Appendix E. Extrapolations for Sustainable Release Rate Formulations

Table E.0. S-Methoprene Formulations and Maximum Application Rates

Formulation	% ai	Application Intervals	Max. application
Briquets	2.1	150 days	0.0058 lbs ai/A/day.
XR Briquets	8.62	30 days	0.014 lbs ai/A/day.
Granular	1.5	30 days	0.005 – 0.01 lbs ai/A/day
	4.25	7 days	0.03 - 0.06 lbs ai/A/day
Sand mix	39.0/pouch (powder)	7 days	0.004-0.017 lbs ai/A/day
Liquid Larvicide	5	7-10	0.007- 0.013 lbs ai/A
	20	7-10	0.007 – 0.013 lbs ai/A

E.1 Calculations used for Assessing S-Methoprene Briquet, Granular, Sand Mix, and Liquid Larvicide Formulations

Briquet:
This formulation is a sustainable release product with recommended repeat treatment every 30- 150 days depending upon briquette size. Application sites are designed to control mosquitoes in small bodies of water. Examples of application sites are: storm drains, catch basins, roadside ditches, fish ponds, ornamental ponds and fountains, other artificial water-holding containers, animal watering troughs, cesspools and septic tanks, waste treatment and settling ponds, flooded crypts, transformer vaults, abandoned swimming pools, tires, construction and other manmade depressions, cattail marshes, water hyacinth beds, vegetation-choked phosphate pits, pastures, meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, tree holes, woodland pools, floodplains, and dredging spoil sites, small bodies of water such as storm drains, catch basins, roadside ditches, ornamental ponds and fountains.

Application rate of XR Briquets 8.62% ai:
Given: 1.19 lbs = 100 briquets or about 84 briquets/lb. Therefore, each briquette weighs 0.012 lbs (5.4 g) with about **0.001 lbs ai/briquet (0.43 g ai).** Maximum application is about 1 briquet per 100 ft^2 of water surface area or 1 briquet per 10 ft^3 (75 gal.) of water up to 2 ft deep with an additional briquete for every 2 ft depth of water in areas deeper than 2 ft (i.e. 4 briquets in 6-8 ft of water) as noted in Table 2.3.1. Theoretically 436 briquets (10 lbs/A) can be applied to one acre of shallow water. Under this scenario, there would be the equivalent of about a total of **0.436 lbs ai/A** contained in these slow release briquets. Assuming an even release rate over 30 days the potential exposure is about **0.014 lbs ai/A/day**.

Application rate of Briquets 2.1% ai:
Given: 17.7 lbs = 220 briquets or about 12 briquets/lb. Each briquette weighs 0.08 lbs (36.2 g) and contains about **0.76 g ai/briquette or the equivalent of 0.002 lbs ai/briquet.** Maximum application is 1 briquet per 100 ft^2 of water surface area or 1 briquet per 10 ft^3 (75 gal.) of water up to 2 ft deep. Use 1 additional briquette for every 2 ft depth of water in areas deeper than 2 ft (i.e. 4 briquets in 6-8 ft of water) as noted in Table 3.1. If this formulation is used to cover one acre, there would be the equivalent of about **0.87 lbs ai/A** (435.6 briquets/A). Assuming an even release rate over 150 days, the potential exposure is about **0.0058 lbs ai/A/day**.

Table E.2. Briquet and XR Briquet Application Chart

Max Water Vol. in Application Site	Briquet Application	Water Depth	Allowable Flow for 30 Day Mosquito Control
0-10 cu ft	1	0 – 2	0 – 1,500 gal
10-20 cu ft	2	2 – 4	1,500 – 3,000 gal
20-30 cu ft	3	4 – 6	3,000 – 4,500 gal
30-40 cu ft	4	6 - 8	4,500 – 6,000 gal

Granular (Pellets)Usage: woodland pools and meadows, pastures and rangeland, vineyards, fruit and nut orchards, berry fields, peat bogs, ornamental water hyacinth beds, vegetation-chocked phosphate pits, dredge soil sites, waster water treatment facilities, waste settling ponds, sewers, septic ditches, animal waste effluent lagoons, storm water retention basins, retention and detention ponds, tree holes, log decks, tires with standing water, ornamental ponds and fountains, flooded crypts, transformer vaults, abandoned swimming pools, and artificial water-holding containers. Fruit and nut orchards, berry fields and bogs, rice fields, and irrigated croplands.

Application rate of pellets 1.5% ai:
Given: This formulation is to be applied at a maximum rate of 10 – 20 lbs /A or about **0.15 – 0.30 lbs ai/A.** If we assume 30 day efficacy and a steady release rate, the daily exposure level is expected to be **0.005 – 0.01 lbs ai/A/day**. Use lower rates (10 lbs/A) when water is shallow (< 2 ft) and vegetation is minimal or use higher rate (20 lbs/A) for deeper water ($\geq$ 2 ft) and heavy vegetation cover.

Application rate of pellets 4.25% ai:
Given: This formulation is to be applied at a maximum rate of 5 – 10 lbs /A or about **0.21 – 0.42 lbs ai/A.** If we assume 7 day efficacy and a steady state release rate, the daily exposure level is expected to be **0.03 – 0.06 lbs ai/A/day**.

Liquid Larvicide: This formulation may be applied via aerial and ground equipment to irrigated croplands after flooding to control mosquito emergence. Examples of such sites are: vineyards, rice fields (including wild rice), date palm orchards, fruit and nut orchards, and berry fields and bogs. Irrigated pastures may be treated after each flooding

without the removal of grazing livestock. This formulation may also be applied to intermittently flooded non crop areas. Typical sites include freshwater swamps and marshes, salt marshes, woodland pools and meadows, dredging spoil sites, drainage areas, waste treatment and settling ponds, ditches and other natural and manmade depressions.

Application rate of Liquid Larvicide 5%:
Given: This 5% formulation has 0.43 lbs ai/gal and is to be applied at the rate of 3 – 4 oz/A or **0.007 – 0.013 lbs ai/A.** Efficacy is about 7-10 days and can be reapplied as needed.

Application of Liquid Larvicide 20%:
Given: The 20% formulation consists of 1.72 lbs ai/gal with an application rate of ¾-1oz of formulation per acre or **0.007-0.013 lbs ai/A**. Efficacy is about 7-10 days with applications as needed.

Pouch (Sand) Usage 39% ai: One application is efficacious for 7 days. Examples of application sites are: storm drains, catch basins, roadside ditches, fish ponds, ornamental ponds and fountains, other artificial water-holding containers, animal watering troughs, cesspools and septic tanks, waste treatment and settling ponds, flooded crypts, transformer vaults, abandoned swimming pools, tires, construction and other manmade depressions, cattail marshes, water hyacinth beds, vegetation-choked phosphate pits, pastures, meadows, rice fields, vineyards, fruit and nut orchards, berry fields and bogs, freshwater swamps and marshes, salt and tidal marshes, tree holes, woodland pools, floodplains, and dredging spoil sites, small bodies of water such as storm drains, catch basins, roadside ditches, ornamental ponds, and fountains. Application rates are noted in Table 2.3.2.

Formulation using 39% ai pouch as follows:
99.0 lbs washed, dry sand
0.1 lb. of ISP PVP/VA W-635
0.5 lbs. of water
2 pouches of B2E-02 (39% S-methoprene x 2); or 0.3 lbs ai
0.10 lb. of Microcel-E Drying Agent

Table E.3 Application of the 39% ai Pouches After Mixture with Sand

Dosage Rate (in Pouches)	Granule Application Rate/Acre (lbs.)	Pouches of B2E-02 to 99 lbs sand
1	5.0	4
1	7.5	3
1	10.0	2
2	5.0	8
2	7.5	6
2	10.0	4
3	5.0	12
3	7.5	9

3	10.0	6
4	5.0	16
4	7.5	12
4	10.0	8

Application of Pouches:
Given: Add 2 pouches or the equivalent of 0.3 lbs ai to 99 lbs of sand the resulting 1 lb of mix is equal to 0.3/100 = 0.003 lbs ai per lb of sand mix. Therefore, 10 lbs of sand mix applied to 1 A is equal to 0.03 lbs ai/A. If there is an increase in the number of pouches used (i.e. 4) but a decrease in sand mix application rate (i.e. 5 lbs sand mix/A) the exposure level is still equal to 0.03 lbs ai/A or the equivalent of 1 pouch dosage rate.

The maximum rate for this pouch formulation is as follows: 0.3 lbs ai (2 pouches) x 4 = 1.2 lbs ai; Pouches and other components are added to make 100 lbs of sand mix resulting in 0.012 lbs ai per lb of sand mix; Therefore, 10 lbs sand mixture/A is equal to 0.12 lbs ai/A. The range of rates are **0.03-0.12 lbs ai/A** for 39% ai B2E-02 pouch. Assuming steady release rate and 7 day efficacy, this formulation is expected to result in **0.004 – 0.017 lbs ai/A/day**.

E.2 Expected Aquatic Environmental Concentrations from Label Extrapolation

After evaluating the label derived applications rates for S-methoprene formulations that include briquets, granulars, liquid, and pouches, the Agency has extrapolated expected worst case environmental concentrations (EEC) for aquatic areas (Table E.3). The briquets are expected to release 2.0 – 5.04 ug/L/day of S-methoprene (1 ft. water) for 150 to 30 days, respectively. The granular formulation EEC values are from 1.8 – 22.0 ug/L/day (EEC values were obtained from the Agency nomograph entitled “EECs of Pesticides in Bodies of Water Immediately Following Direct Applications of from 0.1 to 10.0 lbs ai/A”).

Table E.3. Expected Environmental Concentrations for S-Methoprene Briquets, Granular and Sand Mix

Formulations	% Active ingredient	lbs ai/A/day	Application Intervals (days)	EEC (ug/L/day) for 1 ft water
Briquet	2.1	0.0058	150	2.0
Briquet XR	8.62	.014	30	5.04
Granular	4.25 1.5	0.03 – 0.06 0.005-0.01	7 30	11.0 – 22.0 1.8 – 3.7

Formulations	% Active ingredient	lbs ai/A/day	Application Intervals (days)	EEC (ug/L/day) for 1 ft water
Sand Mix 39% ai/pouch	39.0	0.004 – 0.017	7	1.5 – 6.2

Since S-methoprene is also used on rice fields and canberry bogs to combat mosquotes, the Agency has developed a model for deriving a single, screening-level concentration calculated as a representation of both short and long term surface water exposure to be used for both aquatic ecological risk assessments and drinking water exposure assessments for human health risk assessment (Appendix D). The compound is to be applied within 4 days after flooding but not to be applied after rice reaches the heading stage of growth. Application is directly to water at 1- 4 oz product/A (0.007 - 0.0134 lbs ai/A) resulting in **0.253 - 0.485 ug/L** (Table E.4).

Table E.4. Expected Environmental Concentrations of S-Methoprene Liquid Formulation after Application to Flooded Rice and Caneberry Fields

Formulation	% Active ingredient	Lbs ai/A/day	EEC (ug/L)
Liquid larvicide	5 - 10	0.007 – 0.013	0.253 – 0.485

E.4 Microcosm Study to Determine EEC for Various Methoprene Formulations

A study (Judy and Howell, 1992 MRID 428112-02) was conducted by the registrant (Zoecon Corpations) to determine the concentrations of S-methoprene in freshwater microcosms treated with sustained release Altosid formulations. Single applications of five S-methoprene formulations were applied to microcosm tanks near Oxford, Mississippi, in 1991, to evaluate S-methoprene concentrations present over time. The Liquid Larvicide (5% S-methoprene) was applied at a maximum rate of 4 fluid ounces/A, the XR Briquet (1.8% S-methoprene), and the Briquet (7.9% RS-methoprene) were applied to the microcosm at the rate of 1 briquet/113 ft^2. The pellets (4% S-methoprene) were applied to water at the maximum label rate of 10 lbs/A while the sand mix (1.3% S-methoprene) was applied at the equivalent of 20 lbs /A. water samples were collected prior to application and post application at Days 1, 2, 4, 7, 14, 21, 28, and 35. The conclusions of the study were that no S-methoprene residues were detected at or above the 10 ug/L level in any of the samples at any sampling interval (Table E.5).

Table E.5. Environmental Concentrations of S-Methoprene Found in Freshwater Microcosms Treated with Sustained Release Formulations

Treatment Day	Untreated Control	Briquets (4.0% ai)	Liquid Larvicide (5% ai)	Granular (4.0% ai)	XR Briquets (1.8% ai)	Sand Mix (1.3% ai)
Preapplication	<0.20	<0.20	<0.20	<0.20	<0.20	<0.293
1	0.337	<0.20	2.21	0.601	<0.20	0.347
2	<0.20	4.24	1.54	<0.20	0.703	<0.20
4	<0.20	8.09	0.511	1.21	<0.20	<0.20

7	<0.20	8.09	0.468	2.01	<0.20	<0.20
14	<0.20	0.570	<0.20	0.231	0.224	0.235
21	<0.20	0.243	0.255	0.202	<0.20	<0.20
28	<0.20	0.337	<0.20	0.201	<0.20	<0.20
35	<0.20	0.270	0.203	<0.20	<0.20	<0.20

The Agency adjusted the environmental concentrations of S-methoprene in the microcosm (Table I.6) to reflect maximum label rates for these formulations.

Table I.6. Adjusted Environmental Concentrations of S-Methoprene Found in Freshwater Microcosm Treated with Sustained Release Formulations

Treatment Day	Untreated Control	Briquets (2.1% ai)	Liquid Larvicide (5% ai)	Granular (4.25% ai)	XR Briquets (8.62% ai)	Sand Mix (1.3% ai)
Preapplication	<0.20	<0.20	<0.20	0.21	0.96	<0.293
1	0.337	<0.20	2.21	0.64	0.96	0.347
2	<0.20	2.2	1.54	0.21	3.37	<0.20
4	<0.20	4.24	0.511	1.28	0.96	<0.20
7	<0.20	4.24	0.468	2.1	0.96	<0.20
14	<0.20	0.3	<0.20	0.24	1.07	0.235
21	<0.20	0.13	0.255	0.21	0.96	<0.20
28	<0.20	0.18	<0.20	0.21	0.96	<0.20
35	<0.20	0.14	0.203	0.21	0.96	<0.20

Liquid Larvicide (5% ai): S-methoprene residues averaged residues were noted at 2.21 ug/L on Day 1 and gradually declined to about 0.2 ug/L.

Briquet (2.1% ai): Residue levels increased through Day 4 and Day 5 (4.24 ug/L) and declined from Days 14 – 35.

XR Briquet (8.62% ai): The highest S-methoprene level was on Day 2 (3.37 ug/L). Throughout the remaining study the residues were lower (1.07 - 0.96 ug/L).

Granular (4.25% ai): From Day 1 to Day 7 there was an increase in S-metheprene residues (0.64 – 2.1 ug/L). After Day 14 there appeared to be a steady concentration level (0.21 – 0.24).

Sand Mix (1.3 % ai): These residue values were the lowest ranging from 0.347 ug/L on Day1 to about <0.20 throughout the rest of the test.