

8329-74

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OFFICE OF  
PREVENTION, PESTICIDES  
AND TOXIC SUBSTANCES

Karen J. Larson  
Clarke Mosquito Control Products, Inc.  
159 N. Garden Avenue  
Roselle, Illinois 60172

MAR 1 2007

Dear Ms. Larson:

Subject: Labeling Amendment; Updated First Aid Section  
AROSURF MSF  
EPA Registration No. 8329-74

The labeling referred to above, submitted in connection with registration under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, is acceptable with the following provision:

1. Within the NOTICE section of the label, rephrase the sentence "*Clarke Mosquito Control Products, Inc. makes no warranty, express or implied...*" to read "*To the extent consistent with applicable law, Clarke Mosquito Control Products, Inc. makes no warranty, express or implied...*".

A stamped copy is enclosed for your records. Please submit one (1) final printed copy for the referenced label, incorporating the above changes, before releasing the product for shipment.

Sincerely,

Kable Bo Davis  
Entomologist  
Insecticide-Rodenticide Branch  
Registration Division (7505P)

Enclosure

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[company header + brand logo: AROSURF MSF]

# AROSURF<sup>®</sup> MSF

Monomolecular Surface Film

For control of MOSQUITO LARVAE and PUPAE

**Active Ingredient**

Poly(oxy-1, 2-ethanediyl), a-isooctadecyl- $\omega$ -hydroxy .....100%  
CAS NUMBER 52292-17-8

EPA EST. NO. 56630-WI-1

EPA REG. NO. 8329-74

**CAUTION**  
**KEEP OUT OF REACH OF CHILDREN**

<b>FIRST AID</b>	
<b>If on skin or clothing:</b>	<ul style="list-style-type: none"> <li>• Take off contaminated clothing.</li> <li>• Rinse skin immediately with plenty of water for 15-20 minutes.</li> <li>• Call a poison control center or doctor for treatment advice.</li> </ul>
<b>If in eyes</b>	<ul style="list-style-type: none"> <li>• Hold eye open and rinse slowly and gently with water for 15-20 minutes.</li> <li>• Remove contact lenses, if present, after the first 5 minutes, then continue rinsing the eye.</li> <li>• Call a poison control center or doctor for treatment advice.</li> </ul>
<p><b>Have the product container or label with you when calling a poison control center or doctor, or going for medical treatment. For medical emergencies, call the International Poison Control Center at 1-800-214-7753.</b></p>	

**PRECAUTIONARY STATEMENTS**  
**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**  
**CAUTION**

Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling.

**DIRECTIONS FOR SUE**

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Refer to technical bulletin prior to use.

**ACCEPTED**  
with **COMMENTS**  
In EPA Letter Dated:  
**MAR 1 2007**

Under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, for the pesticide registered under EPA Reg. No. **8329-74**

### STORAGE AND DISPOSAL

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

**STORAGE:** Do not allow water to stand on drum top for prolonged periods of time. Water may seep into drums (through weeping) and cause rust formation which may clog spray nozzles.

**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 by other procedures approved by state or local authorities.

### SPRAY TANK AND MIXING PRECAUTIONS

Thoroughly clean spray systems of contaminants such as petroleum oils, conventional toxicants, and detergent residues prior to the addition of technical AROSURF MSF or when formulating AROSURF MSF with water to prevent possible adverse product interactions and environmental effects. Detergents can act to destroy the film-forming properties of AROSURF MSF. Diesel Oil + AROSURF MSF + water can form a pasty unsprayable material.

Spray tanks should be free of water when using technical AROSURF MSF in non-agitating systems.

Ground spray systems should be equipped with high sheer agitation (e.g. paddle) when adding AROSURF MSF to water in spray tanks. Do not add AROSURF MSF to water in spray systems that do not have agitation.

Premixing of AROSURF MSF with water in high sheer agitation systems is required prior to addition to aircraft spray systems. Conventional by-pass recirculation will not provide adequate agitation to effectively mix AROSURF MSF with water.

### APPLICATION CONSIDERATIONS

AROSURF MSF is not visible on the surface of the water. To check the habitat for the presence and persistence of AROSURF MSF, add a drop of ADOL® Indicator Oil to several locations in the habitat, especially those downwind. If the drop of Indicator Oil forms a tight bead on the surface of the water, AROSURF MSF is present.

Persistent unidirectional winds of 10 mph or greater, surface drainage overflow, or runoff will usually result in poor mosquito control due to displacement or removal of AROSURF MSF from the habitat.

Mosquitoes that require little or no surface contact for breathing, i.e. *Mansonia* spp., *Coquillettidia* spp., *Culex erracticus*, *Culex pilosis*, etc. require properly timed applications at sensitive (surface contacting) stages – the pupae and emerging adult – for maximum impact. The high end of the dosage range is recommended.

The high end of the dosage range is recommended when spraying habitats whose surface characteristics are severe (highly obstructed) to compensate for loss of AROSURF MSF on vegetation or floating debris and to ensure adequate persistence and effective spreading/re-spreading.

The high end of the dosage range is recommended when spraying habitats where multi-directional winds of greater than 10 mph or greater are expected to persist for 24 hours after treatment to ensure adequate persistence and effective spreading/re-spreading.

Significant expansion of the water's surface area from rain or tidal fluxes after the application can be compensated by a dosage that is based on the expected water surface area. This will help assure adequate AROSURF MSF persistence and will eliminate the need for re-treatment of mosquito broods resulting from the new water.

Application of 0.75-1.0 gal/acre can be useful in controlling *Culex* spp. in dynamic (continuous breeding) permanent habitats such as sewage treatment systems. These higher applications prolong film life and thus extend the interval between re-treatment.

<b>Mosquito Habitat</b>		<b>Recommended Application Rates*</b>	
		<b>(Gal/Surface Acre) According to Developmental Stage</b>	
<b>Description</b>	<b>Examples</b>	<b>Larvae</b>	<b>Pupae</b>
Semi-permanent or permanent fresh (including potable and irrigation sources) or salt water habitats with no, low, moderate or high concentrations of emergent or surface vegetation	Salt marshes, ponds, storm water, retention/detention basins, roadside ditches, grassy swales, pot holes, fields, reservoirs, irrigated croplands, etc.	0.3 – 0.5	0.2 – 0.3
Semi-permanent or permanent polluted water habitats containing no, low, moderate or high concentrations of algal mats, emergent or surface vegetation or organic/inorganic debris	Pumping station bunkers, settling, polishing, and evapo-percolation ponds of sewage treatment systems; drainage areas containing effluent from slaughter houses, etc.	0.4 – 0.5	0.2 – 0.3
Note: larvicidal action will usually result in 24-72 hours. Pupicidal action will usually result in 24 hours. Reapply as necessary.			
* AROSURF MSF may also be applied at the recommended rates in water-based formulations at up to 10 percent by volume.			

For Information Call 1-800-323-5727

Manufactured For:  
Clarke Mosquito Control Products, Inc.  
Roselle, Illinois 60172

NET CONTENTS: \_\_\_\_\_ Gal

LOT NO: \_\_\_\_\_

NOTICE: Clarke Mosquito Control Products, Inc. makes no warranty, express or implied, of merchantability, fitness or otherwise concerning the use of this product other than as indicated on the label. User assumes all risks of use, storage or handling not in strict accordance with accompanying label.

® AROSURF MSF is a registered trademark of the Goldschmidt Chemical Corporation licensed to Clarke Mosquito Control Products, Inc.

# AROSURF<sup>®</sup> MSF

Monomolecular Surface Film

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## INTRODUCTION

AROSURF MSF (Monomolecular Surface Film) is a non-petroleum, surface-active oil that is highly effective in controlling the larval and pupal stages of most species of mosquitoes. When applied to a mosquito habitat in low dosages, AROSURF MSF spontaneously and rapidly spreads over the surface of the water to form an ultra-thin film, approximately one molecule in thickness. This film does not kill mosquitoes by the toxic actions characteristic of other larvicides. Instead it exerts a unique physical impact on mosquito populations that cause larvae, pupae, and emerging adults to drown. Since this kill mechanism is physical in nature, AROSURF MSF is not expected to induce resistance in mosquitoes.

### History

The applicability of monomolecular surface film as a potential mosquito control agent was discovered in 1976 by the U.S. Naval Research Laboratory and the Navy Disease Vector Ecology and Control Center as a spin-off of basic research on the use of monomolecular organic surface films for the containment of small oil spills. In 1979, the Lee County Mosquito Control District, Fort Myers, Florida, initiated a cooperative project with the U.S. Naval Research Laboratory to determine if these materials could be used effectively in operational mosquito control programs. Extensive laboratory and field studies indicated that AROSURF MSF was the most effective product for controlling a broad spectrum of mosquitoes, in their natural aquatic breeding habitats, at low surface dosages, and under a wide range of environmental conditions.

## PHYSICAL AND CHEMICAL PROPERTIES

AROSURF MSF is an ethoxylated fatty alcohol belonging to the chemical class of compounds known as nonionic surfactants. It is the two mole ethoxylate of isostearyl alcohol [-poly (oxy-1,2-ethanediyl), alpha-isooctadecyl-omega-hydroxy-]. Its physical characteristics include:

APPEARANCE	Clear light amber liquid,
ODOR	Essentially odorless
ACTIVITY	100%
MOISTURE	1% maximum
DENSITY	0.9118 77°F/77°F (25°C/25°C)
WEIGHT	7.59 #/gallon, at 77°F (25°C)
FLASH POINT	395°F (202°C)
MELTING POINT	19° to 27 °F (-7° to -3°C)
WATER SOLUBILITY	Essentially insoluble, 2.5 ppm
PHOTODEGRADABLE	No
VISCOSITY	64-70 cps at 72°F (22°C)
BOILING POINT	608°F (320°C)
SURFACE TENSION	Reduces S.T. of clean water to 28.2 dyns/cm at 77°F (25°C)

## ADVANTAGES OF AROSURF MSF

AROSURF MSF's advantages over conventional larvicides and petroleum-based larviciding oils for mosquito control programs are:

- EFFECTIVE AT LOW SURFACE DOSAGES
- BREAKS DOWN BY BACTERIAL ACTION
- BROAD SPECTRUM OF ACTIVITY
- NON VOLATILE
- TARGET ORGANISMS UNLIKELY TO DEVELOP RESISTANCE
- PRACTICAL TO APPLY BY CONVENTIONAL TECHNIQUES
- GOOD STORAGE STABILITY (SHELF LIFE)
- BASED UPON RENEWABLE RESOURCES
- USEFUL AGAINST LARVICIDE RESISTANT POPULATIONS

- COST COMPETITIVE AND EFFICIENT
- CAN BE APPLIED TO POTABLE WATER HABITATS

## TOXICOLOGY AND NON-TARGET EFFECTS

AROSURF MSF belongs to the alcohol ethoxylate group of surfactants which have been routinely used in detergent and cosmetic products for over 20 years. The human health and environmental effects of alcohol ethoxylates have been extensively documented. Alcohol ethoxylates are characterized as having relatively weak biological activity and have not been identified with any adverse human health or environmental effects.

### ***Mammal***

The results of acute animal testing demonstrate that AROSURF MSF has a low order of toxicity. The Oral (rat) LD50 is greater than 20,000 mg/kg, the product is non-mutagenic (Ames test), and the dermal LD50 is in excess of 2,000 mg/kg. Eye irritation studies on rabbits indicate no corneal opacity with irritation effects being reversible within 7 days. Primary skin irritation studies on rabbits indicate that the material is irritating, but the effects are reversible. However, when similar primary skin irritation tests were conducted on guinea pigs, only slight irritation was noted.

Studies on closely related fatty acid and fatty alcohol ethoxylates having various degrees of ethoxylation include a 2-year dog study with no-observed-effect-level (NOEL) of 50,000 ppm (1,250 mg/kg); a 2-year rat study with a NOEL of 20,000 ppm (1,000 mg/kg); a 10-month monkey study with a NOEL of 1,000 mg/day.

### ***Non-Target Organisms – Bioassays***

Extensive bioassays conducted on a variety of non-target organisms indicate that AROSURF MSF is one of the most desirable pesticides available for control of mosquito larvae and pupae. Bioassays on the following test organisms were submitted and accepted for fulfilling registration requirements:

#### Birds

Anatidae <i>Anas platyrhynchos</i>	Mallard Duck
Phasianidae <i>Colinus virginianus</i>	Bobwhite Quail

#### Fish

Cyprinodontidae <i>Cyprinodon variegatus</i>	Sheepshead Minnow
Salmonidae <i>Salmo gairdneri</i>	Rainbow Trout
Centrarchidae <i>Lepomis macrochirus</i>	Bluegill

#### Mollusks

Ostreidae <i>Crassostrea virginica</i>	Oyster larvae
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#### Crustaceans

Daphnidae <i>Daphnia magna</i>	Daphnia
Mysididae <i>Mysidopsis bahia</i>	Mysid shrimp

## MODE OF ACTION

AROSURF MSF kills mosquitoes by the physiochemical modification of the water interface of the habitat. Its mode of action is dependent upon the presence (persistence) of the surface film on



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the habitat. Under various conditions, this unique mechanism can be used to kill all or certain developmental stages in the life cycle of some species of mosquitoes.

Modification of the physical properties of the water surface interferes with the normal activities and development of mosquito larvae, pupae, and emerging adults. The surface film kills larvae, pupae, and adults in various stages of emergence by disrupting their normal growth and development physiology, including resting, breathing and molting at the air-water interface. Also, increased wetting of tracheal (breathing) structures leads to drowning (suffocation).

AROSURF MSF can entrap and drown ovipositing (egg-laying) females and resting males of certain species upon contact with the surface film.

AROSURF MSF can wet, sink, and inhibit the eclosion (hatching) of floating eggs and egg rafts of some species of mosquitoes, when high pressure spray application is used.

AROSURF MSF can, therefore, exert ovicidal, larvicidal, Pupicidal and adulticidal impact on natural mosquito populations. This spectrum of activity and mode of action makes AROSURF MSF unique among other mosquito larvicides on the market today.

### **SPEED OF ACTION**

AROSURF MSF can control 1st to 4th instar larvae of most species of mosquitoes within 24 hours after treatment (acute kill); however, UNDER MOST FIELD CONDITIONS, EFFECTIVE CONTROL WILL USUALLY OCCUR WITHIN 48-72 HOURS AFTER TREATMENT (DELAYED KILL). Generalizations on larval instar sensitivity cannot be made from field tests. The rate of larval mortality is related to mosquito species, instar, development within an instar, habitat oxygen levels, habitat surface characteristics, habitat water temperature, and wind speed and direction. Molting of larvae to late instars or to pupae in habitats having high AROSURF MSF pressure was reported in certain cases of delayed mortality. In addition, some reports indicate that larval development can be arrested in a particular instar for prolonged periods under high film pressure before death occurs. In general, when development is arrested by AROSURF MSF, the mortality rate increases with time.

AROSURF MSF control of larvae and pupae is usually more rapid in mosquito habitats having a high water temperature (85-90°F; 29-32°C) and subjected to little or no wind. A species-dependent relationship between the rate of AROSURF MSF induced larvicidal action and the dissolved oxygen levels of a mosquito habitat was reported, i.e. the lower the dissolved oxygen the faster the kill. Low water temperature (less than 70°F; 21°C), windy conditions, and high dissolved oxygen levels will usually result in delayed larval mortality.

AROSURF MSF kills pupae faster than it kills larvae, usually within 24 hours after treatment. Fourth instar larvae of *Anopheles* spp. exhibited sensitivity similar to pupae.

### **DEVELOPMENT OF RESISTANCE**

AROSURF MSF kills mosquitoes by physical rather than by toxic action. Multigenerational challenge tests against larvae of laboratory-reared *Culex quinquefasciatus* indicate that no resistance of mosquitoes to AROSURF MSF is expected to develop from continuous field applications. Therefore, AROSURF MSF is expected to be useful in controlling vector and nuisance mosquitoes currently resistant to mosquito larvicides.

### **SPECTRUM OF ACTIVITY**

AROSURF MSF can be used to kill all species of mosquitoes having frequent contacts with the air-water interface. Species of mosquitoes having minimal surface contacts such as *Coquillettidia* spp., *Mansonia* spp., *Culex erraticus*, and *Culex pilosus* will require specialized surface film

approaches that are keyed to the presence of the surface-sensitive pupal and emerging adult stages.

AROSURF MSF has been shown to kill larvae and/or pupae (i.e. 90-100%) of the following species of mosquitoes under a variety of natural situations:

<u>Species</u> <sup>1</sup>	<u>Habitats</u>	<u>Location</u>
<i>Aedes aegypti</i>	Discarded tires	Florida
<i>Aedes taeniorhynchus</i> *	Coastal and inland salt marshes	Florida
<i>Aedes sollicitans</i>	Coastal salt marshes	Florida
<i>Aedes infirmatus</i>	Grassy fields	Florida
<i>Aedes nigromaculis</i>	Grassy fields, pastures	California
<i>Aedes melanimon</i>	Grassy fields, pastures	California
<i>Aedes Canadensis</i>	Woodland pools	New Jersey
<i>Aedes stimulans</i>	Woodland pools	New Jersey
<i>Aedes vexans</i>	Grassy fields	Florida
<i>Anopheles quadrimaculatus</i> *	Marshy ponds	Florida
<i>Anopheles crucians</i> *	Marshy ponds	Florida
<i>Anopheles atropos</i>	Salt marshes	Florida
<i>Culex quinquefasciatus</i> *	Sewage treatment systems, polluted effluent	Florida
<i>Culex nigripalpus</i> *	Sewage treatment systems, grassy fields, roadside ditches, storm water retention ponds, discarded tires	Florida
<i>Culex salinarius</i>	Marshes, grassy fields	Florida
<i>Culex tarsalis</i>	Standing ponds	California
<i>Psorophora columbiae</i> *	Grassy fields, pastures, roadside ditches	Florida
<i>Psorophora ciliata</i> *	Grassy fields, pastures, roadside ditches	Florida
<i>Psorophora ferox</i>	Wooded fields	Florida
<i>Psorophora howardii</i>	Grassy fields	Florida
<i>Uranotaenia lowii</i> *	Sewage treatment systems	Florida
<i>Uranotaenia sapphirina</i>	Marshy ponds	Florida

\* Tests by helicopter and ground spray equipment – all other tests by ground only.

## FORMULATIONS

### **Technical**

AROSURF MSF is applied directly to mosquito habitats at low volumes from shipping containers, by using ground and aerial techniques. When the product is used in this manner, no mixing with water, solvents, or spreading agents is required.

### **Water-base**

While AROSURF MSF is virtually insoluble in water, a milky water suspension up to 10 percent by volume in water may be prepared through high sheer agitation, which can be applied with standard equipment calibrated to deliver 2-5 gal./acre. This suspension can be sprayed at high volumes to achieve maximum penetration of mosquito habitats where application of the technical material is impeded by vegetation.

AROSURF MSF should be added slowly to a spray tank containing water under vigorous agitation to assure that the product is uniformly suspended in water. AROSURF MSF is lighter than water and will begin to rise to the surface of the water when agitation is stopped. Should this

<sup>1</sup> Control of larvae was generally shown to be acute or delayed; however, control of pupae was acute.

occur, the material should be thoroughly re-agitated before spraying to assure suspension of the product.

The mix can remain in a non-agitated spray tank at outdoor temperatures for long periods without product degradation. To insure a uniform suspension, before spraying, thorough agitation will be required. Be sure to return the material in the hose back into the agitated tank.

### **GENERAL SPRAY TANK AND MIXING PRECAUTIONS**

Clean ground and aerial spray systems thoroughly to remove residues of other mosquito larvicides (such as organophosphates and petroleum oils). Careful cleaning prevents contamination of AROSURF MSF, adverse product interactions, and possible detrimental non-target or environmental effects. For example, mixing diesel No. 2, AROSURF MSF and water can produce a "mayonnaise-like" material that is unsprayable.

Carefully flush the spray system with water if commercial detergents have been used for cleaning purposes. Detergent residues can act to destroy the film-forming properties of AROSURF MSF, and, therefore, its larvicidal effectiveness.

Be sure non-agitating spray systems used for application of technical AROSURF MSF are free of water to prevent the formation of water-AROSURF MSF globules than can inhibit spraying.

Clean AROSURF MSF spills or residues from the outside of vehicles to prevent oily deposits. Standard soaps or detergents are excellent for removing AROSURF MSF from outside surfaces, hands, and clothing.

Do not blend more than 10% by volume of AROSURF MSF in water even when used in a spray system with high speed agitation.

### **RECOMMENDED APPLICATION RATES**

AROSURF MSF can be applied as technical material or as a vigorously agitated water-base suspension, by ground and aerial techniques, to control first, second, third and/or fourth instar larvae of most species of mosquitoes. Control is usually achieved within 24-72 hours after treatment at recommended application rates of 0.3-0.5 gal per surface acre of habitat water. Application rates of 0.2-0.3 gal per surface acre can be used to control pupae and/or emerging adults within 24 hours after treatment. It should be noted that the ideal application rates are dependent on the surface characteristics of the mosquito habitat, wind speed and direction, rainfall, habitat oxygen levels, habitat temperature, mosquito species, larval instar, and stage of development.

Because AROSURF MSF is a surface-active material that is virtually insoluble in water, the volume (depth) of water in the mosquito habitat is not important when calculating application rates.

#### ***Application Considerations***

AROSURF MSF application to habitats subjected to persistent unidirectional winds of 10mph or greater, surface drainage, overflow, or runoff will usually result in poor mosquito control due to displacement or removal of all or most of the AROSURF MSF from the habitat.

AROSURF MSF application to habitats containing mosquitoes that require little or no surface contacts for breathing, such as *Coquillettidia* spp., *Mansonia* spp., *Culex erraticus*, and *Culex pilosis*, will usually result in poor control at recommended dosages if applications are not timed to coincide with the pupal to emerging adult stages. Repetitive applications will usually be necessary if initial application is not timed with sensitive (surface contacting) stages. The high end of the dosage range is recommended in these situations.

AROSURF MSF application at the high end of the dosage range is recommended when spraying habitats whose surface is highly obstructed. The high dosage is expected to compensate for loss of AROSURF MSF on vegetation or floating debris, thereby assuring adequate persistence and effective spreading/re-spreading.

AROSURF MSF application at the high end of the dosage range is recommended with spraying habitats where multi-directional winds of 10mph or greater are expected to persist for 24 hours after treatment.

It is recommended that when habitat surface expansion from rain or tides is expected to occur within 24 hours after treatment, the habitat be treated with an AROSURF MSF dosage that is based on the expected water surface area. This will help assure adequate persistence and can eliminate the need for re-treatment of mosquito broods resulting from the new water.

AROSURF MSF can be useful in controlling *Culex* spp. in certain dynamic permanent water habitats, such as sewage treatment systems. Higher than recommended rates of application (e.g. 0.75-1.00 gallon per surface acre) provide significantly prolonged film life and can greatly extend the interval between applications.

AROSURF MSF has been shown to spread on cold water at temperatures as low as 1°C to form a monomolecular film. Although AROSURF MSF may become visible (opaque) when applied to cold water, the applicator should be assured that the product is spreading, although at a slightly slower rate. The spreadability of the product can be observed by adding a small amount (several milligrams) of baby powder to the surface of a cold water habitat, followed by several drops of AROSURF MSF which will visibly move the baby powder across the water surface.

## **METHODS OF APPLICATION**

### ***Manual Applications***

Because technical AROSURF MSF is applied at low treatment rates of 0.2-0.5 gals per surface acre of water, large areas can be controlled by individual applicators with small, easy-to-carry, inexpensive hand-activated pump sprayers or compressed air sprayers. For example, a 1 gallon sprayer contains sufficient AROSURF MSF to treat three surface acres at a dosage rate of 0.3 gal/acre. Application with individual sprayers has been shown to be useful in areas where vehicle-mounted systems and aerial spray techniques are not suitable.

### ***Automatic Applications***

In controlled or impounded areas, similar to rice fields and sewage treatment ponds, AROSURF MSF can be applied by the use of gravity feed drip devices, such as commercial oilers, to provide prolonged mosquito controlling film pressure.

### ***Vehicle-Mounted Spray Application***

Application of the low recommended dosages of AROSURF MSF is difficult to obtain in conventional vehicle-mounted, high-pressure/high volume spray systems used for roadside ditch larviciding operations. However, it is possible to obtain the correct dosage by forming a suspension of AROSURF MSF in water and equipping the vehicle spray system tank with vigorous paddle agitation. 3-5 gallons per acre (0.2 to 0.5 gallons technical AROSURF MSF) of this milky suspension can be applied while maintaining a reasonable vehicle speed without overdosing. Other spray systems using injection valves or mixing nozzles can also be adapted to produce the water/AROSURF MSF suspensions.

Note: DO NOT add AROSURF MSF to water in a vehicle-mounted spray system that is not equipped with vigorous high-shear agitation. Inaccurate application rates and poor mosquito control can result from casual or improper mixing.

### ***Aerial Application***

Technical AROSURF MSF can be applied at the recommended dosages by helicopters equipped with standard spray systems, provided these systems are modified by decreasing the normal pump pressure, the number of spray nozzles, or the size of the nozzle orifices. With these modifications, aerial application of technical AROSURF MSF is highly effective in controlling immature mosquitoes in uncanopied habitats having little or no emergent or surface vegetation. This technique permits a helicopter to cover large areas without the need for frequent reloading of spray tanks. For example, a helicopter equipped with a spray tank containing 100 gallons of AROSURF MSF and calibrated for application at 0.4 gal/acre, can spray 250 surface acres of mosquito habitat without reloading.

Aerial spraying of technical AROSURF MSF is not recommended for habitats where the water's surface is moderately to highly obstructed (e.g. salt marshes). The cover would prevent the product from reaching the water's surface in sufficient concentrations to be effective. Aerial applications of high volumes of AROSURF MSF/water suspensions can be effective in penetrating moderately vegetated canopies. Applying the mix at rates of 3-5 gal/acre (i.e. 0.2-0.5 gal AROSURF MSF/acre) with helicopter systems using raindrop nozzles has been shown to be effective.

NOTE: Vigorous pre-mixing (e.g., in paddle agitated truck systems) is necessary to suspend the AROSURF MSF in water prior to filling the helicopter spray tanks). The standard recirculating system does not have sufficient agitation to make a uniform suspension.

### **FIELD PERSISTENCE**

AROSURF MSF has a short term residual activity in a mosquito habitat at normal application rates, ultimately biodegrading to carbon dioxide and water by the action of naturally occurring habitat microorganisms. AROSURF MSF exhibits little or no reaction with saline or polluted water to form soluble organic salts. Mosquito control is therefore possible in a wide range of fresh, salt and polluted water habitats.

To be effective in killing immature mosquitoes, AROSURF MSF must be present on the water surface as a monomolecular film for a prolonged period of time. AROSURF MSF will persist for 2 to 10 days after treatment at application rates of 0.2 to 0.5 gallons/surface acres of water. The higher recommended dosages will usually result in longer film stability. Habitat surface characteristics, climatological conditions, microbial concentration of the habitat, and water temperature will effect the duration of the product on the water's surface.

### **MONITORING IN THE HABITAT**

AROSURF MSF is not visible on the surface of the water – its presence does not produce a water sheen. However, the product's surface coverage can be determined by adding a drop of ADOL Indicator Oil to the water surface at several locations in the mosquito habitat. The use of the indicator oil at various intervals after AROSURF MSF application is an important operational tool to determine if additional treatment is necessary. Its use will assure the applicator that delayed kill will occur when rapid kill of mosquitoes is not obtained, preventing unnecessary reapplication. The product's presence can be determined as outline below:

- When the drop of indicator oil does not spread (i.e., forms a compact bead on the surface of the water), the AROSURF MSF film is intact (stable). This small, highly compressed bead of indicator oil on the water's surface indicates that maximum mosquito-controlling film pressure is being exerted on the habitat.
- As the film is degraded by microbial, climatological, or various surface factors, the size (diameter) of the bead of indicator oil steadily increases. An indicator bead the size of a dime indicates that the AROSURF MSF has almost degraded and is only marginally effective. Reapplication is recommended when this is observed.

- A spreading of the indicator oil, characterized by a silvery or slightly colored spreading pattern over the water's surface, indicates AROSURF MSF is either depleted (degraded), absent from the zone tested (e.g. due to wind-induced displacement), or is not sufficiently present to be effective for mosquito control.

NOTE: Application of indicator oil in certain sewage treatment systems, characterized by heavy surface scum and debris, can produce false positive readings. In these cases, it is recommended that a few drops of indicator oil be added to the surface of the habitat prior to an application of AROSURF MSF to assure that the indicator oil will spread.

## **MATERIAL HANDLING**

### ***Storage Stability***

AROSURF MSF naturally resists oxidative rancidity (decomposition), is non-volatile, and non-corrosive and has an essentially unlimited shelf-life when stored in indoor or outdoor facilities at ambient temperatures.

### ***Storage Precautions***

- Do not allow water to stand on drum tops for prolonged periods of time. Water may seep into the drums (through weeping) and cause rust formation which may clog spray nozzles.
- AROSURF MSF stored at or around freezing temperatures will not be damaged, but may become viscous and difficult to handle; due to higher molecular weight components settling in the drum. If this should occur, warm-up and remix the drum contents.
- Seal partially used drums tightly to prevent contamination.
- Use clean equipment when pumping, storing and generally handling AROSURF MSF. The product tends to "clean" equipment by removing rust and pesticide residues.
- Store ADOL Indicator Oil indoors to avoid temperatures below 10°C. Storage at near freezing will cause the product to become pastelike and difficult to apply.

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