1. IDENTIFICATION

Product name:	**ARROW® 2EC HERBICIDE**
Chemical name of active ingredient(s):	Clethodim: (E)-2-[1-[[(3-chloro-2-propenyl)oxy]imino]propyl]- 5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
Manufacturer/Registrant:	Makhteshim Agan of North America, Inc. 4515 Falls of Neuse Road, Suite 300 Raleigh, NC 27609 Phone: 919-256-9300
For fire, spill, and/or leak emergencies, contact Infotrac:	Phone: 1-800-535-5053
For medical emergencies and health and safety inquiries, contact Prosar:	Phone: 1-877-250-9291

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS NUMBER	%	ACGIH/TLV	OSHA/PEL	OTHER	NTP/IARC/OSHA (Carcinogen)
Clethodim	99129-21-2	26.4	-	-	-	NA
Heavy aromatic petroleum hydrocarbons	64742-94-5	22.1	100 ppm 525 mg/m^3	-	-	NA
Contains Naphthalene (% of total)	91-20-3	2.2	10 ppm 52 mg/m^3	10 ppm 50 mg/m^3	-	NTP – 2* IARC –2B**

* Substances which may reasonably be anticipated to be carcinogens.
** Substance is possibly carcinogenic to humans.

3. HAZARDS IDENTIFICATIONS

PHYSICAL PROPERTIES:

APPEARANCE: Amber liquid
ODOR: Mild aromatic

EMERGENCY OVERVIEW: CAUTION. Hazards to humans and domestic animals. Harmful if swallowed. Causes moderate eye irritation. Avoid contact with eyes, skin, or clothing.

POTENTIAL HEALTH EFFECTS

Signs and Symptoms of Systemic Effects: Signs of toxicity in test animals exposed to lethal or near-lethal oral doses included lethargy, ataxia, irregular breathing, lacrimation and loose stools. This product contains a solvent mixture. Solvents, when inhaled, can cause nasal and respiratory irritation and central nervous system effects including dizziness, weakness, fatigue, nausea, headache and possibly unconsciousness and even death. Ingestion of solvents can cause gastrointestinal irritation, nausea, vomiting and diarrhea. Aspiration of low viscosity products can cause chemical pneumonitis, which can be fatal. Acute exposure to naphthalene by inhalation, ingestion, and dermal contact has been associated with hemolytic anemia, damage to the kidneys, cataracts, and, in infants, brain damage.

Eye: Based on an evaluation of the ingredients and/or similar products, this product is expected to cause prolonged and/or significant irritation. The degree of injury will depend on the amount and duration of contact and the speed and thoroughness of the first aid treatment. The expected adverse health effects resulting from an exposure may include redness, swelling and pain, which could last for an extended period of time.

Skin: Based on an evaluation of the ingredients and/or similar products, this product is expected to cause moderate skin irritation. The degree of injury will depend on the amount and duration of contact and the speed and thoroughness of the first aid treatment. The expected adverse health effects resulting from an exposure may include redness and swelling.

Based on an evaluation of the ingredients and/or similar products, this product may cause allergic skin reactions. In sensitized individuals even small exposures can trigger allergic reactions. The expected adverse health effects may include itching, redness, swelling and blistering of the skin.

Based on an evaluation of the ingredients and/or similar products, this product is expected to be minimally toxic when absorbed through the skin. The degree of injury will depend on the amount of material inhaled and the

speed and thoroughness of the first aid treatment. The expected adverse systemic health effects are described above.

Ingestion: Based on an evaluation of the ingredients and/or similar products, this product is expected to be slightly toxic when ingested. The degree of injury will depend on the amount of material ingested and the speed and thoroughness of the first aid treatment. The expected adverse systemic health effects are described above.
Ingestion of this product may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Because of the low viscosity of this substance, it can directly enter the lungs of it is swallowed (this is called aspiration). This can occur during the act of swallowing or when vomiting the substance. Once in the lungs, the substance is very difficult to remove and can cause injury to the lungs and death.

Inhalation: Exposure to high concentrations may result in respiratory irritation. Signs and symptoms may include, but not be limited to, nasal discharge, sore throat, coughing and difficulty in breathing.
Based on an evaluation of the ingredients and/or similar products, this product is expected to be minimally toxic when inhaled. The degree of injury will depend on the amount of material inhaled and the speed and thoroughness of the first aid treatment. The expected adverse systemic health effects are described above.

4. FIRST AID

IF IN EYES:	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
IF ON SKIN OR CLOTHING:	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
IF SWALLOWED:	• Immediately call a poison control center or doctor. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give any liquid to the person. • Do not give anything by mouth to an unconscious person.
IF INHALED:	• Move person to fresh air. • If person is not breathing, call 9-1-1 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or doctor for further treatment advice.
Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact PROSAR at 1-877-250-9291 for emergency medical treatment information.	
NOTE TO PHYSICIAN: Ingestion of this product or subsequent vomiting can result in aspiration of light hydrocarbon liquid, which can cause pneumonitis. Contains petroleum distillate.	

5. FIRE FIGHTING MEASURES

FLASHPOINT: 64.83°C (149° F) (Pensky-Martens Closed Cup)
FLAMMABLE LIMITS (% in air): Not determined
AUTOIGNITION TEMPERATURE: Not determined

FIRE FIGHTING INSTRUCTIONS: Liquid evaporates and forms vapor (fumes), which can catch fire and burn with explosive violence. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Fire hazard is greater as liquid temperature rises above 85°F. Products of combustion from fires involving this material may be toxic. Avoid breathing smoke and mists. Avoid personnel and equipment contact with fallout and runoff. Minimize the amount of water used for fire fighting. Do not enter any enclosed area without full protective equipment, including self-contained breathing equipment. Contain and isolate runoff and debris for proper disposal. Decontaminate personal protective equipment and fire fighting equipment before reuse. Read the entire document.

HAZARDOUS COMBUSTION PRODUCTS: Normal combustion forms carbon dioxide, water vapor and may produce oxides of nitrogen, sulfur. Combustion may produce toxic compounds of chlorine. Incomplete combustion can produce carbon monoxide.

6. ACCIDENTAL RELEASE MEASURES

FOR SPILLS ON LAND

CONTAINMENT: Avoid runoff into storm sewers and ditches which lead to waterways. Contain spilled liquids with dry sorbents.
CLEANUP: Clean up spill immediately. Absorb spill with inert material (such as dry sand or earth), then place in a chemical waste container. Wash the area with soap and water. Pick up wash liquid with additional absorbent and place in a chemical waste container.

FOR SPILLS IN WATER:
CONTAINMENT: This material forms an emulsion in water. Stop or reduce contamination of any water. Isolate contaminated water.
CLEANUP: Remove contaminated water for treatment or disposal.

7. HANDLING AND STORAGE

END USER MUST READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL.

PROHIBITIONS: Do not use or store near flame, sparks or hot surfaces. Use only in well ventilated area. Keep container closed. Do not contaminate water, food, or feed by storage or disposal, or cleaning of equipment. Open dumping is prohibited. Do not weld, heat or drill container. Replace cap or bung. Emptied container still contains hazardous or explosive vapor or liquid.

STORAGE: Keep pesticide in original container. Do not put concentrate or dilute into food or drink containers. Store in cool, dry place. Do not store diluted spray. Do not allow product to freeze. Store above 18° F (-8° C).

STORAGE TEMPERATURE (MIN/MAX):
Minimum: 18° F (-8°C)
Maximum: Normal ambient temperatures.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

THE FOLLOWING RECOMMENDATIONS FOR EXPOSURE CONTROLS/PERSONAL PROTECTION ARE INTENDED FOR THE MANUFACTURE, FORMULATION, AND PACKAGING OF THE PRODUCT. FOR COMMERCIAL APPLICATION AND ON-FARM APPLICATIONS, CONSULT THE PRODUCT LABEL.

EYE PROTECTION: Appropriate eye protection must be worn when working with this material or serious harm can result. Wear protective eyewear.

RESPIRATORY/VENTILATION: This material may be a respiratory irritant and, unless ventilation is adequate, the use of approved respiratory protection is recommended. Use this material only in well-ventilated areas.

SKIN PROTECTION: Do not get on skin or clothing. Skin contact should be avoided by wearing protective clothing including chemical resistant gloves, long sleeved shirt, long pants, shoes and socks. Discard clothing and other absorbent materials that may have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

USER SAFETY RECOMMENDATIONS:
Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

EXPOSURE GUIDELINES: Refer to Section 2.
ENGINEERING CONTROLS: Refer to product label.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Amber liquid
ODOR: Mild aromatic
DENSITY: 0.967 g/mL at 20°C
pH: 4.44
SOLUBILITY: Emulsifies in water

10. STABILITY AND REACTIVITY

STABILITY: Stable under testing methods (54°C for 14 days).
INCOMPATIBILITY: Incompatible with strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
EXPLODABILITY: Not required
OXIDATION/REDUCTION PROPERTIES: Not an oxidizing agent; mild reducing agent
HAZARDOUS COMBUSTION PRODUCTS: Normal combustion forms carbon dioxide, water vapor and may produce oxides of nitrogen, sulfur. Combustion may produce toxic compounds of chlorine. Incomplete combustion can produce carbon monoxide.

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY/IRRITATION STUDIES

Acute oral LD50 (Rat):	Between 2,000 & 5,000 mg/kg
Acute Dermal LD50 (Rat):	>5000 mg/kg
Acute Inhalation LC50:	> 2.09 mg/L @ 4-hour
Eye Irritation (rabbit):	Moderately irritating
Dermal Irritation (rabbit):	Moderately irritating
Dermal Sensitization:	Not a contact sensitizer

SUBCHRONIC TOXICITY (CLETHODIM): Compound-related effects at high doses were decreased body weights, increased liver size and anemia
CARCINOGENICITY (CLETHODIM): Similar effects as seen in subchronic. No treatment related increases in neoplasms were observed in any study.
TERATOGENICITY (CLETHODIM): Developmental toxicity in rats and rabbits was observed only at maternally toxic dose levels.
REPRODUCTION (CLETHODIM): No reproductive toxicity was observed in a study with rats exposed for two generations.
MUTAGENICITY (CLETHODIM): Negative in the following genotoxicity assays: microbial reverse mutation (Ames Assay), **in vitro** chromosome aberration assay in Chinese Hamster Ovary Cells, **in vivo** chromosome aberration assay in Rat Bone Marrow Cells and **in vivo** Unscheduled DNA Synthesis Assay. Clethodim does not present a genetic hazard to intact animal systems.
TOXICITY OF OTHER INGREDIENTS: This product contains a solvent mixture. Solvents, when inhaled, can cause nasal and respiratory irritation and central nervous system effects including dizziness, weakness, fatigue, nausea, headache, and possibly unconsciousness and even death. Ingestion of solvents can cause gastrointestinal irritation, nausea, vomiting, and diarrhea. Prolonged or repeated dermal exposures may cause drying, scaling, and even blistering of the skin. Aspiration of low viscosity products can cause chemical, which can be fatal. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Symptoms include fatigue, concentration difficulties, anxiety, depression, rapid mood swings and short-term memory loss. The reports are not clear with regard to the types of solvents that may cause these symptoms, and there is controversy among scientists to whether the condition exists or is caused by this type of product. Since many other diseases cause some or all of these conditions, a doctor should be consulted if any appear.

Acute exposure to naphthalene by inhalation, ingestion, and dermal contact has been associated with hemolytic anemia, damage to the kidneys, cataracts, and in infants, brain damage. There is limited evidence of fetal and maternal toxicity from exposure to naphthalene.

Chronic (long-term) exposure of workers and rodents to naphthalene has been reported to cause cataracts and damage to the retina. Lesions in the kidneys and thymus, signs of anemia, and reduced spleen weights have been observed in rats and mice chronically exposed via gavage.

12. ECOLOGICAL INFORMATION

AVIAN TOXICITY: The acute toxicity of Clethodim Technical to birds is very low.
Bobwhite quail oral LD_{50} greater than 2 g/kg
Bobwhite quail dietary LC_{50} greater than 6000 ppm
Mallard duck dietary LC_{50} greater than 6000 ppm

No reproductive effects were observed in mallard ducks exposed to 100 ppm of Clethodim Technical. In Bobwhite quail, a slight decrease in viability of embryos of eggs from females exposed to 1000 ppm was observed. A NOEL was established at 300 ppm for this study.

AQUATIC ORGANISM TOXICITY: Clethodim Technical is only slightly toxic to freshwater fish and practically nontoxic to daphnia.

Rainbow Trout 96-hour LC_{50} = 67 mg/l
Bluegill Sunfish 96-hour LC_{50} = 120 mg/l
Daphnia magna 48-hour LC_{50} greater than 120 mg/l

OTHER NON-TARGET ORGANISM TOXICITY: Clethodim Technical was found to be nontoxic to adult worker bees at the highest dose tested, 100 micrograms/bee.

13. DISPOSAL CONSIDERATIONS

END USERS MUST DISPOSE OF ANY UNUSED PRODUCT AS PER THE LABEL RECOMMENDATIONS.

PRODUCT DISPOSAL: Wastes resulting from the use of this product many be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Dispose of product containers, waste containers, and residues according to label instructions and local, state, and federal health and environmental regulations.

14. TRANSPORT INFORMATION

DOT CLASSIFICATION:

Non-bulk: Not regulated

Bulk (>119 gallons): NA1993, Combustible liquid, N.O.S. (Naphthalene), PG III*
* For shipments = 563 gallons RQ is required in shipping description.

INTERNATIONAL TRANSPORTATION:

IMO (vessel): Not regulated

IATA (air): Not regulated

15. REGULATORY INFORMATION

SARA TITLE III CLASSIFICATION:

Section 302:	Not applicable.
Section 311/312:	Acute health hazard (immediate) Delayed health hazard (chronic) Fire Hazard
Section 313:	Naphthalene CAS# 91-20-3 (2.2%)

CA PROPOSITION 65: This product contains a chemical (Naphthalene) that is known to the State of California to cause cancer.
CERCLA RQ: Naphthalene (91-20-3) RQ=100 lbs (Product= 4,545 lbs/563 gals)
RCRA CLASSIFICATION: Under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.
TSCA STATUS: The ingredients of this product are listed on the TSCA inventory or are exempt.

16. OTHER INFORMATION

HAZARD RATINGS	**NFPA**	**HMIS**		
HEALTH:	1	1	0	MINIMAL
FLAMMABILITY:	2	2	1	SLIGHT
REACTIVITY:	0	0	2	MODERATE
			3	HIGH
			4	SEVERE

MSDS DATE: 5-19-10; Supercedes versions dated 2-24-09, 9-24-08; 10-24-05; 1-19-05 and 3-16-04. Changes made to Section 14.

The information contained herein is given in good faith and is believed to be correct, but no warrant, express or implied, is made. Consult Makhteshim Agan of North America, Inc. for further information.