

# lime sulfur (calcium polysulfide)

Review Date: 06/22/2012

CAS #: 1344-81-6

Type	fungicide - insecticide / miticide (spider mites)
Controls	Powdery mildew, anthracnose, scab, and some diseases (Reference 1).
Mode of Action	"Acts by disrupting metabolism but also utilizes the fungicidal properties of elemental sulfur during its degradation and so acts as a protectant" (Reference 3).

## Thurston County Review Summary:

Lime sulfur (calcium polysulfide) fungicide products are rated conditional because there are expected use patterns that are rated high in hazard to birds and small animals and there are other expected use patterns that are rated low in hazard to non-target organisms. The risk to non-target birds and animals is related to the amount of vegetation and insects that is treated and the proximity of non-treated forage (if their entire diet consists of treated forage, the hazard is high).

Calcium polysulfide is a corrosive chemical that can burn the skin and cause irreversible eye damage. Use caution when handling and applying these pesticides and follow all label directions.

## MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	Soluble to very soluble	1	High
Soil Sorption (Kd=mL/g)	Value not found		
Organic Sorption (Koc=mL/g)	Value not found		

### Mobility Summary:

Calcium polysulfide is very water soluble and will quickly degrade in water to form calcium hydroxide and sulfur. Sulfur is expected to incorporate into the soil after it degrades from calcium polysulfide. Heavy rain or over irrigating an area after a large application of calcium polysulfide can result in calcium hydroxide runoff. The hazard for calcium polysulfide (or calcium hydroxide) to move off the site of application with rain or irrigation water is rated moderate (because it is only likely to run off when the area is over watered).

## PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	Value not found		
Biotic or Aerobic Half-life (days)	Stable (degradation chemicals)	3	High
Abiotic Half-life (days)	Stable (degradation chemicals)	3	High
Terrestrial Field Test Half-life (days)	Stable (degradation chemicals)	3	High
Hydrolysis Half-life (days)	Rapid dissociation	1	Low
Anaerobic Half-life (days)	Value not found		
Aquatic Field Test Half-life (days)	Rapid dissociation	1	Low

### Persistence Summary:

Calcium polysulfide is expected to have a very short half-life when used because it will dissociate when it comes into contact with water to become calcium hydroxide and sulfur (which are highly persistent). The hazard for chemical persistence for the parent compound is low but high for the degradation chemicals - the overall hazard is rated high because the mode of action is associated with the degradation chemicals.

## BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	Value not found		
Octanol/Water Partition Coefficient	Value not found		

### Bioaccumulation Summary:

No data could be found regarding the potential for calcium polysulfide or calcium hydroxide to accumulate in fish or animal tissue. But, since these are naturally occurring compounds that are found in food and in nature and that they are added to food in greater quantities than the amounts you would be exposed to with pesticidal use, the hazard for bioaccumulation is considered not applicable for these compounds.

# ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	820 mg/kg	1	Moderate
Avian (LD50)	560 mg a.i./kg	1	Moderate
Honey bee or insect (LD50)	>25 ug ai/bee	2	Low
Annelida -worms (LC50)	>1,000 mg/kg	1	Low
Fish (LC50)	0.97 mg ai/L	2	High
Crustacean (LC50)	2.9 mg ai/L	2	Moderate
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

## Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing of calcium polysulfide indicates that it may be highly toxic to fish but is moderately toxic to animals and birds, and low in toxicity to earthworms. The EPA states that calcium polysulfide is low in toxicity to honeybees (acute contact) although it is known to cause toxicity to other beneficial insects (Reference 1).

The amount of calcium and sulfur that is expected to be introduced into the environment from pesticidal uses is expected to be much less than the naturally occurring levels. Risk assessments evaluated by the EPA determined that the risk to fish and aquatic organisms were low in hazard with the only exception being an aerial application to blueberries (highest application rate) which slightly exceeds the level of concern for endangered aquatic species (because the dose of concern is set much lower for endangered species).

The risk to birds and animals that eat plants and insects that have had calcium polysulfide applied to them (at rates of 3 pounds of active ingredient/acre or greater), exceeds the EPA's level of concern. However, the EPA believes that the risk is overstated because it is believed that the dose of concern that was used in the risk assessment is low because it was set from a study where the animals and birds were fed using a gavage (so the calcium polysulfide was not dissociated and the effects were likely due to its corrosive nature and not reflective of an environmental exposure which would be to calcium hydroxide and sulfur). Risk to non-target organisms from residential uses and application rates were not evaluated.

Broadcast applications of calcium polysulfide fungicides are rated high in hazard but spot spray applications that are not expected to cover much non-target vegetation is rated low in hazard.

# ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Products may be a severe eye irritant						
Products may be a severe eye irritant						
Products may be a severe eye irritant						
Products may be a severe eye irritant						

## Acute Toxicity Risk Assessment Summary:

Calcium polysulfide quickly degrades to calcium hydroxide and sulfur. Calcium hydroxide is one of many hydroxides that are found in food and are generally regarded as safe (GRAS) by the Food and Drug Administration (Reference 1).

Although calcium polysulfide and calcium hydroxide are considered safe for food use and risk from pesticidal post-application exposures are considered low in hazard for human toxicity, it should be noted that they have a very high pH and are considered corrosive chemicals. Contact with the eyes can cause irreversible damage and products may be irritating to skin as well. Follow product label directions for use of protective clothing and eyewear.

# CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Not listed as a known or suspected carcinogen	--	4 and 5	Low
Mutagenicity	Non-mutagenic	--	2	Low
Neurotoxicity - (NOAEL)	Value not found			
Endocrine Disruption	Possible endocrine effects	Decreased embryogenesis	2	Inconclusive
Developmental Toxicity (NOAEL)	Value not found			
Reproductive Toxicity (NOAEL)	Value not found			
Chronic Toxicity (NOAEL)	Value not found			

## Chronic Toxicity Hazard Summary:

Calcium polysulfide is not a known or suspected carcinogen and testing with microorganisms indicates that it is non-mutagenic. Calcium polysulfide exposure to midge eggs caused embryogenesis although evaluation of the testing methods indicates that the response may not be caused by the calcium polysulfide (although the EPA could not rule it out). Therefore, the hazard for endocrine disruption from calcium polysulfide cannot be fully evaluated with the current data. There were no multiple dose studies required by the EPA for calcium polysulfide because it is expected to rapidly degrade in the human body to calcium hydroxide and sulfur (which are both regarded as safe for food use by the Food and Drug Administration). Sulfur was evaluated by the EPA and long term exposures to low levels (which would be expected from pesticidal use) is "generally considered safe" and there are no known risks for developmental or reproductive toxicity, or for mutagenicity (Reference 1). Calcium hydroxide is low in toxicity by ingestion although it is corrosive to the eyes and skin.

# CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Risk from long-term exposures is low in hazard						
Risk from long-term exposures is low in hazard						
Risk from long-term exposures is low in hazard						
Risk from long-term exposures is low in hazard						

## Chronic Toxicity Risk Assessment Summary:

There were no long-term risk assessments performed for calcium polysulfide (because it is expected to quickly dissociate to calcium hydroxide and sulfur). Long-term exposures to calcium hydroxide and sulfur, from pesticidal uses, are rated low in hazard because the levels of these chemicals are expected to be very small compared to the amounts already found in food and in nature.

## Metabolites and Degradation Products:

Calcium polysulfide degrades in the environment and in the body to calcium hydroxide and sulfur.

## Comments:

Calcium polysulfide has a very high pH (about 11.5 which is corrosive) and can cause irreversible eye damage (EPA Toxicity Category I) and is considered mildly irritating to skin (EPA Toxicity Category III). Calcium hydroxide is considered irritating to the lungs and is corrosive to the eyes and skin (Reference 1).

## References

1. USEPA. Office of Prevention, Pesticides and Other Toxic Substances. Reregistration Eligibility Decision for Inorganic Polysulfides. List D - Case No. 4054. September 30, 2005.
2. USEPA. Environmental Fate and Ecological Risk Assessment for the RED of Calcium Polysulfides, a Fungicide/acaricide. October 4, 2005.
3. International Union of Pure & Applied Chemistry. Pesticide Properties Database. lime sulphur. Accessed 6/22/2012.
4. International Agency for Research on Cancer. Agents Classified by the IARC Monographs, Volumes 1-102. (Accessed 6/6/2012). <http://monographs.iarc.fr>
5. USEPA. Science Information Management Branch, Health Effects Division, Office of Pesticide Programs. "Chemicals Evaluated for Carcinogenic Potential" July 19, 2004.