Triclopyr

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: triclopyr

CHEMICAL NAME: [((3,5,6-trichloro-2-pyridinyl)oxy)acetic acid]

Cas No. 55335-06-3

Of the parent chemical, two sibling forms are used in herbicide formulations:

Triclopyr butoxyethyl ester (BEE), Cas No. 64700-56-7, and

Triclopyr triethylamine salt (TEA), Cas No. 57213-69-1

CHEMICAL TYPE: pyridinyloxyacetic acids

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use Pesticide."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the triclopyr formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the triclopyr formulations are listed below:

Forestry Garlon® 4 Herbicide		Garlon ® 3A Herbicide	
Triclopyr (BEE)	61.6 %	Triclopyr (TEA)	44.4 %
Inert	38.4 %	Inert	55.6 %
Garlon® 4 Herbicide		Pathfinder® II Herbicide	
Triclopyr (BEE)	61.6 %	Triclopyr (BEE)	13.6 %
Inert	38.4 %	Inert	86.4 %

RESIDUE ANALYTICAL METHODS: EPA Method 632.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Triclopyr is registered for use in non-crop sites for selective control of woody plants and weeds. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Triclopyr is used to control woody plants and weeds.

MODE OF ACTION: Triclopyr is absorbed by the leaves, bark, and roots, disturbing plant growth.

METHOD OF APPLICATION AND RATES: Aerial (helicopter only) and ground broadcast, spot, and localized applications at 0.2 to 2.5 lbs./acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Apply foliar treatment anytime plant is growing. Bark treatments can be applied any time. Dormant stem applications are made when the plant is dormant.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not apply through any type of irrigation system. Non-target plant advisory. Grazing, haying, and slaughter restrictions (see individual labels).

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of triclopyr (BEE) and (TEA) is 46 days.

ADSORPTION: The K(oc) of triclopyr (BEE) is 780. The K(oc) of triclopyr (TEA) is 20.

PERSISTENCE AND AGENTS OF DEGRADATION: Triclopyr (BEE) and (TEA) are moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Breakdown products are found in very low concentrations and should be relatively non-toxic.

WATER:

SOLUBILITY: Triclopyr (BEE) 23 mg/l in water (pH 7 at 25° C). Triclopyr (TEA) 2,100,000 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Triclopyr (BEE) has a low potential to leach into groundwater and a moderate potential for surface water runoff. Triclopyr (TEA) has a very high potential to leach into groundwater and a low potential for surface water runoff.

AIR:

VOLATILIZATION: Not determined.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

FOR TRICLOPYR (BEE)

MICROORGANISMS:

ACUTE CONTACT TOXICITY: LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY: LC_{50} (rainbow trout 96-hour) 0.65 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 0.36 mg/l

ACUTE TOXICITY: LC_{50} (coho salmon 96-hour) 0.45 mg/l

OVERALL TOXICITY: Highly Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY: LC_{50} (*Daphnia magna* 48-hour) 1.7 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY: EC_{50} (grass shrimp 96-hour) 1.7 mg/l

ACUTE TOXICITY: EC_{50} (eastern oyster 96-hour) 0.32 mg/l

ACUTE TOXICITY: EC_{50} (tidewater silverside 96-hour) 0.45 mg/l

OVERALL TOXICITY: Highly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY: LD_{50} (bobwhite quail) 8490 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 644 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants, invertebrates and vertebrates may be adversely affected if the product is applied directly to the plants or animals, or indirectly, as the result of drift or leaching.

FOR TRICLOPYR (TEA)

MICROORGANISMS:

ACUTE CONTACT TOXICITY: LD_{50} (honey bee contact) >100 ug/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY: LC_{50} (rainbow trout 96-hour) 240 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 471 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY: LC_{50} (*Daphnia magna* 48-hour) 1496 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY: EC_{50} (grass shrimp 96-hour) 58 mg/l

ACUTE TOXICITY: EC_{50} (fiddler crab 96-hour) >1000 mg/l

ACUTE TOXICITY: EC_{50} (eastern oyster 96-hour) >56 mg/l

OVERALL TOXICITY: Slightly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY: LD_{50} (mallard duck) 2055 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) 11,622 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >10,000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 644 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

FOR TRICLOPYR (BEE)

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD_{50} (rat) 803 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Non-Irritant

PRIMARY EYE IRRITATION: Rabbit – Slight Irritant

ACUTE INHALATION: LC_{50} (rat) >4.8 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group D - Not classifiable as a human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: Positive for adverse developmental and reproductive effects.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the triclopyr (BEE) formulations carry the *Caution* signal word due to potential eye, skin, ingestion, and inhalation hazards.

FOR TRICLOPYR (TEA)

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD_{50} (rat) 1847 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Non-Irritant

PRIMARY EYE IRRITATION: Rabbit – Corrosive

ACUTE INHALATION: LC_{50} (rat) >2.6 mg/l

OVERALL TOXICITY: Category I – Highly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group D - Not classifiable as a human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: EPA Group D - Not classifiable as a human carcinogen.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the triclopyr (TEA) formulations carry the *Danger* signal word due to corrosive potential to the eye.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Eye irritation and skin irritation.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: See effects reported under acute toxicity.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None..

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Triclopyr (TEA) is a severe eye irritant.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

Health Effects Associated with Other Formulations: None reported.

VI. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

TRICLOPYR (BEE) - **CAUTION** – HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH THE SKIN.

TRICLOPYR (TEA) - **DANGER** – CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE. HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH THE SKIN. PROLONGED OR REPEATED CONTACT WITH THIS HERBICIDE MAY CAUSE ALLERGIC SKIN REACTIONS

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear protective eyewear (TEA only), and, long-sleeved shirt and long pants, shoes and socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water for 15 minutes. Call physician.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Call physician. Do not induce vomiting.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

Dow AgroSciences, Forestry Garlon® 4 Specialty Herbicide, Specimen Product Label, Label Code: D02-100-003, January 1, 1998

Dow AgroSciences, Forestry Garlon® 4 Specialty Herbicide, Material Safety Data Sheet, MSDS: 004788, September 9, 1999

Dow AgroSciences, Garlon® 3A Specialty Herbicide, Specimen Product Label, Label Code: D02-101-025, January 1, 1998

Dow AgroSciences, Garlon® 3A Specialty Herbicide, Material Safety Data Sheet, MSDS: 004422, September 9, 1999

Dow AgroSciences, Garlon® 4 Specialty Herbicide, Specimen Product Label, Label Code: D02-102-023, January 1, 1998

Dow AgroSciences, Garlon® 4 Specialty Herbicide, Material Safety Data Sheet, MSDS: 004788, September 9, 1999

Dow AgroSciences, Pathfinder® II Specialty Herbicide, Specimen Product Label, Label Code: D02-104-007, November 22, 1999

Dow AgroSciences, Pathfinder® II Specialty Herbicide, Material Safety Data Sheet, MSDS: 004778, December 9, 1999

EPRI, Determination of the Effectiveness of Herbicide Buffer Zones in Protecting Water Quality, EPRI Final Report TR-113160, 1999

Extension Toxicology Network, Pesticide Information Profile, Triclopyr, June 1996
http://ace.orst.edu/info/extoxnet/pips/ghindex.html

Extension Toxicology Network, Toxicology Information Briefs: Bioaccumulation, Revised 1993, http://ace.orst.edu/info/extoxnet/tibs/bioaccum.htm

Spray Drift Task Force, A Summary of Ground Application Studies, 1997 http://www.agdrift.com/publications/Body.htm

USDA Forest Service, Pesticide Fact Sheet, Triclopyr, November 1995
http://www.fs.fed.us/foresthealth/pesticide/index.html

USEPA, Office of Pesticide Programs, Reregistration Eligibility Decision, Triclopyr, EPA-738-R-98-011, October 1998 http://www.epa.gov/oppsrrd1/REDs/

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http://www.epa.gov/oppsrrd1/REDs/

X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

Disclaimers and Other Legal Information:

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