SANAFOAM ROO-PRU

A Foaming Fumigant
Rids Sewer Lines of Roots
Will Not Harm Trees, Non-Systemic

ACTIVE INGREDIENT	BY WEIGHT
Dichlobenil: (2, 6-dichlorobenzonitrile)	50.0%
OTHER INGREDIENTS:	50.0%
TOTAL:	100.0%

KEEP OUT OF REACH OF CHILDREN

CAUTION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID

IF SWALLOWED:
- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to do so by the poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF ON SKIN OR CLOTHING:
- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15 to 20 minutes.
- Call a poison control center or doctor for treatment advice.

IF IN EYES:
- Hold eye open and rinse slowly and gently with water for 15 to 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 INHALED:
- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible.
- Call a poison control center or doctor for further treatment advice

HOT LINE NUMBER

For additional information in case of emergency call toll free (1-800-858-7378). Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

See additional PRECAUTIONARY STATEMENTS on side panels.

EPA Reg. No. 1015-73 **EPA Est. No. 1015-MO-1**

Manufactured For:
Douglas Products and Packaging Company
1550 East Old 210 Highway
Liberty, MO 64068

Net Weight: 1.875 lb (30 oz)

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Harmful if swallowed or absorbed through skin. Avoid contact with eyes, skin or clothing.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Mixers, loaders, applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Chemical-resistant gloves made of any waterproof material
- Chemical-resistant apron when mixing and loading

User Safety Requirements

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

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 outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

Keep out of lakes, ponds or streams. Toxic to fish and aquatic life. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters or rinsate.

GROUND WATER ADVISORY

This chemical has properties and characteristics associated with chemicals detected in ground water. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow may result in ground-water contamination.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. This package contains one-30 oz. water soluble bag for direct addition to the equipment mix tank when making foam applications of SANAFOAM ROO-PRU.

USE PRECAUTIONS AND RESTRICTIONS

Consideration must be given to all sewer service lines and building elevations and basements for the possibility of foam coming up out of drains. Consideration must be given to distance between houses and sewers to be treated, depth of sewers compared to drains in buildings, line obstructions, broken and empty traps. Drains which may be subject to backup and flooding must be plugged. Follow the directions for measurement and use carefully to avoid using excess foam that may be forced up lateral lines to building drains. Do not use in storm, field or other drains unless effluent is treated in a sanitary sewer system. Use a squeegee, dust pan or wet vacuum and garbage bags for spills or backups and dispose of foam and liquid, wash area of spill or back up with water and detergent and flush down drain. If rugs or cloth are contacted, take outside and dry before laundering separately.

Do not use in confined areas without adequate ventilation. Avoid any entry into manholes or confined areas. When absolutely necessary to enter these areas, be sure to use all safety protection equipment and procedures as required by law. When used in inhabited buildings (residences, offices, hospitals, etc.,) windows must be open or an exhaust fan must be operating during the application.

Do not use in potable sewer systems. Do not use in storm, field or other drains unless effluent is treated in a sanitary sewer system. Keep off lawns and plants as they may be severely injured. Foam should be shoveled off planted areas immediately rather than washing off with water.

PRODUCT INFORMATION

SANAFOAM ROO-PRU is surface-active product for dilution in water to be used with a foaming agent [(included with this package)].

SANAFOAM ROO-PRU is a non-systemic chemical for control of roots in sewer mains and drain lines. Only the roots and organic deposits in the sewer lines are affected by SANAFOAM ROO-PRU.

SANAFOAM ROO-PRU is not to be used to treat roots in storm sewers or other drains where the wastewater will not be treated or controlled.

DIRECTIONS FOR USE OF SANAFOAM ROO-PRU WITH TANK MIX OR ON DEMAND/IN LINE MIX

1. Determine which of the collection lines have known root problems.
2. Survey Treatment Area – Confirm the line size and length. Evaluate slope, flow, lateral connections, line length, outfall, line obstructions, terrain and other field conditions. A thorough evaluation prior to starting will assure safe and accurate application of SANAFOAM ROO-PRU.
3. Determine Quantity of Foam Needed - From Table 1 compute the quantity of foam required to fill the length of pipe (in feet) to be treated.

TABLE 1: Foam Requirements and Hose Retrieval Rates for SANAFOAM ROO-PRU

Pipe I.D. (Inches)	Foam Capacities (gal./ft.)	Retrieval Rate (sec./10 ft.)
4	0.7	4.2
6	1.5	9.0
8	2.5	15.0
9	3.3	20.0
10	4.1	24.0
12	5.9	36.0
15	9.2	55.0
16	10.4	62.0
18	13.2	78.0
21	18.0	108.0
24	23.5	141.0
27	29.7	178.0

Example: An 8 in. pipe requires 2.5 gallons of foam per foot to fill the pipe. Therefore, 2500 gallons of foam are required to fill an 8 in. pipe 1000 feet in length (1000 ft. x 2.5 gal/ft. = 2500 gal).

4. Measurement Directions to Produce Desired Quantity of Foam

TABLE 1: Mixing Instructions for Dilution with Foaming Agent

Foam Requirement	Total Mix Volume	Water	Foaming Agent	Sanafoam Roo-Pru
2500 gal.	125.0 gal.	123.82 gal.	1.18 gal.	30 oz. (1 water soluble bag)
5000 gal.	250.0 gal.	247.63 gal.	2.37 gal.	60 oz. (2 water soluble bags)
7500 gal.	375.0 gal.	371.46 gal.	3.54 gal.	90 oz. (3 water soluble bags)

Example: 123.82 gallons of water plus one 30 oz. bag Sanafoam Roo-Pru and 1.18 gallons of foaming agent will produce 2,500 gallons of foam.

MIXING PROCEDURES: TANK MIX

1. Fill the Foamaker Equipment mix tank ¼ to ½ full of clean water leaving room in the tank for the rinse water to be used as described below.
2. Open outer fiberboard container and remove plastic bag containing the SANAFOAM ROO-PRU.
3. Remove the inner containers containing the foaming agent as needed.
4. Remove the SANAFOAM ROO-PRU water soluble inner bag from their labeled protective outer plastic bag. DO NOT OPEN THE WATER SOLUBLE BAG.
5. Place the unopened water soluble bags through the access lid and into the water in the mix tank as needed.
6. Allow about 7 minutes for the bag to dissolve and the powder to thoroughly mix.
7. Transfer the liquid from the foaming agent container as necessary into the Foamaker solution mix tank using the suction pump system on the Foamaker.
8. Triple rinse the foaming agent container (again using the suction pump system to add the rinse water to the mix tank).
9. Add to the mix tank the remainder of the required water and mix thoroughly.
10. Dispose of containers in accordance with disposal instructions.

MIXING PROCEDURES: ON DEMAND/INLINE MIX

1. Fill the Dichlobenil mix tank with five gallons of water.
2. Open outer fiberboard container and remove plastic bag containing the SANAFOAM ROO-PRU.
3. Remove the SANAFOAM ROO-PRU water soluble inner bag from their labeled protective outer plastic bag. DO NOT OPEN THE WATER SOLUBLE BAG.
4. Place the unopened water soluble bag through the access lid and into the water in the Dichlobenil mix tank as needed.
5. Run the mixer on the Dichlobenil mix tank and allow 7 minutes for the bag to dissolve and the powder to thoroughly mix.
6. Place 1.18 gallons of foam concentrate in a five gallon container and fill the container with water up to the five gallon mark.
7. Connect the liquid from the 5 gallon container to the suction pump on the Foamaker.
8. Dispose of empty containers in accordance with the STORAGE AND DOSPOSAL instructions below.

USE SOLUTION PROMPTLY AFTER MIXING. Wash and flush all equipment with water after each day's use.

KEEP OFF DESIRABLE LAWNS AND PLANTS. If spillage occurs on the street or other paved areas near growing plants, immediately flush the spill thoroughly with water at moderate pressure into the sewer line.

APPLICATION GUIDELINES FOR SANAFOAM ROO-PRU

TO APPLY FOAM TO MAIN LINES: Insert foam discharge hose through entire section of line to be treated. Start foam generating equipment and withdraw discharge hose at a rate calibrated to fill the pipe line to capacity (as listed in Table 1), until foam appears at input manhole. Use appropriate foam application equipment designed to produce required foam volume.

You may multiply the retrieval rates in Table 1 by 1.10 to allow for some treatment of laterals (about 3-6 feet) and to allow more foam to push into cracks and broken joints.

IF TREATING A BUILDING LATERAL: Be sure foam application discharge hose is also of a specialized type and is securely positioned into and inflated in the clean-out to prevent foam overflow and/or plug blowout. Operate foam generating equipment until required amount of foam has been produced, as calculated from information in Table 1. Do not overfill lateral.

FOAMAKER Generators are manufactured for Douglas Products to our specifications and are available from Douglas Products.

For additional information on special applications, contact sales representative of manufacturer. All application procedures must be in accordance with established methods and systems as developed by Douglas Products.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

PESTICIDE STORAGE: Do not store near food or feed, seeds, bulbs, tubers, nursery stock or other vegetative matter. Do not store near pet or livestock quarters. Store in a cool, dry, and well ventilated area. Do not open the protective bag outer tube until water soluble bag is needed.

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

STORAGE AND DISPOSAL (CONT.)

CONTAINER DISPOSAL: Plastic Bag – Remove the water soluble bag from the outer protective plastic bag before use in application equipment. Then offer for recycling if available or dispose of empty outer plastic bag in the trash as long as WSP is unbroken.

Outer Fiberboard Container and Other Containers: Non-refillable container. Do not reuse or refill this container. Completely empty containers into application equipment. Then offer for recycling if available, or dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

SPECIAL NOTICE

To the extent consistent with applicable law, seller makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. To the extent consistent with applicable law, buyer assumes all risk of use and/or handling of this material when such use and/or handling is contrary to label instructions.

EPA 20100921

Material Safety Data Sheet
Sanafoam Roo Pru

Section 1. Product and Company Identification

Product Name: Sanafoam Roo Pru®
Product Code: V-F-SAN-ROOPR-06X30O
Effective Date: April 2012

Manufacturer Information:
Douglas Products and Packaging Company
1550 East Old 210 Highway
Liberty, Missouri 64068
Information Phone: (816) 781-4250
Emergency Phone: Chemtrec (800) 424-9300

Section 2. Ingredients and Hazards Identification

Hazardous Components		Occupational Exposure Limits			
Component	CAS Number	OSHA PEL	ACGIH TLV	Weight Percent	Section 313
Dichlobenil *	1194-65-6	NE	NE	50	Yes
Kaolin clay	1332-58-7	5 mg/m^3	2 mg/m^3	37	Yes
Balance is inert filler	NA	NE	NE	13	No

This product does not contain EPCRA Section 313 chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372).

The product is a combination pack of plastic bags of dry dichlobenil powder and liquid containers of AEC. This MSDS is for the dry powder. Please follow the directions on the label and wear the proper personal protective equipment (PPE) see section 8.
Potential Acute Health Effects:
Eyes: Causes eye irritation
Skin: Not expected to cause irritation to the skin
Inhalation: Dust may cause respiratory irritation
Ingestion: Harmful if swallowed

Section 3. Hazard Identification

Irritant
The product is a dry Dichlobenil powder. This MSDS is for the dry powder. Please follow the directions on the label and wear the proper personal protective equipment (PPE); see section 8.

Section 4. First Aid Measures

Special instructions: If this material is spilled on a person, remove contaminated clothing and wash thoroughly with soap and water.
Inhalation: If person has difficulty in breathing, remove to fresh air. If the person still has difficulty, seek medical attention
Skin contact: Wash with soap and water if irritation persists, seek medical attention.
Eye contact: Immediately flush the eyes with copious amounts of water for at least 15 minutes, if irritation persists seek medical attention
Ingestion: Rinse mouth with water, do not induce vomiting; seek medical attention. Note this material has low toxicity under normal conditions of handling and use

Section 5. Fire Fighting Measures

Suitable extinguishing media: Dry chemical, foam, carbon dioxide, or water spray.
Extinguishing media must not be used for safety reasons: None known
Special exposure hazards in fire: The material will form toxic and irritant vapors in a fire situation.
Special protective equipment for fire-fighters: Wear self-contained breathing apparatus and suitable protective clothing for normal fire situations.
Other instructions: Containers can be kept cool by spraying with water spray.

Section 6. Accidental Release Measures

Personal precautions: Do not touch spilled material with bare hands; wear PPE outlined in Section 8 of MSDS.
Environmental precautions: This product is toxic to fish or other aquatic life, consult appropriate regulatory body for their specific regulations concerning Dichlobenil. Studies have shown that the maximum concentration of active ingredient in treated water must not exceed 3 ppm.
Methods for cleaning up: Wear proper PPE outlined in Section 8. Do not wash into sewers or into any body of water. If spill is dry sweep up and place in plastic container for disposal. Material may still be used as per label use if dry.
Other instructions: If dry material is mixed with other materials dry or liquid, absorb with inert absorbent material and consult with local, state or federal regulatory agencies for

Section 7. Handling and Storage

Handling: Avoid contact with skin or eyes, wear chemical resistant gloves and safety glasses or goggles.
Storage: Store in a dry, cool, frost-free ventilated area.
Specific use(s): The product is an herbicide, it used with the liquid component for the prevention of tree root re-growth and entry into sanitary, septic and sewers following mechanical process.

Section 8. Exposure Control/Personal Protection

USA values:	OSHA PEL	ACGIH TLV
Kaolin clay	5.00 mg/m^3	5.00 mg/m^3

Limit values in other countries:

Country	Ingredient	TWA (8 Hour)
Australia (NOHC)	Kaolin	2.00 mg/m^3
Canada	Kaolin	0.05 mg/m^3
UK	Kaolin	2.00 mg/m^3

Occupational exposure controls: Good ventilation is required.
Respiratory protection: Wear a dust/mist filtering respirator (NIOSH)
Hand protection: Wear chemical-resistant gloves
Eye protection: Wear safety glasses or goggles.
Skin protection: Wear long sleeves, long pants, and rubber boots.
Environmental exposure controls: Do not apply directly to lakes, ponds or streams.

Section 9. Physical and Chemical Properties

General information: The product is a tan powder with aromatic odor.
Important health, safety and environmental information. Wear specified PPE as outlined in section 8 and on the label. Process requires specialized application equipment operated by trained staff. Avoid mixing with acidic material as hydrogen sulfide gas may occur.

Physical State	Dry powder	**Specific Gravity (H_2O=1)**	ND
pH	NA	**Solubility**	Powder disperses (14.6 mg/L @ 68 °F (20 °C)
Freezing	NA	Boiling	NA
Point		**Point**	

Section 10. Stability and Reactivity

Conditions to avoid: Avoid extreme heat
Materials to avoid: Avoid strong oxidizers.
Hazardous decomposition products: Oxides of chlorine and nitrogen
Hazardous Polymerization: Will not occur

Section 11. Toxicological Information

Acute toxicity: Dichlobenil Dermal (rabbit) LD_{50} = or >2000 mg/kg
Dichlobenil Oral (rat) LD_{50} = 2 g/kg
Dichlobenil Inhalation (rat)LC_{50} =0.25 mg/l
This product is both an acute and chronic hazard.
Empirical data on effects on humans: Routes of entry, contact, inhalation and ingestion.
Other information on health effects: May irritate the eyes, skin irritation, and respiratory irritation and may be harmful.

Section 12. Ecological Information

THIS PRODUCT CAN CAUSE POLLUTION IN THE ENVIRONMENT AND BE MODERATELY TOXIC TO AQUATIC ORGANISMS.
Other adverse effects: Known herbicide.

Section 13. Disposal Considerations

Pesticide disposal: If wastes are produced dispose according to local state, provincial or federal regulations. Triple rinse the bags before disposal into land fill.

Section 14. Transport Information

Transport class: Not regulated by highway or rail.
Sea transport: Not regulated.
Air transport: Do not ship by air unless packaging meets IATA/ICAO requirements.

Section 15. Regulatory Information

The EPA warning is "**CAUTION**"
Dichlobenil is listed the label
R phrases: R52, R20/21/22
S phrases: S2, S13, and S20/21

EPCRA 311/312 Categories: Immediate (Acute)
Health Effects: Yes
Delayed (Chronic)
Health Effects: Yes

Fire Hazard: No

Sudden Release of Pressure No

Reactivity: No

Right to know classification: Kaolin clay is listed in CA, PA, MN, MA, MI, FL and NJ.
TSCA: None
Reportable Quantity (RQ): None
Prop. 65: Kaolin clay (cancer)
WHMIS: Class D2 (Skin or eye irritant)\
Kaolin clay is listed in chemical inventories in: AICS, ECL, EEC, ENCS, EU, Israel, MAC, MAK, MITI, PICCS, SWISS, Taiwan, USA and UK

Abbreviations:

AICS	Australian Inventory of Chemical Substances
CAS #	Chemical Abstract Service Number
°C	Celsius temperature scale
°F	Fahrenheit temperature scale
ECL	Korean Existing Chemicals List
EEC	European Economic Commission
ENCS	Japanese Existing and New Chemical List
EINECS #	European Inventory of Existing Chemical Substances Number
EU	European Union
(Israel)	2001 proposed list of chemical substances to be regulated under Israel Hazardous Substances Law and Regulations List
MAC	Netherlands
MAK	Germany
MITI	Ministry of International trade and Industry
NA	Not applicable
PEL	Permissible Exposure Limit
PICCS	Philippines Inventory of Chemicals and Chemical Substances
PPE	Personal Protective Equipment
Prop.	Proprietary
NA	Not applicable
ND	Not determined
STEL	Short Term Exposure Limit
SWISS	Giftliste 1
SWISS	Inventory of Notified New Substances
TLV	Threshold Limit Value
TSCA	Toxic Substance Control Act
TWA	Time Weighted Average
(Taiwan)	List of Toxic Chemical Substances regulated under Taiwan Toxic Chemical Substances Control Act of 1086
USA	United States of America
UK	United Kingdom

Section 16. Other Information

(HMIS)			(NFPA)
Health	1	1	Health
Fire	1	1	Fire
Reactivity	0	0	Instability
Personal Protection	E		

Health 4 Deadly 3 Extreme Danger 2 Dangerous 1 Slight hazard 0 No hazard
Fire 4 < 73 °C 3 < 100 °C 2 < 200 °C 1 >200 °C 0 Will not burn
Reactivity/Instability 4 – May detonate 3 Explosive 2 Unstable 1 Normally stable 0 Stable

ENVIRONMENTAL TESTING SOLUTIONS, INC.
TOXICITY TEST REPORT

INTRODUCTION / EXECUTIVE SUMMARY

Report Date: September 30, 2013
ETS Project #: 9205/9207/9220/9282

1.	Client:	Cape Fear Public Utilities
2.	Study:	Acute Toxicity of Root Control Chemicals
3.	Product Tested:	Douglas Products: AEC-3 (M3LF) and Acme/Gordon's BARRIER 50W Dichlobenil Herbicide Duke' Root Control: Cornfoam and Reward Manufacturing Concentrate
4.	Date Received:	September 06 – 10, 2013
5.	Test Species:	Daphnids (*Ceriodaphnia dubia*),
6.	Test Dates:	*Ceriodaphnia dubia*: Screeening: September 18 – 20, 2013 Effluent: September 25 – 27, 2013
7.	Test Type:	48-hour Static Acute for *Ceriodaphnia dubia*
8.	Concentrations Tested Expressed in %:	Screening: 0.00078125, 0.0015625, 0.003125, 0.00625, 0.0125, 0.025, 0.05, 0.1, 0.2 and 0.4% Effluent: 0.0015625, 0.003125, 0.00625, 0.0125, 0.025, 0.05, 0.1, 0.2, 0.4, 0.8 and 1.6%
9.	Test Results: Expressed in %:	Douglas Products: Screening: 24-hour $LC_{50} \geq 0.40$ 48-hour $LC_{50} \geq 0.40$ Effluent: 24-hour $LC_{50} = 0.86$ 48-hour $LC_{50} = 0.67$ Duke's Root Control: Screening: 24-hour $LC_{50} = 0.064$ 48-hour $LC_{50} = 0.017$ Effluent: 24-hour $LC_{50} = 0.048$ 48-hour $LC_{50} = 0.021$
10.	Client Contact: Phone #:	Ms. Pam Ellis (910) 332-6567
11.	Consulting / Testing Lab:	Environmental Testing Solutions, Inc.
12.	Lab Contact: Phone #:	Mr. Jim Sumner (828) 350-9364

METHODS SUMMARY

DOUGLAS PRODUCTS

Samples:

1. Sample Type: Product
2. Sample Information:

Sample ID	Lot Number	ETS Sample Number	Date Received MM-DD-YY	Arrival Temp. (°C)
AEC-2 (M3LF)	Not provided	130906.01	09-06-13	Not applicable
Acme/Gordon's BARRIER 50W Dichlobenil Herbicide	Not provided	130906.02	09-06-13	Not applicable

3. Sample Manipulation:

Application rate:
1.18 gallons of foaming agent (AEC-2) and 30 ounces of Sanafoam Roo-Pru (Acme/Gordon's BARRIER 50 W Dichlobenil Herbicide) is diluted into a total of 125 gallons.

This creates a 9.44 g/L AEC-2 and 1.80 g/L Dichlobenil solution to be applied in the sewer system.

A stock solution of this solution was prepared by diluting 0.9440 g AEC-2 and 0.1800 g Dichlobenil into 100 mL water. This stock solution was used to prepare the concentrations evaluated for acute toxicity.

Screening tests: Soft synthetic water was used to prepare the stock solution and concentrations evaluated for toxicity.

Effluent tests: Operational Effluent collected September 23 – 24, 2013 from 0840 to 0840 from the James Loughlin WWTP was used to prepare the stock solution and concentrations evaluated for toxicity.

Samples from were warmed to test temperature (25.0 ± 1.0°C) in a warm water bath.

METHODS SUMMARY

DUKE'S ROOT CONTROL

Samples:

1. Sample Type: Product
2. Sample Information:

Sample ID	Lot Number	ETS Sample Number	Date Received MM-DD-YY	Arrival Temp. (°C)
Cornfoam	Not provided	130910.13	09-10-13	Not applicable
Reward Manufacturing Concentrate	Not provided	130909.02	09-09-13	Not applicable

3. Sample Manipulation:

Application rate:
3.00 gallons of foaming agent (Cornfoam) and 1.50 gallons of Diquat Dibromide (Reward Manufacturing Concentrate) is diluted into a total of 300 gallons of water.

This creates a 10 g/L Cornfoam and 5 g/L Diquat Dibromide solution to be applied in the sewer system.

A stock solution of this solution was prepared by diluting 1.0000 g Cornfoam and 0.5000 g Diquat Dibromide into 100 mL water. This stock solution was used to prepare the concentrations evaluated for acute toxicity.

Screening tests: Soft synthetic water was used to prepare the stock solution and concentrations evaluated for toxicity.

Effluent tests: Operational Effluent collected September 23 – 24, 2013 from 0840 to 0840 from the James Loughlin WWTP was used to prepare the stock solution and concentrations evaluated for toxicity.

Samples from were warmed to test temperature (25.0 ± 1.0°C) in a warm water bath.

Test Organisms:

Ceriodaphnia dubia

1.	Source:	In-house Cultures
2.	Age:	< 24-hours old

Test Method Summary:

1.	Test Conditions:	Static
2.	Test Duration:	48-hours
3.	Laboratory QC:	Soft Synthetic
4.	Number of Replicates:	4
5.	Organisms per Replicate:	5
6.	Test Initiated:	Screening: 09-18-13 1250 ET Effluent: 09-25-13 1235 – 1250 ET
7.	Test Terminated:	Screening: 09-20-13 1252 ET Effluent: 09-27-13 1230 – 1247 ET
8.	Test Temperature:	25.0 ± 1.0°C
9.	Physical / Chemical Measurements:	Alkalinity and hardness was measured in the laboratory QC water. Daily temperatures were measured in one replicate for each test concentration. Pre- and post-exposure test solutions were analyzed for pH and dissolved oxygen. Pre-exposure test solutions were analyzed for conductivity.
10.	Statistics:	Statistics were performed according to methods prescribed by EPA using ToxCalc version 5.0 statistical software (Tidepool Scientific Software, McKinneyville, CA).

TOXICITY TEST RESULTS (see Appendix B for Bench Sheets)

DOUGLAS PRODUCTS

1. Screening Test

Results of a *Ceriodaphnia dubia* (Genus species) 48-hour Static Acute Toxicity Test (Duration / Type)

Conducted September 18 – 20, 2013

Test Solutions (%)	Percent Surviving	
	24-hours	48-hours
Control	100	100
0.00078125	100	100
0.0015625	100	100
0.003125	100	100
0.00625	100	100
0.0125	100	100
0.025	100	100
0.05	100	100
0.10	100	100
0.20	95	85
0.40	75	65

24-hour NOEC: 0.20%
24-hour LC_{50}: > 0.40% 95% Confidence Limits: Unable to calculate.

48-hour NOEC: 0.10%
48-hour LC_{50}: > 0.40% 95% Confidence Limits: Unable to calculate.

DOUGLAS PRODUCTS

2. Effluent Test

Results of a *Ceriodaphnia dubia* (Genus species) 48-hour Static Acute Toxicity Test (Duration / Type)

Conducted September 25 – 27, 2013

Test Solutions (%)	Percent Surviving	
	24-hours	48-hours
Control	100	100
0.0015625	100	100
0.003125	100	100
0.00625	100	100
0.0125	100	100
0.025	100	100
0.05	100	100
0.10	100	100
0.20	100	100
0.40	95	95
0.80	70	30
1.60	0	0

24-hour NOEC: 0.40%
24-hour LC_{50}: 0.86% 95% Confidence Limits: 0.72 – 1.03%

48-hour NOEC: 0.40%
48-hour LC_{50}: 0.67% 95% Confidence Limits: 0.57 – 0.80%

TOXICITY TEST RESULTS (see Appendix B for Bench Sheets)

DUKE'S ROOT CONTROL

1. Screening Test

Results of a *Ceriodaphnia dubia* (Genus species) 48-hour Static Acute Toxicity Test (Duration / Type)

Conducted September 18 – 20, 2013

Test Solutions (%)	Percent Surviving	
	24-hours	48-hours
Control	100	100
0.00078125	100	100
0.0015625	100	100
0.003125	100	100
0.00625	100	100
0.0125	100	95
0.025	100	0
0.05	85	0
0.10	0	0
0.20	0	0
0.40	0	0

24-hour NOEC: 0.025%
24-hour LC_{50}: 0.064% 95% Confidence Limits: 0.057 – 0.071%

48-hour NOEC: 0.0125%
48-hour LC_{50}: 0.017% 95% Confidence Limits: 0.016 – 0.018%

DUKE'S ROOT CONTROL

2. Effluent Test

Results of a *Ceriodaphnia dubia* (Genus species) 48-hour Static Acute Toxicity Test (Duration / Type)

Conducted September 25 – 27, 2013

Test Solutions (%)	Percent Surviving	
	24-hours	48-hours
Control	100	100
0.0015625	100	100
0.003125	100	100
0.00625	100	100
0.0125	100	100
0.025	100	25
0.05	45	0
0.10	0	0
0.20	0	0
0.40	0	0
0.80	0	0
1.60	0	0

24-hour NOEC: 0.025%
24-hour LC_{50}: 0.048% 95% Confidence Limits: 0.041 – 0.056%

48-hour NOEC: 0.0125%
48-hour LC_{50}: 0.021% 95% Confidence Limits: 0.018 – 0.024%

REFERENCE TOXICANT TEST RESULTS (see Appendix A and C)

Species	Date	Time (ET)	Test Type	Duration	Toxicant	Endpoint (g/L)
Ceriodaphnia dubia	09-11-13	1312	Acute	48-hours	NaCl	LC_{50} = 2.21
Ceriodaphnia dubia	09-25-13	0920	Acute	48-hours	NaCl	LC_{50} = 2.19

Appendix A
ADDITIONAL TOXICITY TEST INFORMATION

SUMMARY OF METHODS

1. *Ceriodaphnia dubia*

   Tests were conducted according to EPA-821-R-02-012 (October 2002). Test vessels consisted of 40-mL polypropylene cups, each containing 30-mL of test solution.

DEVIATIONS / MODIFICATIONS TO TEST PROTOCOL

1. *Ceriodaphnia dubia*: None

DEVIATIONS / MODIFICATIONS TO PRETEST CULTURE OR HOLDING OF TEST ORGANISMS

1. *Ceriodaphnia dubia*: None

PHYSICAL AND CHEMICAL METHODS

1. Reagents, Titrants, Buffers, etc.: All chemicals were certified products used before expiration dates (where applicable).
2. Instruments: All identification, service, and calibration information pertaining to laboratory instruments is recorded in calibration and maintenance logbooks.
3. Temperature was measured by SM 2550 B.
4. Dissolved oxygen was measured by SM 4500 O G.
5. The pH was measured by SM 4500 H+ B.
6. Conductance was measured by SM 2510 B.
7. Alkalinity was measured by SM 2320 B.
8. Total hardness was measured by SM 2340 C.

QUALITY ASSURANCE

Toxicity Test Methods: All phases of the study including, but not limited to, sample collection, handling and storage, glassware preparation, test organism culturing/acquisition and acclimation, test organism handling during test, and maintaining appropriate test conditions were conducted according to the protocol as described in this report and EPA-821-R-02-012. Any known deviations were noted during the study and are reported herein.

REFERENCE TOXICANT TESTS (See Appendix D for control chart information)

1. Test Type: 48-hour acute tests with results expressed as LC_{50} values in g NaCl/L.
2. Standard Toxicant: Sodium Chloride (NaCl crystalline) for *Ceriodaphnia dubia,*
3. Dilution Water Used: Moderately hard synthetic water.
4. Statistics: ToxCalc software Version 5.0 was used for statistical analyses.

REFERENCES

1. USEPA. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, EPA-821-R-02-012 (October 2002).
2. Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012.
3. Quality Assurance Program: Standard Operating Procedures, Environmental Testing Solutions, Inc (most current version).

Appendix B

CHAIN-OF-CUSTODY RECORDS
TOXICITY TEST BENCHSHEETS

ETS
Environmental Testing Solutions, Inc.

351 Depot Street
Asheville, NC 28801
Phone: (828) 350-9364
Fax: (828) 350-9368

Whole Effluent Toxicity Chain-of-Custody Form

Facility: Cape Fear Public Utility
James Loughlin WWTP (Northside)
Root Control Study
NPDES #: NC0023965 Pipe #: R&D County: New Hanover
Purchase order: _____
Species: *Ceriodaphnia dubia*
Test type: **Acute**

Sample information: (to be completed by sample collector)

Composite sample:
Start date: 9-23-13 Time: 0840 am
End date: 9-24-13 Time: 0840 am
Number of samples per hour: Flow proportional
Chilled during collection? yes
If chilled, specify temperature: 1-6°C

Sample location: Operational Effluent
Volume collected for testing: 9L
Number of containers filled for testing: 3
Method of transport to laboratory: Fedex Priority
Comments: _____

Triple rinse sample container with sample before filling. Completely fill the sample container with no air space.

Pack the sample container completely in ice. The sample must be < 6.0°C upon receipt at the laboratory.

Sample custody: (to be completed by sample collector and facility personnel)

Sample collected by:		
Maggie Butler / Adam Poore (Print)	maggie butler / Adam Poore (Signature)	9-24-13 0840 / 9-24-13 0840 (Date and time)

Relinquished by:		
Maggie Butler (Print)	maggie butler (Signature)	9-24-13 0923 (Date and time)

Received by:		
Adam Poore (Print)	Adam Poore (Signature)	9-24-13 0923 (Date and time)

Relinquished by:		
(Print)	(Signature)	(Date and time)

Received by:		
(Print)	(Signature)	(Date and time)

Sample receipt information: (to be completed by ETS personnel)

Fedex

Relinquished to ETS by:		
Adam Poore (Print)	Adam Poore (Signature)	9-24-13 1000 (Date and time)

Received at ETS by:		
JSUMNER (Print)	JSumner (Signature)	09-25-13 1000 (Date and time)

Custody seals intact?: ☑ Yes ☐ No ☐ Not used

Samples received in good condition?: ☑ Yes ☐ No

Sample temperature upon receipt at ETS (°C): 1.6°C

Total residual chlorine upon receipt at ETS: ☐ Present ☑ Absent
(DPD Presence/Absense Indicator, MDL = 0.10 mg/L)

Tracking number: 8033 8807 3497

Project number: 9202 Sample number: 13092502

Comments: _____

09-06 13 1315
RECEIVED FROM UPS
PROJECT 9205
SAMPLE 130906.01

°C	Celsius temperature scale
°F	Fahrenheit temperature scale
ECL	Korean Existing Chemicals List
EEC	European Economic Commission
ENCS	Japanese Existing and New Chemical List
EINECS #	European Inventory of Existing Chemical Substances Number
EU	European Union
(Israel)	2001 proposed list of chemical substances to be regulated under Israel Hazardous Substances Law and Regulations List
MAC	Netherlands
MAK	Germany
MITI	Ministry of International trade and Industry
NA	Not applicable
PEL	Permissible Exposure Limit
PICCS	Philippines Inventory of Chemicals and Chemical Substances
PPE	Personal Protective Equipment
Prop.	Proprietary
NA	Not applicable
ND	Not determined
STEL	Short Term Exposure Limit
SWISS	Giftliste 1
SWISS	Inventory of Notified New Substances
TLV	Threshold Limit Value
TSCA	Toxic Substance Control Act
TWA	Time Weighted Average
(Taiwan)	List of Toxic Chemical Substances regulated under Taiwan Toxic Chemical Substances Control Act of 1086
USA	United States of America
UK	United Kingdom

Section 16. Other Information

Hazardous Material Information (HMIS) **National Fire Protection Association (NFPA)**

Health	3	3	Health
Fire	2	2	Fire
Reactivity	0	0	Instability
Personal Protection	J		NA

Health 4 Deadly 3 Extreme Danger 2 Dangerous 1 Slight hazard 0 No hazard
Fire 4 < 73 °C 3 < 100 °C 2 < 200 °C 1 >200 °C 0 Will not burn
Reactivity/Instability 4 – May detonate 3 Explosive 2 Unstable 1 Normally stable 0 Stable

Section 1. Product and Company Identification

Product Name: AEC-3(M3LF)
Product Code: V-F-AEC-AECSU-02X02G, V-F-AEC-AECSU-06X01G, V-F-AEC-AECSU-10X02L
Effective Date: October 3, 2008

Manufacturer Information: Douglas Products and Packaging Company
1550 East Old 210 Highway
Liberty, Missouri 64068
Information Phone: (816) 781-4250
Emergency Phone: Chemtrec (800) 424-9300

Section 2. Ingredients and Hazards Identification

Hazardous Components		Occupational Exposure Limits			
Component	CAS Number	OSHA PEL	ACGIH TLV	Weight Percent	Section 313
Proprietary Blend*	Various numbers	ND	ND	≥ 98	No
Isopropyl Alcohol	67-63-0	980 mg/m³	980 mg/m³	> 2	No
This product contains the following EPCRA Section 313 chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372).					

* Proprietary blend of alkyl sulfates, salts of alkyl and di-alkyl 2,5 diketotetrahydrofuren, alkyl aryl sulfate, alkyl ethoxylate, fatty solid dichloroamides, glycol and isopropanol. Contains 2% w/w of isopropanol.

Eyes: Causes eye irritation
Skin: May cause irritation to the skin
Inhalation: Vapors may cause respiratory irritation
Ingestion: Get medical attention immediately.

Section 3. Hazard Identification

The primary routes of entry are inhalation and ingestion.
Immediate Health Effects:
Eye Contact: May causes severe irritation, redness and blurred vision.
Skin: Contact with the skin may cause irritation.
Ingestion: May cause flushing, headache, dizziness, nausea and vomiting.
Inhalation: The vapor or fumes from this product may cause respiratory irritation.
Delayed or other Health Effects: Person with pre-existing skin and respiratory problems.
Target Organs: None determined.

Section 4. First Aid Measures

Eye Contact: Flush eyes with water immediately while holding eyelids open. Remove contacts, if worn, after initial flushing and continue flushing for at least 15 minutes. Seek medical attention if irritation persists.
Skin Contact: Use soap and water to remove from the skin, remove contaminated clothing, clean thoroughly before reuse.
Inhalation: Move to fresh air. If not breathing, give rescue breathing. If breathing is difficult give oxygen. Seek medical attention if breathing is still difficult.
Ingestion: If swallowed, get medical attention immediately. DO NOT INDUCE VOMITING. Never give anything by mouth to an unconscious person.

DOUGLAS PRODUCTS

Section 5. Fire Fighting Measures

Flash Point: 130 °F
Flammability Limits: NE
Fire Fighting Media: Dry chemical, carbon dioxide, and water spray.
Special Fire Fighting Procedures: **First responders need to wear full-bunker gear with SCBA, never enter a confined space unless** fully protected with proper personal protective equipment (PPE).

Section 6. Accidental Release Measures

Clean-up Procedures: Wear proper PPE. Stop the source of the release if you are not put at risk. **Use non-**combustible absorbent material to absorb the spill, use non-sparking tools to consider proper disposal.
Spills and Leaks: Dispose in accordance to local, state or federal regulations.

Section 7. Handling and Storage

Handling: Do not get into eyes. Do not taste or swallow. Wash thoroughly after handling.
Storage: Store in original labeled container. Keep in cool and dry areas. Make sure that the containers do not pressurize due to extreme heat.

Section 8. Exposure Control/Personal Protection

Introductory Remarks: Consider the potential hazards of this product outlined in section 3. Use process exposures such as local exhaust ventilation, to control over exposure to airborne levels above recommended exposure limits.
Personal **Protection:**
Eyes: Wear safety goggles or safety glasses to prevent eye contact.
Body: Long sleeve shirts, long pants, socks, rubber boots **and chemical resistant gloves.**
Hands: Chemical resistant gloves
***Respiratory*: Wear an approved respirator that provides protection from this product if the airborne concentrations exceed the recommended exposure limits.**
***Other*: Keep out reach of children.**

Section 9. Physical and Chemical Properties

Odor	**Mild alcohol**	**Vapor Pressure**	**33 torr @ 20 °F**
Color	**Yellow**	**Vapor Density(air=1)**	**2.1**
Physical State	**Liquid**	**Specific Gravity (H_2O=1)**	**1.054 @ 20 °F**
pH	**7.1-7.8**	**Solubility**	**Complete n water**
Evaporation rate(water=1)	**1.7**	**Boiling Point**	**> 100 °F**

Section 10. Stability and Reactivity

Chemical Stability: Considered stable under normal ambient temperatures.
Hazardous Decomposition: At elevated temperatures one can get aldehydes. **If complete combustions oxides of carbon.**
Hazardous Polymerization: Will not occur
Incompatibility-- Materials to Avoid: May react with strong oxidizing agents, such as chlorates, nitrates or peroxides.

Material Safety Data Sheet
AEC-2(M3LF)

Section 11. Toxicological Information

Acute Eye Irritation: **May be irritating**
Acute Skin Irritation: Chronic exposure may be irritating
Acute Dermal Toxicity: Not expected to be toxic through the skin.
Acute Inhalation Toxicity: Not determined, expected to be an irritant to the respiratory system.
Carcinogenic Effects: None
Existing Medical Conditions Aggravated by Exposure: Exposure to inhalation, may cause respiratory problems **and depression of central nervous system.**

Section 12. Ecological Information

Ecotoxicity: The toxicity of this product has not been determined to aquatic organisms; this material should be kept out sewers, drainage systems and all bodies of water.
Environmental Fate: This product should be expected to be readily bio-degradable.

Section 13. Disposal Considerations

Waste Disposal Method: What ever cannot be saved for recovery or recycling should be managed by the local, state or Federal Regulations.
Container Handling and Disposal: All containers should be triple rinsed and disposed of according to local, state and Federal regulations.

Section 14. Transport Information

D.O.T. Classification: Not regulated by US DOT
Shipping Name: AEC-2(M3LF)
Technical Shipping Name: None
UNFIC: None
ID Number: None
Packaging Group: None
Labels: No US DOT Labels

Section 15. Regulatory Information

EPCRA 311/312 Categories:	Immediate (Acute) Health Effects:	Yes
	Delayed (Chronic) Health Effects:	Yes
	Fire Hazard:	Yes
	Sudden Release of Pressure	No
	Reactivity:	No

Right to know classification: Isopropyl alcohol is listed **in CA, PA, MN, MA, MI, FL and NJ.**
TSCA: Propylene glycol, ethanol
Reportable Quantity (RQ): None
Prop. 65: Not listed
WHMIS: Class D2, B (Skin or eye irritant)
Isopropyl alcohol is listed in chemical inventories in: ACIS, ECL, EEC, ENCS, EU, Israel, MAC, MAK, MITI, PICCS, SWISS, **Taiwan, USA and UK**

Abbreviations:

AICS	Australian Inventory of Chemical Substances
CAS #	Chemical Abstract Service Number

DOUGLAS PRODUCTS

May 1, 2001

09-06-13 1315 Jun
RECEIVED FROM UPS
PROJECT 9205 | SAMPLE 130906.02

Material Safety Data Sheet

Product Name: Acme /Gordon's BARRIER 50W Dichlobenil Herbicide

MSDS No.: 507-8 **Version No.:** 013 **EPA Registration No.:** 2217-676

1. Basic Information:

Manufacturer: PBI/Gordon Corporation
Address: 1217 West 12th Street
City, State Zip: Kansas City, MO 64101-1407
Information Contact: Environmental, Health, & Safety Dept.
Information Telephone Number: (816)421-4070
Emergency Contact: Chemtrec
Emergency Telephone Number: (800)424-9300

1	Health
1	Flammability
0	Reactivity
E	Pers. Protection

Last Update: 11/21/00

Chemical State: ☐ Liquid ☐ Gas ☒ Solid
Chemical Type: ☐ Pure ☒ Mixture

2. Ingredients:

☐ Trade Secret *(ND = Not Disclosed)*

CAS No.	Chemical Name	% Range	EHS	NTP	IARC	SUB Z	SARA 313	OSHA PEL	ACGIH TLV	Other Limits
1194656	2,6-Dichlorobenzonitrile (Dichlobenil)	50.0	N	N	N	N	N	NI	NI	NI
1332587	Kaolin clay	36.6	N	N	N	Y	N	5 mg/m3R	2 mg/m3R	5 mg/m3R
14808607	Quartz	<2	N	Y	Y	Y	N	0.1 mg/m3	.05 mg/m3	.05 mg/m3

3. Hazardous Identification:

Hazard Catagory:
☒ Acute ☒ Chronic ☐ Fire ☐ Pressure ☐ Reactive

Hazardous Identification Information:
Aromatic tan powder.

Irritant. May be harmful if absorbed through the skin, or if swallowed.

4. First Aid Measures:

Route(s) of Entry:
Contact, Inhalation, Ingestion.

Health Hazards (Acute and Chronic):
EYES: Contact may cause irritation.

SKIN: Contact may cause skin irritation. May be harmful if absorbed through the skin.

INHALATION: May cause irritation to the respiratory tract.

INGESTION: May cause irritation to the gastrointestinal tract. May be harmful if swallowed.

Signs and Symptoms:
NI

Medical Conditions Generally Aggravated by Exposure:
NI

Emergency **First Aid Procedure:**
EYES: Flush with clean water for 10-15 minutes, holding lids open. If irritation persists, seek medical attention.

SKIN: Bathe and shampoo with soap and water to remove chemicals from skin and hair. If irritation persists, seek medical attention. Launder contaminated clothing separately prior to reuse.

INHALATION: Remove victim to fresh air. Apply artificial respiration if

First Aid Measures (Continued)

needed. If irritation persists, seek medical attention.

INGESTION: Call physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Get medical attention.

Other Health Warnings:
Do not eat, drink or smoke when handling product. Avoid contact with skin, eyes and clothing.

5. Fire Fighting Measures:

Flash Point: NI **F.P. Method:**
Lower Explosive Limit: NI
Upper Explosive Limit: NI

Fire Extinguishing Media:
Foam, CO2, Dry Chemical, Water.

Special Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Unusual Fire and Explosion:
Extreme heat may release chloride and nitrogen oxide gases. Runoff from fire control may cause pollution to surface water. If pollution occurs, notify local authorities.

6. Accidental Release Measures:

Steps to be Taken in Case Material is Released or Spilled:
Do not touch spilled material. See Section 8 for Personal Protective Equipment. Contain and collect the spilled product for reuse or disposal. Cover and label the containers. Wash area with water if possible.

7. Handling and Storage:

Precautions to be Taken:
STORAGE: Do not contaminate water, food, or feed by storage or

Material Safety Data Sheet

Product Name: Acme /Gordon's BARRIER 50W Dichlobenil Herbicide

MSDS No.: 507-8 **Version No.:** 013 **EPA Registration No.:** 2217-676

Handling and Storage (Continued)

disposal.
Store product in original container only and in a locked storage area. For disposal, rinse thoroughly and securely wrap original container in several layers of newspaper and discard in trash. Do not reuse empty container.

Other Precautions:
NI

8. Exposure Controls/Personal Protection:

Ventilation Requirements:
Good local ventilation is required.

Personal Protective Equipment:
CAUTION: Harmful if swallowed or absorbed through the skin. Avoid breathing spray mist. Avoid contact with skin, eyes or clothing. Wear protective clothing including rubber gloves when handling.

PROTECTIVE CLOTHING: Wear long sleeves and pants; chemical-resistant gloves and shoes with socks.

EYE PROTECTION: Wear safety glasses or goggles.

RESPIRATORY PROTECTION: If exposure limits may be exceeded, wear a dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C), or a NIOSH approved respirator with any N, R, P or HE filter.

9. Physical and Chemical Properties:

Boiling Point: NI **Melting Point:** NI

Evaporation Rate (Butyl Acetate = 1) : NI

Vapor Pressure (mm Hg.): See below

Vapor Density (Air = 1): NI

Specific Gravity (H20 = 1): 0.00000

Solubility in Water: Wettable powder.

Appearance and Odor: Tan powder; aromatic.

Other Information:
NI

10. Stability and Reactivity:

Stability:
Stable.

Incompatibility (Materials to Avoid):
Strong oxidizing agents, and/or extreme heat.

Decomposition/By-Products:
Burning may produce chloride and nitrogen oxide gases.

Hazardous Polymerization:
Will not occur.

11. Toxicological Information:

Dermal LD50: >2 g/kg body weight.

12. Ecological Information:

Do not apply directly to lakes, ponds, or streams. Do not contaminate water when disposing of equipment washwater. For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not allow spray to drift onto nontarget crops or vegetation.

13. Disposal Considerations:

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

CONTAINER DISPOSAL: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by state and local authorities by burning. If burned stay out of smoke.

14. Transport Information:

The following guidelines apply for domestic ground transport. If shipping by air or ocean, please contact our Transportation Dept.

Freight Class: Herbicides, NOI - NMFC #50320

In our current available sizes, this product does not qualify as a Hazardous Material.

15. Regulatory Information:

OSHA STATUS: This product is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200.

TSCA STATUS: This product is exempt from TSCA Regulation under FIFRA Section 3(2)(B)(ii) when used as a pesticide.

CERCLA REPORTABLE QUANTITY: 200 pounds of the formulation which contains 100 pounds of Dichlobenil

SARA TITLE III:
SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: None
SECTION 311/312 HAZARD CATEGORIES: Immediate Health Hazard, Delayed Health Hazard
SECTION 313 TOXIC CHEMICALS: None

RCRA STATUS: If discarded in its purchased form, this product would not be a hazardous waste either by listing or by characteristic. However, 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. (40 CFR 261.20-24)

16. Other Information:

REASON FOR ISSUE: To revise MSDS to the ANSI Z400.1-1998 format

NOTE: NI means not indicated.

The information and statements in this Material Safety Data Sheet are believed to accurately reflect the scientific evidence used in making the hazard determination, but is not to be construed as a warranty or representation for which we assume legal responsibility. Additional information may be necessary or desirable depending on particular, exceptional or variable conditions or circumstances of use or storage or because of locally applicable laws or government regulations. Therefore, you should use this information only as a supplement to other information available to you and must make independent determinations of the suitability of the information for your particular circumstances or conditions and of the completeness of the information available from all sources to assure both the proper use of the material described herein, and the safety and health of employees.

ETS

48-Hour Acute Whole Effluent Toxicity Test (EPA-821-R-02-012, Method 2002.0)

Species: *Ceriodaphnia dubia*

Client: Cape Fear Public Utility
Product: DOUGLAS PRODUCTS

Application solution:
0.9440 g AEC-3 (M3LF) and 0.1800 g Acme / Gordon's BARRIER 50W Dichlobenil Herbicide diluted into 100 mL soft synthetic water

Project #: 9205

Dilution preparation information:		*Comments:*
Dilution prep (%)	0.00078125% to 0.20%	0.40% concentration prepared by diluting 0.80 mL application solution into 200 mL soft synthetic water.
Stock volume (mL)	Serial dilutions from 0.40% concentration.	
Diluent volume (mL)		
Total volume (mL)	200	

Test organism information:		*Test information:*	
Organism age:	< 24-HOURS OLD	Randomizing template:	WHITE
Date and times organisms were born between:	09-17-13 1658 TO 09-18-13 0620	Incubator number and shelf location:	1C1
Organism source:	09-10-13 A-C POOLED		
Transfer bowl information:	pH = 7.92 S.U. Temperature = 24.9 °C		
Average transfer volume:	0.1062 mL		

Daily feeding, renewal, or survival count information:

Hours	Date	Feeding		Test initiation, renewal, survival count, or termination		Sample numbers used	SSW Batch used
		Time	Analyst	Time	Analyst		
0	09-18-13	* 0620 1003	JH	Initiation 1250	JH	130906-01 130906-02	09-10-13
24	09-19-13			Survival count 1255	JH		
48	09-20-13			Survival count and renewal 1252	JH		

*In holding prior to test initiation.

Comments:

Test Results:	24-hour	48-hour
Method:	VISUAL INSP	VISUAL INSP
Upper control limit:	NC	NC
Lower control limit:	NC	NC
LC50 (median lethal concentration):	>0.40%	>0.40%

Species: *Ceriodaphnia dubia* Date: 09.18.13

Client: Cape Fear Public Utility – DOUGLAS PRODUCTS

Survival data (number of living organisms):

Hours	Control SSW					0.00078125%					0.0015625%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	
48 Termination	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	

Hours	0.003125%					0.00625%					0.0125%				
	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD
0	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	
48	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	

Hours	0.025%					0.05%					0.10%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	
48 Termination	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	

Hours	0.20%					0.40%				
	P	Q	R	S	T	U	V	W	X	Y
0	S	S	S	S		S	S	S	S	
24	S	S	S	4[d]		3[2d]	4[1d]	4[1d]	4[1d]	
	Mean mortality			~~25%~~ 5%		Mean mortality			25%	
48	4[d]	S	4	4		3	3[1d]	4	3[1d]	
	Mean mortality			~~75%~~ (50)		Mean mortality			35%	

Comment codes: c = clear, d = dead, sk = sick, sm = unusually small

Acute Daphnid Test-24 Hr Survival

Start Date:	9/18/2013	Test ID:	CdFRAC	Sample ID:	Douglas Products
End Date:	9/20/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	PRODUCT
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

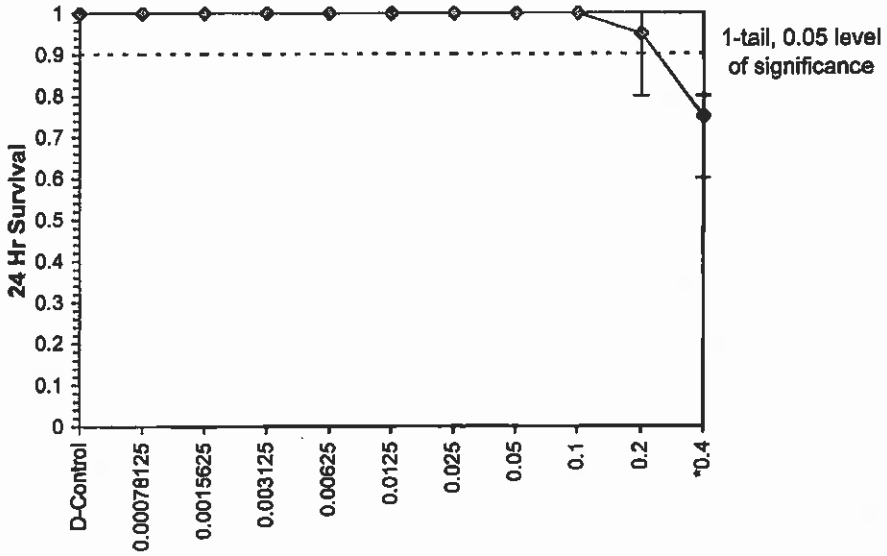
Conc-%	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
0.00078125	1.0000	1.0000	1.0000	1.0000
0.0015625	1.0000	1.0000	1.0000	1.0000
0.003125	1.0000	1.0000	1.0000	1.0000
0.00625	1.0000	1.0000	1.0000	1.0000
0.0125	1.0000	1.0000	1.0000	1.0000
0.025	1.0000	1.0000	1.0000	1.0000
0.05	1.0000	1.0000	1.0000	1.0000
0.1	1.0000	1.0000	1.0000	1.0000
0.2	1.0000	1.0000	1.0000	0.8000
0.4	0.6000	0.8000	0.8000	0.8000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			
0.00078125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.0015625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.003125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.00625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.0125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.025	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.05	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.1	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.2	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4	1.719	2.733	0.0947
*0.4	0.7500	0.7500	1.0519	0.8861	1.1071	10.508	4	8.471	2.733	0.0947

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.49148	0.924	-2.8103	11.2789
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.2	0.4	0.28284	500	0.04906	0.05165	0.03132	0.0024	7.9E-09	10, 33
Treatments vs D-Control										

Dose-Response Plot



ToxCalc v5.0.32

Reviewed by:

Acute Daphnid Test-48 Hr Survival

Start Date:	9/18/2013	Test ID:	CdFRAC	Sample ID:	Douglas Products
End Date:	9/20/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	PRODUCT
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

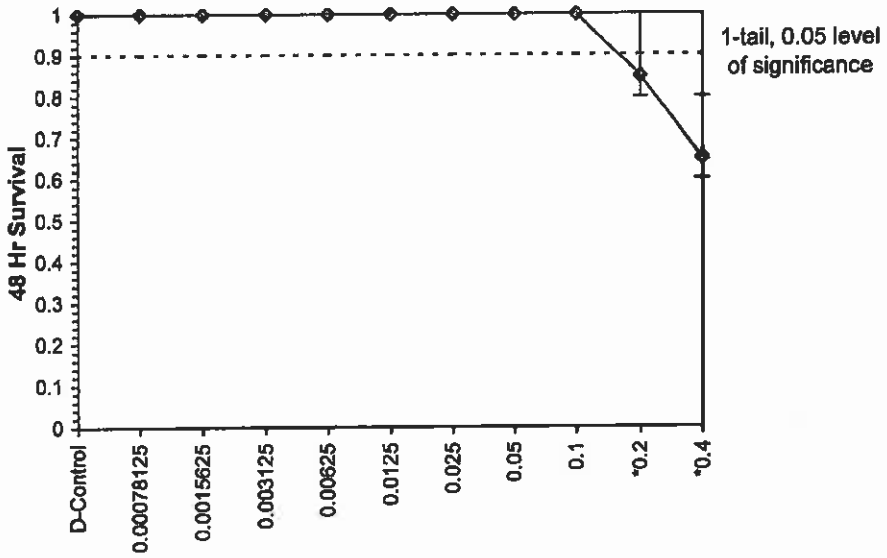
Conc-%	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
0.00078125	1.0000	1.0000	1.0000	1.0000
0.0015625	1.0000	1.0000	1.0000	1.0000
0.003125	1.0000	1.0000	1.0000	1.0000
0.00625	1.0000	1.0000	1.0000	1.0000
0.0125	1.0000	1.0000	1.0000	1.0000
0.025	1.0000	1.0000	1.0000	1.0000
0.05	1.0000	1.0000	1.0000	1.0000
0.1	1.0000	1.0000	1.0000	1.0000
0.2	0.8000	1.0000	0.8000	0.8000
0.4	0.6000	0.6000	0.8000	0.6000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			
0.00078125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.0015625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.003125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.00625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.0125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.025	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.05	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
0.1	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.0947
*0.2	0.8500	0.8500	1.1667	1.1071	1.3453	10.206	4	5.156	2.733	0.0947
*0.4	0.6500	0.6500	0.9413	0.8861	1.1071	11.742	4	11.662	2.733	0.0947

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.49148	0.924	2.81034	11.2789
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.1	0.2	0.14142	1000	0.04906	0.05165	0.06569	0.0024	3.7E-13	10, 33
Treatments vs D-Control										

Dose-Response Plot



ToxCalc v5.0.32

Reviewed by:

Species: *Ceriodaphnia dubia* **Date:** 09-18-13

Client: Cape Fear Public Utility – DOUGLAS PRODUCTS

Daily Chemistry:

		Hours						
		0	4	24	48	48	72	96
	Analyst	JL		JL	KW			
Conc. (%)	Parameter							
Control SSW	pH (S.U.)	7.52			7.69			
	DO (mg/L)	8.0			8.2			
	Conductivity (µmhos/cm)	156						
	Alkalinity (mg $CaCO_3$/L)	35						
	Hardness (mg $CaCO_3$/L)	42						
	Temperature (°C)	24.7		25.1	24.9			
0.00078125	pH (S.U.)	7.46			7.70			
	DO (mg/L)	7.9		*	8.2			
	Conductivity (µmhos/cm)	155						
	Temperature (°C)	24.7		24.9	25.2			
0.0015625	pH (S.U.)	7.46			7.70			
	DO (mg/L)	7.9		*	8.2			
	Conductivity (µmhos/cm)	157						
	Temperature (°C)	24.8		24.9	25.0			
0.003125	pH (S.U.)	7.47			7.69			
	DO (mg/L)	8.0		*	8.2			
	Conductivity (µmhos/cm)	157						
	Temperature (°C)	24.8		25.1	25.1			
0.00625	pH (S.U.)	7.47			7.69			
	DO (mg/L)	8.0		*	8.2			
	Conductivity (µmhos/cm)	157						
	Temperature (°C)	24.8		25.1	25.0			
0.0125	pH (S.U.)	7.48			7.69			
	DO (mg/L)	8.0		*	8.2			
	Conductivity (µmhos/cm)	157						
	Temperature (°C)	24.8		24.8	25.2			
0.025	pH (S.U.)	7.48			7.69			
	DO (mg/L)	8.0		*	8.2			
	Conductivity (µmhos/cm)	156						
	Temperature (°C)	24.8		24.8	25.0			
0.05	pH (S.U.)	7.47			7.69			
	DO (mg/L)	8.0		*	8.3			
	Conductivity (µmhos/cm)	156						
	Temperature (°C)	24.8		24.8	25.0			
0.10	pH (S.U.)	7.47			7.69			
	DO (mg/L)	8.0		*	8.3			
	Conductivity (µmhos/cm)	156						
	Temperature (°C)	24.8		24.8	25.2			
0.20	pH (S.U.)	7.48			7.68			
	DO (mg/L)	8.0		*	8.3			
	Conductivity (µmhos/cm)	158						
	Temperature (°C)	24.8		24.8	24.9			
0.40	pH (S.U.)	7.48			7.68			
	DO (mg/L)	8.0		*	8.3			
	Conductivity (µmhos/cm)	156						
	Temperature (°C)	24.8		24.9	25.0			
		Initial Test Initiation	Final	* Final	Final	Initial Renewal	Final	Final

* INTERMEDIATE CHEMISTRY WAS NOT PERFORMED DUE TO LIMITED VOLUME.

JL

48-Hour Acute Whole Effluent Toxicity Test (EPA-821-R-02-012, Method 2002.0)
Species: *Ceriodaphnia dubia*

Client: Cape Fear Public Utility
Product: DOUGLAS PRODUCTS

Application solution:
0.9440 g AEC-3 (M3LF) and 0.1800 g Acme / Gordon's BARRIER 50W Dichlobenil Herbicide diluted into 100 mL ~~soft synthetic water~~ LOUGHLIN EFFLUENT

Project #: 9282 | 9205

Dilution preparation information:		*Comments:*
Dilution prep (%)	0.0015625% to 0.80%	1.60% concentration prepared by diluting 3.20 mL application solution into 200 mL ~~soft synthetic water~~ LOUGHLIN EFFLUENT
Stock volume (mL)	Serial dilutions from 1.60% concentration.	
Diluent volume (mL)		
Total volume (mL)	200	

Test organism information:		*Test information:*	
Organism age:	< 24 HOURS OLD	Randomizing template:	ORANGE
Date and times organisms were born between:	09-24-13 1650 TO 09-25-13 0715	Incubator number and shelf location:	2B2
Organism source:	09-17-13 A+B POOLED		
Transfer bowl information:	pH = 7.89 S.U. Temperature = 24.9 °C		
Average transfer volume:	0.1062 mL		

Daily feeding, renewal, or survival count information:

Hours	Date	Feeding		Test initiation, renewal, survival count. or termination		Sample numbers used	SSW Batch used
		Time	Analyst	Time	Analyst		
0	09-25-13	* 0715 / 1005	JH	Initiation 1235	JH	* see COMMENTS	09-14-13
24	09-26-13			Survival count 1245	JH		
48	09-27-13			Survival count and renewal 1230	JH		

*In holding prior to test initiation.

Comments: * LOUGHLIN EFFLUENT = 130925.02
PRODUCTS = 130906.01 & 130906.02

Test Results:	24-hour	48-hour
Method:	PROBIT	PROBIT
Upper control limit:	1.03%	0.80%
Lower control limit:	0.72%	0.57%
LC50 (median **lethal** concentration):	0.86%	0.67%

Survival data (number of living organisms):

Hours	Laboratory QC SSW				
	A	B	C	D	E
0 Initiation	5	5	5	5	
24	5	5	5	5	
	Mean mortality			0%	
48 Termination	5	5	5	5	
	Mean mortality			0%	

Species: *Ceriodaphnia dubia* Date: 09-25-13

Client: Cape Fear Public Utility – DOUGLAS PRODUCTS

Survival data (number of living organisms):

Hours	Control Loughlin Effluent					0.0015625%					0.003125%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	
48 Termination	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	

Hours	0.00625%					0.0125%					0.025%				
	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD
0	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	
48	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	

Hours	0.05%					0.10%					0.20%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	
48 Termination	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	

Hours	0.40%					0.80%					1.60%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	4[4th]	S		4[4th]	3[2nd]	3[2nd]	4[4th]		0[5th]	0[5th]	0[5th]	0[5th]	
	Mean mortality			5%		Mean mortality			30%		Mean mortality			100%	
48 Termination	S	S	4	S		1[2nd]	1[2nd]	2[1st]	2[2nd]		0	0	0	0	
	Mean mortality			5%		Mean mortality			70%		Mean mortality			100%	

Comment codes: c = clear, d = dead, sk = sick, sm = unusually small

Acute Daphnid Test-24 Hr Survival

Start Date:	9/25/2013	Test ID:	CdFRAC	Sample ID:	Douglas Products
End Date:	9/27/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4
Loughlin	1.0000	1.0000	1.0000	1.0000
SSW-Lab QC	1.0000	1.0000	1.0000	1.0000
0.0015625	1.0000	1.0000	1.0000	1.0000
0.003125	1.0000	1.0000	1.0000	1.0000
0.00625	1.0000	1.0000	1.0000	1.0000
0.0125	1.0000	1.0000	1.0000	1.0000
0.025	1.0000	1.0000	1.0000	1.0000
0.05	1.0000	1.0000	1.0000	1.0000
0.1	1.0000	1.0000	1.0000	1.0000
0.2	1.0000	1.0000	1.0000	1.0000
0.4	1.0000	1.0000	0.8000	1.0000
0.8	0.8000	0.6000	0.6000	0.8000
1.6	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
Loughlin	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*			0	20
SSW-Lab QC	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4					
0.0015625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017	0	20
0.003125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017	0	20
0.00625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017	0	20
0.0125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017	0	20
0.025	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017	0	20
0.05	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017	0	20
0.1	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017	0	20
0.2	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017	0	20
0.4	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4	1.600	2.733	0.1017	1	20
*0.8	0.7000	0.7000	0.9866	0.8861	1.1071	12.807	4	9.369	2.733	0.1017	6	20
1.6	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20

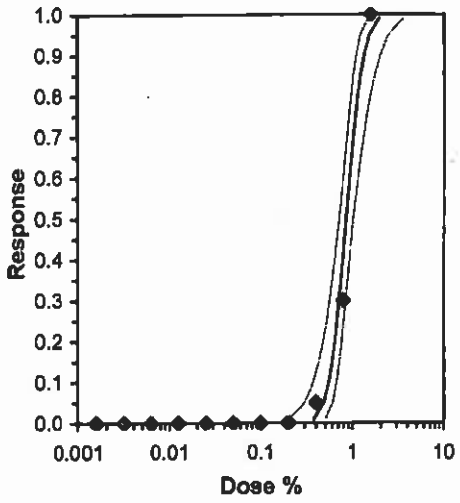
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.59843	0.924	-1.2589	6.55712
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.4	0.8	0.56569	250	0.05331	0.05612	0.04399	0.00277	6.5E-10	10, 33
Treatments vs Loughlin										

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	6.51856	1.4	3.77457	9.26256	0	3.64788	16.919	0.93302	-0.0633	0.15341	5
Intercept	5.41263	0.25011	4.92241	5.90285							
TSCR											

Point	Probits	%	95% Fiducial Limits	
EC01	2.674	0.38003	0.2019	0.50245
EC05	3.355	0.48347	0.30197	0.6031
EC10	3.718	0.54967	0.37264	0.66764
EC15	3.964	0.59938	0.42815	0.71719
EC20	4.158	0.64208	0.47689	0.76113
EC25	4.326	0.68113	0.52183	0.80291
EC40	4.747	0.79038	0.64534	0.93206
EC50	5.000	0.86437	0.72352	1.03337
EC60	5.253	0.94529	0.80183	1.15903
EC75	5.674	1.09691	0.93031	1.43413
EC80	5.842	1.16362	0.98124	1.56951
EC85	6.036	1.24651	1.04122	1.74841
EC90	6.282	1.35925	1.11838	2.00909
EC95	6.645	1.54537	1.23793	2.4795
EC99	7.326	1.96599	1.48575	3.70885

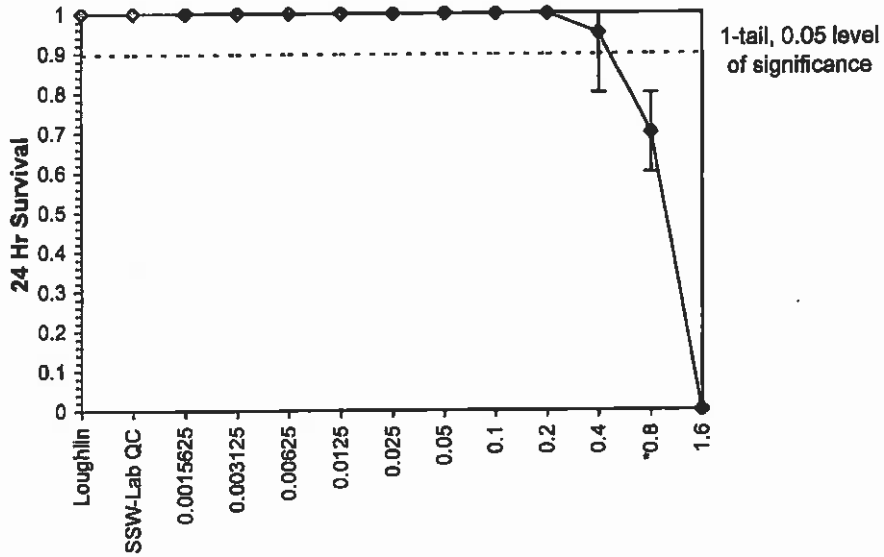


Reviewed by:

Acute Daphnid Test-24 Hr Survival

Start Date:	9/25/2013	Test ID:	CdFRAC	Sample ID:	Douglas Products
End Date:	9/27/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Reviewed by:

Acute Daphnid Test-48 Hr Survival

Start Date:	9/25/2013	Test ID:	CdFRAC	Sample ID:	Douglas Products
End Date:	9/27/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4
Loughlin	1.0000	1.0000	1.0000	1.0000
SSW-Lab QC	1.0000	1.0000	1.0000	1.0000
0.0015625	1.0000	1.0000	1.0000	1.0000
0.003125	1.0000	1.0000	1.0000	1.0000
0.00625	1.0000	1.0000	1.0000	1.0000
0.0125	1.0000	1.0000	1.0000	1.0000
0.025	1.0000	1.0000	1.0000	1.0000
0.05	1.0000	1.0000	1.0000	1.0000
0.1	1.0000	1.0000	1.0000	1.0000
0.2	1.0000	1.0000	1.0000	1.0000
0.4	1.0000	1.0000	0.8000	1.0000
0.8	0.2000	0.2000	0.4000	0.4000
1.6	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed			Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD		Resp	Number
Loughlin	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*				0	20
SSW-Lab QC	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4						
0.0015625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017		0	20
0.003125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017		0	20
0.00625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017		0	20
0.0125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017		0	20
0.025	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017		0	20
0.05	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017		0	20
0.1	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017		0	20
0.2	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.733	0.1017		0	20
0.4	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4	1.600	2.733	0.1017		1	20
*0.8	0.3000	0.3000	0.5742	0.4636	0.6847	22.229	4	20.721	2.733	0.1017		14	20
1.6	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4					20	20

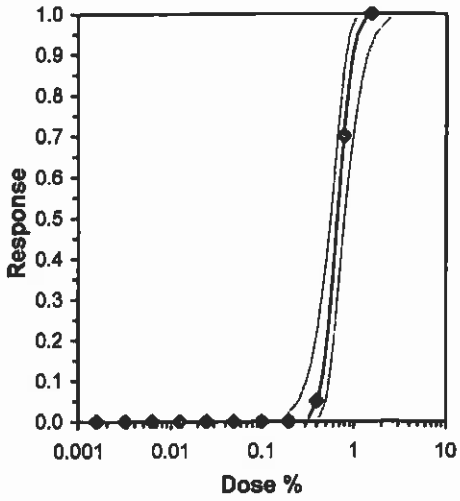
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.59843	0.924	-1.2589	6.55712
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.4	0.8	0.56569	250	0.05331	0.05612	0.21417	0.00277	5.8E-20	10, 33
Treatments vs Loughlin										

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	7.43072	1.67529	4.14716	10.7143	0	0.07012	16.919	1	-0.1714	0.13458	3
Intercept	6.27328	0.37477	5.53874	7.00783							
TSCR											

Point	Probits	%	95% Fiducial Limits	
EC01	2.674	0.32777	0.17772	0.42414
EC05	3.355	0.40484	0.25633	0.49703
EC10	3.718	0.45308	0.31038	0.54299
EC15	3.964	0.48884	0.3522	0.57794
EC20	4.158	0.51926	0.38853	0.6087
EC25	4.326	0.54686	0.42175	0.63778
EC40	4.747	0.62309	0.5119	0.72677
EC50	5.000	0.67398	0.56815	0.79589
EC60	5.253	0.72902	0.62377	0.88109
EC75	5.674	0.83065	0.71312	1.06596
EC80	5.842	0.8748	0.74784	1.1561
EC85	6.036	0.92923	0.78826	1.27437
EC90	6.282	1.00257	0.83958	1.44505
EC95	6.645	1.12203	0.91784	1.74859
EC99	7.326	1.38585	1.07626	2.52041



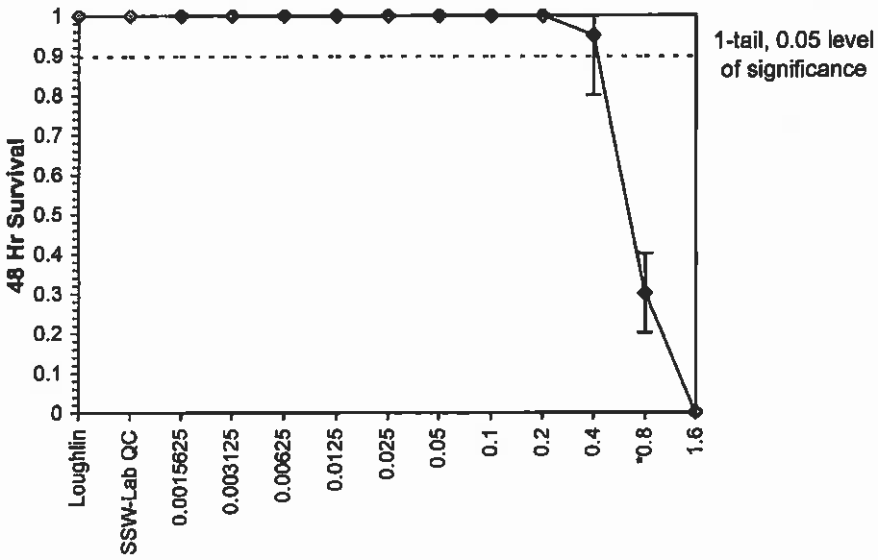
ToxCalc v5.0.32

Reviewed by:

Acute Daphnid Test-48 Hr Survival

Start Date:	9/25/2013	Test ID:	CdFRAC	Sample ID:	Douglas Products
End Date:	9/27/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Reviewed by:

Species: *Ceriodaphnia dubia* Date: 09.25.13

Client: Cape Fear Public Utility – DOUGLAS PRODUCTS

Daily Chemistry:

		Hours						
		0	4	24	48	48	72	96
	Analyst	KW		X	KW			
Conc. (%)	Parameter							
Control SSW	pH (S.U.)	7.51			7.84			
	DO (mg/L)	8.0		X	7.9			
	Conductivity (µmhos/cm)	160						
	Alkalinity (mg $CaCO_3$/L)	33						
	Hardness (mg $CaCO_3$/L)	40						
	Temperature (°C)	24.8		24.9	24.7			
Control Loughlin Effluent	pH (S.U.)	7.54			8.05			
	DO (mg/L)	8.3		X	7.8			
	Conductivity (µmhos/cm)	745						
	Temperature (°C)	25.0		25.2	24.8			
0.0015625	pH (S.U.)	7.61			8.05			
	DO (mg/L)	8.3		X	7.8			
	Conductivity (µmhos/cm)	750						
	Temperature (°C)	25.1		24.8	24.7			
0.003125	pH (S.U.)	7.61			8.05			
	DO (mg/L)	8.3		X	7.9			
	Conductivity (µmhos/cm)	745						
	Temperature (°C)	25.0		25.1	24.9			
0.00625	pH (S.U.)	7.62			8.05			
	DO (mg/L)	8.3		X	7.9			
	Conductivity (µmhos/cm)	746						
	Temperature (°C)	25.0		25.1	24.9			
0.0125	pH (S.U.)	7.63			8.05			
	DO (mg/L)	8.3		X	7.9			
	Conductivity (µmhos/cm)	746						
	Temperature (°C)	25.0		25.1	25.0			
0.025	pH (S.U.)	7.63			8.05			
	DO (mg/L)	8.3		X	7.8			
	Conductivity (µmhos/cm)	749						
	Temperature (°C)	25.0		25.0	24.8			
0.05	pH (S.U.)	7.63			8.05			
	DO (mg/L)	8.4		X	7.8			
	Conductivity (µmhos/cm)	7.54						
	Temperature (°C)	25.1		24.8	24.8			
0.10	pH (S.U.)	7.63			8.04			
	DO (mg/L)	8.4		X	7.9			
	Conductivity (µmhos/cm)	743						
	Temperature (°C)	25.0		24.8	24.8			
0.20	pH (S.U.)	7.63			8.05			
	DO (mg/L)	8.5		X	7.9			
	Conductivity (µmhos/cm)	743						
	Temperature (°C)	25.0		24.8	25.1			
0.40	pH (S.U.)	7.65			8.04			
	DO (mg/L)	8.5		X	7.9			
	Conductivity (µmhos/cm)	747						
	Temperature (°C)	25.0		24.9	24.9			
0.80	pH (S.U.)	7.66			8.03			
	DO (mg/L)	8.6		X	7.9			
	Conductivity (µmhos/cm)	750						
	Temperature (°C)	25.0		25.0	24.9			
1.60	pH (S.U.)	7.66			8.04			
	DO (mg/L)	8.6		X	7.9			
	Conductivity (µmhos/cm)	759						
	Temperature (°C)	25.2		24.9	25.0			
		Initial Test Initiation	Final	Final	Final	Initial Renewal	Final	Final

* INTERMEDIATE CHEMISTRY WAS NOT PERFORMED DUE TO LIMITED VOLUME. JH

From: (918) 583-1155
Rebecca Dykes
Industrial Oils Unlimited
3633 Charles Page Blvd

Tulsa, OK 74127

FedEx Ground

Ship Date: 06SEP13
Act/Wgt: 2.0 LB
CAD: 104905413/INET3430

Invoice #
Reference #
PO #
Dept #
Ship ID

SHIP TO: (828) 350-9364
Jim Sumner, Lab Manager
Enviromental Testing Solutions, Inc

351 Depot Street

ASHEVILLE, NC 28801

(9612019) 0290598 15002186

GND 019 1 of 1
Prepaid

After printing this label:
1. Use the 'Print' button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

Warning: IMPORTANT: TRANSMIT YOUR SHIPPING DATA AND PRINT A MANIFEST:
At the end of each shipping day, you should perform the FedEx Ground End of Day Close procedure to transmit your shipping data to FedEx. To do so, click on the Ground End of Day Close Button. If required, print the pickup manifest that appears. A printed manifest is required to be tendered along with your packages if they are being picked up by FedEx Ground. If you are dropping your packages off at a FedEx drop off location, the manifest is not required.
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DUKES ROOT CONTROL

project # 9220
sample # 130910.13

KDL ETS 09.10.13 1015

MATERIAL DATA SAFETY SHEET

PRODUCT TRADE NAME:	CORNFOAM
REVISION DATE:	01/11/01
TRANSPORTATION:	EMERGENCY PHONE NUMBER (CHEMTRAC) : 800 424 9300
CHEMICAL NAME:	Mixture of Surfactants and coupling agents

SECTION 1 HAZARDOUS INGREDIENTS

This material is not known to contain any chemical listed as a carcinogen by OSHA, IARC or the National Toxicology Program (NIP) at a concentration greater than o.1%.

SECTION 2 FIRE & EXPLOSION HAZARDS

FLASH POINT, °F :	> 200 Pensky--Martin closed cup
FLAMMABLE LIMITS:	N/D
EXTINGUISHING MEDIA:	Dry chemical or waterspray or waterfog or CO2 or Foam or Sand/Earth
SPECIAL FIREFIGHTING PROCEDURES:	N/D
UNUSUAL FIRE & EXPLOSION HAZARDS:	N/D

SECTION 3 HEALTH HAZARD DATA

ORAL TOXICITY:	Irritation and respiratory discomfort.
EYE IRRITATION:	Severe irritation.
SKIN IRRITATION:	Mild to moderate irritation.
PERMISSIBLE CONCENTRATIONS:	
CHRONIC EFFECTS OF OVEREXPOSURE:	No data available.

ACUTE TOXICOLOGICAL PROPERTIES: Mild to moderate irritation.

EMERGENCY FIRST AID PROCEDURES:

SKIN:	Immediately flush with large quantities of water for at least 15 minutes.
EYE:	Immediately flush with large quantities of water for at least 15 minutes.
INHALATION:	Remove to fresh air. If breathing is difficult, give oxygen and call a physician.
ORAL:	If swallowed, call a physician.
ADDITIONAL:	N/D

SECTION 4 SPECIAL PROTECTION INFORMATION

VENTILATION PROCEDURE:	Local, mechanical, special.

GLOVE PROTECTION:	Rubber or plastic, solvent resistant.
EYE PROTECTION:	Chemical safety goggles.
OTHER PROTECTION:	Neoprene protective type apron.

SECTION 5 PHYSICAL DATA

VAPOR PRESSURE:	No data available	VAPOR DENSITY:	N/D
SPECIFIC GRAVITY:	@ 20°C 1.02	EVAPORATION RATE:	N/D
WATER SOLUBILITY:	Soluble	ODOR:	Sweet
PERCENT VOLATILE:	48	APPEARANCE:	Clear liquid
COLOR: Yellow		pH	7
FORM:	Liquid		

PRODUCT TRADE NAME: CORNFOAM

SECTION 6 STABILITY

STABILITY:	Product is stable under normal conditions.
INCOMPATIBILITY:	Keep away from strong oxidizers such as hydrogen peroxide, bromine, and chromic acid.
POLYMERIZATION:	Not applicable.
THERMAL DECOMPOSITION:	Carbon monoxide and carbon dioxide from burning.

SECTION 7 SPILL OR LEAK PROCEDURES

SPILL PROCEDURES:	Absorb with an inert material such as sand, soil or vermiculite; and sweep up and dispose in accordance with federal, state and local regulations.
WASTE DISPOSAL:	Dispose of in accordance with all applicable federal, state and local regulations.

SECTION 8 SPECIAL PRECAUTIONS

SPECIAL PRECAUTIONS:	Precautions to be taken in handling and storage: Store between 40°F and 120°F.

SECTION 9 TRANSPORTATION AND LABELING

DOT PROPER SHIPPING NAME:	Adjuvant spreader, sticker
DOT HAZARD CLASS:	Not hazardous

SECTION 10 OTHER REGULATOR INFORMATION

SECTION 313 (Title III Superfund Amendment and Reauthorization Act) .

THIS PRODUCT DOES NOT CONTAIN ANY CHEMICAL SUBJECT TO THE REPORTING REQUIREMENTS OF SECTION 313 OF TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 AND 40 CFR PART 372

CONTAINS HEXYLENE GLYCOL UP TO 20% MAXIMUM

The information presented herein has been compiled from sources considered to be dependable and is accurate to the best of Kalo's knowledge; however, Kalo makes no warranty whatsoever, expressed or implied, of merchantability or fitness for the particular purpose, regarding the accuracy of such responsibility for injury to recipient or to third persons or for any damage to any property and recipient assumes all such risks.

Syngenta Crop Protection Inc.
410 Swing Road
Greensboro, NC 27409
Tel. 336-632-6000

Transport Order

Requester:	Cosky Steven (COSKYSW_I)	**Cost Center:**	SKB48274
Identifier:	365062	**Shipment:**	Airfreight
To:	Jim Sumner, Lab Manager	**Date Ordered:**	09/05/2013
Phone:	(828) 350-9364	**Date Needed:**	09/12/2013
Delivery Address:		**GLP (Y/N):**	N

Environmental Testing Solutions, Inc.
351 Depot Street
Asheville, NC 28801
United States

Study Number: **Test Number:**

External Remarks: Sample requested per Bill Anderson, Duke.

Request Identifier - 365062

CONFIG	QTY	UNIT	PRODUCT	DESIGN CODE	BATCH ID	Hazardous Material
1	100	ML	REWARD MFG CONC	A12872A	692131	UN:1760,PG: III

09-09-13 1600
RECEIVED FROM UPS
PROJECT 9201
SAMPLE 130909-02

DUKES ROOT CONTROL

Your safety and satisfaction are our highest priorities. **Please review the enclosed MSDSs prior to handling your materials.**

Any questions or concerns regarding this shipment may be directed to the Syngenta Logistical Services group using the contact information below.

Email: gso.samples@syngenta.com

Fax: (336) 632-7690
ATTN: Logistical Services

Mail: Syngenta Crop Protection, LLC
ATTN: Logistical Services
410 Swing Road
Greensboro, NC 27409

syngenta

MATERIAL SAFETY DATA SHEET

Syngenta Crop Protection, LLC
Post Office Box 18300
Greensboro, NC 27419

In Case of Emergency, Call
1-800-888-8372

1. PRODUCT IDENTIFICATION

Product Name: **REWARD MANUFACTURING CONCENTRATE** Product No.: A12872A

EPA Signal Word: Caution

Active Ingredient(%): Diquat Dibromide (37.3%) CAS No.: 85-00-7

Chemical Name: [6,7-dihydrodipyrido(1,2-a:2',1'-c)pyrazinediium dibromide]

Chemical Class: Bipyridilium (dipyridilium) contact herbicide

EPA Registration Number(s): 100-1063 **Section(s) Revised: 14**

2. HAZARDS IDENTIFICATION

Health and Environmental

Toxic if inhaled. Harmful if swallowed. Causes mild eye and skin irritation.

Hazardous Decomposition Products

Flammable hydrogen gas may be formed on contact with aluminum. See "Conditions to Avoid", Section 10.

Physical Properties

Appearance: Dark brown liquid

Odor: Odorless

Unusual Fire, Explosion and Reactivity Hazards

This product may form flammable and explosive hydrogen gas when in contact with aluminum.

During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Material	OSHA PEL	ACGIH TLV	Other	NTP/IARC/OSHA Carcinogen
Diquat Dibromide (37.3%)	Not Established	0.5 mg/m³ TWA	0.5 mg/m³ TWA (0.5 total; 0.08 respirable) ***	No

*** Syngenta Occupational Exposure Limit (OEL)

Ingredients not precisely identified are proprietary or non-hazardous. Values are not product specifications.
Syngenta Hazard Category: C, S

4. FIRST AID MEASURES

Have the product container, label or Material Safety Data Sheet with you when calling Syngenta (800-888-8372), a poison contol center or doctor, or going for treatment.

Ingestion:	If swallowed: Call Syngenta (800-888-8372), a poison control center or doctor immediately for treatment advice. Have the person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so after calling 800-888-8372 or by a poison control center or doctor. Do not give anything by mouth to an unconscious person.
Eye Contact:	If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after 5 minutes, then continue rinsing eye. Call Syngenta (800-888-8372), a poison control center or doctor for treatment advice.
Skin Contact:	If on skin or clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call Syngenta (800-888-8372), a poison control center or doctor for treatment advice.
Inhalation:	If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call Syngenta (800-888-8372), a poison control center or doctor for further treatment advice.

Notes to Physician

To be effective, treatment for ingestion of the product must begin IMMEDIATELY. Treatment consists of binding the active ingredient, diquat, in the gut with suspensions of activated charcoal or bentonite clay, administration of cathartics to enhance elimination and removal of diquat from the blood by charcoal hemoperfusion or continuous hemodialysis.

Medical Condition Likely to be Aggravated by Exposure

None known.

5. FIRE FIGHTING MEASURES

Fire and Explosion

Flash Point (Test Method):	Not Applicable	
Flammable Limits (% in Air):	Lower: Not Applicable	Upper: Not Applicable
Autoignition Temperature:	Not Applicable	
Flammability:	Not Applicable	

Unusual Fire, Explosion and Reactivity Hazards

This product may form flammable and explosive hydrogen gas when in contact with aluminum.

During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

In Case of Fire

Use dry chemical, foam or CO2 extinguishing media. Wear full protective clothing and self-contained breathing apparatus. Evacuate nonessential personnel from the area to prevent human exposure to fire, smoke, fumes or products of combustion. Prevent use of contaminated buildings, area, and equipment until decontaminated. Water runoff can cause environmental damage. If water is used to fight fire, dike and collect runoff.

6. ACCIDENTAL RELEASE MEASURES

In Case of Spill or Leak

Control the spill at its source. Contain the spill to prevent from spreading or contaminating soil or from entering sewage and drainage systems or any body of water. Clean up spills immediately, observing precautions outlined in Section 8. Cover entire spill with absorbing material and place into compatible disposal container. Scrub area with hard water detergent (e.g. commercial products such as Tide, Joy, Spic and Span). Pick up wash liquid with additional absorbent and place into compatible disposal container. Once all material is cleaned up and placed in a disposal container, seal container and arrange for disposition.

7. HANDLING AND STORAGE

This product reacts with aluminum to produce flammable hydrogen gas. Do not mix or store in containers or systems made of aluminum or having aluminum fittings.

Store the material in a well-ventilated, secure area out of reach of children and domestic animals. Do not store food, beverages or tobacco products in the storage area. Prevent eating, drinking, tobacco use, and cosmetic application in areas where there is a potential for exposure to the material. Wash thoroughly with soap and water after handling.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

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

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

Ingestion:	Prevent eating, drinking, tobacco usage and cosmetic application in areas where there is a potential for exposure to the material. Wash thoroughly with soap and water after handling.
Eye Contact:	Where eye contact is likely, use chemical splash goggles.
Skin Contact:	Where contact is likely, wear chemical-resistant gloves (such as barrier laminate, butyl rubber, nitrile rubber, neoprene rubber, natural rubber, polyvinyl chloride [PVC] or Viton), coveralls, socks and chemical-resistant footwear.
Inhalation:	A respirator is not normally required when handling this substance. Use effective engineering controls to comply with occupational exposure limits. In case of emergency spills, use a NIOSH approved respirator with any N, R, P or HE filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Dark brown liquid
Odor:	Odorless
Melting Point:	Not Applicable
Boiling Point:	Not Available
Specific Gravity/Density:	1.202 g/ml @ 68°F (20°C)
pH:	4 - 6

Solubility in H2O

Diquat Dibromide: 718,000 mg/l @ 68°F (20°C) and pH 7.2

Vapor Pressure

Diquat Dibromide: < 10(-8) mmHg @ 77°F (25°C)

10. STABILITY AND REACTIVITY

Stability:	Stable under normal use and storage conditions.
Hazardous Polymerization:	Will not occur.
Conditions to Avoid:	Concentrate should not be stored in aluminum containers. Spray solutions should not be mixed, stored or applied in containers other than plastic, plastic-lined steel, stainless steel or fiberglass.
Materials to Avoid:	Strong alkalis and anionic wetting agents (e.g., alkyl and alkylaryl sulfonates). Corrosive to aluminum.
Hazardous Decomposition Products:	Flammable hydrogen gas may be formed on contact with aluminum. See "Conditions to Avoid", Section 10.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity/Irritation Studies (Finished Product)

Ingestion:		
	Oral (LD50 Female Rat) :	886 mg/kg body weight
Dermal:		
	Dermal (LD50 Rabbit) :	> 5050 mg/kg body weight
Inhalation:		
	Inhalation (LC50 Rat) :	0.62 mg/l air - 4 hours
Eye Contact:	Mildly Irritating (Rabbit)	
Skin Contact:	Slightly Irritating (Rabbit)	
Skin Sensitization:	Not a Sensitizer (Guinea Pig)	

Reproductive/Developmental Effects

Diquat Dibromide: Mutagenicity: No evidence in in vivo assays.
Development Toxicity: In rabbit studies a small percentage of fetuses had minor defects at 3 and 10 mg ion/kg/d.

Chronic/Subchronic Toxicity Studies

Diquat Dibromide: Kidney weight decreases and cataracts seen in dogs at 12.5 mg ion/kg/d.
No evidence for neurotoxic effects in rats dosed up to 400 ppm ion in the diet for 13 weeks.

Carcinogenicity

Diquat Dibromide: No evidence of carcinogenicity in rat and mouse studies.

Other Toxicity Information

None

Toxicity of Other Components

Not Applicable

Target Organs

Active Ingredients

Diquat Dibromide: Eye, kidney

Inert Ingredients

Not Applicable

12. ECOLOGICAL INFORMATION

Ecotoxicity Effects

Diquat Dibromide:

Fish (Rainbow Trout) 96-hour LC50 14.83 ppm

Invertebrate (Water Flea) Daphnia Magna 48-hour EC50 0.77 ppm

Green Algae 4-day EC50 9.4 ppb

Bird (Mallard Duck) 14-day LD50 60.6 mg/kg

Environmental Fate

Diquat Dibromide:

The information presented here is for the active ingredient, diquat dibromide.
Stable in soil and water. Immobile in soil. Sinks in water (after 24 h).

13. DISPOSAL CONSIDERATIONS

Disposal

Do not reuse product containers. Dispose of product containers, waste containers, and residues according to local, state, and federal health and environmental regulations.

Characteristic Waste: Not Applicable

Listed Waste: Not Applicable

14. TRANSPORT INFORMATION

DOT Classification

Ground Transport - NAFTA

Proper Shipping Name: Corrosive Liquid, N.O.S. (Diquat Dibromide)
Hazard Class: Class 8
Identification Number: UN 1760
Packing Group: PG III

Comments

Water Transport - International
Proper Shipping Name: Corrosive Liquid, N.O.S. (Diquat Dibromide), Marine Pollutant
Hazard Class: Class 8
Identification Number: UN 1760
Packing Group: PG III

Air Transport
Proper Shipping Name: Corrosive Liquid, N.O.S. (Diquat Dibromide)
Hazard Class: Class 8
Identification Number: UN 1760
Packing Group: PG III

15. REGULATORY INFORMATION

EPCRA SARA Title III Classification

Section 311/312 Hazard Classes: Acute Health Hazard

Section 313 Toxic Chemicals: Not Applicable

California Proposition 65

None

CERCLA/SARA 302 Reportable Quantity (RQ)

Report product spills >= 268 gal. (based on diquat [RQ = 1,000 lbs.] content in the formulation)

RCRA Hazardous Waste Classification (40 CFR 261)

Not Applicable

TSCA Status

Exempt from TSCA, subject to FIFRA

16. OTHER INFORMATION

NFPA Hazard Ratings		HMIS Hazard Ratings	
Health:	2	Health:	2
Flammability:	1	Flammability:	1
Instability:	0	Reactivity:	0

0	Minimal
1	Slight
2	Moderate
3	Serious
4	Extreme

For non-emergency questions about this product call:

1-800-334-9481

Original Issued Date: 4/11/2002
Revision Date: 2/4/2011 Replaces: 7/13/2010

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

End of MSDS

ETS

48-Hour Acute Whole Effluent Toxicity Test (EPA-821-R-02-012, Method 2002.0)
Species: *Ceriodaphnia dubia*

Client: Cape Fear Public Utility
Product: DUKE'S ROOT CONTROL

Project #: ~~9205~~ (09-18-13) 9207 + 9220

Application solution:
1.0000 g CORNFOAM and 0.5000 g REWARD MANUFACTURING CONCENTRATE (Diquat Dibromide) diluted into 100 mL soft synthetic water

Dilution preparation information:		*Comments:*
Dilution prep (%)	0.00078125% to 0.20%	0.40% concentration prepared by diluting 0.80 mL application solution into 200 mL soft synthetic water.
Stock volume (mL)	Serial dilutions from 0.40% concentration.	
Diluent volume (mL)		
Total volume (mL)	200	

Test organism information:	
Organism age:	< 24-HOURS OLD
Date and times organisms were born between:	09-17-13 1658 TO 09-18-13 0620
Organism source:	09-10-13 A-C POOLED
Transfer bowl information:	pH = 7.92 S.U. Temperature = 24.9°C
Average transfer volume:	0.1062 ml

Test information:	
Randomizing template:	RED
Incubator number and shelf location:	IC2

Daily feeding, renewal, or survival count information:

Hours	Date	Feeding		Test initiation, renewal, survival count, or termination		Sample numbers used	SSW Batch used
		Time	Analyst	Time	Analyst		
0	09-18-13	* 0620 1003	[initials]	Initiation 1250	[initials]	~~130906.01~~ ~~130906.02~~ * (09-18-13)	09-10-13
24	09-19-13			Survival count 1255	[initials]		
48	09-20-13			Survival count and renewal 1252	[initials]		

*In holding prior to test initiation.

* 130910.13
130909.02

Comments:

Test Results:	24-hour	48-hour
Method:	SK	SK
Upper control limit:	0.0712	0.0183
Lower control limit:	0.0571	0.0160
LC50 (median lethal concentration):	0.0637	0.0171

ETS

Species: *Ceriodaphnia dubia* **Date:** 09-18-13

Client: Cape Fear Public Utility – DUKE'S ROOT CONTROL

Survival data (number of living organisms):

Hours	Control SSW					0.00078125%					0.0015625%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%.		Mean mortality			0%.		Mean mortality			0%.	
48 Termination	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%.		Mean mortality			0%.		Mean mortality			0%.	

Hours	0.003125%					0.00625%					0.0125%				
	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD
0	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		S	S	S	S		S	S	S	S	
	Mean mortality			0%.		Mean mortality			0%.		Mean mortality			0%.	
48	S	S	S	S		S	S	S	S		S	4[sk]	S	S	
	Mean mortality			0%.		Mean mortality			0%.		Mean mortality			5%.	

Hours	0.025%					0.05%					0.10%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	S	S	S	S		S	S	S	S		S	S	S	S	
24	S	S	S	S		4[sk]	4[sk]	4[sk]	S		0[sk]	0[sk]	0[sk]	0[sk]	
	Mean mortality			0%.		Mean mortality			15%.		Mean mortality			100%.	
48 Termination	0[sk]	0[sk]	0[sk]	0[sk]		0[dd]	0[dd]	0[dd]	0[sk]		0	0	0	0	
	Mean mortality			100%.		Mean mortality			100%.		Mean mortality			100%.	

Hours	0.20%					0.40%				
	P	Q	R	S	T	U	V	W	X	Y
0	S	S	S	S		S	S	S	S	
24	0[sk]	0[sk]	0[sk]	0[sk]		0[sk]	0[sk]	0[sk]	0[sk]	
	Mean mortality			100%.		Mean mortality			100%.	
48	0	0	0	0		0	0	0	0	
	Mean mortality			100%.		Mean mortality			100%.	

Comment codes: c = clear, d = dead, sk = sick, sm = unusually small

Acute Daphnid Test-24 Hr Survival

Start Date:	9/18/2013	Test ID:	CdFRAC	Sample ID:	Dukes Root Control
End Date:	9/20/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	PRODUCT
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
0.00078125	1.0000	1.0000	1.0000	1.0000
0.0015625	1.0000	1.0000	1.0000	1.0000
0.003125	1.0000	1.0000	1.0000	1.0000
0.00625	1.0000	1.0000	1.0000	1.0000
0.0125	1.0000	1.0000	1.0000	1.0000
0.025	1.0000	1.0000	1.0000	1.0000
0.05	0.8000	0.8000	0.8000	1.0000
0.1	0.0000	0.0000	0.0000	0.0000
0.2	0.0000	0.0000	0.0000	0.0000
0.4	0.0000	0.0000	0.0000	0.0000

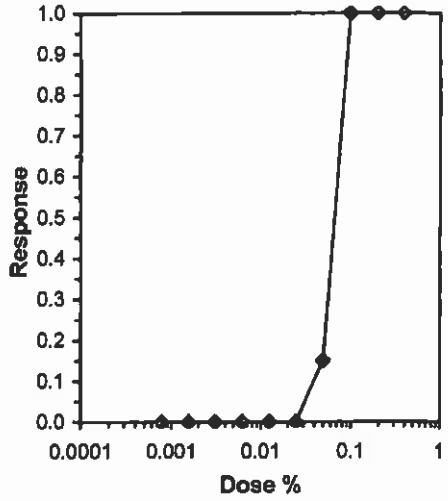
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4				0	20
0.00078125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.480	0.0738	0	20
0.0015625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.480	0.0738	0	20
0.003125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.480	0.0738	0	20
0.00625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.480	0.0738	0	20
0.0125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.480	0.0738	0	20
0.025	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0.000	2.480	0.0738	0	20
*0.05	0.8500	0.8500	1.1667	1.1071	1.3453	10.206	4	6.000	2.480	0.0738	3	20
0.1	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
0.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
0.4	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.40745	0.904	3.42885	18.6356
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.025	0.05	0.03536	4000	0.03696	0.0389	0.01595	0.00177	2.0E-05	7, 24
Treatments vs D-Control										

Trimmed Spearman-Karber

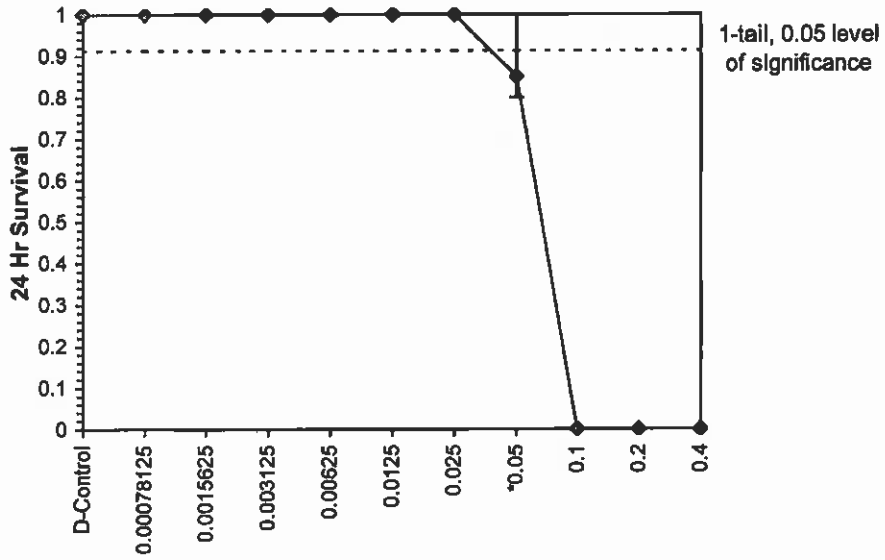
Trim Level	EC50	95% CL	
0.0%	0.0637	0.0571	0.0712
5.0%	0.0651	0.0572	0.0741
10.0%	0.0661	0.0559	0.0782
20.0%	0.0665	0.0616	0.0718
Auto-0.0%	0.0637	0.0571	0.0712



Acute Daphnid Test-24 Hr Survival

Start Date:	9/16/2013	Test ID:	CdFRAC	Sample ID:	Dukes Root Control
End Date:	9/20/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	PRODUCT
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Reviewed by:

Acute Daphnid Test-48 Hr Survival

Start Date:	9/18/2013	Test ID:	CdFRAC	Sample ID:	Dukes Root Control
End Date:	9/20/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	PRODUCT
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
0.00078125	1.0000	1.0000	1.0000	1.0000
0.0015625	1.0000	1.0000	1.0000	1.0000
0.003125	1.0000	1.0000	1.0000	1.0000
0.00625	1.0000	1.0000	1.0000	1.0000
0.0125	1.0000	0.8000	1.0000	1.0000
0.025	0.0000	0.0000	0.0000	0.0000
0.05	0.0000	0.0000	0.0000	0.0000
0.1	0.0000	0.0000	0.0000	0.0000
0.2	0.0000	0.0000	0.0000	0.0000
0.4	0.0000	0.0000	0.0000	0.0000

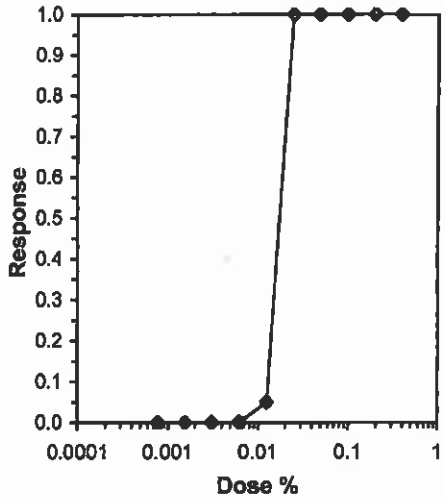
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			0	20
0.00078125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.0015625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.003125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.00625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.0125	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4	16.00	10.00	1	20
0.025	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.05	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.1	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.4	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.46508	0.884	-3.0206	13.9892
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	0.0125	0.025	0.01768	8000
Treatments vs D-Control				

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%	0.0171	0.0160	0.0183
5.0%	0.0174	0.0167	0.0180
10.0%	0.0174	0.0167	0.0180
20.0%	0.0174	0.0167	0.0180
Auto-0.0%	0.0171	0.0160	0.0183

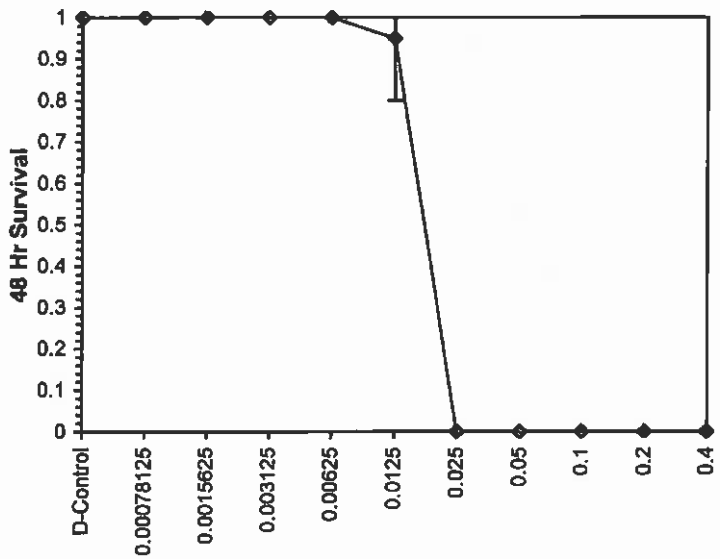


Reviewed by:

Acute Daphnid Test-48 Hr Survival

Start Date:	9/18/2013	Test ID:	CdFRAC	Sample ID:	Dukes Root Control
End Date:	9/20/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	PRODUCT
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Species: *Ceriodaphnia dubia* **Date:** 09.18.13

Client: Cape Fear Public Utility – DUKE'S ROOT CONTROL

Daily Chemistry:

		Hours						
		0	4	24	48	48	72	96
	Analyst	[illegible]		[illegible]	KLO			
Conc. (%)	Parameter							
Control SSW	pH (S.U.)	7.52			7.75			
	DO (mg/L)	8.0			8.0			
	Conductivity (µmhos/cm)	156						
	Alkalinity (mg $CaCO_3$/L)	33						
	Hardness (mg $CaCO_3$/L)	52						
	Temperature (°C)	24.8		24.9	24.8			
0.00078125	pH (S.U.)	7.36			7.75			
	DO (mg/L)	7.7			8.0			
	Conductivity (µmhos/cm)	154						
	Temperature (°C)	24.8		25.1	25.0			
0.0015625	pH (S.U.)	7.42			7.74			
	DO (mg/L)	7.7			8.1			
	Conductivity (µmhos/cm)	156						
	Temperature (°C)	24.7		25.0	24.7			
0.003125	pH (S.U.)	7.43			7.74			
	DO (mg/L)	7.7			8.1			
	Conductivity (µmhos/cm)	157						
	Temperature (°C)	24.7		25.0	24.8			
0.00625	pH (S.U.)	7.43			7.74			
	DO (mg/L)	7.8			8.1			
	Conductivity (µmhos/cm)	157						
	Temperature (°C)	24.7		25.0	24.8			
0.0125	pH (S.U.)	7.44			7.74			
	DO (mg/L)	7.8			8.1			
	Conductivity (µmhos/cm)	157						
	Temperature (°C)	24.7		24.9	24.8			
0.025	pH (S.U.)	7.45			7.72			
	DO (mg/L)	7.8			8.1			
	Conductivity (µmhos/cm)	158						
	Temperature (°C)	24.7		24.9	24.8			
0.05	pH (S.U.)	7.45			7.71			
	DO (mg/L)	7.8			8.1			
	Conductivity (µmhos/cm)	159						
	Temperature (°C)	24.7		24.8	24.9			
0.10	pH (S.U.)	7.44			7.666			
	DO (mg/L)	7.9			8.1			
	Conductivity (µmhos/cm)	157						
	Temperature (°C)	24.7		24.8	25.0			
0.20	pH (S.U.)	7.42			7.64			
	DO (mg/L)	7.9			8.1			
	Conductivity (µmhos/cm)	162						
	Temperature (°C)	24.7		24.8	25.1			
0.40	pH (S.U.)	7.40			7.63			
	DO (mg/L)	7.9			8.1			
	Conductivity (µmhos/cm)	166						
	Temperature (°C)	24.7		24.8	24.8			
		Initial Test Initiation	Final	Final	Final	Initial Renewal	Final	Final

* INTERMEDIATE CHEMISTRY WAS NOT PERFORMED DUE TO LIMITED VOLUME.

48-Hour Acute Whole Effluent Toxicity Test (EPA-821-R-02-012, Method 2002.0)
Species: *Ceriodaphnia dubia*

Client: Cape Fear Public Utility
Product: DUKE'S ROOT CONTROL

Application solution:
1.0000 g CORNFOAM and 0.5000 g REWARD MANUFACTURING CONCENTRATE (Diquat Dibromide) diluted into 100 mL ~~soft synthetic water~~ LOUGHLIN EFFLUENT.

Project #: 9282 / 9207 & 9220

Dilution preparation information:		*Comments:*
Dilution prep (%)	0.0015625% to 0.80%	1.60% concentration prepared by diluting 3.20 mL application solution into 200 mL ~~soft synthetic water~~ LAUGHLIN EFFLUENT
Stock volume (mL)	Serial dilutions from 1.60% concentration.	
Diluent volume (mL)		
Total volume (mL)	200	

Test organism information:		*Test information:*	
Organism age:	< 24 HOURS OLD	Randomizing template:	BLUE
Date and times organisms were born between:	09-24-13 1650 TO 09-25-13 0715	Incubator number and shelf location:	281
Organism source:	09-17-13 A & B POOLED		
Transfer bowl information:	pH = 7.89 S.U. Temperature = 24.9°C		
Average transfer volume:	0.1062 mL		

Daily feeding, renewal, or survival count information:

Hours	Date	Feeding		Test initiation, renewal, survival count, or termination		Sample numbers used	SSW Batch used
		Time	Analyst	Time	Analyst		
0	09-25-13	* 0715 & 1005	JH	Initiation 1250	JH	* SEE COMMENTS	09-4-13
24	09-26-13			Survival count 1255	JH		
48	09-27-13			Survival count and renewal 1247	JH		

*In holding prior to test initiation.

Comments: * LOUGHLIN EFFLUENT = 130925.02
PRODUCTS = 130910.13 & 130909.02

Test Results:	24-hour	48-hour
Method:	SK	SK
Upper control limit:	0.056%	0.024%
Lower control limit:	0.041%	0.018%
LC50 (median lethal concentration):	0.048%	0.021%

Survival data (number of living organisms):

Hours	Laboratory QC SSW				
	A	B	C	D	E
0 Initiation	5	5	5	5	
24	5	5	5	5	
	Mean mortality			0%	
48 Termination	5	5	5	5	
	Mean mortality			0%	

Species: *Ceriodaphnia dubia* Date: 09·25·13

Client: Cape Fear Public Utility – DUKE'S ROOT CONTROL

Survival data (number of living organisms):

Hours	Control Loughlin Effluent					0.0015625%					0.003125%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	5	5	5	5		5	5	5	5		5	5	5	5	
24	5	5	5	5		5	5	5	5		5	5	5	5	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	
48 Termination	5	5	5	5		5	5	5	5		5	5	5	5	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	

Hours	0.00625%					0.0125%					0.025%				
	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD
0	5	5	5	5		5	5	5	5		5	5	5	5	
24	5	5	5	5		5	5	5	5		5	5	5	5	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			0%	
48	5	5	5	5		5	5	5	5		2 d	1 d	0 d	2 d	
	Mean mortality			0%		Mean mortality			0%		Mean mortality			75%	

Hours	0.05%					0.10%					0.20%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	5	5	5	5		5	5	5	5		5	5	5	5	
24	2 sk	3 sk	3 sk	1 sk		0 sk	0 sk	0 sk	0 sk		0 sk	0 sk	0 sk	0 sk	
	Mean mortality			55%		Mean mortality			100%		Mean mortality			100%	
48 Termination	0 sk	0 sk	0 sk	0 sk		0	0	0	0		0	0	0	0	
	Mean mortality			100%		Mean mortality			100%		Mean mortality			100%	

Hours	0.40%					0.80%					1.60%				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0 Initiation	5	5	5	5		5	5	5	5		5	5	5	5	
24	0 sk	0 sk	0 sk	0 sk		0 sk	0 sk	0 sk	0 sk		0 sk	0 sk	0 sk	0 sk	
	Mean mortality			100%		Mean mortality			100%		Mean mortality			100%	
48 Termination	0	0	0	0		0	0	0	0		0	0	0	0	
	Mean mortality			100%		Mean mortality			100%		Mean mortality			100%	

Comment codes: c = clear, d = dead, sk = sick, sm = unusually small

Acute Daphnid Test-24 Hr Survival

Start Date:	9/25/2013	Test ID:	CdFRAC	Sample ID:	Duke's Root Control
End Date:	9/27/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4
Loughlin	1.0000	1.0000	1.0000	1.0000
SSW-Lab QC	1.0000	1.0000	1.0000	1.0000
0.0015625	1.0000	1.0000	1.0000	1.0000
0.003125	1.0000	1.0000	1.0000	1.0000
0.00625	1.0000	1.0000	1.0000	1.0000
0.0125	1.0000	1.0000	1.0000	1.0000
0.025	1.0000	1.0000	1.0000	1.0000
0.05	0.4000	0.6000	0.6000	0.2000
0.1	0.0000	0.0000	0.0000	0.0000
0.2	0.0000	0.0000	0.0000	0.0000
0.4	0.0000	0.0000	0.0000	0.0000
0.8	0.0000	0.0000	0.0000	0.0000
1.6	0.0000	0.0000	0.0000	0.0000

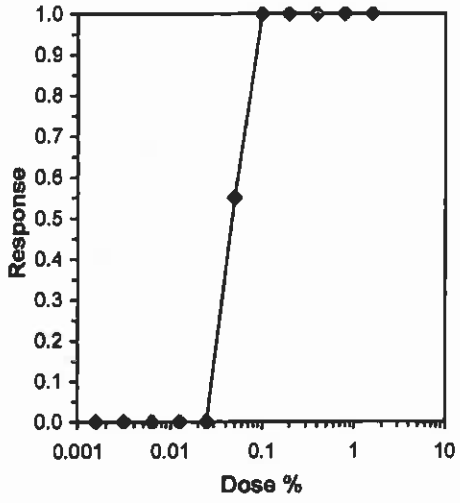
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
Loughlin	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		0	20
SSW-Lab QC	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4				
0.0015625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.003125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.00625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.0125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.025	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
*0.05	0.4500	0.4500	0.7301	0.4636	0.8861	27.587	4	10.00	10.00	11	20
0.1	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.4	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.8	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
1.6	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.48544	0.896	-1.5066	10.8198
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	0.025	0.05	0.03536	4000
Treatments vs Loughlin				

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%	0.0483	0.0414	0.0563
5.0%	0.0481	0.0406	0.0571
10.0%	0.0480	0.0396	0.0581
20.0%	0.0476	0.0371	0.0611
Auto-0.0%	0.0483	0.0414	0.0563

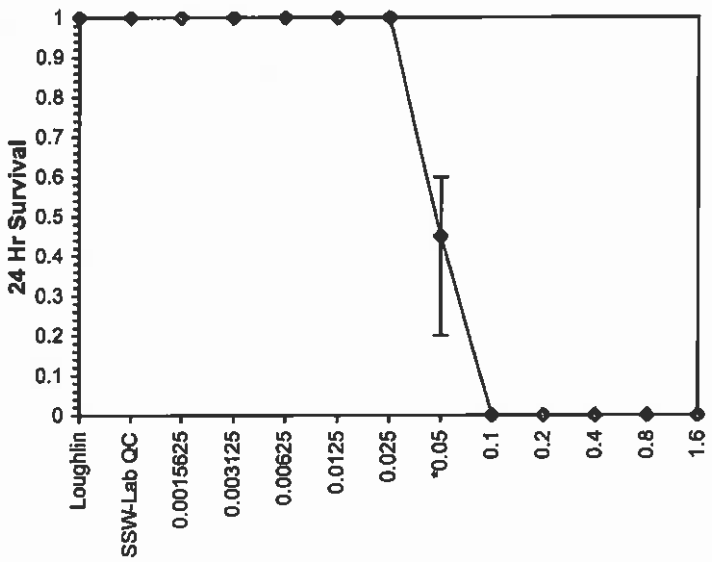


Reviewed by:

Acute Daphnid Test-24 Hr Survival

Start Date:	9/25/2013	Test ID:	CdFRAC	Sample ID:	Duke's Root Control
End Date:	9/27/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Reviewed by:

Acute Daphnid Test-48 Hr Survival

Start Date:	9/25/2013	Test ID:	CdFRAC	Sample ID:	Duke's Root Control
End Date:	9/27/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4
Loughlin	1.0000	1.0000	1.0000	1.0000
SSW-Lab QC	1.0000	1.0000	1.0000	1.0000
0.0015625	1.0000	1.0000	1.0000	1.0000
0.003125	1.0000	1.0000	1.0000	1.0000
0.00625	1.0000	1.0000	1.0000	1.0000
0.0125	1.0000	1.0000	1.0000	1.0000
0.025	0.4000	0.2000	0.0000	0.4000
0.05	0.0000	0.0000	0.0000	0.0000
0.1	0.0000	0.0000	0.0000	0.0000
0.2	0.0000	0.0000	0.0000	0.0000
0.4	0.0000	0.0000	0.0000	0.0000
0.8	0.0000	0.0000	0.0000	0.0000
1.6	0.0000	0.0000	0.0000	0.0000

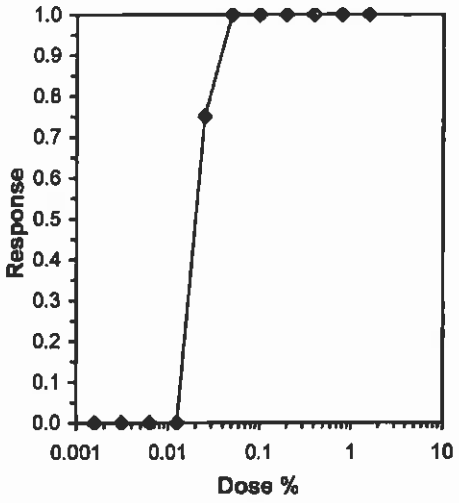
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
Loughlin	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		0	20
SSW-Lab QC	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4				
0.0015625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.003125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.00625	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
0.0125	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
*0.025	0.2500	0.2500	0.5146	0.2255	0.6847	42.578	4	10.00	10.00	15	20
0.05	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.1	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.4	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
0.8	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20
1.6	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.52427	0.884	-1.3844	9.04402
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	0.0125	0.025	0.01768	8000
Treatments vs Loughlin				

Trimmed Spearman-Karber

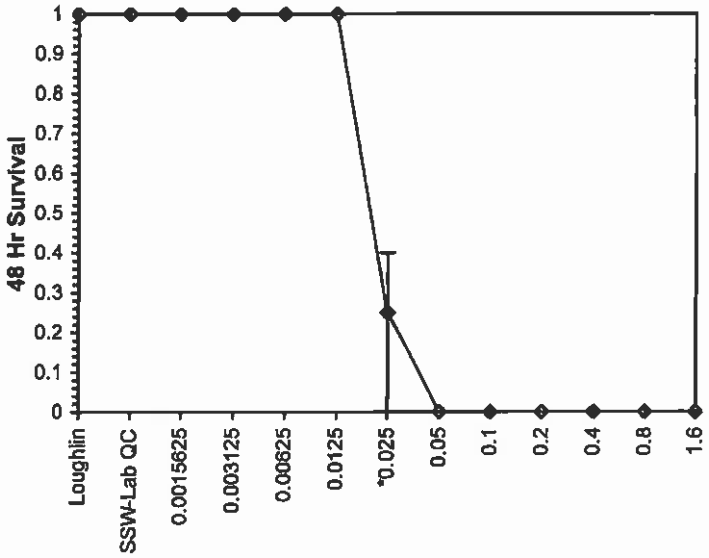
Trim Level	EC50	95% CL	
0.0%	0.0210	0.0184	0.0240
5.0%	0.0207	0.0179	0.0239
10.0%	0.0204	0.0174	0.0238
20.0%	0.0199	0.0170	0.0234
Auto-0.0%	0.0210	0.0184	0.0240



Acute Daphnid Test-48 Hr Survival

Start Date:	9/25/2013	Test ID:	CdFRAC	Sample ID:	Duke's Root Control
End Date:	9/27/2013	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	ACUTE-EPA-821-R-02-012	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Species: *Ceriodaphnia dubia* Date: 09-25-13

Client: Cape Fear Public Utility – DUKE'S ROOT CONTROL

Daily Chemistry:

		Hours						
		0	4	24	48	48	72	96
	Analyst	KW			KW			
Conc. (%)	Parameter							
Control SSW	pH (S.U.)	7.51			7.75			
	DO (mg/L)	8.0			7.9			
	Conductivity (µmhos/cm)	1600						
	Alkalinity (mg $CaCO_3$/L)							
	Hardness (mg $CaCO_3$/L)							
	Temperature (°C)	24.9		24.9	24.8			
Control Loughlin Effluent	pH (S.U.)	7.54			7.99			
	DO (mg/L)	8.3			7.9			
	Conductivity (µmhos/cm)	745						
	Temperature (°C)	25.1		25.1	24.7			
0.0015625	pH (S.U.)	7.61			7.99			
	DO (mg/L)	8.4			7.9			
	Conductivity (µmhos/cm)	735						
	Temperature (°C)	25.0		24.8	24.7			
0.003125	pH (S.U.)	7.62			8.01			
	DO (mg/L)	8.4			7.9			
	Conductivity (µmhos/cm)	743						
	Temperature (°C)	25.2		24.8	24.7			
0.00625	pH (S.U.)	7.63			8.01			
	DO (mg/L)	8.4			7.9			
	Conductivity (µmhos/cm)	745						
	Temperature (°C)	25.0		24.9	24.9			
0.0125	pH (S.U.)	7.63			8.02			
	DO (mg/L)	8.4			7.9			
	Conductivity (µmhos/cm)	746						
	Temperature (°C)	25.0		25.0	25.0			
0.025	pH (S.U.)	7.63			8.01			
	DO (mg/L)	8.5			7.9			
	Conductivity (µmhos/cm)	745						
	Temperature (°C)	25.0		24.9	24.7			
0.05	pH (S.U.)	7.62			8.01			
	DO (mg/L)	8.5			7.9			
	Conductivity (µmhos/cm)	747						
	Temperature (°C)	25.0		25.2	24.7			
0.10	pH (S.U.)	7.63			8.01			
	DO (mg/L)	8.6			7.9			
	Conductivity (µmhos/cm)	749						
	Temperature (°C)	25.0		25.0	24.8			
0.20	pH (S.U.)	7.63			8.00			
	DO (mg/L)	8.7			7.9			
	Conductivity (µmhos/cm)	756						
	Temperature (°C)	25.1		25.0	25.0			
0.40	pH (S.U.)	7.63			8.01			
	DO (mg/L)	8.7			7.9			
	Conductivity (µmhos/cm)	767						
	Temperature (°C)	25.1		25.0	24.8			
0.80	pH (S.U.)	7.64			8.01			
	DO (mg/L)	8.7			7.9			
	Conductivity (µmhos/cm)	768						
	Temperature (°C)	25.1		25.1	24.8			
1.60	pH (S.U.)	7.64			8.02			
	DO (mg/L)	8.7			8.0			
	Conductivity (µmhos/cm)	782						
	Temperature (°C)	25.0		24.9	24.8			
		Initial Test Initiation	Final	Final	Final	Initial Renewal	Final	Final

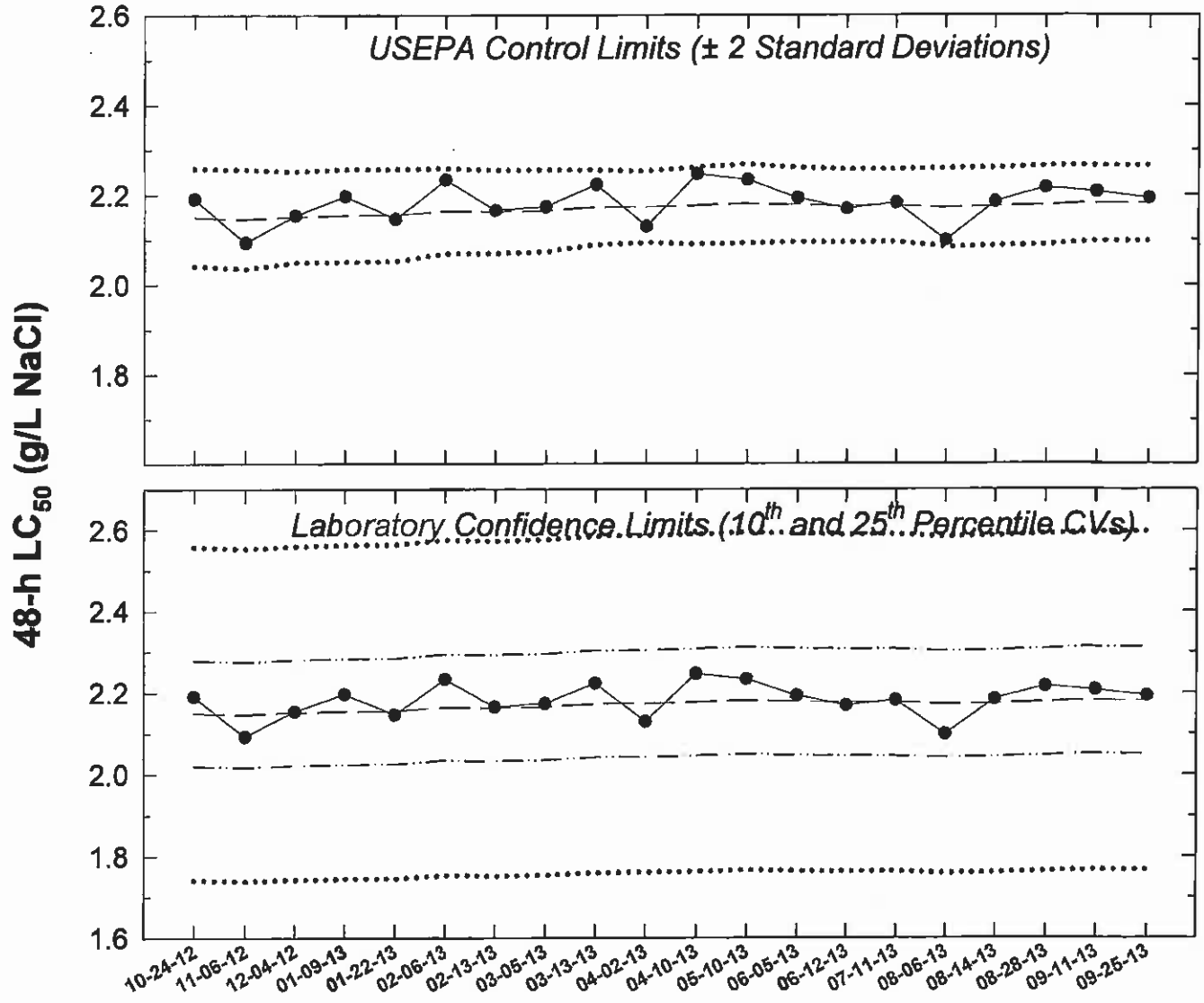
* INTERMEDIATE CHEMISTRY WAS NOT PERFORMED DUE TO LIMITED VOLUME.

Appendix C

REFERENCE TOXICANT TEST
CONTROL CHART INFORMATION

Environmental Testing Solutions, Inc.

Ceriodaphnia dubia
Acute Reference Toxicant Control Chart



—●— **48-hour LC_{50}** = median lethal concentration. An estimation of the concentration of sodium chloride which is lethal to 50% of the test organisms in 48-hours.

— — · **Central Tendency** (mean LC_{50})

—··—·· **10th Percentile Confidence Limits** (mean $LC_{50} \pm S_{A.10}$)

····· **Control Limits or 25th Percentile Confidence Limits** (mean $LC_{50} \pm S_{A.25}$ or 2 Standard Deviations)

Graphs generated from associated excel spreadsheet.
Excel spreadsheet entered by: J. Sumner
Reviewed by: _____

Label 5 Gal.

SANAFOAM VAPOROOTER II

RESTRICTED USE PESTICIDE DUE TO ACUTE TOXICITY
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

A FOAMING FUMIGANT RIDS SEWER LINES OF ROOTS WILL NOT HARM TRESS, NON-SYSTEMIC

1. SANAFOAM VAPOROOTER II liquid concentrate

Active Ingredients	% by weight
Metam-Soudim (sodium methyldithiocarbamate)	30.0%
Inert Ingredients (includes foaming agent)	70.0%
Total	100.0%

2. DRY INGREDIENTS

Active Ingredients	
Dichlobenil 50W (2,6-dichlorobenzonitrile)	50.0%
Inert Ingredients	50.0%
Total	100.0%

KEEP OUT OF REACH OF CHILDREN
DANGER
CAUSES SKIN IRRITAION. SEE OTHER LABEL PRECAUTIONS

Si Usted no entiende la etiqueta, busque a su supervisor para que se a expique a usted en detalle. (If you don't understand the label, find your supervisor to explain it to you in detail).

STATEMENT OF PRACTICAL TREATMENT

IF INHALED: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.
IF ON SKIN: Wash with plenty of soap and water. Get medical attention.
IF SWALLOWED: Drink promptly a large quantity of milk, egg whites, gelatin solution, or if these are not available drink large quantities of water. Avoid alcohol. Do not induce vomiting or give anything by mouth to and unconscious person.
IF IN EYES: Flush with plenty of water for at least 15 minutes. Call a physician if irritation persists

SEE PRECAUTIONARY STATEMENTS ON SIDE PANELS SEE ADDITIONAL PRECAUTIONARY STATEMENTS ON CONTAINERS INSIDE THIS PACKAGE

EPA Reg. No. 1015-70 EPA Est. No. 1015-MO-1

Net Contents:

1. SANAFOAM VAPOROOTER II liquid concentrate 5 gal
2. DRY INGREDIENTS (dichlobenil 50W) 30 oz.

DOUGLAS PRODUCTS & PACKAGING
1550 Old 210 Highway
Liberty, MO 64068-9459

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Refer to the protective clothing and equipment information under PRECAUTIONARY STATEMENTS and use all required protective clothing and equipment. The metam-sodium and dichlobenil may be used only in combination and with a foaming agent (contained in the liquid concentrate) to control roots in sewer systems according to the directions for use.

DIRECTIONS FOR USE OF SANAFOAM VAPOROOTER II WITH FOAMAKER GENERATORS

DIRECTIONS WHICH OF THE COLLECTION LINES HAVE KNOWN ROOT PROBLEMS

1. SURVEY TREATMENT AREA
Confirm the line size and length. Evaluate slope, flow, lateral connections, line length, outfall, line obstructions, terrain and other field conditions. A thorough evaluation prior to starting will assure safe

and accurate application of SANAFOAM VAPOROOTER II.

2. DETERMINE QUATITY OF FOAM NEEDED
From Table 1 compute the quantity of foam required to fill the length of pipe (in feet) to be treated.

TABLE 1: Foam Requirements and Hose Retrieval Rates for SANAFOAM VAPOROOTER II APPLICATIONS

PIPE I.D. (INCHES)	FOAM CAPACITIES (gal/ft.)	RETRIEVAL RATE (sec/10ft)
4	0.7	4.2
6	1.5	9.0
8	2.5	15.0
9	3.3	20.0
10	4.1	24.0
12	5.9	36.0
15	9.2	55.0

Example: An 8" pipe requires 2.5 gallons of foam per foot to fill the pipe. Therefore, 3750 gallons of foam are required to fill and 8" pipe 1500 feet in length (1500 ft X 2.5 gal/ft = 3150 gal).

3. MEASUREMENT DIRECTIONS TO PRODUCE DESIRED QUANTITY OF FOAM
(See Table 2)

TABLE 2: Mixing Instructions For Diluting SANAFOAM VAPOROOTER II LIQUID CONCENTRATE

FOAM REQIREMENT	TOTAL MIX VOLUME	WATER	SANAFOAM VAPOROOTER II
125 gal	6.25 gal	6 gal	1.0 qt
250 gal	12.50 gal	12 gal	0.5 gal
500 gal	25 gal	24 gal	1.0 gal
1250 gal	62.5 gal	60 gal	2.5 gal
2500 gal	125 gal	120 gal	5.0 gal
3750 gal	187.5 gal	180 gal	7.5 gal
5000 gal	250 gal	240 gal	10.0 gal

Example: 180 gallons of water plus 7.5 gallons of Sanafoam Vaporooter II solution will produce 3750 gallons of foam. (See Users Manual for mixing instructions when using Jet-Set Equipment).

4. MIXING PROCEDURES

a. Fill the Foamaker Equipment mix tank _ to _ full of clean water leaving room in the tank for the rinse water to be used as described below.
b. Open outer fiberboard container and remove plastic tube containing the dichlobenil herbicide.
c. Remove the 5-gallon inner containers containing the Sanafoam Vaporooter II Liquid Concentrate as needed.
d. Remove the Dichlobenil 50W bag and empty contents into the water in the mix tank as needed.
e. Allow about 7 minutes for the powder to thoroughly mix.
f. Transfer the liquid from the 5-gallon containers as necessary into the Foamaker solution mix tank using the suction pump system on the Foamaker.
g. Triple rinse the 5-gallon liquid container (again using the suction pump system to add the rinse water to the mix tank).
h. Add to the mix tank the remainder of the required water and mix thoroughly.
i. Dispose of containers in accordance with disposal instructions.

USE SOLUTION PROMPTLY AFTER MIXING. Wash and flush all equipment with water after each day's use.

KEEP OFF DESIRABLE LAWNS AND PLANTS. If spillage occurs on the street or other paved areas near growing plants, immediately flush the spill thoroughly with water at moderate pressure into the sewer line.

APPLICAION GUIDELINES FOR SANAFOAM VAPOROOTER II

1. TO APPLY FOAM TO MAIN LINES: Insert foam discharge hose through entire section of line to be treated. Start foam generating equipment and withdraw discharge hose at a rate calibrated to fill the pipeline to capacity (as listed in Table 1), until foam appears at input manhole. Use appropriate foam application equipment designed to produce required foam volume.

You may multiply the retrieval rates in Table 1 by 1.10 to allow for some treatment of laterals (about 3-6 feet) and to allow more foam to push into cracks and broken joints.

2. IF TREATING A BUILDING LATERAL: Be sure foam application discharge hose is also of a specialized type and is securely positioned into and inflated in the clean-out to prevent foam overflow and/or plug blowout. Operate foam generating equipment until required amount of foam has been produced, as calculated from information in Table 1.

CAUTION: Care should be taken not to overfill lateral.

FOAMAKER Generators produce 20 gallons of foam from each gallon of Sanafoam Vaporooter II mixed solution.

FOAMAKER Generators are manufactured for Douglas Products & Packaging to our specifications and are available from Douglas. For additional information on special applications, see User's Manual or contact sales representative of manufacturer. All application procedures must be in accordance with established methods and systems as developed by Douglas Products & Packaging.

SPECIAL NOTICE

Douglas Products & Packaging makes no warranty, expressed or implied, including the warranties of merchantability and/or fitness for any particular purpose, concerning this material, except for those which are contained on this label.

PRECAUTIONARY STATEMENTS
DANGER
HAZARDS TO HUMAN AND DOMESTIC ANIMALS

Corrosive, causes skin irritation. May be harmful or fatal if absorbed through skin or inhaled. Harmful if swallowed. Causes eye irritation. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Do not get in eyes, on skin or on clothing. Do not breathe vapor or spray mist. A mask or pesticide respirator jointly approved by the Mining Enforcement and Safety Administration and the National Institute for Enforcement and Safety Administration and the National Institute for Occupational Safety and Health must be available for use in case of an emergency. Wear protective clothing and chemical resistant gloves. Wash thoroughly with soap and water after handling and before eating or smoking. Remove contaminated clothing and wash before reuse.

Keep all unprotected persons, children, livestock and pets away from treated area or where there is danger of drift, such as a spill.

Do not rub eyes or mouth with hands. If you feel sick in any way, STOP work and get help immediately. See Statement of Practical Treatment.

PROTECTIVE CLOTHING AND EQUIPMENT REQUIREMENTS

1. The following protective clothing and equipment are required to be used by persons actually engaged in carrying out any operations that are likely to involve direct contact with metam-sodium including mixing, loading, equipment calibrations or adjustments, cleaning and repair of application equipment, entering into treated areas, sampling, clean up of spills, rinsate disposal, or any other activities likely to result in direct contact with the product. This protective equipment must also be used for any operations that are carried out within six feet of unshielded, pressurized hosed containing metam-sodium solutions.

a. Splash resistant eye protection.
b. Body covering including shirt and long pants or long sleeved clothing. When a closed system is not used, mixers and loader must also wear a chemical resistant apron or cloth coveralls.
c. Chemical resistant gauntlet-type gloves and boots.
2. The following protective equipment must be worn at all times by persons operating or monitoring application equipment.

a. Chemical resistant footwear.
b. Body covering including shirt and long pants or long sleeved clothing.
3. The following protective clothing and equipment must be immediately available at all times for use by persons operating or monitoring application equipment.

a. A properly fit tested NIOSH or MSHA approved half face respirator with organic vapor cartridge(s). This equipment must be worn in case of emergencies or leads when the pungent, rotten egg or sulfur-like odor of metam-sodium is detected.
b. Chemical resistant gauntlet-type gloves. These must be worn when a person is engaged in carrying out any operation that is likely to involve direct contact with the product, including the operations listed in paragraph No. 1 above.

USE PRECAUTIONS

Consideration must be given to all sewer service lines and building elevations and basements for the possibility of foam coming up out of drains. Consideration must be given to distance between houses and sewers to be treated, depth of sewers compared to drains in buildings, line obstructions, broken and empty traps. Drains which may be subject to backup and flooding must be plugged. Follow the directions for measurement and use carefully to avoid using excess foam that may be forced up lateral lines to building drains. Do not use to storm, field or other drains unless effluent is treated in a sanitary sewer system. Building occupants should exit structures if the rotten egg or sulfur-like odor of metam-sodium is detected. Open windows and ventilate with fans. Flush drains with ample water if the odor comes from them. Use a squeegee, dust pan or wet vacuum and garbage bags for spills or backups and dispose of foam and liquid, wash area of soil or back up with water and detergent and flush down drain. If rugs or cloth are contacted, take outside and dry before laundering separately.

Do not use in confined areas without adequate ventilation. Avoid any entry into manholes or confined areas. When absolutely necessary to enter these areas, be sure to use all safety protection equipment and procedures as required by law.

ENVIRONMENTAL HAZARDS

Keep out of lakes, ponds or streams. Toxic to fish and aquatic life. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters. Equipment washwaters and wastes resulting from the use of this product may be disposed of on site according to label directions or at an approval waste disposal facility. Do not use in portable sewer systems. Do not use in storm, field or other drains unless effluent is treated in a sanitary sewer system. Keep off lawns and plants as they may be severely injured. Foam should be shoveled off planted areas immediately rather than washing off with water.

ENVIRONMENTAL USE PRECAUTIONS

High concentrations of these chemicals in wastewater may adversely affect the biological sewage breakdown process in wastetwater treatment plants. Large scale to sewage collection systems in proximity to a sewage treatment plant should be divided into smaller sectional treatments done at one or two day intervals to minimize effects on the sewage treatment process. Inform appropriate wastewater treatment plant officials prior to use so they may check for any unusual rotten egg or sulfur-like odor of metam-sodium above that of sewage and monitor the performance of filter beds or digesters. If the odor is detected at the sewage treatment plant or the biological breakdown process is adversely affected, root control applications should cease until normal conditions are established. Subsequent treatments should be reduced in size or volume and spread over greater time intervals.

NOTE: Never exceed the daily use of more than 15 gallons of Sanafoam Vaporooter II Liquid Concentrate for each million gallons of sewage flow (MGD) into the wastewater treatment plant (WWTP). Example: Inflow into the WWTP is 2.4 MGD, therefore, use a maximum of 36 gallons (2.4 x 15) of Sanafoam Vaporooter II per day. When Vaporooter within one mile distance of the WWTP or when applying at night reduce the maximum application use by 50% to 18 gallons (36 x 5). The above maximum daily use must extend over and eight hour work period.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flames.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE: Do not store near food or feed,, seed, bulbs, tubers, nursery stock or other vegetative matter. Do not store near pet or livestock quarters. Store in a cool, dry, and well ventilated area. Keep containers tightly closed when not in use.

DISPOSAL: Wastes resulting from the use of this product may be disposed of on site by discharging into sewer pipes being treated or at and approved waste disposal facility.

PLASTIC CONTAINERS: Triple rinse (or equivalent). Then offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

PLASTIC BAGS: Then Disposal of empty outer tube in a sanitary landfill or by incineration or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

OUTER BOX: Dispose of empty box in a sanitary landfill or by incineration or, if allowed by state and local law, by burning. If burned, stay out of smoke.

PRODUCT INFORMATION

SANAFOAM VAPOROOTER II is a foaming, surface-active formulation of metam-sodium plush DICHLOBENIL 50W for dilution in water.

SANAFOAM VAPOROOTER II is a non-systemic chemical for control of roots in sewer mains and drain lines. Only the roots and organic deposits in the sewer lines are affected by Sanafoam Vaporooter II liquid concentrate.

SANAFOAM VAPOROOTER II is packaged to contain separate units within an outer fiberboard container; a plastic tube of dichlobenil herbicide powder and a plastic container holding the Sanafoam Vaporooter II Liquid Concentrate.

SANAFOAM VAPOROOTER II should not be used to treat roots in storm sewers or other drains where the wastewater will not be treated or controlled.

BACK

MATERIAL SAFETY DATA SHEET

Douglas Products and Packaging Co.
1550 E. Old 210 Highway
Liberty, MO, 64068
Phone: (816-781-4250)
Fax: (816-781-1043)

Manufacturer's Name:
Douglas Products and Packaging Co.
Liberty, Mo. 64068
1550 E. Old 210 Highway

Emergency Telephone No.
1-800-424-9300 (Chemtrec)
Day Telephone: 1 -816- 781-4250
Night Telephone 1-816- 781-4650

SECTION 1- GENERAL INFORMATION

Trade Name: SANAFOAM VAPOROOTER®II
Chemical Family: Root Control
EPA Reg. No: 1015-70

SECTION II – INGREDIENTS

Material or Component Hazard Data	CAS#	%	OSHA/ ACGIH	PEL	TLV ppm
Sodium Methyldithiocarbamatic	137-42-8	30.00	-	-	-
Isopropyl Alcohol	67-63-0	-/-	-	-	-
Inert Ingredients		70.00	-	-	-
Dichlobenil 50W	1194-65-6	50.00	-	-	-
Inert Ingredients		50.00	-	-	-

SECTION III- PHYSICAL DATA

The fiber board box holds 3 containers; 2 15-ounce plastic bags containing dichlobenil POWDER and a 5-gallon plastic container of the metam-sodium/foaming agent solution. When applicable, the plastic container contents will be referred to as the LIQUID and the plastic bag contents as the POWDER.

HMIS: Health- 3 **Flammability- 2** **Reactivity- 0** **Personal Protection -G**

	Product Description	
Physical Properties	Liquid	Powder
Appearance	Light green to yellow	Tan powder
Odor	sulfur-like	slightly aromatic
Boiling Point	N/A	N/A
Specific Gravity	1.15 (H2o=1)	N/A
Vapor Density	N/A	N/A
Melting Point	N/A	N/A
Vapor Pressure	N/A	N/A
Evaporation Rate	N/A	N/A
Soluble in water	miscible	insoluble, dispersible
PH	7.5 to 9.5	N/A

SECTION IV- FIRE AND EXPLOSION DATA

Flash Point:	150 Degrees F (Pen sky-Martins CC) This flashpoint results from the presence of a small quantity of isopropyl alcohol (less than 1%), the product is nonflammable.
Extinguishing Media:	Water
Fire Fighting Techniques:	Wear full face, self-contained breathing apparatus and impervious protective clothing. Evacuate non-essential personnel from the area. The fiber board boxes contain plastic containers, so cool with a water spray to avoid container rupture. The break down products resulting from high heat is irritating to the respiratory tract and may cause breathing difficulty and pulmonary edema. Run off from fire control of dilution with water may cause pollution or contamination of building, grounds and equipment.

SECTION V-REACTIVITY DATA

Conditions contributing to instability:	Avoid mixing with acidic material as evolution of Hydrogen Sulfide may occur
Incompatibility:	The LIQUID may decompose on exposure to bases. The POWDER is corrosive to brass, copper, zinc and aluminum.
Hazardous Decomposition Products:	The product will decompose in extreme heat.

Conditions Contributing to Hazardous Polymerization: None Known

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Section VI- Health Hazard Data

Principal routes of entry are: skin contact, eye contact or inhalation. Irritation may result from skin or eye contact with either the LIQUID or the POWDER. No data has been identified which address medical conditions that are generally recognized as being aggravated by exposure to this product.

Carcinogenicity: **NTP:** Not listed **IARC:** Not listed **OSHA:** Not listed

Laboratory studies on Metam Sodium have shown some carcinogenic effects in laboratory animals. *In vitro* laboratory studies have shown some evidence of mutagenicity, but there is no conclusive evidence *in vivo*.

The United States Environmental Protection Agency, in its May 21, 2004 Metam Sodium Occupational and Residential Exposure Assessment concluded;

> "For the applications in commercial (i.e., sewer system) and small scale agricultural settings (i.e., sprinkling can, hose proportioner, potting soil, and tree replant scenarios), the non-cancer and cancer risks related to metam sodium are below HED's level of concern at some level of protection for most scenarios. There are no data available to assess non-cancer and cancer risks to MITC for these application techniques."

SECTION VII- EMERGENCY PROCEDURES

Eye Contact:	Flush eyes with water for at least 15 minutes and get medical attention if eye irritation persists.

Skin Contact:	Immediately remove contaminated clothing and shoes and flush with plenty of water to avoid skin irritation.
Inhalation:	In confined spaces such as tanks and manholes: Remove to fresh air. If breathing has stopped, start artificial respiration procedures and get medical attention immediately.
Ingestion:	Give several glasses of water. Do not induce vomiting. Get medical attention immediately. These materials are not listed in accepted cancer registries, such as NTP or LARC.

SECTION VIII- SPILLS, LEAKS, AND DISPOSAL PROCEDURES

Use appropriate safety equipment when dealing with spills and leaks. Add absorptive granules, such as litter, and sweep up the absorbents.
Place in a waste disposal container for safe and legal disposal. Then clean area with a minimum amount of water.
Waste Disposal Method:
For container disposal, triple rinse the containers and place rinse water into the application equipment solution tank or sanitary sewer manhole. Puncture or cut container in three places and dispose of container in a sanitary landfill. Ensure that all federal, state and local regulations for disposal are followed. Do not hose spillage onto adjacent planted areas. These herbicides may adversely affect desirable lawns, shrubs and trees. Foam should be shoveled off planted areas immediately.

SECTION IX- SPECIAL HANDLING AND PROTECTION INFORMATION

Eye Protection: Avoid eye contact with this material. Use of face shield and glasses or goggles is recommended.

Respiratory Protection: Avoid breathing vapor or mist. Use self contained breathing apparatus in confined spaces, such approved pesticide respirator with pre-filter is useful to avoid mists or dust fumes. Examples of NIOSH/MSHA respirators for this use are: * Wilson TC-23C-751, TC-23C-747, TC-23C-791 and TC-23C-792

- North TC-23C-74/190
- Easi-Care (3M) #7300S NSN 4240-01-246-5404
  This equipment must be worn if a pungent sulfurous odor persists. Always read respirator instruction booklet for your personal respirator before using.

Skin Protection: Avoid skin contact with this material for it can be a severe skin irritant if not washed off. Use gauntlet-type unlined rubber gloves and long sleeved shirts.

Other: A large volume of water (10 gallons or more) should be available to wash any spills off personnel.

SECTION X- SPECIAL PRECAUTIONS/STORAGE

- Keep out of reach of children.
- Do not store near food or foodstuff.
- The LIQUID portion of the product is toxic to fish.
- Keep children and pets out of storage and treatment area.
  The information and statement on the material safety data sheet is believed to accurately reflect the scientific evidence used in making the hazard determination, but is not to be construed as a warranty or representation for which we assume legal responsibility.
- To extent product quality:
- Avoid prolonged exposure to temperatures below 33 degrees F to prevent package damage,
- Avoid prolonged exposure to temperatures above 90 degrees F to prevent foam quality. Never store near heat source or in direct sunlight.

The information presented herein for consideration, while not guaranteed, is true and accurate to the best of our knowledge. No warranty, or guaranty is expressed or implied regarding the accuracy or reliability of such information and we shall not be liable for any loss or consequential damage arising out of the use thereof.

Date Revised: 08-11-08

Material Safety Data Sheet
DICHLOBENIL
SANAFOAM VAPOROOTER COMPONENT 2

Section 1. Product and Company Identification

Product Name: DICHLOBENIL, Sanafoam Vaporooter Component 2
Product Code: V-2-PWD-DICHL-001
Effective Date: August 11, 2008

Manufacturer Information:
Douglas Products and Packaging Company
1550 East Old 210 Highway
Liberty, Missouri 64068
Information Phone: (816) 781-4250
Emergency Phone: Chemtrec (800) 424-9300

Section 2. Ingredients and Hazards Identification

Hazardous Components		Occupational Exposure Limits			
Component	CAS Number	OSHA PEL	ACGIH TLV	**Weight Percent**	Section 313
Dichlobenil *	1194-65-6	NE	NE	50	**Yes**
Kaolin clay	1332-58-7	5 mg/m^3	2 mg/m^3	37	Yes
Balance is inert filler	NA	NE	NE	13	No
This product contains the following EPCRA Section 313 chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372).					

* Note! This is the dry component of SANAFOAM VAPOROOTER® II and weighs 850.5 grams for each of the two packages

The product is a combination pack of plastic bags of dry dichlobenil powder and liquid containers of Metam sodium/IPA/foaming agent. This MSDS is for the dry powder. Please follow the directions on the label and wear the proper personal protective equipment (PPE) see section 8.

Potential Acute Health Effects:
Eyes: Causes eye irritation
Skin: Not expected to cause irritation to the skin
Inhalation: Dust may cause respiratory irritation
Ingestion: Harmful if swallowed

Section 3. Hazard Identification

Irritant
The product is a dry Dichlobenil powder. This MSDS is for the dry powder. Please follow the directions on the label and wear the proper personal protective equipment (PPE); see section 8.

Section 4. First Aid Measures

Special instructions: If this material is spilled on a person, remove contaminated clothing and wash thoroughly with soap and water.
Inhalation: If person has difficulty in breathing, remove to fresh air. If the person still has difficulty, seek medical attention
Skin contact: Wash with soap and water if irritation persists, seek medical attention.
Eye contact: Immediately flush the eyes with copious amounts of water for at least 15 minutes, if irritation persists seek medical attention

Ingestion: Rinse mouth with water, do not induce vomiting; seek medical attention. Note this material has low toxicity under normal conditions of handling and use

Section 5. Fire Fighting Measures

Suitable extinguishing media: Dry chemical, foam, carbon dioxide, or water spray.
Extinguishing media must not be used for safety reasons: None known
Special exposure hazards in fire: The material will form toxic and irritant vapors in a fire situation.
Special protective equipment for fire-fighters: Wear self-contained breathing apparatus and suitable protective clothing for normal fire situations.
Other instructions: Containers can be kept cool by spraying with water spray.

Section 6. Accidental Release Measures

Personal precautions: Do not touch spilled material with bare hands; wear PPE outlined in Section 8 of MSDS.
Environmental precautions: This product is toxic to fish or other aquatic life, consult appropriate regulatory body for their specific regulations concerning Dichlobenil. Studies have shown that the maximum concentration of active ingredient in treated water must not exceed 3 ppm.
Methods for cleaning up: Wear proper PPE outlined in Section 8. Do not wash into sewers or into any body of water. If spill is dry sweep up and place in plastic container for disposal. Material may still be used as per label use if dry.
Other instructions: If dry material is mixed with other materials dry or liquid, absorb with inert absorbent material and consult with local, state or federal regulatory agencies for

Section 7. Handling and Storage

Handling: Avoid contact with skin or eyes, wear chemical resistant gloves and safety glasses or goggles.
Storage: Store in a dry, cool, frost-free ventilated area.
Specific use(s): The product is an herbicide, it used with the liquid component for the prevention of tree root re-growth and entry into sanitary, septic and sewers following mechanical process.

Section 8. Exposure Control/Personal Protection

USA values:	OSHA PEL	ACGIH TLV
Kaolin clay	5.00 mg/m^3	5.00 mg/m^3

Limit values in other countries:

Country	Ingredient	TWA (8 Hour)
Australia (NOHC)	Kaolin	2.00 mg/m^3
Canada	Kaolin	0.05 mg/m^3
UK	Kaolin	2.00 mg/m^3

Occupational exposure controls: Good ventilation is required.
Respiratory protection: Wear a dust/mist filtering respirator (NIOSH)
Hand protection: Wear chemical-resistant gloves
Eye protection: Wear safety glasses or goggles.
Skin protection: Wear long sleeves, long pants, and rubber boots.
Environmental exposure controls: Do not apply directly to lakes, ponds or streams.

Section 9. Physical and Chemical Properties

General information: The product is a tan powder with aromatic odor.
Important health, safety and environmental information. Wear specified PPE as outlined in section 8 and on the label. Process requires specialized application equipment operated by trained staff. Avoid mixing with acidic material as hydrogen sulfide gas may occur.

Physical State	Dry powder	**Specific Gravity** (H_2O=1)	ND
pH	NA	**Solubility**	Powder disperses (14.6 mg/L @ 68 °F (20 °C)

Freezing Point	NA	**Boiling Point**	NA

Section 10. Stability and Reactivity

Conditions to avoid: Avoid extreme heat
Materials to avoid: Avoid strong oxidizers.
Hazardous decomposition products: Oxides of chlorine and nitrogen
Hazardous Polymerization: Will not occur

Section 11. Toxicological Information

Acute toxicity: Dichlobenil Dermal (rabbit) LD_{50} = or >2000 mg/kg
Dichlobenil Oral (rat) LD_{50} = 2 g/kg
Dichlobenil Inhalation (rat)LC_{50} =0.25 mg/l
This product is both an acute and chronic hazard.
Empirical data on effects on humans: Routes of entry, contact, inhalation and ingestion.
Other information on health effects: May irritate the eyes, skin irritation, and respiratory irritation and may be harmful.

Section 12. Ecological Information

THIS PRODUCT CAN CAUSE POLLUTION IN THE ENVIRONMENT AND BE MODERATELY TOXIC TO AQUATIC ORGANISMS.
Other adverse effects: Known herbicide.

Section 13. Disposal Considerations

Pesticide disposal: If wastes are produced dispose according to local state, provincial or federal regulations. Triple rinse the bags before disposal into land fill.

Section 14. Transport Information

Transport class: Not regulated by highway or rail.
Sea transport: Not regulated.
Air transport: Do not ship by air unless packaging meets IATA/ICAO requirements.

Section 15. Regulatory Information

The EPA warning is "CAUTION"
Dichlobenil is listed the label
R phrases: R52, R20/21/22
S phrases: S2, S13, and S20/21

EPCRA 311/312 Categories:	Immediate (Acute) Health Effects:	Yes
	Delayed (Chronic) Health Effects:	Yes
	Fire Hazard:	No
	Sudden Release of Pressure	No
	Reactivity:	No

Right to know classification: Kaolin clay is listed in CA, PA, MN, MA, MI, FL and NJ.
TSCA: None
Reportable Quantity (RQ): None
Prop. 65: Kaolin clay (cancer)
WHMIS: Class D2 (Skin or eye irritant)\
Kaolin clay is listed in chemical inventories in: AICS, ECL, EEC, ENCS, EU, Israel, MAC, MAK, MITI, PICCS, SWISS, Taiwan, USA and UK

Abbreviations:

AICS	Australian Inventory of Chemical Substances

CAS #	Chemical Abstract Service Number
°C	Celsius temperature scale
°F	Fahrenheit temperature scale
ECL	Korean Existing Chemicals List
EEC	European Economic Commission
ENCS	Japanese Existing and New Chemical List
EINECS #	European Inventory of Existing Chemical Substances Number
EU	European Union
(Israel)	2001 proposed list of chemical substances to be regulated under Israel Hazardous Substances Law and Regulations List
MAC	Netherlands
MAK	Germany
MITI	Ministry of International trade and Industry
NA	Not applicable
PEL	Permissible Exposure Limit
PICCS	Philippines Inventory of Chemicals and Chemical Substances
PPE	Personal Protective Equipment
Prop.	Proprietary
NA	Not applicable
ND	Not determined
STEL	Short Term Exposure Limit
SWISS	Giftliste 1
SWISS	Inventory of Notified New Substances
TLV	Threshold Limit Value
TSCA	Toxic Substance Control Act
TWA	Time Weighted Average
(Taiwan)	List of Toxic Chemical Substances regulated under Taiwan Toxic Chemical Substances Control Act of 1086
USA	United States of America
UK	United Kingdom

Section 16. Other Information

Hazardous Material Information (HMIS) **National Fire Protection Association (NFPA)**

Health	1	1	Health
Fire	1	1	Fire
Reactivity	0	0	Instability
Personal Protection	J		NA

Health 4 Deadly 3 Extreme Danger 2 Dangerous 1 Slight hazard 0 No hazard
Fire 4 < 73 °C 3 < 100 °C 2 < 200 °C 1 >200 °C 0 Will not burn
Reactivity/Instability 4 – May detonate 3 Explosive 2 Unstable 1 Normally stable 0 Stable

Material Safety Data Sheet
AEC-2(M3LF)

Section 1. Product and Company Identification

Product Name: AEC-3(M3LF)
Product Code: V-F-AEC-AECSU-02X02G, V-F-AEC-AECSU-06X01G, V-F-AEC-AECSU-10X02L
Effective Date: October 3, 2008

Manufacturer Information:

Douglas Products and Packaging Company
1550 East Old 210 Highway
Liberty, Missouri 64068
Information Phone: (816) 781-4250
Emergency Phone: Chemtrec (800) 424-9300

Section 2. Ingredients and Hazards Identification

Hazardous Components		Occupational Exposure Limits			
Component	CAS Number	OSHA PEL	ACGIH TLV	Weight Percent	Section 313
Proprietary Blend*	Various numbers	ND	ND	≥ 98	No
Isopropyl Alcohol	67-63-0	980 mg/m^3	980 mg/m^3	≥ 2	No
This product contains the following EPCRA Section 313 chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372).					

* Proprietary blend of alkyl sulfates, salts of alkyl and di-akyl 2,5 diketotetrahydrofuren, alkyl aryl sulfate, alkyl ethoxylate, fatty solid diethanolamides, glycol and isopropanol. Contains 2% w/w of isopropanol.

Eyes: Causes eye irritation
Skin: May cause irritation to the skin
Inhalation: Vapors may cause respiratory irritation
Ingestion: Get medical attention immediately.

Section 3. Hazard Identification

The primary routes of entry are inhalation and ingestion.
Immediate Health Effects:
Eye Contact: May causes severe irritation, redness and blurred vision.
Skin: Contact with the skin may cause irritation.
Ingestion: May cause flushing, headache, dizziness, nausea and vomiting.
Inhalation: The vapor or fumes from this product may cause respiratory irritation.
Delayed or other Health Effects: Person with pre-existing skin and respiratory problems.
Target Organs: None determined.

Section 4. First Aid Measures

Eye Contact: Flush eyes with water immediately while holding eyelids open. Remove contacts, if worn, after initial flushing and continue flushing for at least 15 minutes. Seek medical attention if irritation persists.
Skin Contact: Use soap and water to remove from the skin, remove contaminated clothing, clean thoroughly before reuse.
Inhalation: Move to fresh air. If not breathing, give rescue breathing. If breathing is difficult give oxygen. Seek medical attention if breathing is still difficult.
Ingestion: If swallowed, get medical attention immediately. DO NOT INDUCE VOMITING. Never give anything by mouth to an unconscious person.

Section 5. Fire Fighting Measures

Flash Point: 130 °F
Flammability Limits: NE
Fire Fighting Media: Dry chemical, carbon dioxide, and water spray.
Special Fire Fighting Procedures: First responders need to wear full-bunker gear with SCBA, never enter a confined space unless fully protected with proper personal protective equipment (PPE).

Section 6. Accidental Release Measures

Clean-up Procedures: Wear proper PPE. Stop the source of the release if you are not put at risk. Use non-combustible absorbent material to absorb the spill, use non-sparking tools to consider proper disposal.
Spills and Leaks: Dispose in accordance to local, state or federal regulations.

Section 7. Handling and Storage

Handling: Do not get into eyes. Do not taste or swallow. Wash thoroughly after handling.
Storage: Store in original labeled container. Keep in cool and dry areas. Make sure that the containers do not pressurize due to extreme heat.

Section 8. Exposure Control/Personal Protection

Introductory Remarks: Consider the potential hazards of this product outlined in section 3. Use process exposures such as local exhaust ventilation, to control over exposure to airborne levels above recommended exposure limits.
Personal Protection:
Eyes: Wear safety goggles or safety glasses to prevent eye contact.
Body: Long sleeve shirts, long pants, socks, rubber boots and chemical resistant gloves.
Hands: Chemical resistant gloves
Respiratory: Wear an approved respirator that provides protection from this product if the airborne concentrations exceed the recommended exposure limits.
Other: Keep out reach of children.

Section 9. Physical and Chemical Properties

Odor	Mild alcohol	**Vapor Pressure**	33 torr @ 20 °F
Color	Yellow	**Vapor Density(air=1)**	2.1
Physical State	Liquid	**Specific Gravity (H_2O=1)**	1.054 @ 20 °F
pH	7.1-7.8	**Solubility**	Complete n water
Evaporation rate(water=1)	1.7	**Boiling Point**	> 100 °F

Section 10. Stability and Reactivity

Chemical Stability: Considered stable under normal ambient temperatures.
Hazardous Decomposition: At elevated temperatures one can get aldehydes. If complete combustions oxides of carbon.
Hazardous Polymerization: Will not occur
Incompatibility~ Materials to Avoid: May react with strong oxidizing agents, such as chlorates, nitrates or peroxides.

Section 11. Toxicological Information

Acute Eye Irritation: May be irritating
Acute Skin Irritation: Chronic exposure may be irritating
Acute Dermal Toxicity: Not expected to be toxic through the skin.
Acute Inhalation Toxicity: Not determined, expected to be an irritant to the respiratory system.
Carcinogenic Effects: None
Existing Medical Conditions Aggravated by Exposure: Exposure to inhalation, may cause respiratory problems and depression of central nervous system.

Section 12. Ecological Information

Ecotoxicity: The toxicity of this product has not been determined to aquatic organisms; this material should be kept out sewers, drainage systems and all bodies of water.
Environmental Fate: This product should be expected to be readily bio-degradable.

Section 13. Disposal Considerations

Waste Disposal Method: What ever cannot be saved for recovery or recycling should be managed by the local, state or Federal Regulations.
Container Handling and Disposal: All containers should be triple rinsed and disposed of according to local, state and Federal regulations.

Section 14. Transport Information

D.O.T. Classification: Not regulated by US DOT
Shipping Name: AEC-2(M3LF)
Technical Shipping Name: None
UNFIC: None
ID Number: None
Packaging Group: None
Labels: No US DOT Labels

Section 15. Regulatory Information

EPCRA 311/312 Categories:	Immediate (Acute) Health Effects:	Yes
	Delayed (Chronic) Health Effects:	Yes
	Fire Hazard:	Yes
	Sudden Release of Pressure	No
	Reactivity:	No

Right to know classification: Isopropyl alcohol is listed in CA, PA, MN, MA, MI, FL and NJ.
TSCA: Propylene glycol, ethanol
Reportable Quantity (RQ): None
Prop. 65: Not listed
WHMIS: Class D2, B (Skin or eye irritant)
Isopropyl alcohol is listed in chemical inventories in: ACIS, ECL, EEC, ENCS, EU, Israel, MAC, MAK, MITI, PICCS, SWISS, Taiwan, USA and UK

Abbreviations:

AICS	Australian Inventory of Chemical Substances
CAS #	Chemical Abstract Service Number

°C	Celsius temperature scale
°F	Fahrenheit temperature scale
ECL	Korean Existing Chemicals List
EEC	European Economic Commission
ENCS	Japanese Existing and New Chemical List
EINECS #	European Inventory of Existing Chemical Substances Number
EU	European Union
(Israel)	2001 proposed list of chemical substances to be regulated under Israel Hazardous Substances Law and Regulations List
MAC	Netherlands
MAK	Germany
MITI	Ministry of International trade and Industry
NA	Not applicable
PEL	Permissible Exposure Limit
PICCS	Philippines Inventory of Chemicals and Chemical Substances
PPE	Personal Protective Equipment
Prop.	Proprietary
NA	Not applicable
ND	Not determined
STEL	Short Term Exposure Limit
SWISS	Giftliste 1
SWISS	Inventory of Notified New Substances
TLV	Threshold Limit Value
TSCA	Toxic Substance Control Act
TWA	Time Weighted Average
(Taiwan)	List of Toxic Chemical Substances regulated under Taiwan Toxic Chemical Substances Control Act of 1086
USA	United States of America
UK	United Kingdom

Section 16. Other Information

Hazardous Material Information (HMIS) **National Fire Protection Association (NFPA)**

Health	3	3	Health
Fire	2	2	Fire
Reactivity	0	0	Instability
Personal Protection	J		NA

Health 4 Deadly 3 Extreme Danger 2 Dangerous 1 Slight hazard 0 No hazard
Fire 4 < 73 °C 3 < 100 °C 2 < 200 °C 1 >200 °C 0 Will not burn
Reactivity/Instability 4 – May detonate 3 Explosive 2 Unstable 1 Normally stable 0 Stable

Nitrification Inhibition Analysis For Sanafoam Vaporooter II

Summary Report

August 21, 2007

Prepared by:

Great Lakes Environmental Center
739 Hastings St.
Traverse City, MI 49686

Nitrification Inhibition Analysis
For Sanafoam Vaporooter II

Summary Report

Introduction

Nitrification is the biological oxidation of ammonia with oxygen into nitrite followed with the oxidation of these nitrites into nitrates. Nitrification plays an important role in the removal of nitrogen from municipal wastewater. Nitrification is a two-step aerobic process, each step facilitated by a different type of bacteria. The oxidation of ammonia (NH_3) to nitrite (NO_2^-) is most often facilitated by *Nitrosomonas* spp. (nitroso = ammonium). Nitrite oxidation to nitrate (NO_3^-), though traditionally believed to be facilitated by *Nitrobacter* spp. (nitro=nitrite), is now known to be facilitated in the environment almost exclusively by *Nitrospira* spp.

Denitrification requires anoxic conditions to encourage the appropriate biological communities to form. It is facilitated by a wide diversity of bacteria. Sand filters, lagooning and reed beds can all be used to reduce nitrogen, but the activated sludge process (if designed well) can do the job the most easily. Since denitrification is the reduction of nitrate to nitrogen gas, an electron donor is needed. This can be, depending on the wastewater, organic matter, sulfide, or an added donor like methanol.

Wastewater treatment plants which nitrify are generally very concerned about any industrial waste which may detrimentally inhibit nitrification. Douglas Products & Packaging, a distributor of the Sanafoam Vaporooter II product, wishes to apply this product within the Hampton Roads Sanitation District (HRSD) in Virginia. HRSD has requested that a test of Vaporooter II (primary active ingredient is metam sodium) be completed to ensure that there will be no detrimental effect on their wastewater treatment processes.

Vaporooter is a combination of herbicides that are placed in sewer lines as foam for the purpose of eliminating roots and preventing further destruction of sewer pipe caused by live tree roots. Only roots within the pipe and a very short distance outside the pipe are affected. Trees and shrubs immediately above the ground are not harmed. Vaporooter is composed of

1) an herbicide which penetrates root cell walls, bursts them and causes the root to die and decay, 2) a root growth inhibitor that attaches to surface-active organic material to inhibit further root cell division or growth for approximately three years,
3) a surfactant blend which strips away grease and slime from the roots permitting penetration of the formulation into the root mass, and 4) a foaming agent which provides a durable, fine-textured "vehicle" to carry Vaporooter into maximum contact with all roots and pipe surfaces (from product website: http://www.douglasproducts.com).

HRSD has developed a specific laboratory protocol for nitrification inhibition studies as well as a specific modification of this protocol for testing of metam sodium based products (Appendix A). This report details the results of testing of the Sanafoam Vaporooter II product.

Methods

Treatment Plant Test Material

The nitrification inhibition test protocol specifies that the HRSD's VIP or Nansemond plant mixed liquor be utilized as a source of nitrifying biomass. Because the mixed liquor and raw water influent for the tests must be collected and used the same day as the test, this would preclude using HRSD material as shipping would require at least one day. HRSD allows the use of substitute material as long as it generally conforms to the following operational characteristics of the HRSD raw water influent: BOD of 200-250 ppm, COD of 500-600 ppm, TSS of 125-175 ppm, ammonia of 20-30 ppm and industrial loading of less than 20% (Matt Cox, HRSD, personal communication). Based on these parameters, it was suggested that the Traverse City Wastewater Treatment Plant, located within 3 miles of the GLEC laboratory, would be a viable alternative. The Traverse City WWTP is a nitrifying treatment plant with the following raw water influent characteristics (12 month average): BOD of 280 ppm, TSS of 248 ppm, ammonia of 27.9 ppm, and minimal industrial loading. Traverse City does not monitor for COD. A comparison of the HRSD and Traverse City WWTP (TC WWTP) indicates that the TC WWTP has approximately 15% higher BOD and 40% higher TSS. Conversations with HRSD indicated that the tests could utilize TC WWTP raw water influent diluted approximately 20% with deionized water, and use the undiluted mixed liquor

(Matt Cox, HRSD, personal communication). COD concentrations were measured by GLEC on Traverse City raw water influent diluted 20% with deionized water (as per test protocol) and concentrations ranged from 175 – 200 ppm.

Raw water influent from the TC WWTP was sampled hourly and composited into a 50 liter container. Five liters of influent water was then drawn from this influent composite for use in each days test. The use of a composite influent sample reduced the variability inherent in the raw influent stream from day to day. Eight liters of mixed liquor sample was collected from an aeration basin at the TC WWTP, and this was considered representative based on the expertise of the WWTP operators. These samples were utilized in the analysis described below.

Vaporooter Treatment Levels

HRSD's treatment protocol requires that specific target concentrations of the product are utilized. HRSD states the primary target concentration to be the largest volume of product to be used in any single application project (per day and in units of gallons) divided by 300,000 gallons (lowest hourly flow expected at any HRSD plant at any time of day). This is referred to as target concentration "X". Each nitrification inhibition test was required to be run at a minimum 0.5X, X and 2X concentrations. At the request of Douglas Products, GLEC also ran test concentrations of 0.25X and 0.125 X in addition to the other three. For the purposes of this project, all concentrations were calculated on the basis of complete Vaporooter product, not based on the 30% active ingredient. Discussions with Douglas Products indicated that the maximum amount of Vaporooter applied for any single project, for a day, is approximately 15 gallons. Therefore, given the total Vaporooter maximum product volume and the lowest treatment plant flow rate, that would equate to a concentration of 50 ppm total product (concentration X). The concentrations used for these nitrification inhibition tests are: 2X (100 ppm), X (50 ppm), 0.5X (25 ppm), 0.25X (12.5 ppm) and 0.125X (6.25 ppm).

Nitrification Inhibition Protocol

Approximately eight liters of TC WTTP mixed liquor and five liters of composite raw water influent were collected in a five gallon plastic container with a sealable lid and transported to

the GLEC laboratory. The mixed liquor was allowed to settle for 20 minutes and the liquid was carefully decanted off the top. The solids were immediately aerated after settling in order to bring the dissolved oxygen (D.O.) to a level between 2.0 and 4.0 mg/L. Samples of the aerated solids were collected and submitted for analysis of TSS. During aeration, the specific ammonia electrode (Orion Model 9512 electrode, Orion Model 811 millivolt/pH meter) were calibrated using standard GLEC SOPs. Stock solutions of Vaporooter II in deionized water were made for each day's test, such that the target concentrations (6.25, 12.5, 25, 50, and 100 ppm) were achieved in the final treatment volumes. This consisted of adding the appropriate Vaporooter stock solution to raw influent to reach a volume of 225 mL. The final experimental volumes consisted of 50 mL of aerated mixed liquor solids in a beaker, along with 225 mL of treatment. Three replicate beakers were prepared for each of the five treatment levels. Samples of the raw influent control and treatment concentration X were collected prior to the start of the test run, and after the conclusion of the test for analysis of cynanide (CN). In addition, random treatment samples were collected and analyzed for ammonia by EPA Method 350.2 to compare to the concentrations measured by the Orion ammonia probe.

Immediately after the addition of the treatment concentrations, an aliquot in each of the beakers and the control was removed and starting concentrations of ammonia were measured. The beakers were placed on a shaker table with individual aeration lines for each beaker. This helped to maintain the D.O. between 2.0 and 4.0 mg/L and to keep the solutions well mixed. The time at which each treatment was added to its respective test beaker was recorded. D.O. was monitored during the test period to ensure that the samples were maintained within the desired D.O. range.

The concentration of ammonia was measured in one of the control beakers after two hours to determine if approximately 50% of the starting ammonia concentration had been consumed. The rate of ammonia consumption was calculated and if 50 % had not been consumed, an estimate of the additional test time required for 50% consumption was then calculated. The test was terminated when approximately 50% ammonia in the controls was consumed. Ammonia concentrations were measured in all replicates of each concentration, and the test

time noted. An ammonia consumption rate was calculated for each treatment, and compared to controls to determine if any inhibition of nitrification was present. The observed ammonia consumption readings for each test concentration and companion control was plotted using Axum 6.0 (Mathsoft Corp.) as a basic line plot. Data were expressed as ammonia consumption per hour (mg/L/hr).

Initial nitrification inhibition tests did always show any appreciable ammonia consumption. The Orion ammonia electrode may experience interference from constituents within the test solution. For example, the Orion probe cannot differentiate between monomethylamine (MMA) and ammonia. Because monomethylamine will not nitrify and it is difficult to break down, it was important to determine if the Vaporooter product itself would be a source of MMA or any other source of interference which could potentially bias the ammonia readings. In addition, the surfactants used in the Vaporooter product may also confuse the numbers slightly since they may be made from ammonium salts. An assessment was conducted using the Vaporooter II product at all test concentrations. Deionized water (as a replacement for the influent/mixed liquor) was combined with Vaporooter to achieve the target test concentrations. The ammonia concentration was measured at each of these concentrations, and again after two hours duration to determine if the Vaporooter product itself contributes to the measured ammonia concentration.

Results

Table 1 shows the ammonia consumption rate data as calculated for each test run. There is variability between the test events, as would be expected from differences in both the raw influent and the mixed liquor. In general, it appears that the 0.5X, X and 2X concentrations (25, 50 and 100 ppm Vaporooter II) depress the nitrification process at the TC WWTP, across all five test events. The degree of inhibition differs from each test. A graphical representation of the tests is shown in Figures 1 through 5).

The determination of whether Vaporooter product itself is a source of interference with the ammonia probe does not indicate any specific problem. The data (Table 2) show a low background concentration which is consistent across all treatment levels. In addition,

analytical measurements of ammonia concentrations taken to compare to the Orion ammonia probe with the accepted laboratory determination of ammonia are tabulated in Table 3. In general, the measured concentrations between the probe and analytical tests were very consistent and demonstrated less than 10% difference. Cyanide was not detected in the influent controls or the "X" concentration at the beginning or ends of the test runs (Table 4).

Discussion

The goal of wastewater treatment is the removal of contaminants from the water in order to decrease the possibility of detrimental impacts on humans and the rest of the ecosystem. The term "contaminant" is used here to refer to an undesirable constituent in the water or wastewater that may directly or indirectly affect human or environmental health. Many contaminants, including a wide variety of organic compounds and metals, are toxic to humans and other organisms. Other types of contaminants are not toxic, but nevertheless pose an indirect threat to our well-being. For example, loading of nutrients (e.g., nitrogen and phosphorus) to waterways can result in excessive growth of algae and unwanted vegetation, diminishing the recreational, economic and aesthetic values of lakes, bays and streams.

Nitrogen is found in domestic wastewater mostly in the form of ammonia and organic nitrogen. These can be converted to nitrate nitrogen by bacteria, if the wastewater treatment plant is designed to provide enough oxygen and a long enough "sludge age" to develop these slow-growing types of organisms. The nitrate which is produced may be discharged; it is still usable as a plant nutrient, but it is much less toxic than ammonia. If more complete removal of nitrogen is required, a biological process can be set up which reduces the nitrate to nitrogen gas. Wastewater treatment plants which are optimized to remove ammonia, and perhaps subsequently remove the nitrate as well are cautious about potential industrial waste discharges which may inhibit the nitrification process.

The results for these nitrification inhibition trials do indicate there is a potential threshold for an observed effect. This threshold is somewhere near 25 ppm total Vaporooter product (approximately 7.5 ppm metam sodium, 30% active ingredient). At concentrations below 25

ppm Vaporooter product (in these tests, 12.5 ppm and below), there appears to be very little impact on ammonia consumption. It should be noted that the threshold concentration of 25 ppm does not eliminate nitrification, but is an approximate product level at which an observed effect is more distinct (see Figures 1-5). This threshold is also based on a worst-case scenario of the lowest hourly flow at the smallest HRSD facility combined with the largest daily amount of Vaporooter likely to be applied. In practice, it would be unlikely that the entire amount of Vaporooter product would impact any treatment plant in a single hourly event, due to the specific characteristics of the Vaporooter "foam" delivery system which helps retain much of the active ingredient at the application site (Justin Fearn, Douglas Products, personal communication). Additionally, there was not any detectable cyanide produced from the metam sodium active ingredient in these tests, either in the controls or "X" concentration, and thus this was not considered a significant problem.

Table 1. Data from the Nitrification Inhibition tests for HRSD using raw influent and mixed liquor from the Traverse City Wastewater Treatment Plant, Traverse City, Michigan. Values shown for each concentration are ammonia concentration (mg/L). Rate is expressed mg NH_3 consumed/L/Hr. Start and End ammonia concentrations are mean of three replicates.

Ammonia (mg/L)

Test 1	**Control**	**0.125X**	**0.25X**	**0.5X**	**X**	**2X**	**Test Duration**
Start	20.69	22.19	24.10	26.13	25.04	21.75	3.5 hrs
End	10.26	13.90	15.98	20.91	20.39	18.39	
Rate	**2.98**	**2.37**	**2.32**	**1.49**	**1.33**	**0.96**	
Test 2	**Control**	**0.125X**	**0.25X**	**0.5X**	**X**	**2X**	**Test Duration**
Start	19.39	21.02	22.25	25.16	26.37	28.87	5.0 hrs
End	10.62	17.72	18.63	22.46	24.86	26.94	
Rate	**1.75**	**0.66**	**0.72**	**0.54**	**0.30**	**0.39**	
Test 3	**Control**	**0.125X**	**0.25X**	**0.5X**	**X**	**2X**	**Test Duration**
Start	22.26	22.50	22.34	22.90	22.89	23.21	2.25 hrs
End	11.53	12.62	12.89	14.37	15.98	15.91	
Rate	**4.77**	**4.39**	**4.20**	**3.79**	**3.07**	**3.24**	
Test 4	**Control**	**0.125X**	**0.25X**	**0.5X**	**X**	**2X**	**Test Duration**
Start	22.30	23.00	24.44	22.01	24.16	24.21	3.0 hrs
End	11.32	11.81	15.41	14.83	14.00	18.24	
Rate	**3.66**	**3.73**	**3.01**	**2.39**	**3.40**	**1.99**	
Test 5	**Control**	**0.125X**	**0.25X**	**0.5X**	**X**	**2X**	**Test Duration**
Start	21.97	21.67	22.50	23.52	23.98	24.23	3.5 hrs
End	11.02	11.57	13.02	18.56	19.33	20.34	
Rate	**3.13**	**2.89**	**2.71**	**1.42**	**1.33**	**1.11**	

Table 2. Ammonia data (mg/L) from Vaporooter II test to determine if the test product produces a background ammonia reading using the Orion Model 9512 Ammonia electrode. Test was run as a companion, set up normally using raw water influent and mixed liquor compared to only deionized water. The average measured ammonia background concentration using the ammonia probe calibration blank from each of the five test runs (Table 1) is shown for comparison.

Ammonia (mg/L)

	Control	0.125X	0.25X	0.5X	X	2X
Normal Test Set-Up	21.61	21.70	22.19	22.96	23.38	23.55
DI Water Only	0.17	0.21	0.23	0.19	0.18	0.22
Test Blank Average (5 Tests)		0.22				

Table 3. Comparison of ammonia concentrations as measured by the Orion Model 9512 Ammonia electrode and by EPA Method 350.2. Concentrations expressed in mg/L. Start and End indicate when sample was taken during the test run.

Ammonia (mg/L)

Test Concentration	Orion 9512 Probe	EPA Method 350.2	% Difference
Control (Start)	21.6	22.6	4.4
Control (End)	13.1	14.3	8.4
0.125 X (End)	14.4	15.2	5.3
0.25X (End)	14.9	16.2	8.0
0.5X (End)	15.6	15.9	1.9
X (End)	17.0	18.5	8.1
2X (End)	17.8	18.3	2.7

Table 4. Measured concentrations of cyanide (CN) in controls and concentration X at start and end of each test.*

Test Concentration	Test 1	Test 2	Test 3
Control (Start)	ND**	ND	ND
Control (End)	ND	ND	ND
X (Start)	ND	ND	ND
X (End)	ND	ND	ND

* Cyanide analysis not done on Test 4 and 5 due to Non Detects on Tests 1 through 3.
**ND = Not Detected. Limit of Detection = 0.005 mg/L

Figure 1. Ammonia consumption rate (mg NH_3/L/Hr) for Test #1. Concentration "X" is based on the maximum Vaporooter II product usage and lowest hourly flow rate at any HRSD treatment plant.

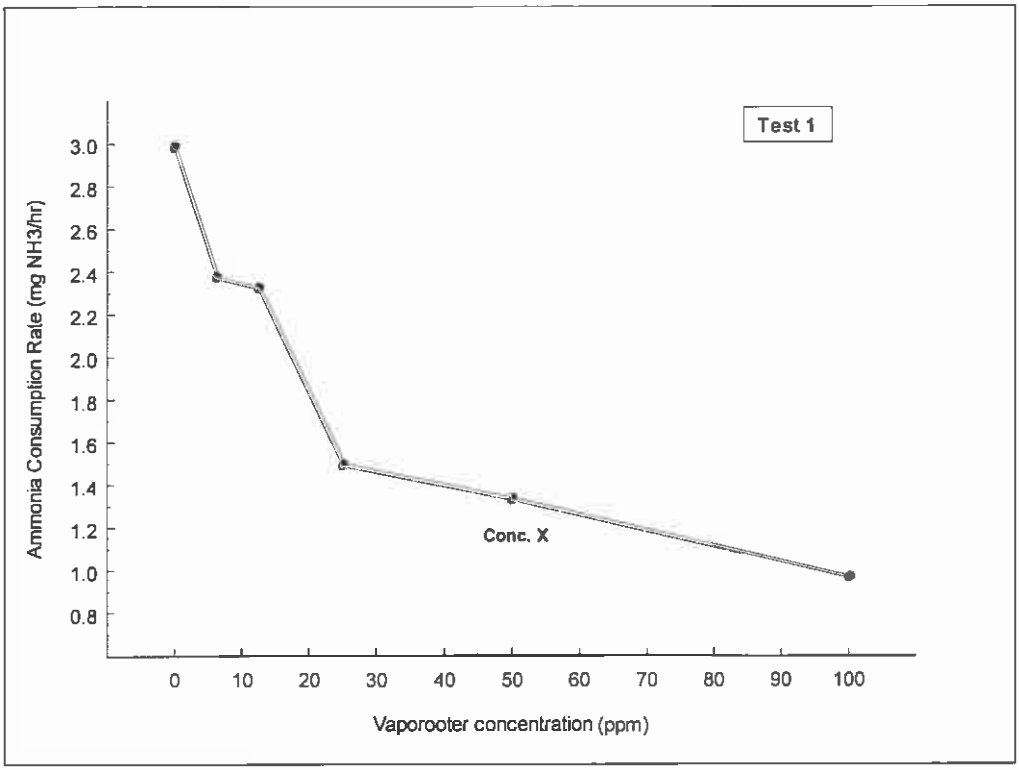


Figure 2. Ammonia consumption rate (mg NH_3/L/Hr) for Test #2. Concentration "X" is based on the maximum Vaporooter II product usage and lowest hourly flow rate at any HRSD treatment plant.

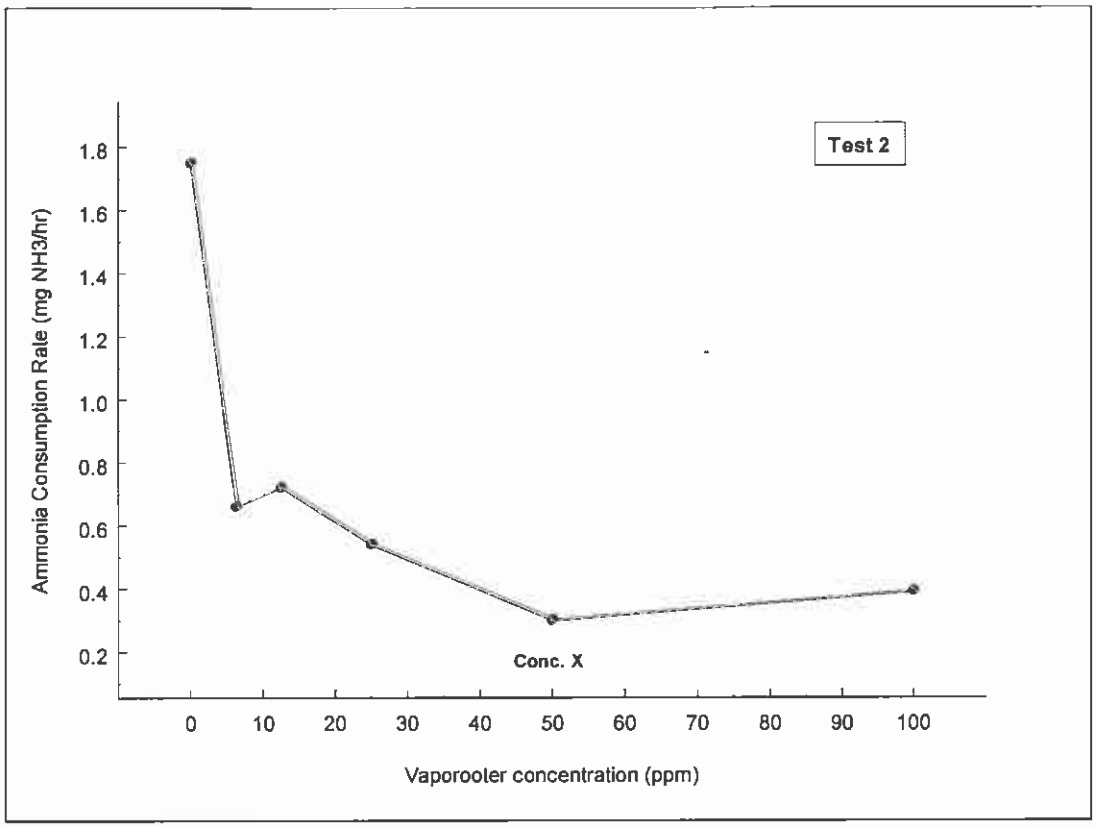


Figure 3. Ammonia consumption rate (mg NH_3/L/Hr) for Test #3. Concentration "X" is based on the maximum Vaporooter II product usage and lowest hourly flow rate at any HRSD treatment plant.

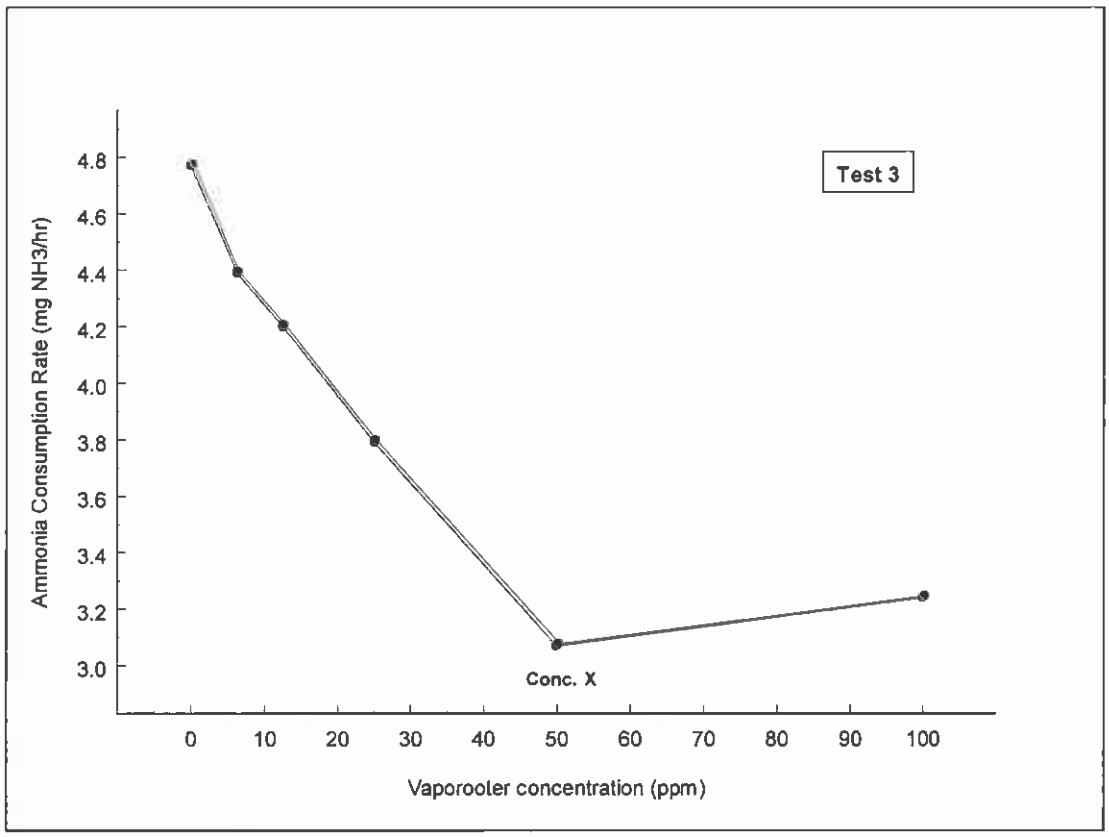


Figure 4. Ammonia consumption rate (mg NH_3/L/Hr) for Test #4. Concentration "X" is based on the maximum Vaporooter II product usage and lowest hourly flow rate at any HRSD treatment plant.

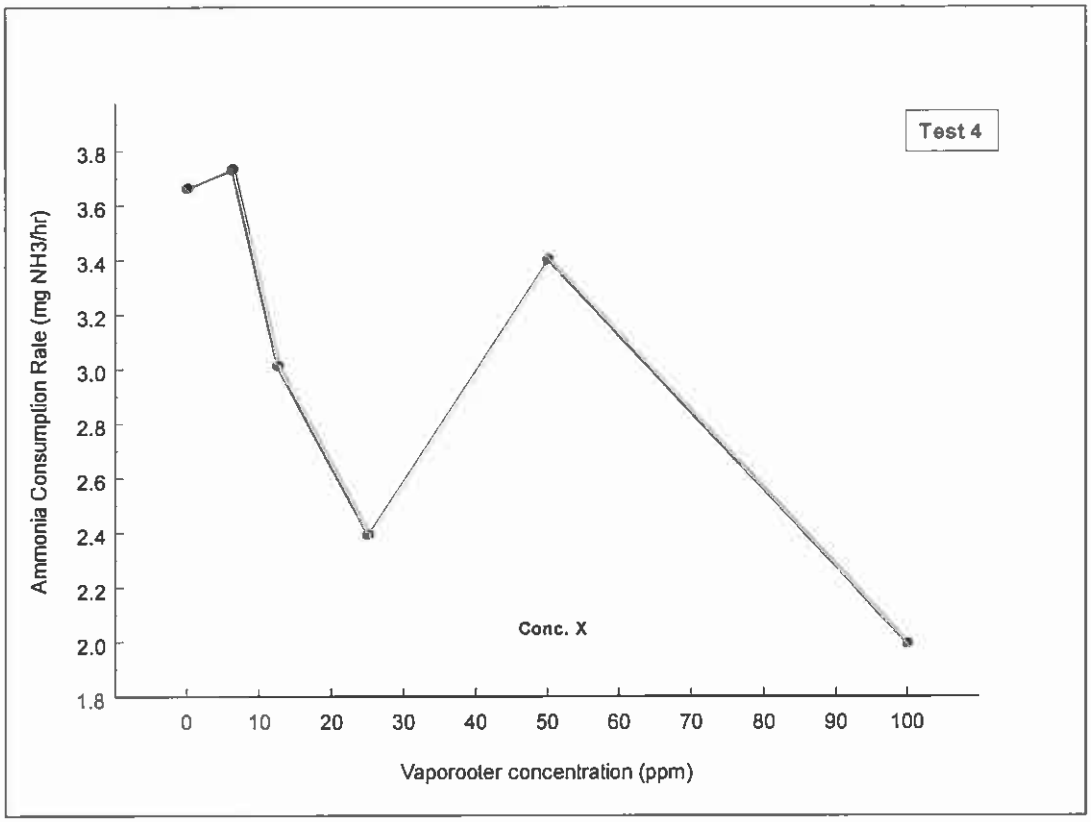
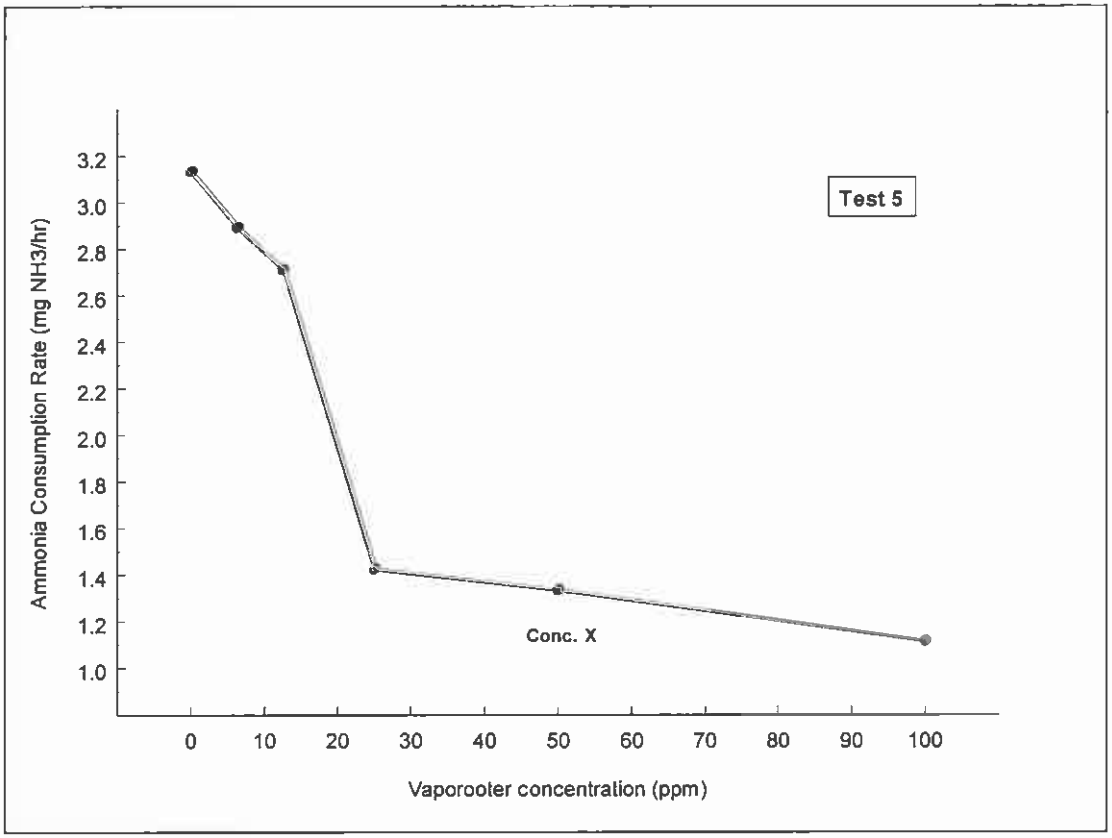


Figure 5. Ammonia consumption rate (mg NH_3/L/Hr) for Test #5. Concentration "X" is based on the maximum Vaporooter II product usage and lowest hourly flow rate at any HRSD treatment plant.



APPENDIX A

NITRIFICATION INHIBITION STUDY

This test can be used to determine the potential of industrial waste discharges and/or internal POTW process streams to inhibit nitrification. Two control waters have been referenced; each is specific to the study objectives. Control #1 represents the raw influent of a facility which is unaffected by its constituents and is different than that of the plant in question, which is presumably already affected. Control #1 is necessary if toxicity is suspected in the service area of a facility (due to toxicity in the raw influent of the plant in question). Control #2 represents the raw influent of the facility in question if that influent is known to be non-toxic. Control #2 is necessary if toxicity is suspected of an internal process stream within the plant. Control #1 should be selected carefully from a facility with a service area similar to that of the plant experiencing problems or projected to experience problems.mThe influent from an affected plant can not be used to study industrial waste discharges because that waste already affects the influent of that plant. If the problem has not been determined to be service area or plant-specific, the first step of the study should be to compare Control #1 to Control #2 in terms of ammonia conversion rates. Significant differences in the rates will determine if the problem is within the plant or service area. It is a good idea to run both controls at all times to determine baseline responses for each. These baselines can then be used as a reference point for changes which may be implemented either in the service area or in the plant, or both.

The critical steps in this test which influence variability and interpretation of results are the assigning of representative aliquots of solids and sample to each test chamber and the recording of time at initial and final ammonia measurements. The utility of this test is maximized when intra-treatment variability is minimized. Questions can be addressed to Jim Pletl, Environmental Scientist, Hampton Roads Sanitation District, 757-460-4246.

1. Collect 2.5-5 liters of mixed liquor and allow to settle. The mixed liquor tested should be obtained from a facility which currently does not suffer from inhibition of nitrification. TSS of mixed liquor should be 2-3000 mg/l and TVSS should be 65-75%. Final settling volume of the 2.5-5 liter collection should be approximately 1.0 liter. This will be enough to test 4 samples. Allow at least 10 minutes for settling. Prepare ammonia probe and meter for operation. Fresh, untested mixed liquor should be used each day.

2. Bring control water(s) to room temperature, depending of study objectives.

3. Decant off liquid from mixed liquor sample. Aerate solids ASAP after settling, bringing DO to 2.0- 4.0 mg/l.

4. Prepare a 1000 ppm NH3 standard with 3.147 g anhydrous NH4Cl in a one liter volumetric flask. Use DI water for dilution.

5. Bring samples to room temperature.

6. Measure ammonia in all samples, including controls. You will need to calibrate ammonia probe at 10 mg/l and 50 mg/l, therefore prepare standards for these concentrations from the 1000 mg/l standard prepared above. Prepare the ammonia probe standards as follows using DI water every Monday:

Standard	ml 1000 mg/l std/liter
10 mg/l	10 ml
50 mg/l	50 ml

7. Label 3 500- ml beakers for each control and sample. Label each of the three beakers for each treatment as "a", "b", and "c". Three replicates per treatment are required, at a minimum, to address intra- treatment variability.

8. Pour exactly 50 mls of solids into each beaker, being sure that the solids are well mixed while aliquots are drawn, measuring with a graduated cylinder. Pour 100 mls of well- mixed solids into a TSS sample bottle and submit for analysis of TSS and TVSS. Date sample and label appropriately. (Note: Use larger proportionate volumes of solids and sample to get more reproducible results, if available. Volumes of 100- 200 mls of solids and 450- 900 mls of sample are preferable, but reproducing the ratio of sample to solids existing full- scale is very important.)

9. Normalize ammonia concentrations in all samples and controls as follows. This example only shows one industrial waste sample, but the approach can be used on any number of industrial waste and/or process stream samples (control water used is study objective and sample specific). This approach will insure that the ammonia levels between controls and treatments will be similar. Significantly different ammonia levels between treatments may result in different ammonia uptake rates by mixed liquor independent of treatment(s) being tested, which will confound the study results. This example only assumes that 1- liter of each control and samples are being prepared, the ammonia adjustments will vary for the controls if more control water is required.

Treatment	B	C ml 1000 ppm NH3	ml DI
ind.wst.	ind. wst. NH3	highest B - ind.wst. B	highest C - ind. wst.C
Cntrl #2	Cntrl #2 NH3	highest B - Cntrl #2 B	highest C - Cntrl #2C
Cntrl #1	Cntrl #1 NH3	highest B - Cntrl #1 B	highest C - Cntrl #1 C

For example, if ind. wst. sample = 30 mg/l total NH3, Cntrl #2 = 25 mg/l total NH3 and Cntrl #1 = 20 mg/l total

Treatment	B	NH3: C ml 1000 ppm NH3	ml DI
ind. wst.	30	30 - 30 = 0	10 - 0 = 10
Cntrl #2	25	30 - 25 = 5	10 - 5 = 5
Cntrl #1	20	30 - 20 = 10	10 - 10 = 0

The final ammonia concentration in all samples for this example should be 30 mg/l NH3/(1.0 + .015 l) = 29.6 mg/l NH3. Remember that the calculations are based on the highest "B" and "C" achieved, regardless of sample identification. Each sample should be adjusted to 25-30 mg/l total ammonia if initial concentrations of all samples are relatively low. This will facilitate measurable differences in controls and treatments, which is required to calculate conversion rates and to determine differences between controls and treatments. However it is also important that the concentrations be similar between all samples, even if all concentrations are raised to some arbitrary level.

10. Normalization of pH between controls may be necessary if they differ significantly (more than 0.5 pH units). pH influences ammonia conversion rates and will confound data interpretation if significantly different between treatments and controls. The pH of samples should be adjusted only after preparing dilutions.

11. Prepare industrial waste dilutions by combining these samples with the Control #1 water as a percentage equal to that occurring full-scale at the plant in question. Prepare process stream dilutions by combining with the Control #2 water as a percentage equal to that occurring full-scale at the plant in question. For example, if an industrial waste makes up 5% of a facilities raw influent, then add 50 mls of the wastewater from that industry to 950 mls of raw, non-toxic influent (Control #1). Measure the ammonia concentration of each control and prepared treatment at this time.

12. Pour exactly 225 ml of each treatment (when using 50 mls of solids) into the appropriately labeled beakers and aerate gently immediately to bring DO between 2.0-4.0 mg/l in each beaker. Addition of treatments to the solids should occur immediately after the treatments are prepared in #11 above. Record the time at which each treatment is added to its respective test beaker. Monitor DO for the entire test to keep within the specified

range in all beakers. The use of stir plates and bars should be considered if aeration is not sufficient to keep each beaker's contents evenly mixed throughout the test.

13. Measure ammonia after 2 hours in one beaker of Control #1 and note the time. The test can be terminated if 50% or more of the original ammonia has been consumed since the test began for that beaker. Test termination consists of taking final ammonia measurements for all remaining beakers and noting the time of each measurement. The time to be recorded is when the sample is fixed for analysis. The test should continue if 50% of the ammonia has not been consumed. Extrapolate how much longer the test should last based on the rate of uptake thus far measured. If the initial ammonia is 25 mg/l and the final is 15 mg/l for a two- hour period, then the amount of time left in the test is approximately:

[{(.5)(**2** hrs)(25 mg/l)}/(25 mg/l - 15 mg/l)] - **2** hrs = 0.5 hrs = 30 additional minutes

Please note that this is an example. If the time that has passed since th e initial ammonia measurement for the Control #1 replicate in question is different than 2 hours, insert the actual time into the parts of the equation which are in bold type. Wait the additional time projected and then measure the ammonia concentration and time for all test beakers. Adjustment of data for the first control beaker may be necessary since the solids:sample ratio is now higher due to removal of sample for the initial ammonia analysis used to terminate the test.

14. Calculate the mg of NH3 consumed per hour for each beaker. Compare average uptake rate for each treatment against Control #1 for each day tested. Normalize data for TVSS (mg NH3 consumed/hr/mg TVSS) for comparisons between days.

MEMORANDUM

TO: Industrial Waste Manager

FROM: Environmental Scientist

DATE: June 17, 2005

SUBJECT: Nitrification Inhibition and CN testing of metam sodium

The following represents an outline for a study plan to investigate the potential for metam- sodium based products to inhibit nitrification and liberate CN:

1. Follow the SOP entitled "Nitrification Inhibition Study" to conduct each experiment.

2. Use HRSD's VIP or Nansemond plant mixed liquor as a source of nitrifying biomass; check with HRSD as to which one when the study is to begin. If other sources of biomass are to be used, they must be approved for use by HRSD prior to beginning the study.

3. Calculate the target concentration of product to test by dividing the largest volume of product to be used in any single project, per day and in gallons, by 300,000 gallons (the lowest hourly flow expected at any HRSD plant at any time of day). This will provide the worse case concentration occurring at any plant at any time. For the purposes of this study, this will be referred to as concentration X.

4. Each day's study will test the product at 0.5X, X and 2X to establish a dose response curve. This study, therefore, will only confirm potential for toxicity at these concentrations and less. The use of higher concentrations must be verified through further study.

5. Those funding the study may opt to use product in the test that has been pre- exposed to conditions similar to that in the field to address any product degradation/transformation issues that may influence study conclusions. This is acceptable, but the process for preparing the product in this fashion must be outlined and approved by HRSD prior to beginning testing.

6. The control for this study should be, if possible, Nansemond Plant raw influent. This influent will be used to dilute the product to the desired concentrations prior to testing and without the product as a benchmark for comparison. Only one control needs to be tested (in triplicate) in contrast to that described in the SOP. If another control is selected it must be approved by HRSD prior to beginning the study.

7. The product, in whatever form tested using the nitrification inhibition

SOP, will be tested for cyanide at concentration X using a 40 CFR Part 136 approved procedure. The Nansemond plant raw influent should also be sampled for cyanide prior to exposure to the product or the inhibition tests. At the completion of the inhibition tests each day, samples are also to be taken from the concentration X replicates and the control for cyanide analysis.

8. Calculate the ammonia conversion rate for each concentration of product and the control, each day, by dividing the difference between the initial and final ammonia readings for each replicate by the duration of the test for each replicate. Report these conversion rates for each replicate and treatment, for each day of study.

9. The inhibition test must be conducted a minimum of 5 different calendar days using mixed liquor and raw influent collected from the plants on the same day as each respective test. This is necessary to address variability in nitrifying biomass and influent quality. Mixed liquor and raw influent cannot be used unless they are collected the same day they are used and tested.

10. Questions can be addressed by Jim Pletl of HRSD, 757- 460- 4246, jpletl@hrsd.com.

This study may raise issues that require further study; HRSD must reserve the right to request additional information if necessary.