MSDS Revision Date (dd/mm/yyyy): 12/10/2009

MATERIAL SAFETY DATA SHEET

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Product identifier : **Nufos 4E**

Product Code(s) : None reported.

Product Use : Insecticide

Chemical Family : Organophosphate

Supplier's name and address:

Cheminova Inc.
PO Box 110566
One Park Drive
Research Triangle Park, NC, USA
27709

Manufacturer's name and address:

Refer to Supplier

Information Telephone No. : 919-474-6600 (8:00 AM - 5:00 PM, EST, Monday-Friday)

24 Hr. Emergency Tel # : Chemtrec 1-800-424-9300 (Within Continental U.S.); Chemtrec 703-527-3887 (Outside U.S.).
For Medical Emergencies: (800) 303-6950

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients	CAS #	% (weight)	ACGIH TLV		OSHA PEL	
			TWA	STEL	PEL	STEL
Chlorpyrifos	**2921-88-2**	30.00 - 60.00	0.1 mg/m³ (inhalable fraction and vapor)	N/Av	N/Av	N/Av
Heavy aromatic solvent naphtha	**64742-94-5**	30.00 - 60.00	N/Av	N/Av	N/Av	N/Av
Castor oil, ethoxylated	**61791-12-6**	1.00 - 5.00	N/Av	N/Av	N/Av	N/Av
Calcium dodecylbenzene sulfonate	**26264-06-2**	1.00 - 5.00	N/Av	N/Av	N/Av	N/Av

This material is classified as hazardous under OSHA regulations (29CFR 1910.1200).

SECTION 3 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Yellow to light brown liquid. Aromatic odour.
Caution! Combustible liquid and vapor. Dangerous exothermic decomposition may occur at temperatures greater than 320°F / 160° C. Harmful if inhaled. Harmful or fatal if swallowed. Can enter the lungs and cause damage. May cause eye and skin irritation. Contains material which can cause nervous system damage. May be dangerous for the environment. This material is highly toxic to fish, aquatic invertebrates and insects. This material is toxic to aquatic plants.

POTENTIAL HEALTH EFFECTS

Target organs : Eyes, skin, respiratory system, digestive system, central nervous system.

Routes of exposure : *Inhalation:* YES *Skin Absorption:* YES *Skin & Eyes:* YES *Ingestion:* YES

Signs and symptoms of short-term (acute) exposure

Inhalation : May be fatal if inhaled. This material can cause organophosphorous poisoning. Symptoms of poisoning may include headache, nausea, vomiting, blurred vision, tightness in chest, drooling and frothing of mouth and nose, convulsions, coma and death.

Skin : Causes moderate skin irritation. Readily absorbed through the skin. Causes symptoms similar to those listed for inhalation.

Eyes : May cause moderate eye irritation. Readily absorbed through eye surfaces. Causes symptoms similar to those listed for inhalation.

Ingestion : May be fatal if ingested. Causes symptoms similar to those listed for inhalation. This product may present an aspiration hazard. Aspiration into the lungs during swallowing or subsequent vomiting may cause chemical pneumonitis, which can be fatal.

Effects of long-term (chronic) exposure

: Prolonged or repeated overexposure may cause behavioral changes. Prolonged or repeated overexposure could cause adverse liver effects. Prolonged or repeated skin exposure may cause redness, a burning sensation, drying and cracking of the skin (dermatitis).

Conditions aggravated by overexposure

: Pre-existing skin, eye, respiratory and central nervous system disorders.

Carcinogenic status : See TOXICOLOGICAL INFORMATION, Section 11.

Additional health hazards : See TOXICOLOGICAL INFORMATION, Section 11.

Potential environmental effects

: This material is highly toxic to fish and wildlife. This material is toxic to aquatic plants. See ECOLOGICAL INFORMATION, Section 12.

Cholinesterase inhibitor. May cause central nervous system depression. May cause damage to the peripheral nervous system. See TOXICOLOGICAL INFORMATION, Section 11.

SECTION 4 - FIRST AID MEASURES

Inhalation : Immediately remove person to fresh air. If breathing has stopped, give artificial respiration. Obtain medical attention immediately.

Skin contact : Immediately flush skin with running water for at least 15 minutes, while removing contaminated clothing. Obtain medical attention immediately. Wash contaminated clothing before reuse.

Eye contact : Immediately flush eyes thoroughly with running water for at least 20 to 30 minutes. Obtain medical attention immediately.

Ingestion : Induce vomiting ONLY under the direct supervision of qualified medical personnel or a poison control centre. Never give anything by mouth to an unconscious person. Obtain medical attention immediately.

Notes For Physician : This product contains a cholinesterase inhibitor affecting the central and peripheral nervous systems and producing respiratory depression. Decontamination procedures such as whole body washing, gastric lavage and administration of activated charcoal are often required. If symptoms are present, administer atropine sulphate in large doses. Two to four mg intravenously or intramuscularly as soon as possible. Repeat at 5 to 10 minute intervals until signs of atropinization appear. Maintain full atropinization until all organophosphate is metabolised. Obidoxime chloride (Toxogonin), alternatively pralidoxime chloride (2-PAM), may be administered as an adjunct to, but not a substitute for atropine, which is a symptomatic and often life-saving antidote. Treatment with oxime should be maintained as long as atropine sulphate is administered. At first sign of pulmonary edema, the patient should be given supplemental oxygen and treated symptomatically. Continued absorption may occur and relapse may occur after initial improvement. VERY CLOSE SUPERVISION OF THE PATIENT IS INDICATED FOR AT LEAST 48 HOURS, DEPENDING ON THE SEVERITY OF POISONING.

SECTION 5 - FIRE FIGHTING MEASURES

Fire hazards/conditions of flammability

: Combustible liquid and vapor. This material may burn when exposed to extreme heat, flame and other ignition sources. Material may decompose rapidly when exposed to heat and flame. Heat of decomposition may cause closed containers to build up pressure and explode.

Flammability classification (OSHA 29 CFR 1910.1200)

: Combustible Liquid Class III A.

Flash point : 151°F / 66°C

Flash point Method : Pensky Martens Closed Cup

Auto-ignition temperature : N/Av

Lower flammable limit (% by vol.) : 0.6 (Aromatic solvent naphtha)

Upper flammable limit (% by vol.) : 7.0 (Aromatic solvent naphtha)

Oxidizing properties : None known.

Flame Projection Length : N/Ap

Flashback observed : N/Ap

Explosion data: Sensitivity to mechanical impact / static discharge

: Not expected to be sensitive to mechanical impact or static discharge.

Suitable extinguishing media : Carbon dioxide or dry chemical for small fires. For large fires, use water spray or foam.

Special fire-fighting procedures/equipment

: Firefighters should wear proper protective equipment and self-contained breathing apparatus with full face piece operated in positive pressure mode. Move containers from fire area if safe to do so. Dike for water control. Water spray may be useful in cooling equipment exposed to heat and flame. Avoid spreading burning liquid with water spray used for cooling purposes.

Hazardous combustion products

: Carbon oxides; nitrogen oxides (NOx); sulfur oxides; Hydrogen chloride; Ethyl mercaptan; Diethyl sulfide; irritating fumes and smoke.

NFPA Rating

: 0 - Minimal 1 - Slight 2 - Moderate 3 - Serious 4 - Severe

: *Health:* 2 *Flammability:* 2 *Instability:* 1 *Special Hazards:* None

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Personal precautions : Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. All persons dealing with clean-up should wear the appropriate protective equipment including self-contained breathing apparatus. Refer to Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION, for additional information on acceptable personal protective equipment.

Environmental precautions : Ensure spilled product does not enter drains, sewers, waterways, or confined spaces. If necessary, dike well ahead of the spill to prevent runoff into drains, sewers, or any natural waterway or drinking supply.

Spill response/cleanup : Remove all sources of ignition. Ventilate area of release. Stop the spill at source if it is safe to do so. Contain and absorb spilled material with inert, non-combustible absorbent material, such as sand. Sweep up and shovel into suitable containers for disposal. Rinse spill area with soda lye. Do not flush into surface water or sanitary sewer system. Ensure spilled product does not enter drains, sewers, waterways, or confined spaces. Large spills that soak into the ground should be dug up, placed into suitable containers and disposed of appropriately (see Section 13). Notify the appropriate authorities as required.

Prohibited materials : None known.

Special spill response procedures

: In case of a transportation accident, in the United States contact CHEMTREC at 1-800-424-9300 or International at 1-703-527-3887. If a spill/release in excess of the EPA reportable quantity is made into the environment, immediately notify the national response center in the United States (phone: 1-800-424-8002).
US CERCLA Reportable quantity (RQ):
Chlorpyrifos (1 lb / 0.454 kg)
The additional chemical listed below is believed to be at trace levels or is a trace component of Ethoxylated castor oil (CAS # 61791-12-6).
Ethylene oxide (10 lbs / 4.54 kg)

SECTION 7 - HANDLING AND STORAGE

Safe Handling procedures : This material is a toxic liquid. Wear chemically resistant protective equipment during handling. Use only in well-ventilated areas. Avoid contact with eyes, skin and clothing. Do not breathe vapours or spray mist. Keep away from children and all unprotected persons. Do not use near sources of heat, flame or direct sunlight. Do not heat above 131°F / 55°C, and avoid local heating above this temperature. Keep away from incompatibles. Use caution when opening cap. Keep containers tightly closed when not in use. Wash thoroughly after handling.

Storage requirements : Store in a cool, dry, well ventilated area. Product is stable when stored in coated, unopened drums at ambient temperatures. Keep away from excessive heat, open flames, sparks and other possible sources of ignition. Keep away from incompatibles. Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Inspect periodically for damage or leaks. No smoking in the area.

Incompatible materials : Strong alkalis; Strong oxidizing agents; Amines.

Special packaging materials : Always keep in containers made of the same materials as the supply container.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

Ventilation and engineering measures

: Provide sufficient ventilation to keep vapour concentration below the given TLV and/or PEL.

Respiratory protection : Respiratory protection is required. Wear a pesticide respirator jointly approved by the MSHA and NIOSH. Advice should be sought from respiratory protection specialists.

Skin protection : Wear impervious gloves, such as barrier laminate, butyl rubber, nitrile rubber or viton. Advice should be sought from glove suppliers.

Eye / face protection : Chemical splash goggles must be worn when handling this material.

Other protective equipment : Wear impervious chemical apron and protective clothing (water-proof pants, coat, hat and boots) to prevent skin contact. An eyewash station and safety shower should be made available in the immediate working area.

General hygiene considerations

: Avoid breathing vapour or mist. Avoid contact with skin, eyes and clothing. Do not eat, drink, smoke or use cosmetics while working with this product. Before removing gloves clean them with soap and water. Always wash hands, face and arms with soap and water before smoking, eating or drinking. After work, take off all protective equipment, work clothes and shoes, and wash with soap and water. Respirator should be cleaned and filter replaced according to manufacturer's instructions. Wear only clean, uncontaminated clothes when leaving place of work. Persons working with this product for a longer period should have frequent blood tests for cholinesterase levels. If the cholinesterase levels fall below a critical point, no further exposure should be allowed until it has been determined, by means of blood tests, that cholinesterase levels have returned to normal.

Permissible exposure levels : For individual ingredient exposure levels, see Section 2.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Physical state : Liquid

Appearance : Yellow to light brown liquid.

Odour : Aromatic.

Odour threshold : N/Av

pH : 5.9 @ 77°F / 25°C(1% solution)

Boiling point : Decomposition temperature: 320°F / 160°C

Specific gravity : 1.084 @ 68°F / 20°C

Melting/Freezing point : <32°F / <0°C

Coefficient of water/oil distribution : Chlorpyrifos: Kow = 9100; log Kow = 4.959

Vapour pressure (mmHg @ 20° C / 68° F) : Chlorpyrifos: 1.87 x 10 -5 mmHg @ 77°F / 25° C
Aromatic solvent naphtha : 0.6 mmHg @ 68°F / 20°C

Solubility in water : Emulsifies
Chlorpyrifos : 0.94 mg/L @ 25°C

Vapour density (Air = 1) : N/Av

Evaporation rate (n-Butyl acetate = 1) : N/Av

Volatile organic Compounds (VOC's) : N/Av

Volatiles (% by weight) : N/Av

SECTION 10 - REACTIVITY AND STABILITY DATA

Stability and reactivity : Stable if handled below 131°F / 55°C. At higher temperatures decomposition will take place and lower the quality of the product. The released heat from decomposition can raise the temperature further and accelerate decomposition. May corrode iron, steel, tin plate and copper. May be hydrolyzed in water by heating and adjusting the pH (alkaline).

Hazardous polymerization : Will decompose rapidly above 320°F / 160°C, significantly increasing the risk of inducing explosions. The decomposition is to a considerable extent dependant on time as well as temperature due to exothermic and autocatalytic reactions. The reactions involve rearrangements and polymerisation.

Conditions to avoid : Keep this product away from heat, sparks, flame, and other sources of ignition (e.g. pilot lights, electric motors, static electricity).

Materials To Avoid And Incompatibility

: Avoid contact with incompatible materials. See Section 7 (Handling and Storage) for further details.

Hazardous decomposition products

: None known, refer to hazardous combustion products in Section 5.

SECTION 11 - TOXICOLOGICAL INFORMATION

Toxicological data : LD50 Oral (rat): 205 mg/kg
LD50 Dermal (rat): >4000 mg/kg
LC50 Inhalation: 2.16 mg/L/4 hrs

Carcinogenic status : No components are listed as carcinogens by ACGIH, IARC, OSHA or NTP.

Reproductive effects : Not expected to have other reproductive effects.

Teratogenicity : Not expected to be a teratogen.

Mutagenicity : Not expected to be mutagenic in humans.

Epidemiology : Not available.

Sensitization to material : Not expected to be a skin or respiratory sensitizer.

Synergistic materials : Not available.

Irritancy : Irritating to eyes and skin.

other important hazards : Cholinesterase inhibitor. Repeated exposures to cholinesterase inhibitors may, without warning, cause increased susceptibility to doses of any cholinesterase inhibitor.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental effects : The ecological characteristics of this product have not been fully investigated. This material is highly toxic to fish, aquatic invertebrates and insects. The product should not be allowed to enter drains or water courses, or be deposited where it can affect ground or surface waters. Do not discharge product unmonitored into the environment. This material is highly toxic to fish, aquatic invertebrates and insects. This material is toxic to aquatic plants.

Important environmental characteristics

: This product is a pesticide. The active ingredient is: Chlorpyrifos. The active ingredient is readily biodegradable. The active ingredient undergoes rapid degradation in the environment and, without problems, in sewage treatment plants. No adverse effects are found at concentrations up to 100 g/L in waste water treatment plants. Degradation occurs both aerobically and anaerobically, and biologically as well as abiologically. The active ingredient is not mobile in soil, but it is strongly absorbed to soil.

Ecotoxicological : The active ingredient is: Chlorpyrifos

The toxicity of the active ingredient to wildlife species is measured to be:

Fish - 96-Hr LC50, Rainbow trout (Salmo gairdneri) = 3 g/L

Invertebrates - 48-Hr LC50, Daphnids (Daphnia magna) = 1.7 g/L

Algae - 72-Hr IC50, Green algae (Selenastrum capricornutum) = 0.14 mg/L

Birds - LD50, Bobwhite quail (Colinus virginianus) = 13.3 mg/kg

LD50, Mallard duck (Anas platyrhynchos) = 75.6 mg/kg

Bees - LD50, Honey-bees (Apis mellifera), acute oral = 0.36 µg/bee

LD50, Honey-bees (Apis mellifera), topical = 0.070 µg/bee

SECTION 13 - DISPOSAL CONSIDERATIONS

Handling for Disposal : Handle waste according to recommendations in Section 7.

Methods of Disposal : Do not contaminate water, foodstuffs, feed or seed by storage or disposal. For disposable containers, triple rinse (or equivalent) containers and add rinse material to disposal tank. Follow any additional local, state or federal requirements for cleaning containers prior to disposal. Make the empty, rinsed container unsiutable for further use by puncturing. Dispose in accordance with all applicable federal, state, provincial and local regulations. Contact your local, state, provincial or federal environmental agency for specific rules.

RCRA : If this product, as supplied, becomes a waste in the United States, it may meet the criteria of a hazardous waste as defined under RCRA, Title 40 CFR 261. It is the responsibility of the waste generator to determine the proper waste identification and disposal method. For disposal of unused or waste material, check with local, state and federal environmental agencies.

SECTION 14 - TRANSPORTATION INFORMATION

Regulatory Information	UN Number	Shipping Name	Class	Packing Group	Label
49CFR/DOT	UN3018	ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC (Chlorpyrifos)	6.1	III	
49CFR/DOT Additional information	None.				
TDG	UN3018	ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC (Chlorpyrifos)	6.1	III	
TDG Additional information	None.				

MSDS Revision Date (dd/mm/yyyy): 12/10/2009

SECTION 15 - REGULATORY INFORMATION

US Federal Information:

OSHA: This material is classified as hazardous under OSHA regulations (29CFR 1910.1200).

CERCLA Reportable Quantity (RQ) (40 CFR 117.302): See Section 6

SARA TITLE III: Sec. 302, Extremely Hazardous Substances, 40 CFR 355: No Extremely Hazardous Substances are present in this material.

SARA TITLE III: Sec. 311 and 312, MSDS Requirements, 40 CFR 370 Hazard Classes: Fire Hazard; Immediate (Acute) health hazard; Chronic Health Hazard. Under SARA Sections 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are 500 pounds for the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SARA TITLE III: Sec. 313, Toxic Chemicals Notification, 40 CFR 372: This material may be subject to the SARA notification requirements, since it contains Toxic Chemical constituents. All of Toxic Chemical constituents listed below are believed to be at trace levels or are trace components of the Ethoxylated castor oil (CAS # 61791-12-6) or the Aromatic solvent naphtha (64742-94-5).
Ethylene oxide (CAS # 75-21-8)
Trimethylbenzene (CAS #95-63-6)

US State Right to Know Laws:

California Proposition 65: This product contains a chemical known to the State of California to cause cancer, birth defects or other reproductive harm: The chemical listed below is believed to be at trace levels or is a trace component of Ethoxylated castor oil (CAS # 61791-12-6).
Ethylene oxide (CAS #75-21-8)

International Information:

This product is a Pest Control Product and is not regulated as a Controlled Product under the Hazardous Products Act (HPA). For informational purposes, this product would have the following WHMIS classification:
Class B3 (Combustible Liquids)
Class D1B (Materials Causing Immediate and Serious Toxic Effects, Toxic Material)
Class D2B (Materials Causing Other Toxic Effects, Toxic Material)
Class F (Dangerously Reactive Material)

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

SECTION 16 - OTHER INFORMATION

HMIS Rating :

* - Chronic hazard	0 - Minimal	1 - Slight	2 - Moderate	3 - Serious	4 - Severe
Health:	*2	*Flammability:*	2	*Reactivity:*	1

Legend :

ACGIH: American Conference of Governmental Industrial Hygienists
CA: California
CAS: Chemical Abstract Services
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR: Code of Federal Regulations
DOT: Department of Transportation
EPA: Environmental Protection Agency
HMIS: Hazardous Materials Identification System
HSDB: Hazardous Substances Data Bank
IARC: International Agency for Research on Cancer
Inh: Inhalation
MSHA: Mine Safety and Health Administration
N/Ap: Not Applicable
N/Av: Not Available
NFPA: National Fire Protection Association
NIOSH: National Institute of Occupational Safety and Health
NTP: National Toxicology Program
OSHA: Occupational Safety and Health Administration
PEL: Permissible exposure limit
RCRA: Resource Conservation and Recovery Act
RTECS: Registry of Toxic Effects of Chemical Substances
SARA: Superfund Amendments and Reauthorization Act
STEL: Short Term Exposure Limit
TDG: Canadian Transportation of Dangerous Goods Act & Regulations
TLV: Threshold Limit Values
TPQ: Threshold Planning Quantity

MSDS Revision Date (dd/mm/yyyy): 12/10/2009

TSCA: Toxic Substance Control Act
TWA: Time Weighted Average
WHMIS: Workplace Hazardous Materials Identification System

References : 1. ACGIH, Threshold Limit Values and Biological Exposure Indices
2. International Agency for Research on Cancer Monographs
3. Canadian Centre for Occupational Health and Safety, CCInfoWeb databases (Chempendium, HSDB, RTECs).
4. Material Safety Data Sheet from manufacturer.
5. US EPA Title III List of Lists
6. California Proposition 65 List

Prepared for: Cheminova Inc PO Box 110566 One Park Drive, Suite 150 Research Triangle Park, NC 27709 Please direct all enquiries to Cheminova.	
Prepared by: ICC The Compliance Center Inc. **Canada: 1-888-977-4834** **USA: 1-888-442-9628** http://www.thecompliancecenter.com	The Compliance Center Inc. HAZARDOUS MATERIALS REGULATIONS SPECIALISTS

DISCLAIMER OF LIABILITY

This Material Safety Data Sheet was prepared by ICC The Compliance Center Inc. using information provided by / obtained from Cheminova Inc and CCOHS' Web Information Service. The information in the Material Safety Data Sheet is offered for your consideration and guidance when exposed to this product. ICC The Compliance Center Inc and Cheminova Inc expressly disclaim all expressed or implied warranties and assume no responsibilities for the accuracy or completeness of the data contained herein. The data in this MSDS does not apply to use with any other product or in any other process.
This Material Safety Data Sheet may not be changed, or altered in any way without the expressed knowledge and permission of ICC The Compliance Center Inc. and Cheminova Inc.

MSDS Preparation Date (dd/mm/yyyy)

: 18/08/2003

MSDS Reviewed Date (dd/mm/yyyy)

: 12/10/2009

Revision No. : 4

Revision Information : (M)SDS sections updated: All

END OF DOCUMENT