

Trinexapac-ethyl

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: trinexapac-ethyl

CHEMICAL NAME: 4-(cyclopropyl-a-hydroxymethylene)-3,5-dioxo-cyclohexanecarboxylic acid ethylester

CAS No. 95266-40-3

CHEMICAL TYPE: Cyclopropyl Derivative of Cyclohexenone

PESTICIDE CLASSIFICATION: Plant Growth Retardant

REGISTERED USE STATUS: "General Use."

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 trinexapac-ethyl formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the two trinexapac-ethyl formulations are listed below:

Primo WSB [®]	Trinexapac-ethyl	25%
	Inert	75%
Primo Liquid [®]	Trinexapac-ethyl	12%
	Inert	88%

RESIDUE ANALYTICAL METHODS: Information not available.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Registered as a growth retardant for grasses.

OPERATIONAL DETAILS:

TARGET PLANTS: Trinexapac-ethyl is used to regulate the growth of many types of grasses.

MODE OF ACTION: Foliar uptake reduces cell growth.

METHOD OF APPLICATION: Low-pressure sprayers at various application rates (see label). Do not apply through any type of irrigation system.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Various (see label), however, as trinexapac-ethyl is a foliar growth retardant, it must be applied to emerged plants to be effective.

DRIFT CONTROL: Trinexapac-ethyl is applied mixed with water/surfactant. Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not apply through any type of irrigation system. Do not graze area or feed forage after application.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: Information not available.

ADSORPTION: Information not available.

PERSISTENCE AND AGENTS OF DEGRADATION: Information not available.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS:
Information not available.

WATER:

SOLUBILITY: 2.11 mg/l at 20° C.

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Information not available.

AIR:

VOLATILIZATION: 0.003 Pa at 20° C.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Information not available; however, Primo Liquid® is a NFPA Class IIIA combustible liquid.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY: LD₅₀ (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: LC₅₀ (rainbow trout 96-hour) 68 mg/l

ACUTE TOXICITY: LC₅₀ (bluegill sunfish 96-hour) >130 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY: EC₅₀ (*Daphnia magna* 48-hour) 142.5 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY: EC₅₀ (grass shrimp 96-hour) No information.

ACUTE TOXICITY: EC₅₀ (eastern oyster 96-hour) No information.

OVERALL TOXICITY:

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY: LD₅₀ (mallard duck) >2000 mg/kg

AVIAN ACUTE ORAL TOXICITY: LD₅₀ (bobwhite quail) >2250 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC₅₀ (bobwhite quail) >5620 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC₅₀ (mallard duck) >5200 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD₅₀ (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-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

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD₅₀ (rat) >5050 mg/kg

ACUTE DERMAL TOXICITY: LD₅₀ (rabbit) >2020 mg/kg

PRIMARY IRRITATION SCORE: Slight

PRIMARY EYE IRRITATION: Moderate

ACUTE INHALATION: LC₅₀ (rat) >2.7 mg/l

OVERALL TOXICITY: Category III – Caution – Slightly Toxic (dry formulations)

OVERALL TOXICITY: Category II – Warning – Moderately Toxic (liquid formulations)

CHRONIC TOXICITY:

CARCINOGENICITY: Increase in stomach tumors in male mice at 2000-ppm dose rate.

DEVELOPMENTAL: None observed.

REPRODUCTIVE: None observed.

MUTAGENICITY: None observed.

HAZARD: Based on the results of animal studies, trinexapac-ethyl may cause an increase in carcinogenicity. Tests on dogs show liver, kidney and brain effects (unspecified) at >5000 ppm doses.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Slight eye irritation caused by clay binding agents.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: There have been no reported effects on workers manufacturing the products.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

HEALTH RISK MANAGEMENT PROCEDURES: See Section VII.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

Dry formulations

TRINEXAPAC-ETHYL - CAUTION – HARMFUL IF ABSORBED THROUGH THE SKIN OR INHALED. CAUSES MODERATE EYE IRRITATION. AVOID CONTACT WITH EYES, SKIN OR CLOTHING AND BREATHING DUST OR SPRAY MIST.

Liquid formulations

TRINEXAPAC-ETHYL - WARNING – CAUSES EYE IRRITATION. DO NOT GET IN EYES. HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN. AVOID CONTACT WITH SKIN OR CLOTHING. AVOID BREATHING VAPOR OR SPRAY MIST.

PROTECTIVE PRECAUTIONS FOR WORKERS: Use safety glasses. Use impervious gloves when prolonged or frequently repeated contact could occur. In enclosed spaces, use NIOSH-approved dust respirator. Long sleeve shirt, long pants, shoes and socks are recommended. Do not enter treated areas without shoes until sprays have dried.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation develops.

SKIN: Wash all exposed areas with soap and water. Wash all contaminated clothing prior to reuse. Call a physician if irritation develops.

INGESTION: Give large quantity of water and induce vomiting. Call a physician or Poison Control Center. Administer activated charcoal (6-8 teaspoons) with a large amount of water. Immediately transport to a medical care facility.

INHALATION: Move to fresh air. Provide artificial respiration if necessary. Call physician if breathing difficulty continues.

HANDLING, STORAGE AND DISPOSAL: Keep dry and store away from food, feed or other material to be used or consumed by humans or animals. Do not contaminate water. Dispose of only in accordance with local, state and federal regulations. Primo Liquid® is a NFPA Class IIIA combustible liquid.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Large spills should be reported to CHEMTREC (800-424-9300) for assistance. Prevent runoff. 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

EC₅₀ - 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: $K(oc) = \text{conc. adsorbed}/\text{conc. dissolved}/\% \text{ organic carbon in soil}$

LC₅₀ – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD₅₀ – 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

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

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

International Chemical Safety Cards, trinexapac-ethyl, ICSC: 1268, (<http://www.vetmed.ucdavis.edu/msds>).

Novartis, Primo Liquid[®] Product Label, EPA RN 100-729, 1997.

Novartis, Primo Liquid[®] Material Safety Data Sheet, August 10, 1998.

Novartis, Primo WSB[®] Product Label, EPA RN 100-752, 1998.

Novartis, Primo WSB[®] Material Safety Data Sheet, August 10, 1998.

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

US EPA, [trinexapac-ethyl], TSCA Test Submission Data Base, September 1997.

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 LD₅₀ mg/kg)	Avian (Acute Oral LD₅₀ mg/kg)	Avian LC₅₀ (mg/kg)	Fish or Aquatic Invertebrates LC₅₀ (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.

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