

Appendix D. Derivation of Daily Percent Decline in Turf Transferable Residues and Dislodgeable Foliar Residues for Organophosphate Pesticides

LifeLine™ determines the dislodgeable (transferable) residues on turf and the foliage of vegetable gardens on the days following an application using a simple percent daily decline. In this analysis the daily decline is determined either by recommendations from EPA staff or by fitting the data on daily changes in transferable residues used in the June 11 assessment. EPA staff provided estimates for Naled, Malathion, and Fenthion on turf of 100%, 50% and 50% respectively. Percent daily declines were required for Fenamiphos, Trichlorfon, Acephate and Bensulide on turf and Malathion on gardens.

For Trichlorfon and Fenamiphos data is taken from the input files used in the software runs from the June 11 assessment reported that only 4% and 2% of the dislodgeable residue remained after 24 hours. Therefore, the percent daily decline used are 96% and 98%.

For the remaining pesticides, data are available for 5 to 14 days following application. The approach used for estimating the percent decline for these pesticides is to fit the reported values of the TTR and transferable foliage residues to an exponentially declining function. This data is taken from the input files used in the software runs from the June 11 assessment. Where the data on residues are given as uniform distributions, the average value of the distribution was calculated and used to fit the model.

In an exponentially decline the residue concentration at a time t (C_t) is given by the formula:

$$C_t = C_0 e^{-kt}$$

rearranging the equation gives

$$-\ln(C_t / C_0) = kt$$

The slope of the line formed by plotting $-\ln(C_t / C_0)$ against t , will give the value of k . The best value of k can be found by using a simple linear regression model constrained to pass through the origin.

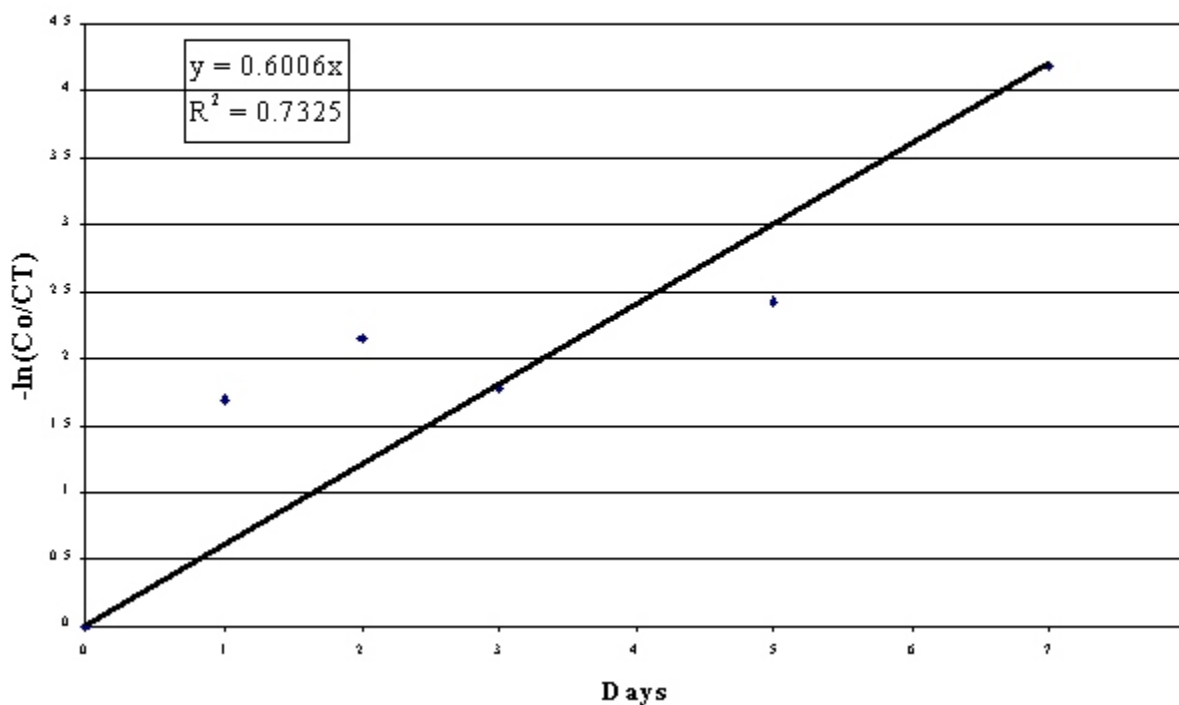
Once the value of k is determined, the percent daily decline is given by:

$$\text{Percent Daily Decline} = (1 - e^{-k}) * 100$$

The following are the data and plots for Acephate, Bensulide and Malathion. All three sets of data were reasonable well fitted by the decline models with R² values ranging from 0.64 to 0.97. The resulting percent daily declines for the three pesticides are 45% for Acephate on golf courses, 30% for Bensulide on turf and golf courses, and 38% for Malathion on vegetable gardens.

Day	Minimum Value	Maximum Value	Mean Conc. (Ct)	(Ct/C0)	-LN(Ct/C0)
0	0.0000718	0.00065	0.000361	1	0
1	0.0000218	0.00011	0.0000659	0.183	1.7
2	0.000016	0.0000676	0.0000418	0.116	2.16
3	0.0000221	0.0001	0.0000611	0.169	1.77
5	0.0000146	4.88E-05	0.0000317	0.0878	2.43

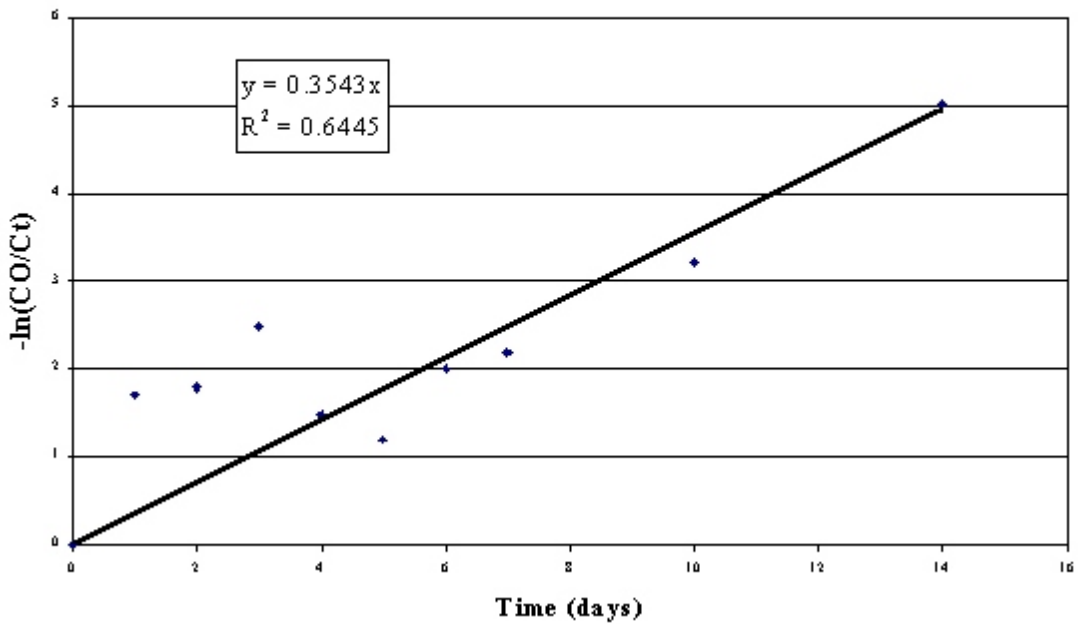
Acephate Plot of -ln(C0/CT) vs. Time



7	0.000003	0.000008	0.000005	0.0151	4.19
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Day	Minimum Value	Maximum Value	Mean Conc. (Ct)	(Ct/C0)	-LN(Ct/C0)
0	0.0001303	0.00068	0.000405	1	0
1	0.0000471	0.0001	0.0000736	0.182	1.71
2	0.0000212	0.000113	0.0000671	0.166	1.80
3	0.000014	0.000053	0.0000335	0.0827	2.49
4	0.0000881	0.000096	0.0000921	0.227	1.48
5	0.0000437	0.000201	0.000122	0.302	1.20
6	0.0000492	5.87E-05	5.39E-05	0.133	2.02
7	0.0000122	7.76E-05	0.0000449	0.111	2.20
10	0.0000066	0.000026	0.0000163	0.0402	3.21
14	0.0000014	0.000004	0.0000027	0.00666	5.01

Bensulide Plot of $-\ln(C_0/C_t)$ vs. Time



Day	Minimum Value	Maximum Value	Mean Conc. (Ct)	(Ct/C0)	-LN(Ct/C0)
0	0.00259	0.00294	0.00277	1	0.00
1	0.00179	0.00216	0.00198	0.714	0.336
2	0.0011	0.00142	0.00126	0.456	0.786
3	0.00093	0.00109	0.00101	0.365	1.01
5	0.00019	0.00032	0.000255	0.0922	2.38
6	0.00012	0.0002	0.00016	0.0579	2.85
7	0.00006	0.00008	0.00007	0.0253	3.68

Plot of $-\ln(C_0/CT)$ vs. Time for Malathion in Gardens

