioaccumulation.

ACUTE TOXICITY

Test Subject	Value	Reference	Rating
Mammalian (LD50)	>5,000 mg/kg	2	Low
Avian (LD50)	>2,510 mg/kg	2	Low
Honey bee or insect (LD50)	>25 ug/bee	2	Low
Annelida -worms (LC50)	>1,000 mg/kg	2	Low
Fish (LC50)	>150 mg/L	2	Low
Crustacean (LC50)	>150	2	Low
Mollusk (LC50)	Not found		
Amphibian (LD50 or LC50)	Not found		

Acute Toxicity Summary:

Toxicity testing of mesulfuron methyl indicates that it is low in toxicity to mammals, birds, bees, worms, fish and other aquatic organisms.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Applicator using a broadcast application	0.25 mg/kg/day	0.0045 mg/kg/day	55	Skin absorption	6	Low
Child drinking pond water after a spill into it.	0.25 mg/kg/day	0.034 mg/kg/day	7.3	Drinking contaminated	6	Moderate
Child drinking contaminated stream water	0.25 mg/kg/day	0.000000014 mg/kg/day	17,857,000	Drinking contaminated	6	Low
Combined routes of exposure were not calculated.						

Acute Toxicity Risk Assessment Summary

The US Forest Service calculated the exposures to workers applying metsulfuron methyl and to children consuming contaminated surface water. The expected exposures to workers is at least 55 times less than the EPA calculated dose of concern and is considered low in hazard (for all application types).

Exposures to children drinking contaminated surface water was calculated for an accidental spill into a pond (which does not relate to an approved use). The resulting exposure is 7 times less than the dose of concern (which rates as "moderate in hazard"). Since this exposure is not relevant to an actual approved use of the herbicide it is presented to show the relative safety of the approved uses. The potential exposure to a child drinking contaminated stream water following an approved use of metsulfuron methyl is 17,000,000 times less than the dose of concern and is very low in hazard.

The potential exposures to people following an herbicidal use of metsulfuron methyl is considered low in hazard.

CHRONIC TOXICITY

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Not listed	- -	4	Low
Mutagenicity	Not mutagenic or genotoxic	- -	5	Low
Neurotoxicity - (NOAEL)	Not listed	- -	4	Low
Endocrine Disruption	Not listed	- -	4	Low
Developmental Toxicity (NOAEL)	700 mg/kg/day	None	3	Low
Reproductive Toxicity (NOAEL)	250 mg/kg/day	None	3	Low
Chronic Toxicity (NOAEL)	25 mg/kg/day	Decreased weight gain	3	Check risk

Chronic Toxicity Summary:

Metsulfuron methyl is not considered a known or suspected carcinogen, and testing also indicates that it is not a mutagen, it is not a known endocrine disruptor, and it does not appear to cause developmental or reproductive toxicity. In soil, about 47% of the applied metsulfuron methyl is expected to degrade to the chemical saccharin. Saccharin was originally classified by the International Agency on Reseach of Cancer as "2B - possibly carcinogenic to humans" (which would fail the County's review criteria) to "3 - not classifiable as to human carcinogenicity" (which passes the County's review criteria). Long-term toxicity testing indicates that the first signs of toxicity is decreased body weight gain at dietary concentrations of 25 mg/kg/day.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Exposures to treated vegetation were not evaluated						
Multiple routes of exposures were not evaluated						
Person eating contanimated fruit	0.25 mg/kg/day	0.0024 mg/kg/day	104	Ingestion	6	Low
Person eating a normal diet of contaminated fish	0.25 mg/kg/day	0.00000000026 mg/kg/day	960,000,000	Ingestion	6	Very low

Chronic Toxicity Risk Assessment Summary:

The long-term exposure risk assessment performed by the US Forest Service only included dietary inputs (ingestion of contaminated foods). The worst-case scenario for eating contaminated fruit has a calculated exposure 100 times less than the EPA's dose of concern. Eating contaminated fish creates an exposure 900,000,000 times less than the dose of concern. Both of these risk assessments indicate that long-term exposures to metsulfuron methyl from contaminated food is low in hazard.

DegradationProducts:

In soil metsulfuron methyl is expected to break down to saccharin (up to 47%), phenylurea (up to 17%), methyl 2-(aminosulfonyl) benzoate (up to 17%), and 2-(aminosulfonyl) benzoic acid (up to 16%) Reference 2.

Comments:

Metsulfuron methyl is considered an eye and skin irritant but is not considered a skin sensitizer (Reference 3).

References

1. Zhejiang Univ Sci B. 2006 March; 7(3): 202–208. Published online 2006 February 27. doi: 10.1631/jzus.2006.B0202
2. International Union of Pure & Applied Chemistry (IUPAC). Pesticide Properties Database, metsulfuron methyl. (Accessed 10/30/2009). Http://sitem.herts.ac.uk/aeru/iupac/
3. USEPA. Integrated Risk Information System, Ally (CASRN 74223-64-6). Last Revised 06/30/1988.
4. Scorecard - The Pollution Information Site. Health Effects (Accessed 10/30/2009). http://www.scorecard.org/health-effects/
5. EXTOXNET, Extension Toxicology Network. Pesticide Information Profiles; Metsulfuron-methyl. Revised 10/96.
6. Klotzbach, J. and Durkin, P. Prepared for USDA, Forest Service. Forest Health Protection. Metsulfuron Methyl - Human Health and Ecological Risk Assessment. December 2004.