brodifacoum

Review Date: 10/20/2011

CAS #: 56073-10-0

Type	Single-dose rodenticide.
Controls	Primarily used to control Norway rats, roof rats, and mice.
Mode of Action	Brodifacoum is an anticoagulant that slows or stops blood clotting resulting in hemorrhaging and death.

Thurston County Review Summary:

Rodenticide products containing brodifacoum as an active ingredient are rated high in hazard and fail Thurston County's pesticide review criteria. Brodifacoum products are considered high in hazard due to their risk to children or animals that eat bait products and to predators that eat rodents that have consumed bait. The EPA stated that compared to other rodenticide active ingredients, brodifacoum is one of four anticoagulant baits that represent the highest level of risk to wildlife (Reference 1).

Due to the potential ecological risks associated with the use of brodifacoum bait products, the EPA anticipates classifying them as restricted use pesticides (restricting purchase and use of these products to commercial applicators).

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	0.004	4	Low
Soil Sorption (Kd=mL/g)	Value not found		
Organic Sorption (Koc=mL/g)	50,000	4	Low

Mobility Summary:

Brodifacoum is not water soluble, adheres strongly to soil, and is not likely to leach into groundwater. Rodenticides containing brodifacoum are formulated into products that are in paraffin block (wax-like material) or pellet form and are placed into tamper-resistant feeding stations or secured in place. The use of feeding stations and paraffin blocks will limit the movement of brodifacoum more than its chemical properties and chemical movement is most likely to be from animals carrying away bait fragments (if possible). The hazard for brodifacoum to move off the site of application is rated low.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.0000000098	3	Low
Biotic or Aerobic Half-life (days)	157	3	High
Abiotic Half-life (days)	Value not found		
Terrestrial Field Test Half-life (days)	57	4	Moderate
Hydrolysis Half-life (days)	30	3	Moderate
Anaerobic Half-life (days)	Value not found		
Aquatic Field Test Half-life (days)	Value not found		

Persistence Summary:

Brodifacoum in bait form will not break down to half of their applied concentration within 60 days, therefore the hazard for persistence is rated high.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	Value not found		
Octanol/Water Partition Coefficient	log Kow = 8.5	4	High

Bioaccumulation Summary:

The octanol/water partition coefficient is high (greater than 5), which indicates that brodifacoum is likely to accumulate in fish or animal tissue. Rat metabolism studies showed that over 77% of administered brodifacoum remained in the rat after 10 days (Reference 3). Although animals that eat brodifacoum are not expected to live long, the hazard for bioaccumulation is rated high.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	0.4 mg/kg	3	High
Avian (LD50)	0.26 mg/kg	3	High
Honey bee or insect (LD50)	Value not found		
Annelida -worms (LC50)	Value not found		
Fish (LC50)	0.015 mg/L	3	High
Crustacean (LC50)	0.98 mg/L	3	High
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that brodifacoum is highly toxic to animals, birds, fish and other aquatic organisms. The risk to fish and other aquatic organisms from the use of brodifacoum products is considered low (because these products are not soluble in water and are not expected to get into water bodies). There have been many reported poisonings to pets from exposures to anticoagulant rodenticides. The EPA states that the most common causes of poisoning are due to careless bait placement, overuse of baits, failure to discard poisoned rodents, and intentional poisoning. The risk of toxicity to pets and wildlife that consume bait is rated high.

Brodifacoum and other second generation anticoagulant baits can kill rodents with one feeding but they do not die for several days. There is real potential for the rodents to feed on the baits multiple times and get a combined dose that is much higher than the lethal dose. There are several studies that show that birds and animals that eat poisoned rodents can get a dose that is lethal to them as well (References 1 and 2). Risk of toxicity or death to predators (coyotes, owls, etc.) that consume rodents that have eaten bait is rated high.

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Child eating 5 gram bait	Ingestion	Unknown	Unknown	None	1, 2, and 3	High
Risk from handling baits was not calculated						
Exposures from breathing bait dust not evaluated						
Other exposures were not calculated						

Acute Toxicity Risk Assessment Summary:

The risk of toxicity to chidren who eat bait is rated high in hazard because one bite of a bait could cause toxicity or kill the child.

Due to the potential risk from repeated exposures from handling and placing baits, the EPA requires the use of protective equipment (respirators and eye protection) for occupational handlers.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Not listed	- -	7	N/A
Mutagenicity	Value not found	None noted	3	Low
Neurotoxicity - (NOAEL)	Value not found			Data gap
Endocrine Disruption	Not listed	- -	5 and 6	Low
Developmental Toxicity (NOAEL)	0.02 mg/kg/day	No developmental toxicity	3	Low
Reproductive Toxicity (NOAEL)	Value not found			Data gap
Chronic Toxicity (NOAEL)	0.001 mg/kg/day	Blood in uteri	3	Check risk

Chronic Toxicity Hazard Summary:

Brodifacoum is not listed as a known or suspected carcinogen by the International Agency for Research on Cancer and the EPA waived the requirement for a cancer study because there are no food uses of brodifacoum. All mutagenicity studies with brodifacoum reviewed by the EPA were negative for mutagenic potential. Neurotoxicity testing and reproductive toxicity data could not be found for brodifacoum (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
Long-term exposures were not evaluated						
Long-term exposures were not evaluated						
Long-term exposures were not evaluated						
Long-term exposures were not evaluated						

Chronic Toxicity Risk Assessment Summary:

Long-term exposures are not expected and risk from long-term exposures was not evaluated. Occupational handlers of bait products are required to wear appropriate respirators, gloves, and eye protection to minimize or eliminate potential exposures.

Metabolites and Degradation Products:

The major degradation chemical of brodifacoum was identified as carbon dioxide (36% after 56 weeks) with eleven other carbon containing compounds isolated that could not be identified (Reference 3).

Comments:

Brodifacoum is considered a minor eye irritant (EPA Toxicity Category III) but is not considered more than a mild skin irritant (although highly toxic) and is not considered a skin sensitizer (Reference 3).

References

1. USEPA. Office of Prevention, Pesticides and Toxic Substances. "Risk Mitigation Decision for Ten Rodenticides." May 28, 2008.
2. USEPA. Office of Prevention, Pesticides and Toxic Substances. "Proposed Risk Mitigation Decision for Nine Rodenticides." January 17, 2007.
3. USEPA. Office of Prevention, Pesticides and Toxic Substances. Reregistration Eligibility Decision (RED) Rodenticide Cluster. July 1998.
4. International Union of Pure & Applied Chemistry. Pesticide Properties Database. brodifacoum (Ref: WBA 8119). Accessed 10/21/2011. http://sitem.herts.ac.uk/aeru/iupac/
5. Scorecard - The Pollution Information Site. Health Effects / Endocrine Toxicants (Accessed 10/20/2011). http://www.scorecard.org/health-effects.
6. Illinois EPA. "Endocrine Disruptors Strategy". February, 1997.
7. International Agency for Research on Cancer. Agents Classified by the IARC Monographs, Volumes 1-102. (Accessed 10/20/2011). http://monographs.iarc.fr