

Memorandum

To: Elaine Krueger

CC: Suzanne Condon

From: Michael Celona

Date: July 28, 2006

Re: Choice of Anvil 10+10 for Aerial Mosquito Control

The purpose of this memorandum is to summarize the current rationale for the inter-agency decision that the primary choice for future aerial spraying involves using an insecticide containing the active ingredient sumithrin (i.e., Anvil 10+10).

All four pesticide products meet both the Federal and State regulatory standards for registration and that when used in accordance with directions for use, warnings and cautions and for the uses for which they are registered, will not generally cause unreasonable adverse effects on the environment or human health. The chemical properties of sumithrin with consideration of its toxicity and environmental fate profile; overall, indicate that sumithrin provides the widest margins of safety for human and environmental health when used properly by professionals trained to conduct mosquito control. It may be further noted that studies show sumithrin to be short-lived in the environment, to break down rapidly in sunlight, and to be less toxic to aquatic species than the alternatives considered (HSDB, 2006; Paul *et al*, 2005). Based at least in part on these properties, sumithrin is the most widely used product by mosquito control districts for ground-based spraying.

All pesticides which were registered for use in Massachusetts, labeled for aerial application, and included in the State's contract for emergency mosquito management were identified. Staff from the Department of Agricultural Resources, Pesticide Bureau generated a list of the four pesticides that met these three requirements. The four pesticides were Scourge (active ingredient resmethrin), Anvil 10+10 (active ingredient sumithrin), Kontrol 30+30 (active ingredient permethrin), and Fyfanon ULV (active ingredient malathion). These pesticides were subsequently evaluated using several parameters, including:

- Formulation
- Label "Signal Word
- Use classification
- Chemical components

- Percentage of active ingredient
- Application rate
- Half-life
- Aquatic toxicity

Scourge (Resmethrin)

Scourge is the trademark name of a product containing the active ingredient resmethrin. Resmethrin is a synthetic pyrethroid insecticide whose active ingredient is similar to pyrethrins, which are derived from chrysanthemum plants (EPA, 2002). Resmethrin has been registered with U.S. Environmental Protection Agency (EPA) since 1971 and has been used in Massachusetts and throughout the U.S. for many years. It is used to control flying and crawling insects in mushroom houses, food handling establishments, the home, lawn, garden, and industrial sites (ATSDR, 2005). Presently, Scourge is classified as a “restricted use” product due to its toxicity to fish, meaning that only certified pesticide applicators or persons under their direct supervision can use it and it cannot be applied in or around waterbodies (EPA, 2002). Of the three pyrethroids products (i.e., permethrin, resmethrin, and sumithrin) evaluated by the Department of Environmental Protection, Office of Research and Standards for aquatic toxicity, resmethrin was ranked second in its toxicity to fish (DEP, 2005). Its half-life in water was measured in hours, which is less than sumithrin (half-life of 1-3 days) and permethrin (half-life of 3-5 days) [Paul *et al*, 2005].

When used in mosquito control, resmethrin, is mixed with both a synergist [i.e., piperonyl butoxide (PBO)] that increases its potency and duration of effectiveness (NPIC, 2006). It is also mixed with a solvent/diluent (e.g. mineral oil). PBO acts by inhibiting the ability of the insect to detoxify the insecticide. PBO is classified by EPA as a possible human carcinogen (EPA, 2004).

Anvil 10+10 (Sumithrin)

Anvil 10+10 is the trademark name of a product containing the active ingredient sumithrin. Sumithrin is a synthetic pyrethroid insecticide whose active ingredient is similar to pyrethrins,

which are derived from chrysanthemum plants (EPA, 2002). Sumithrin has been registered with EPA since 1975 and in Massachusetts since 1980. It is used commercially (e.g., food handling establishments), as well as by homeowners to control insects in homes and gardens and on pets (HPD, 2006). It is classified as a “general use” product, meaning that its use is not limited to professionals alone, but may be purchased and used by the general public. Of the three pyrethroid products (i.e., permethrin, resmethrin, and sumithrin) evaluated by the Department of Environmental Protection, Office of Research and Standards for aquatic toxicity, sumithrin was the least toxic to fish (DEP, 2005). Its half-life (1-3 days) was more than resmethrin (half-life of hours), but less than permethrin (half-life of 3-5 days) [Paul *et al*, 2005].

When used in mosquito control, sumithrin is mixed with a synergist (i.e., PBO) that increases its potency and duration of effectiveness, and then applied with a solvent/diluent (i.e., mineral oil).

Kontrol 30+30 (Permethrin)

Kontrol 30+30 is the trademark name of a product containing the active ingredient permethrin. Permethrin is also a synthetic pyrethroid insecticide whose active ingredient is similar to pyrethins, which are derived from chrysanthemum plants (EPA, 2002). Permethrin has been registered with EPA since 1977 and has been used in Massachusetts and throughout the U.S. for many years. It is used in products such as household insecticide foggers, tick and flea sprays for pets, termite treatments, and agricultural and livestock insecticides (EPA, 2002; HPD, 2006). It is classified as a “general use” product, meaning that its use is not limited to professionals alone, but may be purchased and used by the general public. Of the three pyrethroids products (i.e., permethrin, resmethrin, and sumithrin) evaluated by the Department of Environmental Protection, Office of Research and Standards for aquatic toxicity, permethrin was ranked second as the most toxic to fish (DEP, 2005). Its half-life in water (half-life of 3-5 days) was more than sumithrin (half-life of 1-3 days) and resmethrin (half-life of hours) [Paul *et al*, 2005].

When used in mosquito control, permethrin, is mixed with both a synergist (i.e., PBO) that increases its potency and duration of effectiveness, and a solvent/diluent (e.g., mineral oil).

Fyfanon ULV (Malathion)

Fyfanon ULV is the trademark name of a product containing the active ingredient malathion. Malathion is a synthetic organophosphate insecticide. It has been registered for use in the U.S. since 1956 and has been used in Massachusetts and throughout the U.S. for many years. Malathion was used in 1990 during the last Massachusetts aerial mosquito spraying event. In addition to mosquito control, it is also used to treat a wide variety of agricultural crops, gardens, and for the control of head lice (HPD, 2006). Its half-life in water, which is the amount of time required for 50% of the chemical to breakdown, was estimated to be between several days and several weeks (ATSDR, 2003). It is a general use pesticide product, meaning that its use is not limited to professionals alone, but may be purchased and used by the general public.

Summary

Based on this summary evaluation and other data (see Table), Anvil 10+10 (sumithrin) appears to be the most optimal product of choice for aerial application, particularly considering that it has the lowest application rates while still being efficacious in killing mosquitoes. Studies show that the primary active ingredient, sumithrin, is short-lived in the environment and breaks down rapidly in sunlight (HSDB, 2006; ATSDR, 2005) and slightly less toxic to aquatic species than the alternatives considered (DEP, 2005; Paul *et al*, 2005).

References

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Table: Product Characteristics

Product Name	First Active Ingredient	Second Active ingredient	Formulation	Label Signal Wording	Classification	% Active Ingredient	Half-life	Water Solubility	Soil Mobility
Scourge	Resmethrin	Piperonyl butoxide	Ultralow Volume Concentrate	Caution	Restricted Use	18%	Hours	Insoluble	Low to immobile
Anvil 10+10	Sumithrin	Piperonyl butoxide	Ultralow Volume Concentrate	Caution	General Use	10%	1-3 days	Insoluble	Low to immobile
Kontrol 30+30	Permethrin	Piperonyl butoxide	Ultralow Volume Concentrate	Caution	General Use	30%	3-5 days	Insoluble	Low to immobile
Fyfanon ULV	Malathion	N/A	Ultralow Volume Concentrate	Caution	General Use	96.5%	Several days to several weeks	Slightly soluble	Somewhat mobile