diquat dibromide

Review Date: 5/26/2009

Type	Aquatic contact herbicide - nonselective
Controls	Non-selective submerged aquatic plants - it destroys the plant tissue that it comes into contact with (since it is not a systemic herbicide it will not circulate through the plant to kill roots).
Mode of Action	Works as a desiccant by reacting with molecular oxygen to produce a superoxide anion that destroys plant cells.

Thurston County Review Summary:

Diquat dibromide has a single dose mortality concentration (LD50) for cows of 30-56 mg/kg, which is considered too highly toxic to mammals by Thurston County's review criteria. The potential exposure to a child swimming in a waterbody, on the day it was treated with diquat dibromide, is considered high in hazard for toxicity. The concentration of diquat dibromide after an aquatic application is high enough to cause death to aquatic invertebrates. Therefore, herbicides containing diquat dibromide as an active ingredient fail Thurston County's review criteria due to the toxicity hazard they present at expected environmental concentrations.

MOBILITY

Property	Value	Reference	Rating
Solubility (mg/L)	700,000	3	High
Soil Sorption (Kd=mL/g)	Not found		
Organic Sorption (Koc=mL/g)	3,000 - 500,000	5	Low

Mobility Summary:

When this product is used to manage submerged vegetation it will disperse quickly in the water column until it adheres to a plant or clay particle. The result is that the product will not travel far in water with little flow or has a fair amount of suspended sediments and vegetation. The less suspended particulates in the water the greater the potential for the product to migrate with water flow. Even though this chemical is very water soluble, it adheres to soil and sediment so strongly that it is considered low in hazard for mobility.

PERSISTENCE

Property	Value	Reference	Rating
Vapor Pressure (mm Hg)	<0.00000001	7	High
Biotic or Aerobic Half-life (days)	31-50	5	Moderate
Abiotic Half-life (days)	Stable	3	High
Terrestrial Field Test Half-life (days)	>365	6	High
Hydrolysis Half-life (days)	Stable	6	High
Anaerobic Half-life (days)	>270	5	High
Aquatic Field Test Half-life (days)	<2	6	Low

Persistence Summary:

In every environment diquat dibromide is very persistent. But, due to the nature of the chemical, it will become bound to soil and sediment so tightly that even if it is ingested it will remain bound to the soil and not metabolized. In aquatic applications, diquat dibromide has been removed from the water column (by binding to vegetation and suspended particles) within a few days, but the chemical will still be adhered to the sediments for years. The persistence hazard of diquat dibromide is rated as high.

BIOACCUMULATION

Property	Value	Reference	Rating
Bioaccumulation Factor	Not found		
Bioconcentration Factor	Not found		
Octanol/Water Partition Coefficient	Kow = 0.000025	5	Low

Bioaccumulation Summary:

Diquat dibromide has a very low octanol / water partition coefficient so it is not expected to bind tightly to fish or animal tissue. The hazard for bioaccumulation is considered low.

ACUTE TOXICITY

Test Subject	Value	Reference	Rating
Mammalian (LD50)	30-56 mg/kg	2	High
Avian (LD50)	31-60.1 ppm a.e.	5	Moderate
Honey bee or insect (LD50)	100 ug/bee	5	Low
Annelida -worms (LC50)	Not found		
Fish (LC50)	12.3 mg/L	2	Moderate
Crustacean (LC50)	0.048 mg/L	5	High
Mollusk (LC50)	0.34 mg/L	5	High
Amphibian (LD50 or LC50)	Not found		

Acute Toxicity Summary:

Diquat dibromide has a single dose mortality concentration (LD50) for cows of 30-56 mg/kg, which is considered too highly toxic to mammals by Thurston County's review criteria. Also, a single lake application can cause adverse effects including mortality to aquatic invertebrates, which is rated as high in hazard for non-target toxicity. Sub-lethal effects to fish have been documented at expected environmental concentrations including; severe respiratory distress in yellow perch, decreased swimming ability in rainbow trout, and adversely effected the ability of Coho salmon smolt to migrate downstream (Reference 5). It is also considered highly toxic to aquatic organisms (oysters and crustaceans), moderately toxic to birds and fish, and low in toxicity to bees.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Applicator / handler exposures were not evaluated						
Child 7-10 yrs	0.01 mg/kg/day	0.0055 mg/kg/day	1.8	Dermal	3	High
Adult	0.01 mg/kg/day	0.0013 mg/kg/day	7.7	Dermal	3	Moderate
Combined exposures were not evaluated						

Acute Toxicity Risk Assessment Summary

Short-term risk assessment exclusively for aquatic applications tested the exposures to swimmers entering treated water on the same day as the application. The risk assessment for a child swimming on the day of an aquatic application can result in a exposure to a child that is more than half of the EPA's calculated dose of concern. This potential exposure is rated as high in hazard by Thurston County's review criteria. The same exposure to an adult is rated as moderate in hazard.

There were no risk assessments evaluated for an applicator performing tank mixing and applying to an aquatic environment.

CHRONIC TOXICITY

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	E	Evidence of non-carcinogenicity for humans	1	Low
Mutagenicity	Negative	- -	2	Low
Neurotoxicity - (NOAEL)	- -	Negative	4	Low
Endocrine Disruption	- -	Negative	3	Low
Developmental Toxicity (NOAEL)	12 mg/kg/day	Skeletal alterations + weight loss	3	Check risk
Reproductive Toxicity (NOAEL)	4 mg/kg/day	Decrease in live pups + kidney lesions	3	Check risk
Chronic Toxicity (NOAEL)	0.5 mg/kg/day	Cataracts, decreased adrenal weights	3	Check risk

Chronic Toxicity Summary:

Testing of diquat dibromide showed that it does not cause neurotoxicity, mutagenicity, or endocrine disruption (Reference 3). The EPA cancer classification is "E" for evidence of non-carcinogenicity for humans. Reproductive and developmental toxicity was observed at doses that were higher than those that caused maternal toxicity. The first adverse effects observed in the long-term toxicity tests were cataracts, and decreased adrenal and epididymides weights.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Post-application contact exposure was not assessed						
No combined exposure was evaluated						
Drinking water exposure not evaluated						
Dietary exposure was not evaluated						

Chronic Toxicity Risk Assessment Summary:

The EPA did not identify any herbicidal uses of diquat dibromide that would result in a long-term exposure except when they are used on crops. Since there are no identified long-term exposures from the herbicidal use of diquat dibromide in an aquatic setting, the hazard for toxicity from a long-term exposure is considered low.

DegradationProducts:

None identified

Comments:

Diquat dibromide is a moderate to severe eye irritant, slight skin irritant, but is not considered a skin sensitizer.

References

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5. Final Risk Assessment for Diquat Dibromide Appendix A. Publication Number 02-10-046. Washington State Department of Ecology Water Quality Program, November 2002.
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