CARES Residential Module (Part 2)

Bruce M. Young
Bayer CropScience

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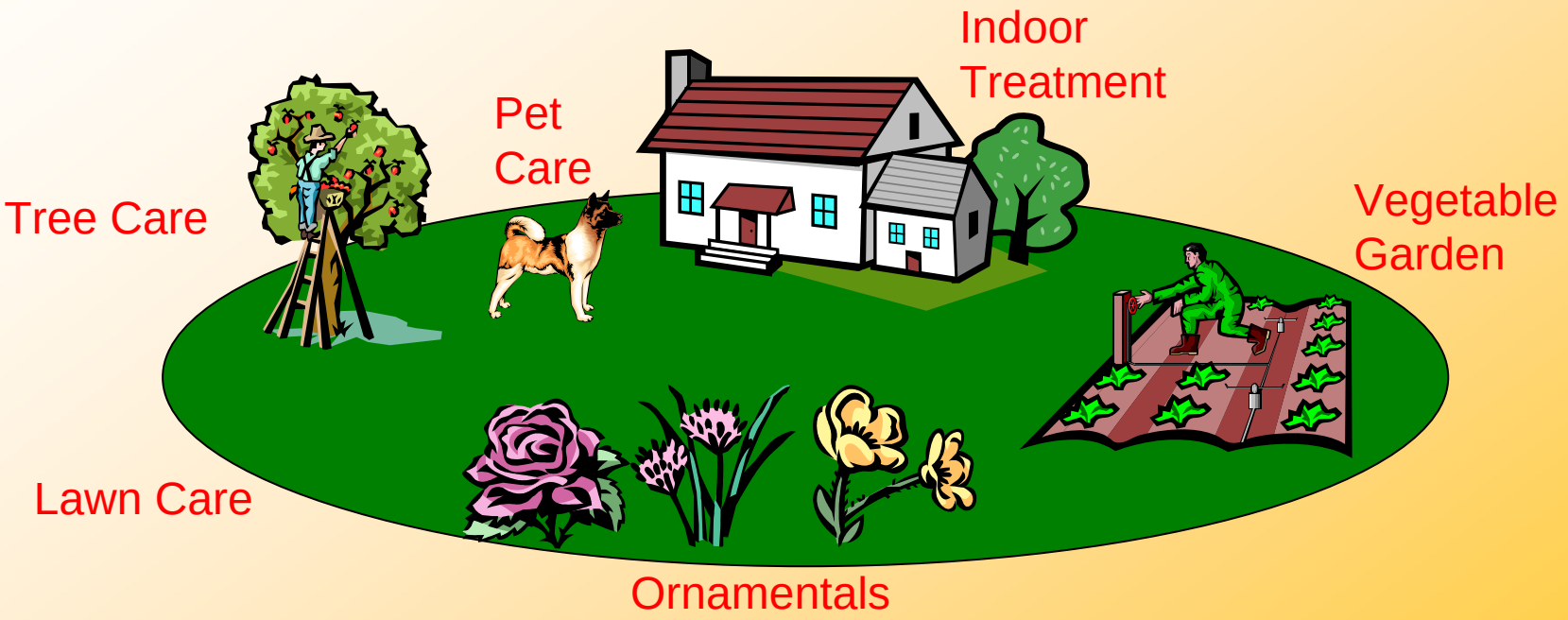
Objectives

- How to use residential module with real-world scenarios
- Use Group to create unique scenario.
- Address probabilities (scenario, product, monthly, weekly, co-occurrence)
- How to specify distributions and create new files
- Understand output tables from residential assessment

The Real World

Residential Scenarios



- Scenarios – different locations for pesticide application
- Products – different formulations in each scenario
- Application Methods – different ways to apply

Residential Scenarios

 Lawn Care
 Vegetable Garden Care
 Ornamental Plant Care
 Tree Care
 Pick Own Fruits/Vegetables
 Termite Control
 Rodent Control
 Swimming Pool Use
 Outdoor Fogger Use

- Custom - allows duplicate scenarios (i.e. spot treatment)

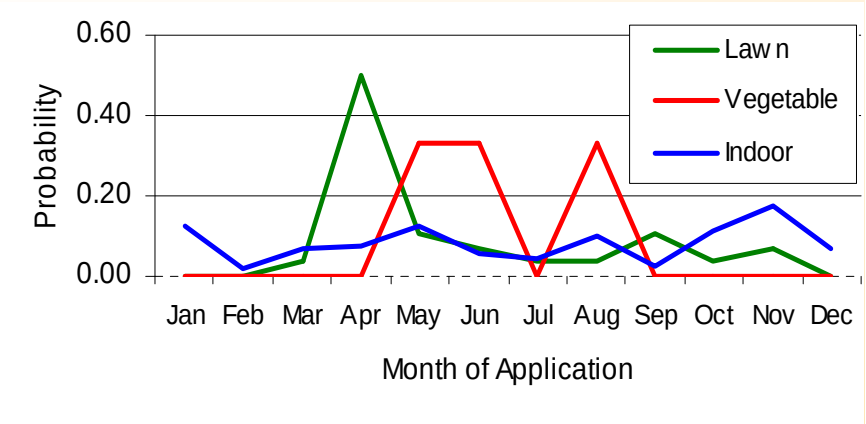
 Pet Care
 Indoor Fogger Use
 Indoor Treatment
 Crack & Crevice Treatment
 Paint/Wood Treatment
 Impregnated Materials
 Detergent / Handsoap Use
 Custom
 Golf Course
 Public Health

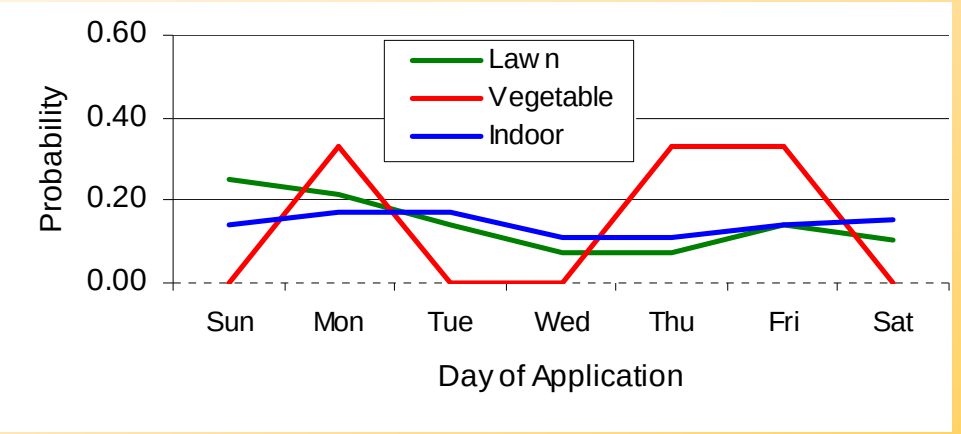
Reference: U.S. Environmental Protection Agency. Standard Operating Procedures for Residential Exposure Assessments. 1997 and 2001 (revised).

Scenarios and Assessment Algorithms

			SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5
		Scenario	Lawn Care	Vegetable	Ornamental	C&C	Indoor
		CARES ID	101	102	103	106	112
		Product	PowerForce Conc.	PowerForce Conc. PowerForce RTU	PowerForce Conc. PowerForce RTU	Home Pest Control	Tempo 20WP
		User	Consumer	Consumer	Consumer	Consumer	Professional
Receptor	Pathway	Route	Assessment Method	Assessment Method	Assessment Method	Assessment Method	Assessment Method
Adult	*During Application (18+ yrs.)*	Dermal	Unit Exposure, Area Treated (Dermal 101)	Unit Exposure, Area Treated (Dermal 101)	Unit Exposure, Area Treated (Dermal 101)	Unit Exposure, Formula Used (Dermal 102)	None
		Inhalation	Unit Exposure, Area Treated (Inhalation 101)	Unit Exposure, Area Treated (Inhalation 101)	Unit Exposure, Area Treated (Inhalation 101)	Unit Exposure, Formulation Used (Inhalation 102)	None
	Post Application	Dermal	Transfer Coefficient, Area (Dermal 104)	Transfer Coefficient, Area (Dermal 104)	Transfer Coefficient, Area (Dermal 104)	None	Transfer Coefficient, Residue (Dermal 103)
		Inhalation	None	None	None	Air Concentration, Specified (Inhalation 103)	Air Concentration, Specified (Inhalation 103)
Child (0 to 6 yrs.)	*Post Application*	Dermal	Transfer Coefficient, Area (Dermal 104)	None	None	None	Transfer Coefficient, Residue (Dermal 103)
		Ingestion	Mass Balance (Ingestion 107)	None	None	None	Mass Balance (Ingestion 107)
		Inhalation	None	None	None	Air Concentration, Specified (Inhalation 103)	Air Concentration, Specified (Inhalation 103)

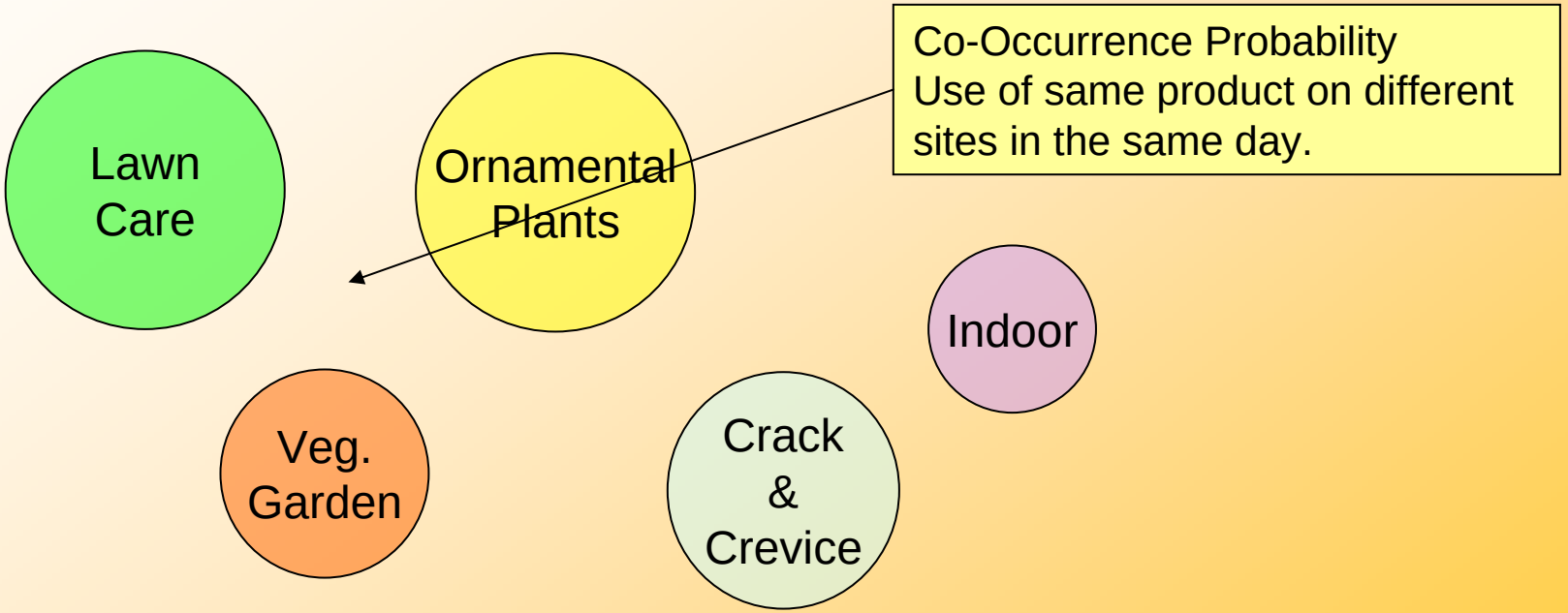
Event Allocation





- Determine monthly probabilities.
- Determine daily probabilities.
- Number of applications per year.
- Time interval between applications.

Scenario Probability & Co-Occurrence Probability



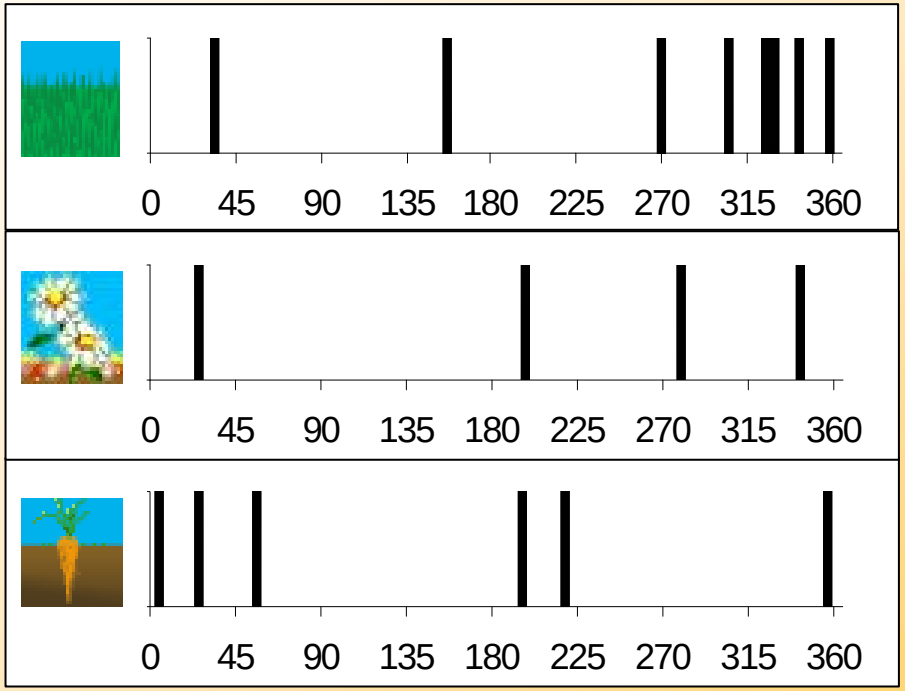
- Each scenario has a probability of occurring in the U.S. population.
- Scenarios are NOT INDEPENDENT Events.
- CARES only program to track co-occurrence probability.

Event Allocation Co-Occurrence Probability

Co-Occurrence Probability	Lawn Care	Veg. Garden Care	Ornamental Plants	Crack & Crevice	Indoor
Lawn Care	0	0.00	0.25	0.00	0.00
Veg. Garden Care	0.15	0	0.33	0.00	0.00
Ornamental Plants	0.16	0.02	0	0.00	0.00
Crack & Crevice	0.01	0.00	0.00	0	0.00
Indoor	0.00	0.00	0.00	0.00	0

- Co-Occurrence (correlation) – Not independent events.
- 3 types – all on same date
  - Use of same product on different sites (i.e., herbicide on lawn and garden).
  - Multiple applications of the same product to same site (i.e., repellent).
  - Use of multiple products (“class”) on same or different sites (cumulative).

Event Allocation



Estimates exposure based on EPA Residential Exposure Algorithms

Provides timing of application events for each individual in the population.

Residential Assessment Algorithms

- 03 Transfer Coefficient, Residue Based
- 04 Transfer Coefficient, Area Treated Based
- 05 Transfer Factor, Residue Based
- 06 Transfer Factor, Area Treated Based
- 07 Fraction Transferred
- 08 Flux Rate
- 09 Water Concentration
- 10 Film Thickness

- 01 Unit Exposure, Area Treated Based
- 02 Unit Exposure, Formulation Used
- 01 Unit Exposure, Area Treated Based
- 02 Unit Exposure, Formulation Used

- 03 Air Concentration, Specified
- 04 Air Concentration, Calculated

- 01 Granules/Pellets (Formulation)
- 02 Grass/Plants
- 03 Soil
- 04 Paint Chips
- 05 Water Concentration
- 06 Flux Rate
- 07 Mass Balance
- 08 Fraction Transferred
- 09 EPA SOPs Method

- 23 Residential Assessment Algorithm based on EPA SOP (algorithms)
- Application (4) and Post-Application (19) Exposures
- Route Exposures – Dermal (10), Inhalation (4), Ingestion (9)
- RAM parameters – scenario specific (area treated, etc.)

Exposure Methods

Applicator Exposure

Professional (no exposure)

Consumer

Post-Application Exposure

Hand-to-Mouth

$$Exposure_{oral} = \frac{Trans.\ Residue\ x\ Contact\ Freq.\ x\ Surface\ Area\ x\ Trans.\ Eff.\ x\ Duration}{Body\ Weight}$$

$$Exposure_{dermal} = \frac{Trans.\ Residue\ x\ Transfer\ Coefficient\ x\ Duration}{Body\ Weight}$$

Inhalation

$$Exposure_{inhalation} = \frac{Unit\ \ Exposure_{inhalation}\ \ x\ \ Applicatio\ \ n\ \ x\ \ Area}{Duration\ \ x\ \ Body\ \ Weight}$$

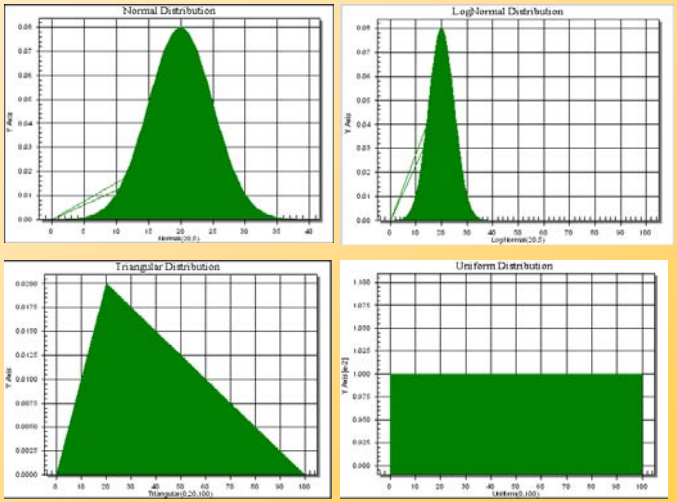
$$Exposure_{inhalation} = \frac{Air\ Conc.\ x\ Inhalation\ Rate\ x\ Duration}{Body\ Weight}$$

Dermal

$$Exposure_{dermal} = \frac{Unit\ Exposure_{dermal}\ x\ Application\ x\ Area}{Duration\ x\ Body\ Weight}$$

Residential Parameter Distributions

- 8 Distribution types for parameters.
  - Single
  - Normal (mean, s.d., min., max.)
  - Lognormal (GM, GS, min, max)
  - Triangular (most likely, min, max)
  - Uniform (min, max)
  - Discrete (empirical)
  - Percentile (non-interpolated)
  - Percentile (interpolated)



- Specify random seed, values selected from distribution curve.

Pre-Residential Checklist – Part 1

- What are the scenarios?
  - 19 scenarios based on EPA Residential SOP.
  - What is scenario probability?

- What are the products?
  - How many products for each scenario?
  - Product formulation type?
  - Professional or Consumer application?
  - What is the “within” scenario probability of product use?
  - What are product specific parameters (i.e., application rate, unit exposure, air concentration, etc.)?

Pre-Residential Checklist – Part 2

- What are the residential assessment methods?
  - Applicator exposure – dermal or inhalation?
  - Post-Application exposure – dermal, inhalation, or ingestion (H-to-M)?
  - Adult or Children exposure?
  - What are RAM scenario specific parameters (i.e., area treated, transfer coefficient, exposure duration, etc.)?

- What is the event probability?
  - What is monthly and weekly probability?
  - What is co-occurrence probability?
  - What is the frequency of application?
  - What is the application interval (days between applications)?

Residential Data Sources

- Sources of Data?
  - Survey data (i.e., NHGPUS)
  - Product use data (i.e., REJV)
  - Product label
  - Market share information
  - EPA SOP defaults
  - Published literature or company studies

Case Study – Example #2

- Please refer to Residential Example #2 in CARES Practice Workbook

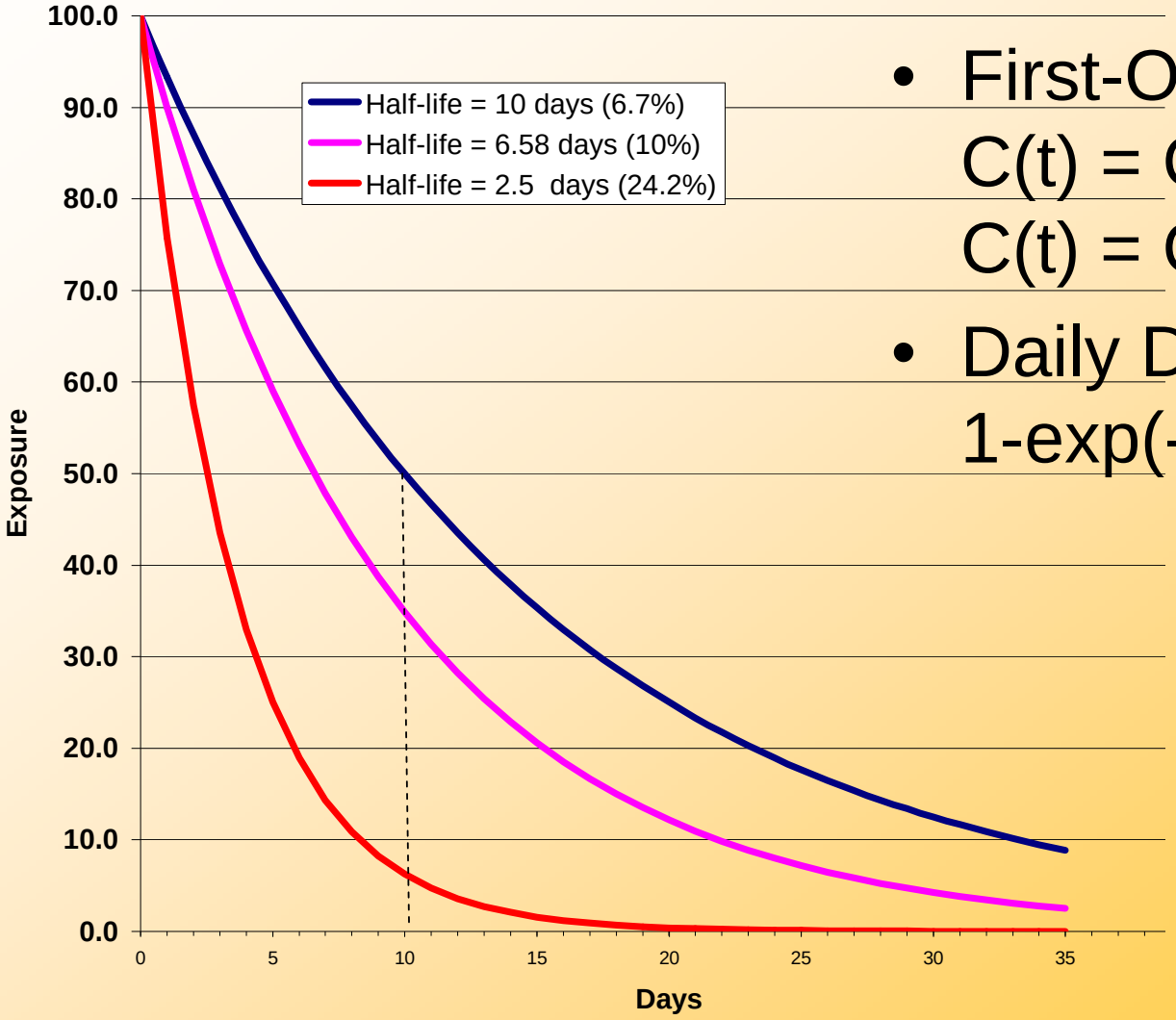
LogNormal

- Lognormal distribution requires 4 inputs:
  arithmetic mean(μ)
  standard deviation(σ)
  min
  max
- If given GM=10 and GSD=2, then:

μ = GM*EXP(1/2*LN(GSD)^2) = 12.72

σ = GM*SQRT(EXP(2*LN(GSD)^2-EXP(ln(GSD)^2)) = 9.9

Half-Life



- First-Order Degradation
  $C(t) = C_o \exp^{-k*t}$
  $C(t) = C_o \exp^{-\ln(2)/H}$
- Daily Dissipation = 1-exp(-ln(2)/H))

Questions?