NUFARM AGRICULTURE INC.

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

SUPPLIED BY:
Nufarm Agriculture Inc.
5507 1st Street, SE
Calgary, AB T2H 1H9

Phone Number: (403)-253-8471
Fax Number: (403)-253-8478

MANUFACTURED BY:
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Calgary, AB T2H 1H9

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PRODUCT:	**Signal Herbicide**
PCP NUMBER:	29172
DATE PREPARED:	March 24, 2009
PREPARER:	Brent R. McLennan
CHEMICAL FAMILY/USE:	Carboxylic acid derivative herbicide
FORMULA:	$C_{17}H_{13}ClFNO_4$ (clodinafop-propargyl), $C_{18}H_{22}ClNO_3$ (cloquintocet-mexyl)
CHEMICAL SYNONYMS:	Clodinafop-propargyl; propanoic acid, 2-[4-[(5-chloro-3-fluoro-2-pyridinyl)oxy]-phenoxy]-2-propynyl ester; 2-propynyl (2*R*)-2-[4-[(5-chloro-3-fluoro-2-pyridinyl)oxy]phenoxy]propanoate. Cloquintocet-mexyl; 1-methylhexyl [(5-chloro-8-quinolinyl)oxy]acetate

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients not precisely identified are proprietary or non-hazardous. Values are not product specifications.

Ingredients	Wt. %	CAS NO.
Naphthalene	≤ 6	91-20-3
n-Methylpyrrolidone	≤ 9	872-50-4
Petroleum Solvent	45-48	64742-94-5
Cloquintocet-Mexyl	5-7	99607-70-2
Clodinafop-Propargyl	22-24	105512-06-9

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: CAUTION-POISON. Keep out of reach of children. Avoid contact with skin, eyes and clothing. Causes eye, skin and respiratory passage irritation. Allergic skin reactions are possible. Exposure to high vapour levels may cause headache, dizziness, numbness, nausea, incoordination, or other central nervous system effects.

EFFECTS OF ACUTE EXPOSURE: Causes eye, skin and respiratory passage irritation. Allergic skin reactions are possible. Exposure to high vapor levels may cause headache, dizziness, numbness, nausea, incoordination, or other central nervous system effects.
INGESTION: Slightly toxic. CAUTION - POISON
SKIN CONTACT: Causes skin irritation. WARNING – SKIN IRRITANT Allergic skin reactions are possible.
INHALATION: Exposure to high vapor levels may cause headache, dizziness, numbness, nausea, incoordination, or other central nervous system effects.
EYE CONTACT: Causes eye irritation. WARNING – EYE IRRITANT
MEDICAL CONDITIONS AGGRAVATED: Pre-existing eye, skin and respiratory disorders may be aggravated by exposure to this product.
CHRONIC/SUBCHRONIC (TARGET ORGAN) EFFECTS: Liver changes, anemia and skin reactions.
CHRONIC EFFECTS/CARCINOGENICITY: Increased incidences of benign tumors in mice (liver) and rats (ovary, prostate).
REPRODUCTIVE / DEVELOPMENTAL TOXICITY: None Observed.
PRINCIPLE ROUTES OF EXPOSURE: Skin, eyes, mouth, lungs.
TOXICOLOGICALLY SYNERGISTIC MATERIALS: None known.
OTHER: See Section 11.

4. FIRST AID MEASURES

IF POISONING IS SUSPECTED, immediately contact the poison information centre, doctor or nearest hospital. Have the product container, label or Material Safety Data Sheet with you when calling a poison control center or doctor, or going for treatment. Tell the person contacted the complete product name, and the type and amount of exposure. Describe any symptoms and follow the advice given. Call the Nufarm 24 Hour Emergency Response Number (1-800-424-9300) or Prosar (1-877-325-1840) for further information.
INGESTION: Take patient to nearest hospital or contact poison control centre. Take container, label booklet or product name and Pest Control Product Registration Number with you when seeking medical attention.
Provided the patient is conscious, wash out mouth with water. Do not give anything by mouth to an unconscious person. Do not induce vomiting unless directed by a physician or a poison control center. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer water.
SKIN: Immediately remove contaminated clothing and wash skin, hair and fingernails thoroughly with soap and water. Flush skin with running water for a minimum of 20 minutes. Obtain medical attention if irritation occurs.
INHALATION: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is labored, give oxygen. Obtain immediate medical attention.
EYES: Immediately flush eyes with clean water, holding eyelids apart for a minimum of 20 minutes. Remove contact lenses, if present, after 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice. Obtain medical attention immediately if irritation persists.
NOTE TO PHYSICIAN:
There is no specific antidote if this product is ingested. Treat symptomatically.
Contains petroleum distillate – vomiting may cause aspiration pneumonia.

5. FIRE FIGHTING MEASURES

FLASH POINT AND METHOD: .....62°C (PM CC)
CONDITIONS OF FLAMMABILITY: .....Flammable liquid
FLAMMABLE LIMITS IN AIR - Upper (%):.....7.0
FLAMMABLE LIMITS IN AIR - Lower (%):.....1.0
AUTOIGNITION TEMPERATURE: .....510°C
SENSITIVITY TO MECHANICAL IMPACT (Y/N):.....Not sensitive

SENSITIVITY TO STATIC DISCHARGE: .....Low
EXTINGUISHING MEDIA: Use water fog or mist, (avoid excess water), foam, carbon dioxide, dry powder or halon extinguishant. Wear full protective clothing and self-continued breathing apparatus. Evacuate nonessential personnel from buildings, area, and equipment until decontaminated. Water runoff can cause environmental damage. Contain run-off water with, for example temporary earth barriers.
SPECIAL FIREFIGHTING PROCEDURES: Firefighters should wear self-contained breathing apparatus and full protective clothing when fighting chemical fires. Minimize and contain water runoff.
Hazardous combustion products: Oxides or carbon and smoke are likely. Also toxic fumes of Cl^- and NO_x from decomposition of active ingredients.
Unusual Fire, Explosion and Reactivity Hazards: Combustible liquid. Can release vapours that form explosive mixtures at temperatures at or above the flash point. Heavy vapours can flow along surfaces to distant ignition sources and flash back. During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.
Conditions under which flammability could occur: This product contains aromatic hydrocarbon. Temperatures above the flash point. Keep fire exposed containers cool by spraying with water.

6. ACCIDENTAL RELEASE MEASURES

ACTION TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Use safety equipment and procedures appropriate to the size of the spill. Keep unnecessary people away. Avoid runoff to natural waters and sewers. Surround and absorb spills with inert material such as perlite, sawdust, clay granules, vermiculite, sand or dirt. Contain all affected material in a closed, labeled container for proper disposal. Isolate from other waste materials. Clean contaminated area such as hard surfaces with detergent and water, collecting cleaning solution for proper disposal. Large spills to soil or similar surfaces may necessitate removal of top soil.

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: KEEP OUT OF REACH OF CHILDREN and animals. Keep away from food and feed products. Prevent eating, drinking, tobacco use, and cosmetic application in areas where there is a potential for exposure to the material. After work, rinse gloves and remove protective equipment. Wash hands thoroughly with soap and water after handling, and before eating, tobacco use, drinking, or using the toilet. Wash contaminated clothing before re-use and separate from household laundry. Keep containers closed when not in use. Keep product, wash or rinse water, and contaminated materials out of water, away from crops, and away from access by people, animals and birds.

Appropriate storage practices/requirements: Store in original container only in a well-ventilated, cool, dry secure area. Protect from heat, sparks and flame. Do not expose sealed containers to temperatures above 40°C. Keep separate from other products to prevent cross contamination. Rotate stock. Clean up spilled material immediately.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

Ingredient	TWA	ACGIH TLV	STEL	Units
Naphthalene	10 ppm TWA **	10 ppm TWA (skin)	N/E	ppm
n-Methylpyrrolidone	10 ppm TWA ****	N/E	N/E	ppm
Petroleum Solvent	100 mg/m^3 (15 ppm) TWA *	N/E	N/E	mg/m^3 (ppm)

Cloquintocet-Mexyl	10 ppm TWA ***	N/E	N/E	ppm
Clodinafop-Propargyl	N/E	N/E	N/E	-

* Recommended by manufacturer
** Recommended by NIOSH
*** Manufacturer's Occupational Exposure Limit (OEL)
**** Recommended by AIHA (American Industrial Hygiene Association)

ENGINEERING CONTROLS: Ensure work areas have ventilation, containment, and procedures sufficient to maintain airborne levels below the TLV. Warehouses, production area, parking lots and waste holding facilities must have adequate containment to prevent environmental contamination. Provide separate shower and eating facilities.

THE FOLLOWING RECOMMENDATIONS FOR EXPOSURE CONTROLS/PERSONAL PROTECTION ARE INTENDED FOR THE MANUFACTURE, FORMULATION, PACKAGING AND USE OF THIS PRODUCT.

FOR COMMERCIAL APPLICATIONS AND/OR ON-FARM APPLICATIONS CONSULT THE PRODUCT LABEL.

GENERAL: Avoid breathing vapours or aerosols. Avoid contact with eye, skin and clothing. Wash thoroughly after handling and before eating, drinking, or using tobacco.
RESPIRATORY PROTECTION EQUIPMENT: A respirator is not normally required when handling this substance. Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below exposure limits. A NIOSH-certified combination air-purifying respirator with an N,P or R 95 or HE class filter and an organic vapor cartridge may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a pressure demand atmosphere-supplying respirator if there is any potential for uncontrolled release, exposure levels are not known, or under any other circumstances where air-purifying respirators may not provide adequate protection.
PROTECTIVE GLOVES: Wear chemical-resistant (such as nitrile or butyl) gloves.
EYE AND FACE PROTECTION: Where eye contact is likely, use chemical splash goggles. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. For overhead exposure, wear chemical-resistant headgear.
OTHER PROTECTIVE EQUIPMENT: Where contact is likely, wear coveralls, socks and chemical-resistant footwear.
VENTILATION: Use only in well ventilated area.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: Physical data are typical values, but may vary from sample to sample. A typical value should not be construed as a guaranteed analysis or as a specification.

BOILING POINT:.....177-210°C
VAPOR PRESSURE and reference temperature: .....4.0 x 10^{-8} mmHg @ 20°C (Clodinafop-Propargyl Technical)
VAPOR DENSITY (air = 1): .....NA
FREEZING POINT:.....-31°C
MELTING POINT: .....N/A
PHYSICAL STATE: .....Liquid
ODOUR:.....Aromatic solvent
COLOUR: .....Light to dark brown liquid
ODOR THRESHOLD (ppm): .....NA
EVAPORATION RATE (butyl acetate = 1): .....Aromatic hydrocarbon 0.03 (BuAc=1)
SPECIFIC GRAVITY (water = 1):.....1.06 – 1.10 g/cm^3

DENSITY @ 25°C: ..... 1.06 – 1.10 g/cm^3
pH: ..... 4-7 (1% aqueous solution)
SOLUBILITY IN WATER (20°C): ..... 4 mg/L @25° C (Clodinafop-Propargyl Technical)
COEFFICIENT OF WATER/OIL DISTRIBUTION: ..... NA
VISCOSITY: ..... 26.3 cps @21° C

10. STABILITY AND REACTIVITY

STABILITY: Stable at room temperature.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS THERMAL DECOMPOSITION/COMBUSTION PRODUCTS: Can decompose at high temperatures forming toxic gases.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers, strong acids, alkalies.
CONDITIONS TO AVOID: Ignition sources. Temperatures below -17°C (2°F) or above 62°C (144 °F)

11. TOXICOLOGICAL INFORMATION

ACUTE ORAL LD_{50} (mg/kg): ..... >2,276 mg/kg (Rat) body weight
ACUTE DERMAL LD_{50} (mg/kg): ..... >4,000 mg/kg (Rat) body weight
ACUTE INHALATION LC_{50} (mg/l): ..... >3.5 mg/L (Rat) air – 4 hours
OTHER: Moderately irritating in eyes and on skin (rabbit). Skin sensitizer (Guinea Pig).

Toxicity of Other Components

The acute toxicity test results reported above for the finished product take into account any acute hazards related to the "other components" in the formulation.

Cloquintocet-Mexyl
Causes mild eye and skin irritation. Toxic if inhaled or swallowed. Allergic skin reactions are possible.

Naphthalene (≤ 6%)
Exposure to naphthalene can cause cataracts, liver damage, kidney failure, respiratory failure, hematuria, anemia, damage to red blood cells, leukocytosis, or coma.
Carcinogen Status:
NTP: Anticipated Carcinogen
IARC: Group 2B Possible Human Carcinogen

Petroleum Solvent
Inhalation of vapors at high concentrations can cause central nervous system (CNS) effects (e.g. dizziness, headache, etc.), irritation to eyes or respiratory tract.

n-Methylpyrrolidone (≤ 9%)
May cause respiratory tract irritation. Repeated or prolonged exposure may cause drying and cracking of the skin.

Target Organs

Active Ingredient

Clodinafop-Propargyl:	Liver, skin, bone marrow.

Inert Ingredients

Cloquintocet-Mexyl:	Eye, skin, lung, digestive tract.
Naphthalene:	Eye, liver, kidney, respiratory tract, blood, CNS.
Petroleum Solvent:	Respiratory tract, stomach, liver, thyroid, urinary bladder, CNS, skin.

n-Methylpyrrolidone: Eye, skin.

12. ECOLOGICAL INFORMATION

Summary of Effects

Signal Herbicide kills certain grass weeds selectively in cereal crops. If sufficient exposure occurs, it may be harmful to grass species. The active ingredient clodinafop propargyl is also highly toxic to fish, but has low toxicity to birds and mammals and practically no toxicity to insects (bees).

Eco-Acute Toxicity

Clodinafop-Propargyl:

Bees LC_{50}/EC_{50}	> 100 µg/bee
Invertebrates (Water Flea) LC_{50}/EC_{50}	> 2 ppm
Fish (Trout) LC_{50}/EC_{50}	0.39 ppm
Fish (Bluegill) LC_{50}/EC_{50}	0.21 ppm
Birds (8-day dietary - Bobwhite Quail) LC_{50}/EC_{50}	> 5,200 ppm
Birds (8-day dietary - Mallard Duck) LC_{50}/EC_{50}	> 5,200 ppm

Eco-Chronic Toxicity

Clodinafop-Propargyl:

Invertebrate (*Daphnia magna*) 21-Day Reproduction EC50	0.14 mg./L
Fish (Rainbow Trout): 21 Day NOEC	0.15 mg./L

Environmental Fate

The active ingredient clodinafop-propargyl is biologically degraded by microorganisms in soil or water, and is also degraded by soil hydrolysis and photolysis. It has a low bioaccumulation potential. It is not persistent in the environment, with DT_{50} values of less than one day in soil or natural water. The mobility in soil is low to moderate. Signal Herbicide as a bulk liquid sinks in water (24 hr observation) and gradually disperses as an emulsion.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: For information on disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Disposal should be made in accordance with federal, provincial and local regulations. Contact the manufacturer and the provincial regulatory agency in case of a spill, and for clean up of spills.

Do not reuse container for any purpose. If applicable, return container in accordance with return program. If a recyclable container, dispose of at a container collection site. Contact local distributor, dealer or municipality for the location of the nearest collection site. Before taking the container to the collection site, triple or pressure rinse the empty container adding rinsings to spray tank, and make container unsuitable for further use. If there is no container collection site in your area, dispose of the container in accordance with provincial requirements.

14. TRANSPORT INFORMATION

CANADIAN TDG DESCRIPTION (Road & Rail): Not regulated. Not dangerous for transport by road/rail in Canada. Contact manufacturer for updates to transport information.

15. REGULATORY INFORMATION

WHMIS HAZARD CLASS: Exempt
WHMIS TRADE SECRET: Exempt. (This product is regulated under the Pest Control Products Act - WHMIS exempt.)

HAZARD RATING SYSTEMS
National Fire Code classification: IIIA (Min. 70 ºC) Comb.Liq.

16. OTHER INFORMATION

EMERGENCY TELEPHONE NUMBERS:
For spills or transportation accidents, Chemtrex, 1-800-424-9300.
For health or environmental emergencies, Prosar, 1-877-325-1840.
For product and use information, Nufarm Agriculture Inc., 1-800-868-5444.

REVISIONS:
The following has been revised since the last issue of this MSDS: New.

ADDITIONAL INFORMATION:
Abbreviations used throughout the MSDS are:
NA = Not available
NAp = Not applicable
N/E = None Established.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

Company and public references utilized in preparation of the MSDS.

END OF MSDS