Efficacious Insecticides Against Bed Bugs
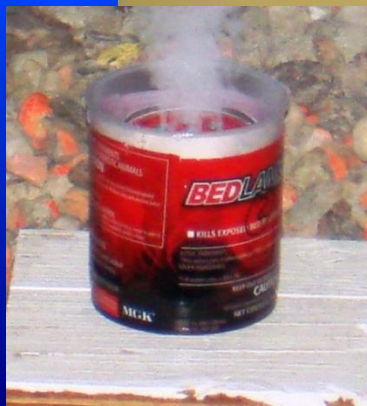
Dr. Bill Donahue
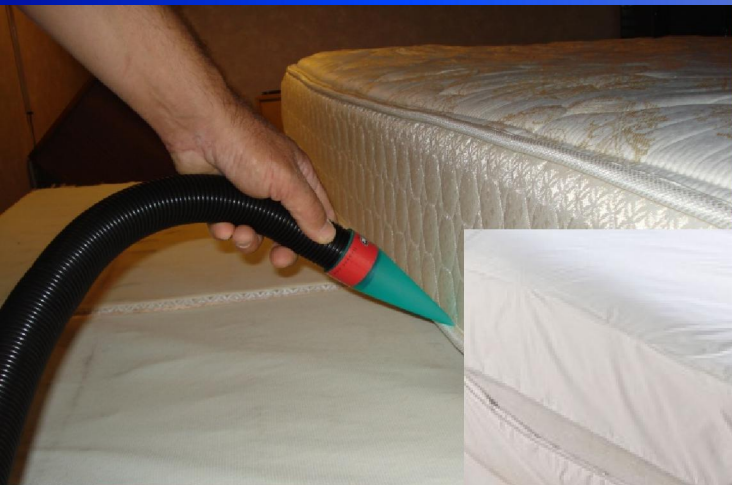
www.sierraresearchlaboratories.com

Nebraska Urban Pest Management Conference
February 10-11, 2015

Bed Bug Control Methods

- Heat Treatments

- Sanitation - Vacuuming

- Dusts

- Liquid Concentrates

- Foggers & Aerosols

- RTU Sprays

- Inspection -Traps - Dogs

- Encasements

- Exempt Products

Urban IPM

Center Well

Outer Pitfall

- Heat Treatments
- Cold Treatments
- Vacuuming
- Cultural Practices e.g. reduce harborage, physical barriers, discard infested items

Research

- Product Development

- New Application Methods

- Label Expansion

"Brood Centers"

- Bed bugs are **thigmotactic** preferring rough surfaces such as wood or paper.

- Cluster together in contact with each other where fecal matter, egg shells and exuvia accumulate - Semiochemicals

- Return to these harborages after a blood meal.

- Quiescent state while digestion takes place.

- Stimulus to leave harborage? Hunger? Over Crowding?

Resistance or Strain Differences?

- Resistance – The genetically acquired ability of an organism to survive a pesticide application at doses that once killed most individuals of the same species.

- Baseline dose response

- Field-collection and colony start-up
  - Diff. rates of reproduction, length of time until obtaining usable numbers
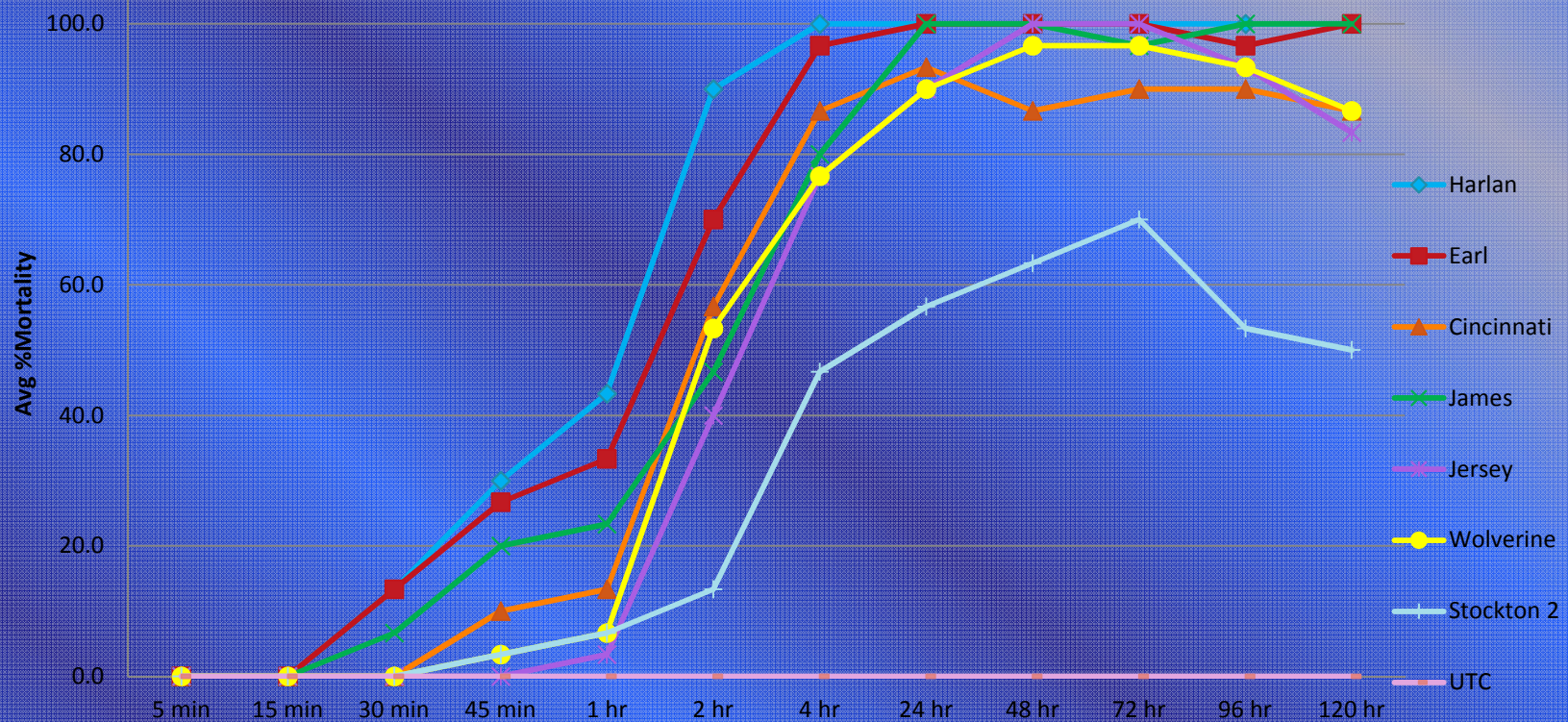
Mortality of Bed Bugs Exposed to Glass Panels Treated With 0.05% Technical Permethrin, 2012
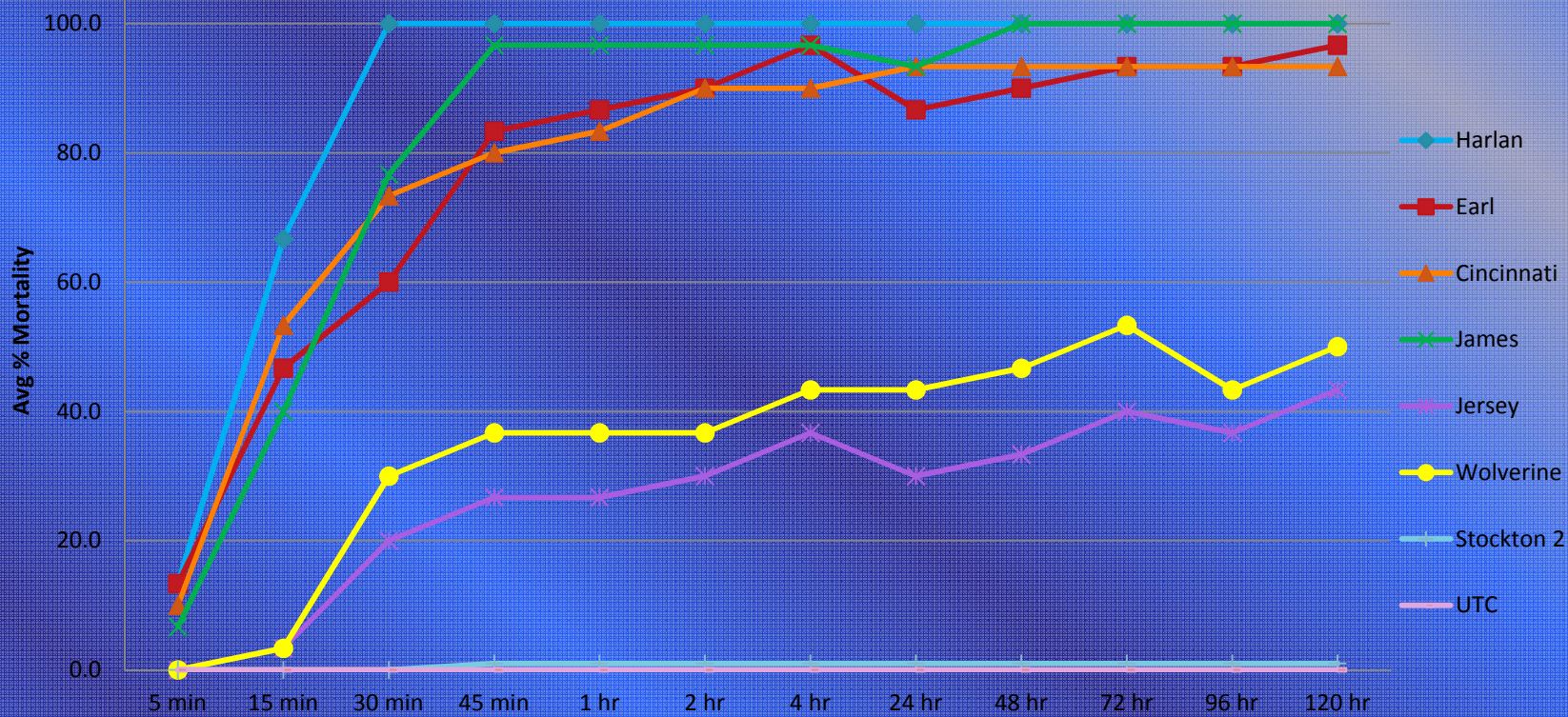
Mortality of Bed Bugs Exposed to Glass Panels Treated With 0.05% Technical Deltamethrin, 2012
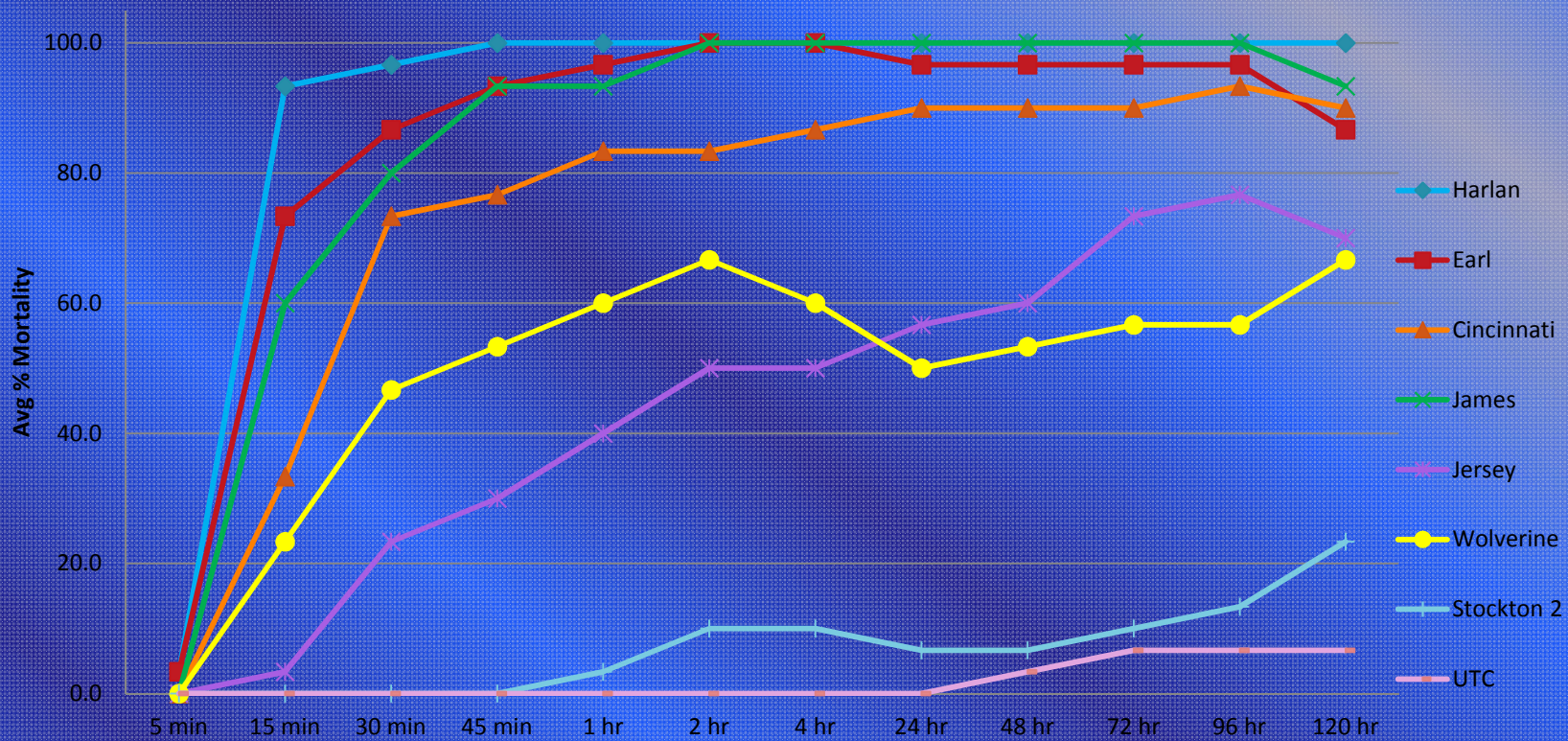
Knockdown and >24 Hour Mortality of Bed Bugs Exposed to Glass Panels Treated With 0.05% Technical Imidacloprid , 2012

Resistance can be Reversible

Mortality of Cincinnati Strain Bed Bugs Exposed to 0.05% Permethrin on Glass Panels

Legend:
- Permethrin technical 5-Jun-08
- Permethrin formulation 27-Jul-10
- Permethrin technical 17-Jan-12
- Permethrin formulation 6-Mar-12

Y-axis: Avg % Mortality (0.0% to 100.0%)
X-axis: 5 min, 15 min, 30 min, 1 hr, 2 hr, 4 hr, 6 hr, 24 hr
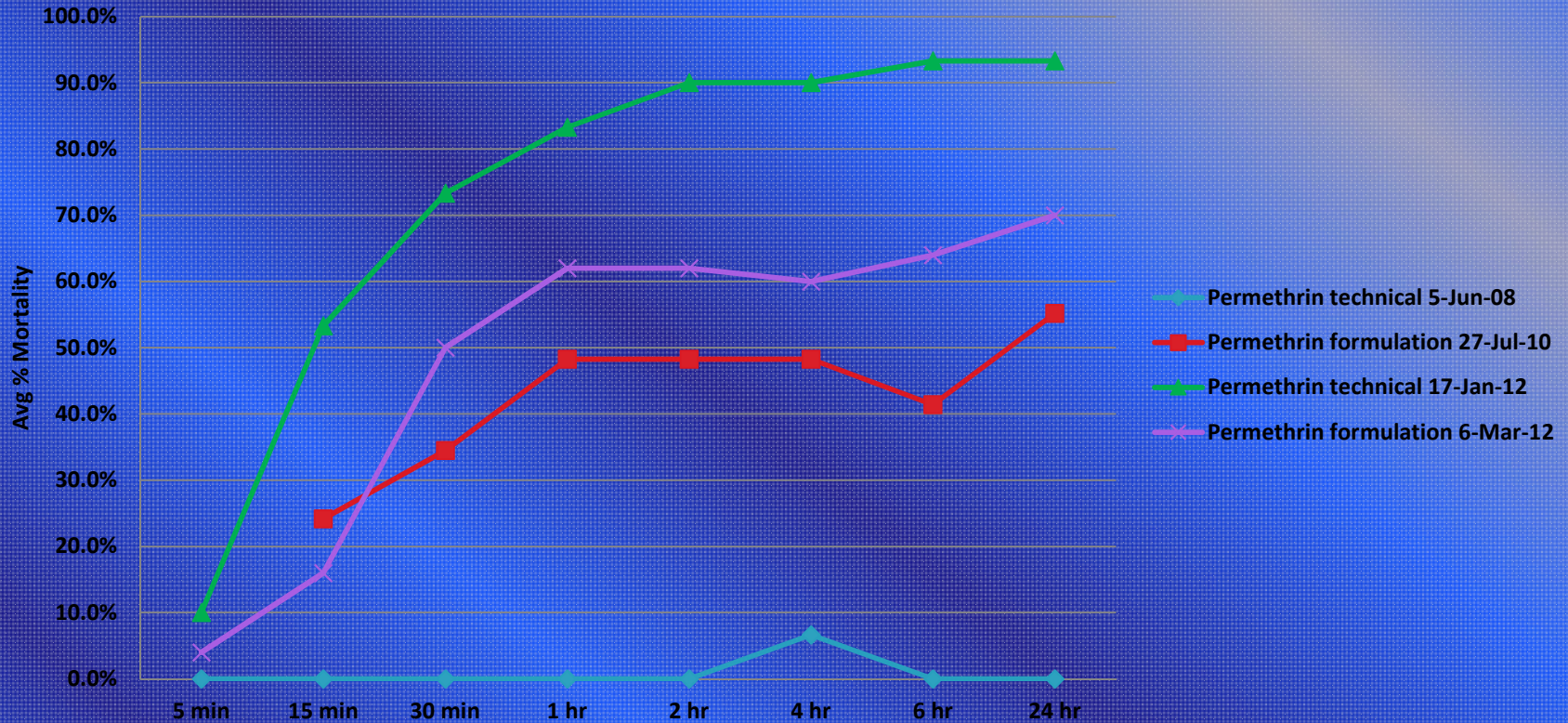
Dose Response Bioassays

House Flies, Stable Flies, Litter Beetles, Bed Bugs, Fleas & Ticks
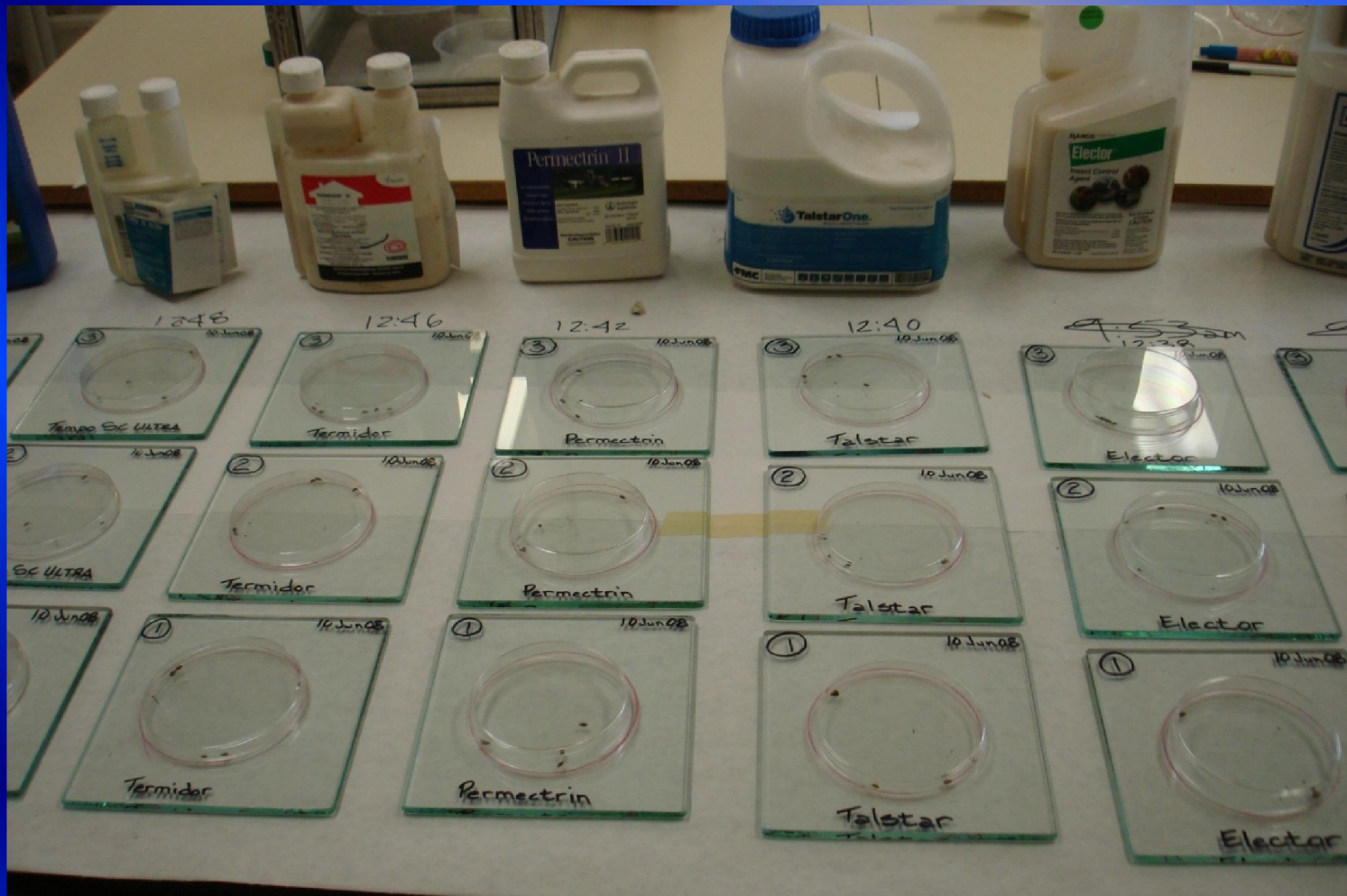
Tank Mix – Concentrates
Residual % Mortality @ 72 hours

Product	Substrate	Day 1	Day 30
Phantom® SC	Ceramic Tile	62.7	36.0
	Painted Plywood	57.1	3.9
	Unpainted Plywood	68.6	12.0
Phantom® SC + Microcare®	Ceramic Tile	100	96.0
	Painted Plywood	100	40.0
	Unpainted Plywood	100	87.8

Residual Aerosol Evaluation
Bedlam® Plus (Sumithrin, MGK-264, Imidacloprid)

Substrate	24 hr Mortality
Ceramic Tile	100%
Carpet	100%
Mattress Ticking	100%
Unpainted Plywood	76%
Painted Plywood	100%

Bed Bug Ovicidal Activity (Direct Spray) 98%

RTU Sprays
Direct Application "Chemical Fly Swatters"

Product	Bed Bug Strain	KD @ 2-hrs	Mortality @ 24-hrs
De Flea (Dioctyl Sodium Sulfosuccinate + Undecylenic Acid)	Cincinnati	97.5%	97.5%
	Earl	100%	100%
Bed Bug Rid (Cinnamon Oil + DE)	James	86.0%	66.0%
	Earl	100%	94.1%
	Harlan	100%	94.0%

EPA Exempt (25b) Products – No Toxicology, Efficacy or Product Safety Studies Required

EcoSmart®Organic Home Pest Control – 2-Phenethyl propionate + rosemary and peppermint oils

Natria™ Home Pest Control – Soy bean oil + eugenol

EPA Exempt (25b) Products Compared with EPA Registered Products

- Laboratory KD Studies – Direct Applications
- Cirkil™ RTU – NEEM -100% @ 5 min - 96 hours
- CimeXa™ - Silica Gel – 0-34% @ 5 min-4 hrs, 100% 24-96 hrs.
- Bonide® - Permethrin – 100% @ 5 min-4 hrs, 94-96% 24-96 hrs.
- EcoSmart – Organic 25b formulation – 100% @ 5 min – 4 hrs, 88-96% 24-96 hrs.
- Natria™ - 25b formulation – 66% @ 5 min, 48% @ 96 hrs.

New Efficacy Testing Guidelines
OCSPP (Office of Chemical Safety & Pollution Prevention)

- General Considerations – 810.3000
- Premises Treatments – 810.3500
- Proposed Bed Bug Testing Guidelines?
- Known resistance profile –LD Tests
- Rearing Bed Bug Strains for Testing
- Statistical Analysis - ≥90-95% Efficacy
- Over 80 pages of Guidelines?
- Very Little Input from Industry or Entomologists?

Points to Ponder

- **New A.I.'s, Formulations, Product Forms**

- **IPM – Insecticide Resistance**

- **Public Demand – Industry Direction – "25b"**

- **Experimental Design – Efficacy – EPA Registrations**

Questions?