



Droplet Emission Study

Prallethrin

Understanding what happens to the Prallethrin formula in the air with product use.

In 2023, Thermacell measured prallethrin droplets and conducted a simulation to understand the movement of those droplets emitted from fuel-powered devices when used outdoors.



What happens to the mosquito control formula once it is released into the air?

“As we know, Thermacell devices work by using an internal heating element to activate and disperse a mosquito control formula into the air to form a zone of area protection. When using Thermacell fuel-powered mosquito control devices, droplets within the Prallethrin formula are tiny, emitted at an average size of 5.58 microns. **Due to the small size of the droplets emitted, they will remain suspended in the air and will break down after a period of hours in the presence of sunlight and other elements in the atmosphere.**” – Dr. John Hainze, VP of Science & Research at Thermacell

VIEW DATA

THE TEST

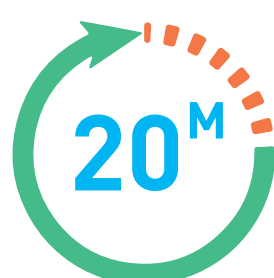
Methodology:

First, droplet size and emission was measured using lasers and a high-speed camera. Then, droplet behavior was simulated using air movement, temperature, and humidity with the measured droplet size and emission data. All play a role in how the droplets act in the air.

Measured Conditions:



Droplet emission measurements taken at 20-second intervals to track changes over time.



Droplet size measurements taken over a 20-minute device run time.

Simulated Conditions:



Droplet behavior was simulated with mathematical models using data collected over 20-minute run time.



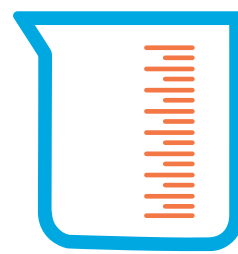
Low wind speed of 0.1 mph (0.16 km/h) was set to simulate a still air environment as a worst-case-scenario.



Humidity was simulated at 50%.



Temperature was simulated at 25°C.



The amount of total Prallethrin formula (inactive + active ingredients) that falls to surrounding surfaces when the Thermacell device is in use was measured.

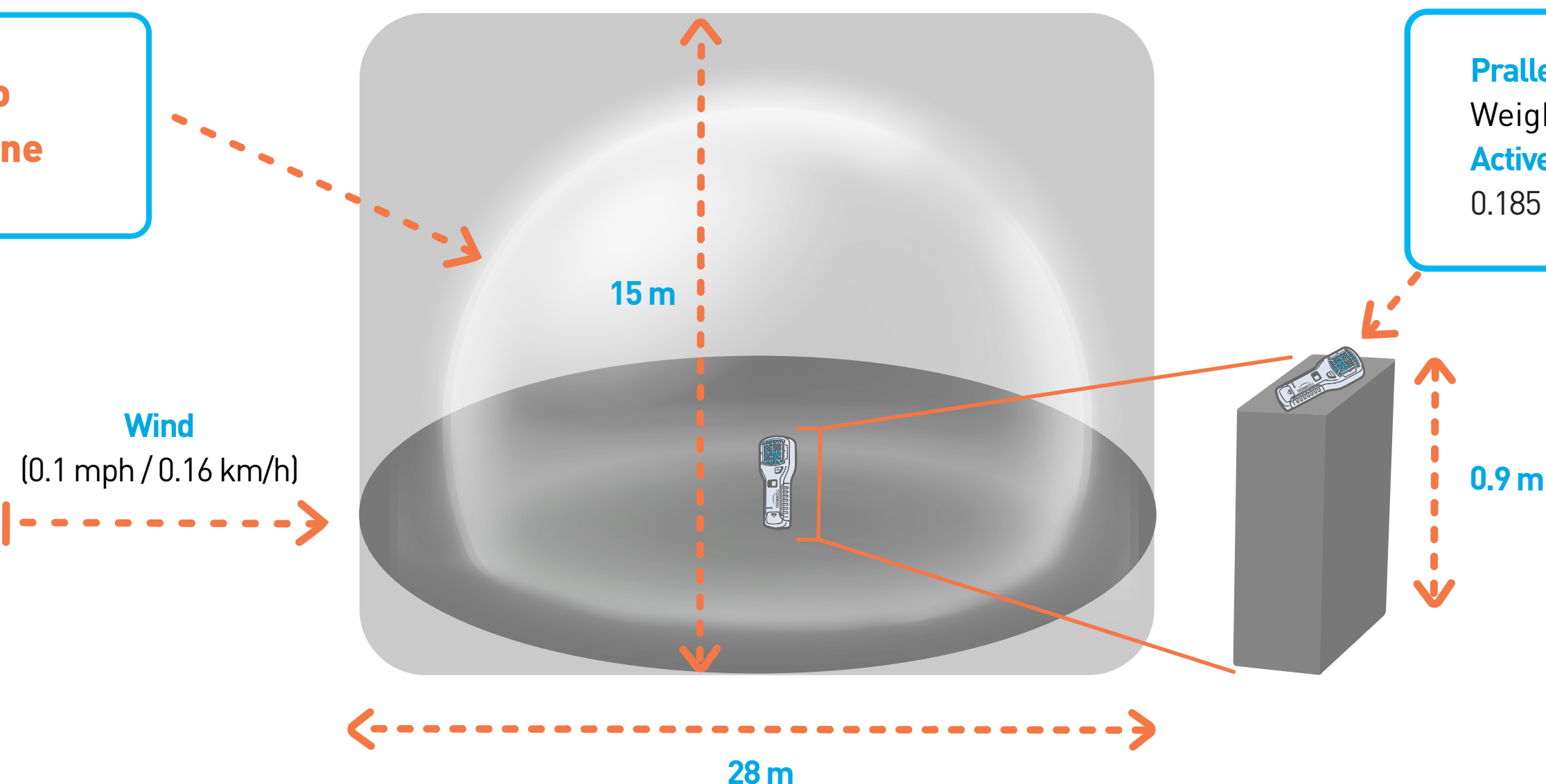
In a past deposition study, less than 1 billionth of a gram of the **active ingredient** was found on surrounding surfaces.

In this study, less than 2% of the **total formula** was found on surfaces immediately around the device.

That means **more than 98% of the formula actively controls mosquitoes in the air and will break down before reaching surfaces.**

Both studies were run in a still air environment as a worst-case-scenario.

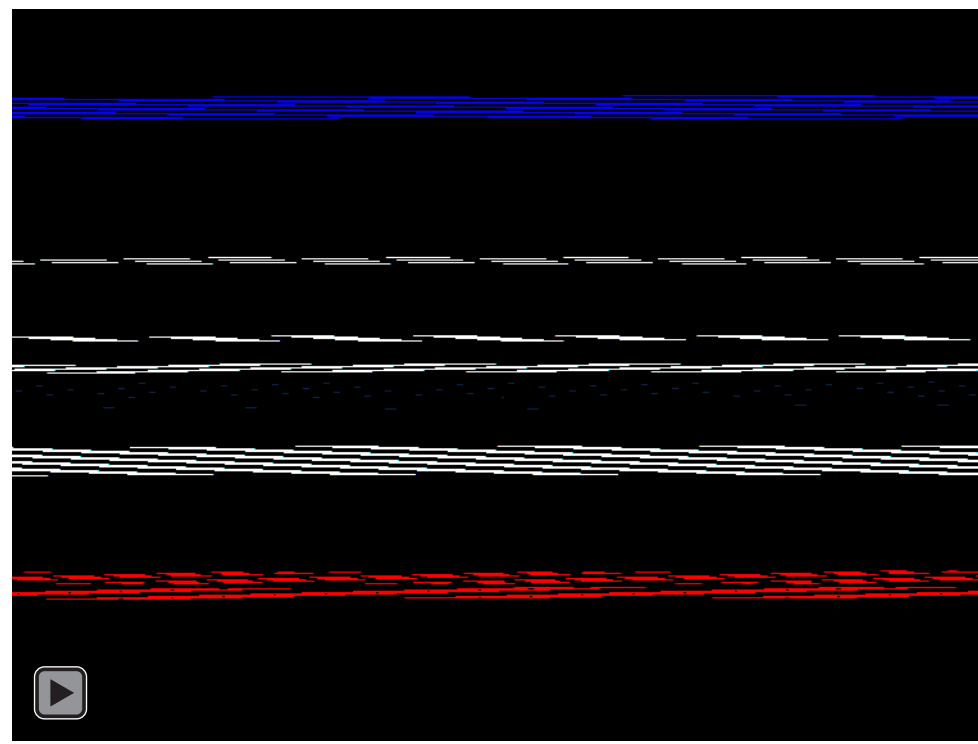
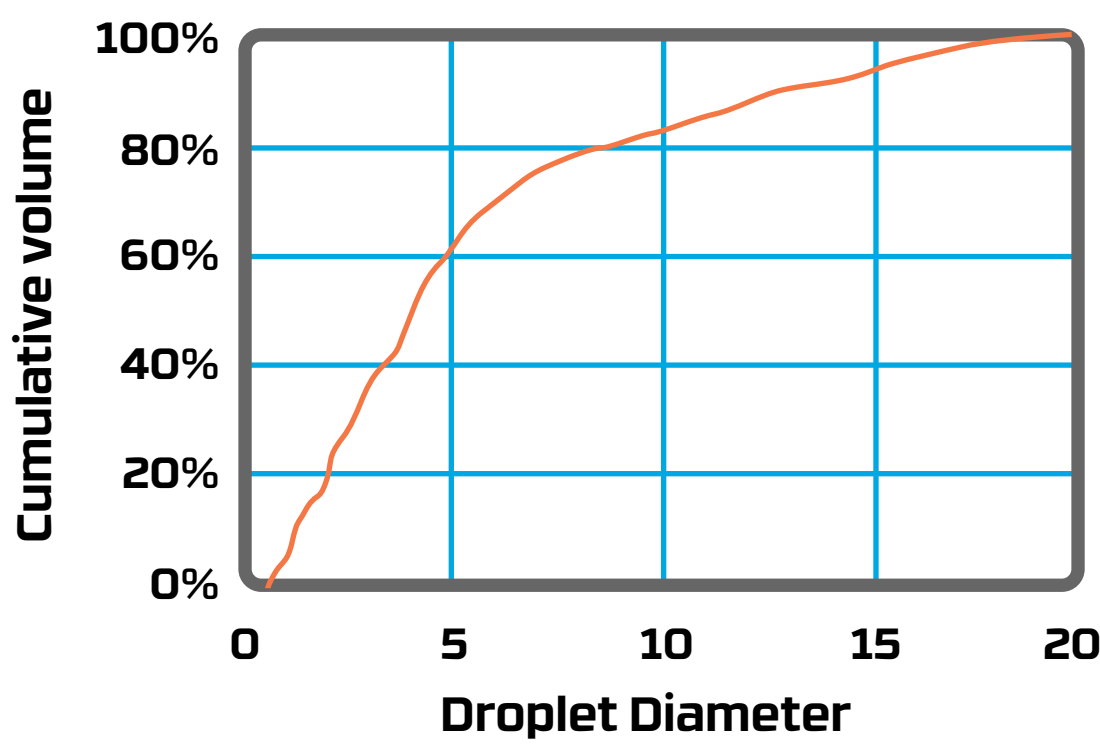
Mosquito Control Zone




THE RESULTS

Conclusion:

Due to their small size, droplets will remain suspended in the air almost indefinitely and will evaporate over time. Lastly, when simulating real device use, 98% of the Prallethrin formula will remain suspended in the air to actively control mosquitoes before the active ingredient begins breaking down.



 Thermacell Formula	Average Droplet Size	% of Total Formula Mass Deposited on Surfaces
Prallethrin (10.86% w/w) + Inactive Ingredients	5.58 Microns	~1.6%

Comparing Droplet Diameter:

- Average Wood Smoke Particle - 0.2-3 Microns
- Average Fine Human Hair Diameter - 40 Microns
- Average Human Sneeze Droplet - 10-100 Microns

Prallethrin breaks down within hours once released into the environment:

- 1 - Degrades in atmosphere in reaction with ozone (18-minute half-life)
- 2 - Directly breaks down on sterile water surface when exposed to sunlight (13.6-hour half-life)
- 3 - Decomposes in soil when exposed to sunlight (24.8-26.9-day half-life)

Source:  
National Center for Biotechnology Information [2022]. PubChem Annotation Record for Prallethrin.  
Source: Hazardous Substances Data Bank (HSDB). Retrieved January 31, 2022 from  
<https://pubchem.ncbi.nlm.nih.gov/source/hsdb/8169>.

Study Reference

Ngoc Pham, Ph.D. [2023] Fate and Transport of Particles Released from Thermacell Mosquito Repellers: A Perspective from Computational Fluid Dynamics Simulation, Advanced CAE, Science & Innovation Incubator, SC Johnson. Report number: TRI-CHM-0055