cholecalciferol

Review Date: 01/24/2012

CAS #: 67-97-0

Type	Rodenticide
Controls	Rats and mice, pocket gophers, moles, voles, prairie dogs, ground squirrels, chipmunks.
Mode of Action	Causes excessive amounts of calcium in the blood and body tissue which causes mineralization and blockage in blood vessels (Reference 1).

Thurston County Review Summary:

Cholecalciferol (Vitamin D3) is considered high in hazard and products containing it fail Thurston County's pesticide review criteria. Cholecalciferol is rated high in hazard because the risk of toxicity to children and non-target animals that directly consume bait is rated high (and to a lesser degree the risk to non-target animals that consume poisoned rodents is also rated high in hazard).

Cholecalciferol is not considered a mobile chemical and is not highly persistent. There may be a risk for chemical accumulation in animals that manage to live to consume small amounts over a period of time although the risk is not very well defined. The potential for toxicity from long-term exposures to humans or animals has not been evaluated and is considered a data gap.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	0.000022	3	Low
Soil Sorption (Kd=mL/g)	Value not found		
Organic Sorption (Koc=mL/g)	1,500,000	4	Low

Mobility Summary:

Cholecalciferol is not soluble in water and adheres very strongly to soil with organic matter. The hazard for cholecalciferol to move off the site of application with rain or irrigation water is low.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.0000000024	3	High
Biotic or Aerobic Half-life (days)	5	4	Low
Abiotic Half-life (days)	Value not found		
Terrestrial Field Test Half-life (days)	Value not found		
Hydrolysis Half-life (days)	Value not found		
Anaerobic Half-life (days)	Value not found		
Aquatic Field Test Half-life (days)	Value not found		

Persistence Summary:

Cholecalciferol is not expected to dissipate into the air and when it is not formulated in a wax bait or stored in a bait station it can degrade quickly in the environment. Since only one value could be found for the degradation of cholecalciferol (with no information about its route of degradation) it is conservatively rated moderate in hazard for persistence (likely to degrade to half of the applied concentration between 7 and 60 days).

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	3, 30 and 1,000,000	3, 4 and 7	Low, Low and High
Octanol/Water Partition Coefficient	log Kow = 10.2	4	High

Bioaccumulation Summary:

The large octanol/water partition coefficient (log Kow > 5) indicates that there is potential for cholecalciferol to accumulate in fish or animal tissue. The EPA reported a calculated bioconcentration factor of 30 and the European Union reported a factor of 1,000,000. The EPA's value would indicate a low potential for accumulation and the European Union factor would indicate a large potential for accumulation in fish or animal tissue. The overall hazard for bioaccumulation is rated moderate.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	11.8 mg/kg	3	High
Avian (LD50)	2,000 mg/kg	4	Low
Honey bee or insect (LD50)	Value not found		
Annelida -worms (LC50)	Value not found		
Fish (LC50)	1,000 mg/l	4	Low
Crustacean (LC50)	13 mg/l	4	Moderate
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity indicates that cholecalciferol is highly toxic to animals, moderately toxic to aquatic invertebrates but low in toxicity to birds and fish.

The risk of toxicity or death to small mammals that eat cholecalciferol bait exceeds the EPA's level of concern although the risk to birds from primary poisoning (eating bait) is considered low to moderate (Reference 3). The EPA's level of concern was also exceeded for small animals from secondary poisoning (eating poisoned animals). Secondary poisoning testing was performed in New Zealand for both dogs and cats. The dogs suffered cholecalciferol toxicity in the form of hypercalcemia from eating poisoned rodents and the cats did not show toxicity (Reference 5). The hazard of toxicity or death to non-target animals that directly consume bait or that eat poisoned animals is rated high by Thurston County's pesticide review criteria.

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Human risk assessments could not be located.						
Human risk assessments could not be located.						
Human risk assessments could not be located.						
Human risk assessments could not be located.						

Acute Toxicity Risk Assessment Summary:

Human risk assessments for short-term exposures could not be located.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Used as a cancer	- -	6	Low
Mutagenicity	10 mg/plate	Negative for mutagenic effects	7	Low
Neurotoxicity - (NOAEL)	Value not provided	Anorfexia, headaches, etc.	8	
Endocrine Disruption	Cholecalciferol is a hormone	Effects calcium level in blood	6	High
Developmental Toxicity (NOAEL)	Value not found	- -	- -	Data gap
Reproductive Toxicity (NOAEL)	Value not found	Maternal toxicity with developmental toxicity	- -	Moderate
Chronic Toxicity (NOAEL)	Value not found	Hypercalcemia	6	Unknown

Chronic Toxicity Hazard Summary:

Cholecalciferol (vitamin D3) is a steroid chemical produced within the skin by sunlight. Cholecalciferol causes no direct biological activity although in the liver it is converted into 25-hydroxycholecalciferol and then converted to 1,25-dihydroxycholecalciferol in the kidneys (Reference 6). 1,25-dihydroxycholecalciferol causes calcium to be released from bones and the stomach resulting in an increase of calcium in the blood stream and the calcification (hardening) of organ tissue. Because cholecalciferol is produced in one area of the body and causes an effect to another part of the body, it is considered a hormone, and therefore an endocrine disruptor (a chemical that interferes with the hormone system).

There were no studies that assessed the carcinogenic potential of cholecalciferol but, Vitamin D is used to treat some cancers. Developmental studies with rabbits were cited as having produced developmental toxicity along with maternal toxicity. No data could be found to determine if chloecalciferol is considered a reproductive toxicant and is considered a data gap.

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Human risk assessments could not be located.						
Human risk assessments could not be located.						
Human risk assessments could not be located.						
Human risk assessments could not be located.						

Chronic Toxicity Risk Assessment Summary:

Human risk assessments for long-term exposures were not required by the EPA and could not be located from another source.

Metabolites and Degradation Products:

In animals, cholecalciferol is metabolized to 25-hydroxycholecalcilferol and 1,25-dihydroxycholecalciferol (Reference 3).

Comments:

Cholecalciferol is not considered 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. "Risk Mitigation Decision for Ten Rodenticides." May 28, 2008.
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3. USEPA. Office of Prevention, Pesticides and Toxic Substances. Risk of Cholecalciferol Use to the Federally Endangered Salt Marsh Harvest Mouse. 12/28/11.
4. International Union of Pure & Applied Chemistry. Pesticide Properties Database. Cholecalciferol. Accessed 1/24/2012. http://sitem.herts.ac.uk/aeru/iupac/
5. Easton, et al. "Non-target and Secondary Poisoning Risks Associated with Cholecalciferol." New Zealand Plant Protection 53:299-304 (2000).
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7. National Library of Medicine HSDB Database. TOXNET. Toxicology Data Network. Cholecalciferol. http://toxnet.nlm.nih.gov/ Accessed March 2012.
8. Hardman, J.G., L.E. Limbird, P.B., A.G. Gilman. Goodman and Gilman's The Pharmacological Basis of Therapeutics. 10th ed. New York, NY: McGraw-Hill, 2001.