Dichlorprop-p (2,4-DP-p)

Review Date: 04/19/2012
CAS #: 15165-67-0

Type	Terrestrial herbicide - selective post-emergent plant growth regulator.
Controls	Annual and perrenial broadleaf weeds.
Mode of Action	Causes excessive cell division, growth, and damage to vascular tissue (Reference 1).

Thurston County Review Summary:

This review covers the chemicals dichlorprop-p (2,4-DP-p acid - CAS# 15165-67-0), 2,4-DP-p dimethylamine salt (2,4-DP-p DMAS - CAS# 104786-87-0), and 2,4-DP-p ethylhexyl ester (2,4-DP-p EHE- CAS# 865363-39-9). 2,4-DP-p DMAS and 2,4-DP-p EHE quickly dissociate to the 2,4-DP-p acid form in the environment so the data used to rate these chemicals is based on the hazards and risks associated with the acid form.

2,4-DP-p is rated high in hazard and herbicide products containing it as an active ingredient fail Thurston County's pesticide review criteria. 2,4-DP-p is rated high in hazard due to the level of risk of toxicity to birds and animals that eat a diet of 2,4-DP-p treated vegetation and insects at expected environmental concentrations. The risk to children that eat granular products is rated moderate in hazard, but is very close to the high hazard determination. 2,4-DP-p is considered a mobile chemical in the environment (likely to move off the site of application with rain or irrigation water).

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	729	1	Moderate
Soil Sorption (Kd=mL/g)	Value not found		
Organic Sorption (Koc=mL/g)	44	3	High

Mobility Summary:

2,4-DP-p is moderately soluble in water and adheres poorly to soil. The hazard for 2,4-DP-p to move off the site of application with rain or irrigation water is rated high.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.00000047	1	Moderate
Biotic or Aerobic Half-life (days)	14	1	Moderate
Abiotic Half-life (days)	<4 (photolysis in water)	1	Low
Terrestrial Field Test Half-life (days)	35 (risk assessments)	1	Moderate
Hydrolysis Half-life (days)	Stable	1	High
Anaerobic Half-life (days)	159 aquatic	1	High
Aquatic Field Test Half-life (days)	15	3	Moderate

Persistence Summary:

2,4-DP-p is not expected to dissipate significantly into the air after an herbicide application and it is likely to take more than one week but less than two months to degrade to half of the applied concentration. If 2,4-DP-p leaches deeply into soil or gets into aquatic sediment where there is little oxygen, then it can degrade much slower. The overall hazard for chemical persistence of 2,4-DP-p is rated moderate.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	Value not found		
Octanol/Water Partition Coefficient	log Kow = -0.56	2	Low

Bioaccumulation Summary:

The octanol/water partition coefficient for 2,4-DP-p indicates that it is not likely to accumulate in fish or animal tissue. Rat metabolism studies indicate that 2,4-DP-p is quickly absorbed and the majority of the chemical eliminated within 5 days (Reference 6). The hazard for bioaccumulation is rated low.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	567 mg/kg	2	Moderate
Avian (LD50)	242 mg/kg (2,4-DP-p DMAS)	1	Moderate
Honey bee or insect (LD50)	>200 ug/bee	3	Low
Annelida -worms (LC50)	>1,000 mg/kg	3	Low
Fish (LC50)	>214 mg ae/L	1	Low
Crustacean (LC50)	558 mg ae/L	1	Low
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing of 2,4-DP-p indicates that it is moderately toxic to animals and birds but low in toxicity to insects, worms, fish and other aquatic organisms.

In ecological risk assessments, the potential exposures to birds that forage on treated grass, plants, and insects (at labeled use rates) is calculated to exceed the level of concern and is rated high in hazard. The calculated short-term dietary exposures to animals that eat treated grass, vegetation, and insects is below the level of concern for application rates under 1 pound of active ingredient per acre but is exceeded at 6 pounds of active ingredient per acre. Many of the potential long-term dietary exposures exceed the EPA's level of concern at 6 pounds of active ingredient per acre and at rates of 0.75 pounds of active ingredient per acre (Reference 1). The risk of toxicity to birds and animals that eat a diet of 2,4-DP-p treated vegetation and insects is rated high in hazard. The risk to fish and other aquatic organisms from expected environmental concentrations of 2,4-DP-p from herbicidal uses does not exceed the EPA's level of concern and is rated low in hazard.

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Hand application of granules	Inhalation	0.051 mg/kg/day	0.0001 mg/kg/day	440	1	Low
Mix / apply liquid product with hose end sprayer	Inhalation	0.051 mg/kg/day	0.00009 mg/kg/day	560	1	Low
Child's hand-to-mouth activities on treated grass	Ingestion	0.051 mg/kg/day	0.011 mg/kg/day	4.6	1	Moderate
Child eating granular product on treated grass	Ingestion	0.051 mg/kg/day	0.021 mg/kg/day	2.4	5	Moderate - high

Acute Toxicity Risk Assessment Summary:

In dermal toxicity testing, there was no systemic toxicity observed at the highest dose of 2,4-DP-p of 1,000 mg/kg/day. Additionally, there was no evidence of developmental toxicity from dermal exposures to 2,4-DP-p (Reference 1). The EPA's calculated risk from potential inhalation exposures of 2,4-DP-p to residential applicators (for all application types) is rated low in hazard.

Potential exposures to adult residential applicators (following all product label directions) are all several hundred times less than the dose of concern and are rated low in hazard.

Potential exposures to children that play in treated grass can range from low to high in hazard. The potential exposures calculated for a child conducting hand-to-mouth activities on a treated lawn is about 5 times less than the EPA's dose of concern and is rated moderate in hazard. The potential exposure that a child can get from eating granular products applied to a lawn was calculated for two active ingredient concentrations. For both product concentrations the risk to a child eating 0.3 grams/day of 2,4-DP-p granular product is rated moderate in hazard (but very close to high in hazard).

Risk to occupational applicators was only calculated to be high in hazard when the application rate was up to 6 pounds of active ingredient per acre. All other potential exposures from applications using less than one pound of active ingredient per acre were rated low in hazard (except for mixing and loading wettable powder products for a 100 acre application which are high in hazard without a respirator and moderate in hazard with a respirator).

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Not Likely to be Carcinogenic to Humans	- -	1	Low
Mutagenicity	Value not found	Mixed results (mostly negative)	6	Low
Neurotoxicity - (NOAEL)	250 mg/kg (LOAEL)	Adverse body function	6	Check risk
Endocrine Disruption	Degradation chemical is suspected disruptor	- -	4	Moderate
Developmental Toxicity (NOAEL)	80 mg/kg/day	Incompletely ossified sternebra +	6	Low
Reproductive Toxicity (NOAEL)	152 mg/kg/day	Decreased pup weight	6	Low - moderate
Chronic Toxicity (NOAEL)	3.6 mg/kg/day	Change in urine chemistry	1	Check risk

Chronic Toxicity Hazard Summary:

The degradation chemical of 2,4-DP-p is 2,4-dichlorophenol which is a suspected endocrine disruptor. In toxicity testing, developmental toxicity was observed at concentrations higher than maternally toxic doses. There were no multigenerational studies with 2,4-DP-p, but there was a single-generation reproductive study performed that induced toxicity to the fetus only at doses higher than maternally toxic doses (low potential hazard). Reproductive studies (2-generation) using 2,4-DP produced reproductive toxicity along with maternal toxicity (moderate potential hazard). Neurotoxicity was observed at very high doses (nearly 70 times higher than the concentration producing the first observeable adverse effect from long-term exposures). Although mutagenicity testing showed that 2,4-DP-p is reactive with DNA and was considered clastogenic in a Chinese hamster ovary chromosomal aberration assay - the EPA concluded that it does not represent a mutagenic hazard because there was no gene mutation or chromasomal abberation and other toxicities were not sufficient to conclude mutagenic potential (Reference 6).

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 risk assessments did not include an assessment for inhalation exposures (because only short-term inhalation exposures are expected) or dermal exposures (because there was no systemic toxicity observed with dermal testing of 2,4-DP-p). Long-term oral exposures were assessed only for dietary and drinking water exposures - which are not part of Thurston County's review criteria.

Metabolites and Degradation Products:

2,4-DP-p degrades to 2,4-dichlorophenol, 2,4dichloroanisole, and carbon dioxide (Reference 1).

Comments:

2,4-DP-p is part of the chlorophenoxy group of herbicides (which also includes 2,4-D, MCPA, 2,4,5-T and mecoprop).

2,4-DP-p is corrosive to the eyes (EPA Toxicity Category I for primary eye irritation) but is not a considered a skin irritant (EPA Toxicity Category IV) or a dermal sensitizer, however, 2,4-DP-p EHE and 2,4-DP-p DMAS are considered dermal sensitizers (Reference 1).

References

1. USEPA. Office of Prevention, Pesticides and Toxic Substances. Reregistration Eligibility Decision for Dichlorprop-p (2,4-DP-p). EPA 738-R-07-008. August 29, 2007.
2. USEPA. Office of Prevention, Pesticides and Toxic Substances. 2,4-DP-p: Occupational and Residential Exposure Assessment for the Reregistration Eligibility Decision. April 03, 2007.
3. International Union of Pure & Applied Chemistry. Pesticide Properties Database. dichlorprop-P (Ref: BAS 044H). Accessed 4/18/2012. http://sitem.herts.ac.uk/aeru/iupac/
4. Illinois EPA. "Endocrine Disruptors Strategy". February, 1997.
5. USEPA. Office of Prevention, Pesticides and Toxic Substances. 2,4-DP-p: Refined Occupational and Residential Exposure Assessment of Granular Products for the Reregistration Eligibility Decision. August 07, 2007.
6. USEPA. Office of Prevention, Pesticides and Toxic Substances. 2-(2,4-dichlorophenoxy) R-propionic acid (2,4-DP-p), its salts and esters. HED Human Health Risk Assessment. DP: D342620. August 13, 2007.