dichlobenil (2,6-dichlorobenzonitrile)

Review Date: 09/07/2011
CAS #: 1194-65-6

Type	Terrestrial - pre-emergent, selective, systemic herbicide
Controls	Annual grass weeds, broadleafed weeds, and certain perrennial weeds.
Mode of Action	Stops seed germination, limits cell wall synthesis, and limits root and shoot growth.

Thurston County Review Summary:

Dichlobenil fails Thuston County's pesticide review criteria because it is rated high in hazard based on its classification as a possible human carcinogen and reproductive toxicant. Dichlobenil is also rated high in hazard for mobility and persistence.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	25	1	Moderate
Soil Sorption (Kd=mL/g)	0.2 to 10	1	High
Organic Sorption (Koc=mL/g)	49 to 323	1	High

Mobility Summary:

Dichlobenil is not very soluble in water and adheres poorly to all soil types. The hazard for dichlobenil to move off the site of application or to leach into soil with rain or irrigation water is rated high.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.0005	1	Low
Biotic or Aerobic Half-life (days)	70	4	High
Abiotic Half-life (days)	Value not found		
Terrestrial Field Test Half-life (days)	16 (CA) and 241 (OR)	1	Moderate to high
Hydrolysis Half-life (days)	>150 days	1	High
Anaerobic Half-life (days)	2.8		High
Aquatic Field Test Half-life (days)	15 (FL) and 69 (OR)	1	Moderate to high

Persistence Summary:

The main route of dissipation of dichlobenil is by volatilization (evaporation). The rate of dissipation into the air varies greatly depending on temperature and soil incorporation. If granular products are incorporated into the soil, dichlobenil will degrade very slowly (nearly half of the applied concentration may be in the soil a year after application). If dichlobenil gets deep into soil or sediment where there is little or no oxygen, diclobenil will persist for years. Field testing in warmer climates (California and Florida) indicates that dichlobenil dissipates at a moderate rate compared to a cooler climate (Oregon) where the persistence was much longer. The hazard for persistence for dichlobenil is rated high (especially in western Washington State).

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	32 (fillet) to 110 (viscera)	1	Low
Octanol/Water Partition Coefficient	log Kow = 2.9	1	Moderate

Bioaccumulation Summary:

Bioconcentration tests indicate that dichlobenil has some accumulation in fish although, when they are moved to clean water after the exposure, over 85% of the dichlobenil leaves the fish body. The potential for dichlobenil to bioaccumulate is rated low.

ACUTE TOXICITY HAZARD - ECOTOXICITY

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	1470 mg/kg (BAM)	1	Moderate
Avian (LD50)	683 mg/kg	1	Moderate
Honey bee or insect (LD50)	>120 ug/bee	1	Low
Annelida -worms (LC50)	135 mg/kg	4	Moderate
Fish (LC50)	7.2 mg/L	4	Moderate
Crustacean (LC50)	6.2 mg/L	4	Moderate
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

"To reduce environmental risks to birds, mollusks, fish, invertebrates, and non-target plants, a reduction of the 20 lb. ai/A maximum application rate to 10 lbs ai/A is being imposed. In addition, to mitigate acute risks to endangered birds, the Agency is requiring that the label for the 10G formulation impose soil incorporation" (Reference 1). Because dichlobenil products come in granular form and are hand-applied by homeowners at the highest application rates, Thurston County believes that the label changes will not fully reduce the risk to birds. So, the risk to birds from potential ingestion of dichlobenil products is rated high in hazard. Thurston County can not determine if the label rate changes will adequately reduce the risk to aquatic organisms.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Adult applying granules with shaker can	Dermal + inhalation	0.45 mg/kg/day	0.032 mg/kg/day	14	1	Low
Adult applying granules with belly grinder	Dermal + inhalation	0.45 mg/kg/day	0.32 mg/kg/day	1.4	1	High
Female drinking contaminated surface water	Ingestion	0.45 mg/kg/day	0.015 mg/kg/day	30	1	Low
Contact exposures were not assessed by EPA						

Acute Toxicity Risk Assessment Summary:

Short-term exposures were compared to a dose of concern of 0.45 mg/kg/day based on developmental toxicity studies and a safety factor of 100. The two residential applicator exposure assessments assume that there is no protective clothing worn and that; 1) an entire shaker can is applied 2) belly grinder application is to 1000 square foot area. Potential exposures from a shaker can application is calculated to be 14 times less than the dose of concern and is rated low in hazard. The potential exposure from applying a granular diclobenil product to a 1000 square foot area with a belly grinder applicator is more than half of the dose of concern and is rated high in hazard.

An exposure assessment was made for a woman drinking surface water that is contaminated from expected runoff concentrations of dichlobenil. Potential short-term exposures are calculated to be 30 times less than the dose of concern and is rated low in hazard.

CHRONIC TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	EPA Group C	"Possible human carcinogen"	1	High
Mutagenicity	Non-mutagenic	None observed	1	Low
Neurotoxicity - (NOAEL)	Data not found			
Endocrine Disruption	Not a known endocrine disruptor	- -	2 and 3	Low
Developmental Toxicity (NOAEL)	45 mg/kg/day (at maternally toxic dose)	External, visceral, and skeletal defects +	1	Moderate
Reproductive Toxicity (NOAEL)	3 mg/kg/day (without maternal toxicity)	Reduced pup weight	1	High
Chronic Toxicity (NOAEL)	1.25 mg/kg/day	Increased liver and thyroid weights	1	Check risk

Chronic Toxicity Hazard Summary:

Developmental toxicity was observed along with maternal toxicity, although the maternal toxicity was decreased food consumption and weight loss and the toxicity to the developing fetus was significant. Reproductive toxicity was observed to the pups in the form of decreased weight without maternal toxicity. Reproductive toxicity without maternal toxicity is considered high in hazard by Thurston County's review criteria. Dichlobenil is classified as a possible human carcinogen by the EPA, which Thurston County also rates as high in hazard.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Adult drinking contaminated water	Ingestion	0.013 mg/kg/day	0.00135 mg/kg/day	10	1	Low
Non-nursing infant drinking contaminated water	Ingestion	0.013 mg/kg/day	0.0034 mg/kg/day	About 3	1	Low
Contact exposures were not assessed by EPA						
Combined exposures were not assessed by EPA						

Chronic Toxicity Risk Assessment Summary:

The EPA's tier one (initial screening) contaminated drinking water assessment is very conservative. It calculates the concentration of dichlobenil in potential drinking water by determining the runoff from a treated agricultural field into a six foot deep pond that is ten times smaller than the field. The assessment takes into account chemical adhesion to soil and chemical breakdown - but it does not factor in potential dissipation through water filtration or aeration. Long-term exposures to the general population, from drinking contaminated surface water, was calculated to be about ten times less than the dose of concern and are rated low in hazard. The same drinking water exposure to a non-nursing infant is rated moderate in hazard (potential exposures calculated to be between 10% and 50% of the dose of concern).

The EPA did not calculate risk assessments for post-application exposures from contact with skin. The EPA believes that exposures during the application of dichlobenil herbicides are less than exposures to the herbicide after its applied. So, since the risk assessments for herbicide applications were below the EPA's level of concern - the post-application exposures are also expected to be below the level of concern.

The long-term risk assessments indicate that the risk of toxicity from expected long-term exposures to dichlobenil, from herbicidal uses, are rated low in hazard.

Metabolites and Degradation Products:

The metabolites of dichlobenil include 2,6-dichlorobenzamide (BAM), 2,6-dichlorobenzoic acid (2,6-DCBA), and O-chlorobenzamide (OBAM).

Comments:

Dichlobenil is not an eye or skin irritant (EPA Toxicity Category IV) and is not considered a skin sensitizer (Reference 1).

References

1. USEPA. Office of Prevention, Pesticides and Toxic Substances. Reregistration Eligibility Document - Dichlobenil. EPA-738-R-98-003. October 1998.
2. Scorecard - The Pollution Information Site. Health Effects / Endocrine Toxicants (Accessed 9/12/2011). http://www.scorecard.org/health-effects.
3. Illinois EPA. "Endocrine Disruptors Strategy". February, 1997.
4. International Union of Pure & Applied Chemistry. Pesticide Properties Database. dichlobenil (Ref: H 133). Accessed 9/12/11. http://sitem.herts.ac.uk/aeru/iupac/