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M E M O R A N D U M

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SUBJECT: DEVELOPMENT OF SUB-CHRONIC AIR CONCENTRATION ESTIMATES ASSOCIATED WITH A SINGLE FUMIGANT APPLICATION

Background

The Worker Health and Safety (WHS) branch previously requested air concentration estimates associated with a single fumigant for various sample averaging times less than or equal to 24 hours (hrs) (Barry, 2008). Estimates for iodomethane and chloropicrin were produced for use in the WHS exposure appraisals. The exposure appraisals also include sub-chronic exposure scenarios. Thus, two-week air concentration estimates were requested. For both chloropicrin and iodomethane. In addition, 30-day iodomethane air concentration estimates were requested for comparison with the Air Resources Board (ARB) ambient air concentration data for methyl bromide because the use pattern of iodomethane is expected to be similar to methyl bromide. Thus, the ARB methyl bromide ambient monitoring results can be used as a surrogate for the eventual iodomethane ambient air concentrations.

Methods

The sub-chronic exposure air concentration estimates were produced by extension of the 24 hr air concentration estimates (see Barry, 2008). The same single study flux profiles were used to produce flux profiles of 2-week (chloropicrin and iodomethane) and 30-day duration (iodomethane only). The chloropicrin study flux profiles were based on two-week field studies and were adequate without fitting or extrapolation. Flux profiles for five application methods are available: broadcast/untarp, bed/untarp, bed/tarp, broadcast/tarp, and bed/drip/tarp. (Beard et al., 1996; Rotandardo, 2004). The broadcast/tarp application method has three flux profiles from three separate field studies in Arizona, Washington, and Florida (Table 1).

For iodomethane WHS requested both 2-week and 30-day estimates (Table 2). As part of the registration process the registrant conducted eight studies to characterize the flux profile of iodomethane following application to soil by three different methods: broadcast/tarp, bed/tarp, and drip/tarp (Baker et al., 2001; Baker et al., 2002a; Baker et al., 2002b; Baker et al., 2003; Baker et al., 2004a; Baker et al., 2004b; Baker et al, 2004c). In contrast to the chloropicrin studies, the iodomethane studies were conducted to 10 or 11 days. Consequently, in order to estimate 2-weeks or 30-days, a three parameter lognormal function was fit to the 10 or 11 days iodomethane flux profiles. This function was integrated from the end of measured values out to 14 days or 30 days and the resulting integration added to the measured flux in order to extend the flux estimates out to 2-weeks or 30-days (Table 3).

The procedure to estimate the 2-week and 30-day average air concentration was a follows:

1. Simulate the generic 24-hr centerline downwind air concentrations based on the 100ug/m^2sec generic flux.
2. Adjust the generic 24-hr air concentration to 2-week or 30-day average air concentration. This is the averaging time adjustment factor (development of this adjustment factor will be presented below).
3. Develop each application method flux profile so that it extends for the 2-week or 30-day interval. This is the flux profile development.
4. Calculate the average 24-hr flux over that period and divide by 100. This number represents the average flux on any given day over the 2-week or 30-day interval scaled to the 100ug/m^2sec generic flux.
5. Multiply the 2-week or 30-day average air concentration by the scaled average 24-hr flux to obtain the estimated 2-week or 30-day air concentration for a particular study. This estimates represents the 2-week or 30-day air concentration for an application made at the application rate used in the study.
6. Adjust the 2-week or 30-day air concentration estimate for a particular study to obtain estimates for application rates other than that used in the study.

These steps are illustrated in the EXCEL spreadsheets for iodomethane and chloropicrin in Appendix A.

1. Simulate the generic 24-hour centerline downwind air concentrations

These generic 24-hour centerline downwind air concentration estimates are produced using the 100ug/m^2sec generic flux and the Department of Pesticide Regulation (DPR) standard weather conditions of 1.4 m/s and C stability. See Barry (2008) for method details.

2. Averaging time adjustment factor

The adjustment factors to obtain the 2-week and 30-day average air concentrations from the generic 24-hr air concentrations were derived based upon the U.S. Environmental Protection Agency (EPA) Modeling Guidelines. The 2-week and 30-day average air concentration is the air concentration that would be measured by an air sampler at a particular spot if that air sampler continually drew air over the 2-week or 30-day sampling period.

The basic equation relating air concentrations averaged over different sampling times can be found in Turner (1994) and was reviewed in Barry (2000):

$$\chi_s = \chi_k \left(t_k / t_s \right)^p$$

where:

χ_κ = base concentration
χ_s = desired concentration
t_k = base averaging interval (shorter interval)
t_s = desired averaging interval (longer interval)
p = power law exponent

The adjustment factor, or multiplier is the portion of the equation shown below:

$$\left(t_k / t_s \right)^p$$

The value of p, the power law exponent varies, depending upon the range of averaging times of interest. For example, in U.S. EPA air toxics modeling guidelines (U.S. EPA, 1992a; U.S. EPA, 1992b) the value of p is between 0.096 and 0.29 to obtain the recommended multiplier for adjusting a 1 hr air concentration to between a 3 hr and an annual air concentration. The progression of the values of p and resulting multipliers for adjusting a 1 hour air concentration are shown below:

Averaging Time	Exponent	Multiplier
3 hr	p = 0.096	0.9
8 hr	p = 0.17	0.7
24 hr	p = 0.28	0.4
annual	p = 0.28	0.08

For the sub-chronic exposure assessment an average 24 hr air concentration will be adjusted to a 2 week or a 30 day air concentration. Based upon the above relationships, p = 0.28 is the appropriate exponent value for these adjustments. The multipliers are 0.48 for 2 weeks and 0.39 for 30 days. The justification for this exponent value and the multipliers is shown below.

First, to conform to the U.S. EPA exponent values, adjustment of the 1 hr to 24 hr is as follows:

$$multiplier_{1hr \rightarrow 24hr} = \left(1/24\right)^{0.28} = 0.41$$

The 1 hr to 2 weeks (336 hrs) multiplier:

$$multiplier_{1hr \rightarrow 336hr} = \left(1/336\right)^{0.28} = 0.196$$

The 1 hr to 30 days (720 hrs) multiplier:

$$multiplier_{1hr \rightarrow 720hr} = \left(1/720\right)^{0.28} = 0.158$$

By extension of the equation -

The 24 hr to 2 weeks (336 hrs) multiplier:

$$multiplier_{24hr \rightarrow 336hr} = \left(24/336\right)^{0.28} = 0.48$$

The 24 hr to 30 day (720 hr) multiplier:

$$multiplier_{24hr \rightarrow 720hr} = \left(24/720\right)^{0.28} = 0.39$$

The ratio of the 24 hr multiplier to the 2 week multiplier and the 24 hr multiplier to the 30 day multiplier illustrates that p = 0.28 is the appropriate multiplier for adjusting a 24 hr air concentration to averaging times between 24 hrs and annual:

$$1hr \rightarrow 336hr : 1hr \rightarrow 24hr = 0.196/0.41 = 0.48$$

$$1hr \rightarrow 720hr : 1hr \rightarrow 24hr = 0.158/0.41 = 0.39$$

3. Flux profile development

Table 3 shows a summary of the subchronic flux estimates for iodomethane. Two of the studies (Guadalupe, drip/tarp and Oxnard, bed/tarp) measured flux that projected 100 percent loss of the applied mass within the 10 days of the application. These measured flux profiles were used "as is" and zeros were used to fill in the remaining days out to 30 days.

For the remaining iodomethane studies a 3 parameter log-normal function was fit to the measured daily flux and used to extend the flux profiles to 30 days. The function was integrated from the end of measured values to 14 days. The resulting flux was added to the measured flux to estimate the 2-week cumulative flux. Similarly, the function was integrated from the end of measured values to 30 days and the result was added to the measured flux to estimate the 30 day cumulative flux.

4. Calculate the average 24-hr flux over the desired period

This number represents the average flux on any given day during the 2-week or 30-day interval. Where necessary the 2-week and 30-day average 24-hr flux estimates were adjusted to prevent projected mass loss from exceeding applied mass. Final flux estimates are shown in Table 3.

5. Multiply the 2-week or 30-day average air concentration by the scaled average 24-hr flux to obtain the estimates 2-week or 30-day air concentration for a particular study

This adjustment scales the generic 2-week or 30-day average air concentration from the 100 ug/m^2sec generic flux to the flux observed for the actual study application rate. It is accomplished by dividing the average 2-week or 30-day flux by the 100ug/m^2sec generic flux to get a scaled flux value. The generic concentrations are multiplied by the scaled flux value to estimate the 2-week or 30-day air concentration for an application made at the application rate used in the study.

6. Adjust the 2-week or 30-day air concentration estimate for a particular study to obtain estimates for application rates other that that use in the study

Since air concentrations are assumed to be proportional to flux and flux is assumed to be proportional to application rate, 2-week or 30-day air concentration estimates for other application rates can be obtained by applying an adjustment factor that expresses the desired application rate as a proportion of the study application rate.

Results

Appendix A shows results of the procedure for both Chloropicrin and Iodomethane. Appendix B shows the 3 parameter log-normal fits to develop the Iodomethane flux profiles. Appendix C contains the Chloropicrin and Iodomethane flux profiles used to calculate the average 24-hr flux values.

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Table 1. Summary of application rates and flux estimates from chloropicrin studies used to estimate off-site air concentrations.

Study Location	Application Method	Study Application Rate[a] (lb/acre)	Study Effective Broadcast Application Rate (lb/acre)	2-week 24 hr average flux (ug/m^2sec)
Arizona	Broadcast/Untarp	171	171	10.39
Arizona	Bed/Untarp	149	86	5.39
Arizona	Broadcast/Tarp	332	332	12.37
Arizona	Bed/Tarp	377	189	21.45
Washington	Broadcast/Tarp	343	343	9.54
Florida	Broadcast/Tarp	346	346	12.33
California	Bed/Drip/Tarp	300	156	2.24

[a] This application rate is the “treated acre” rate. For broadcast application methods the Study Application Rate and the Study Effective Broadcast Application Rate will be the same. For bed type applications an adjustment must be made to the Study Application Rate to account for the portions of the field that are untreated

Table 2. Iodomethane studies used to estimate off-site air concentrations.

Study	Application Method	Study Treated Acre Application Rate[a]	Study Effective Broadcast Application Rate	175 lb/acre Adjustment Factor	87.5 lb/acre Adjustment Factor
Watsonville, California	Broadcast/Tarp	252	252	0.69	0.35
Manteca, California	Broadcast/Tarp	242	242	0.72	0.36
LaSelva Beach, California	Drip/Tarp	235	162	1.08	0.54
Camarillo, California	Drip/Tarp	175	119	1.47	0.74
Guadalupe, California	Drip/Tarp	174	139	1.26	0.63
Oxnard, California	Bed/Tarp	244	171	1.02	0.51
Guadalupe, California	Bed/Tarp	179	143	1.22	0.61

[a] This application rate is the “treated acre” rate which is only the treated soil area excluding nontreated areas such as furrows. For broadcast application methods the Study Application Rate and the Study Effective Broadcast Application Rate will be the same. For bed type applications an adjustment must be made to the Study Application Rate to account for the portions of the field that are untreated.

Table 3. Summary of the iodomethane 2-week and 30-day factors to estimate the sub-chronic air concentrations.

Study (Application Method)	Study Effective Broadcast Application Rate (lb/ac)	3 Parameter Log-Normal Function R^2 (%)	First Sampling Interval Duration (hrs)	First Sampling Interval Proportion of 24 hrs	Study Reported Measured Proportion Mass Lost	2-week 24 hr average flux (ug/m^{2}sec)	2-week Mass lost (lb/ac)	2-week Proportion of Mass Applied	30-Day 24hr average flux (ug/m^{2}sec)	30-Day Mass Lost (lb/ac)	30-Day Proportion of Mass Applied
Watsonville, California (broadcast/tarp)	252	99.7	22	0.92	0.58	13.58	146.0	0.58	6.48	150.0	0.59
Manteca, California (broadcast/tarp)	242	98.5	19	0.86	0.94	22.1	238.0	0.98	10.47	242.0	1.00
LaSelva Beach, California (drip/tarp)	162	99.9	19	0.86	0.45	7.27	78.4	0.48	3.40	78.5	0.48
Camarillo, California (drip/tarp)	119	99.8	22	0.92	0.83	9.18	98.9	0.83	4.29	99.0	0.83
Guadalupe, California (drip/tarp)	139	-[1]	23	0.96	1.00	12.88	139.0	1.00	6.04	139.0	1.00
Oxnard, California (bed/tarp)	171	-[1]	19	0.86	1.00	15.85	171.0	1.00	7.40	171.0	1.00
Guadalupe, California (bed/tarp)	143	99.9	21	0.87	0.97	12.68	136.8	0.96[2]	5.93	136.9	0.96[2]

[1] These two studies measured flux that results in 100 percent mass loss within the first 10 days.
[2] This mass loss differs slightly from 0.97 due to rounding difference between the study report and calculations in this memorandum.

Appendix A

Iodomethane - 2 week concentrations

					vol 52875-026		**vol 52875-007**		**vol 52875-056**		
					Manteca		**Watsonville**		**LaSelva Beach**		
		24hr	**2 week**		**Field Study**		**Field Study**		**Field Study**		
feet	**meters**	**generic con**	**generic conc**		**242 lbs/ac**	**175 lbs/ac**	**252 lbs/ac**	**175 lbs/ac**	**162 lbs/ac**	**175 lbs/ac**	**87.5 lbs/ac**
10	3.04	2589.13	1242.78		274.65	197.75	168.77	116.45	90.35	97.58	48.79
50	15.2	2350.75	1128..6		249.37	179.54	153.23	105.73	82.03	88.59	44.30
100	30.4	2018.72	968.98		214.15	154.18	131.59	90.80	70.45	76.08	38.04
300	91.2	1373.99	659.52		145.75	104.94	89.56	61.80	47.95	51.78	25.89
500	152	1083.24	519.96		114.91	82.74	70.61	48.72	37.80	40.82	20.41
###	760	379.24	182.04		40.23	28.97	24.72	17.06	13.23	14.29	7.15
		2 week adj*	0.48								
				flux adjustment	0.221		0.1358		0.0727		
				app rate multiplier#		0.72		0.69		1.08	0.54

	vol 52875-063			**vol 52875-089**			**vol 52875-046**			**vol 52875-064**		
	Camarillo			**Guadalupe**			**Oxnard**			**Guadalupe**		
	Field Study			**Field Study**			**Field Study**			**Field Study**		
feet	**119 lbs/ac**	**175 lbs/ac**	**87.5 lbs/ac**	**139 lbs/ac**	**175 lbs/ac**	**87.5 lbs/ac**	**171 lbs/ac**	**175 lbs/ac**	**87.5 lbs/ac**	**143 lbs/ac**	**175 lbs/ac**	**87.5 lbs/ac**
10	114.09	167.71	84.42	160.07	201.69	100.84	196.98	200.92	100.46	157.58	192.25	96.13
50	103.58	152.27	76.65	145.33	183.12	91.56	178.85	182.42	91.21	143.08	174.55	87.28
100	88.95	130.76	65.83	124.81	157.25	78.63	153.58	156.66	78.33	122.87	149.90	74.95
300	60.54	89.00	44.80	84.95	107.03	53.52	104.53	106.62	53.31	83.63	102.02	51.01
500	47.73	70.17	35.32	66.97	84.38	42.19	82.41	84.06	42.03	65.93	80.43	40.22
###	16.71	24.56	12.37	23.45	29.54	14.77	28.85	29.43	14.71	23.08	28.16	14.08
flux adjustment	0.0918			0.1288			0.1585			0.1268		
app rate multiplier#		1.47	0.74		1.26	0.63		1.02	0.51		1.22	0.61

* this adjustment converts the generic 24hr conc to a generic 2week conc
** this adjustment converts the 2 week generic air concentration (based on 100ug/m2sec) to an air concentration based on average 24hr flux over the 2 week flux profile from the study. e.g. from Table 3: 0.221=(22.1ug/m2sec)/(100ug/m2sec) and (0.221)*(1242.78) = 274.65ug/m3
# this multiplier scales the concentrations from the study to the desired application rate e.g.: (0.72)*(274.655) = 197.75
the multiplier is calculated as: 175/242 = 0.72 and scales the application rate from 242lb/ac to 175lb/ac
Any additional broadcast application rates can be obtained by calculating the app rate multiplier.

Concentrations shown are model results and 2 decimal places are retained to minimized rounding differences in calculations
Concentrations should be rounded to 2 significant figures for use in the Exposure Appraisal

Appendix A
Iodomethane - 30 day concentrations

feet	meters	24hr generic con	30 day generic conc	vol 52875-026 Manteca Field Study 242 lbs/ac	175 lbs/ac	vol 52875-007 Watsonville Field Study 252 lb/ac	175 lb/ac	vol 52875-056 LaSelva Beach Field Study 162 lbs/ac	175 lbs/ac	87.5 lb/ac	vol 52875-063 Camarillo Field Study 119 lb/ac	175 lbs/ac	87.5 lbs/ac	vol 52875-089 Guadalupe Field Study 139 lbs/ac	175 lbs/ac	87.5 lbs/ac	vol 52875-046 Oxnard Field Study 171 lbs/ac	175 lbs/ac	87.5 lbs/ac	vol 52875-064 Guadalupe Field Study 143 lbs/ac	175 lbs/ac	87.5 lbs/ac
10	3.04	2589.13	1009.76	105.72	76.12	65.43	45.15	34.33	37.08	18.54	43.32	63.68	32.06	60.99	76.85	38.42	74.72	76.22	38.11	59.88	73.05	36.53
50	15.2	2350.75	916.79	95.99	69.11	59.41	40.99	31.17	33.66	16.83	39.33	57.82	29.10	55.37	69.77	34.89	67.84	69.20	34.60	54.37	66.33	33.16
100	30.4	2018.72	787.30	82.43	59.35	51.02	35.20	26.77	28.91	14.45	33.78	49.65	24.99	47.55	59.92	29.96	58.26	59.43	29.71	46.69	56.96	28.48
300	91.2	1373.99	535.86	56.10	40.39	34.72	23.96	18.22	19.68	9.84	22.99	33.79	17.01	32.37	40.78	20.39	39.65	40.45	20.22	31.78	38.77	19.38
500	152	1083.24	422.46	44.23	31.85	27.38	18.89	14.36	15.51	7.76	18.12	26.64	13.41	25.52	32.15	16.08	31.26	31.89	15.94	25.05	30.56	15.28
###	760	379.24	147.90	15.49	11.15	9.58	6.61	5.03	5.43	2.72	6.35	9.33	4.70	8.93	11.26	5.63	10.94	11.16	5.58	8.77	10.70	5.35
		30 Day adj*	0.39																			
			flux adjustment	0.1047		0.0648		0.0340			0.0429			0.0604			0.0740			0.0593		
			app rate multiplier#		0.72		0.69		1.08	0.54		1.47	0.74		1.26	0.63		1.02	0.51		1.22	0.61

* this adjustment converts the generic 24hr conc to a generic 30 Day conc

** this adjustment converts the 30 day generic air concentration (based on 100ug/m2sec) to an air concentration based on average 24hr flux over the 30 day flux profile from the study. e.g. from Table 3: 0.1047=(10.47ug/m2sec)/(100ug/m2sec) and (0.1047)*(1009.7607) = 105.72ug/m3

this multiplier scales the concentrations from the study to the desired application rate e.g.: (0.720)*(105.72) = 75.12
the multiplier is calculated as: 175/242 = 0.72 and scales the application rate up from 242lb/ac to 175lb/ac
Any additional broadcast application rates can be obtained by calculating the app rate multiplier.

Concentrations shown are model results and 2 decimal places are retained to minimized rounding differenced in calculations
Concentrations should be rounded to 2 significant figures for use in the Exposure Appraisal

Appendix A
Chloropicrin 2 week averages

		24hr	2 week		AZ broad/untarp			AZ bed/untarp			AZ bed/tarp		
feet	**meters**	**generic conc**	**generic conc**		**171 lb/ac**	**175 lb/ac**	**500 lb/ac**	**86 lb/ac**	**175 lb/ac**	**250 lb/ac**	**189 lb/ac**	**350 lb/ac**	**500 lb/ac**
10	3.04	2589.13	1242.78		129.13	132.09	377.56	66.99	136.32	194.73	266.58	493.17	706.43
50	15.2	2350.75	1128.6		117.24	119.93	342.80	60.82	123.77	176.80	242.03	447.76	641.39
100	30.4	2018.72	968.98		100.68	102.99	294.38	52.23	106.28	151.83	207.85	384.52	550.80
300	91.2	1373.99	659.52		68.52	70.10	200.36	35.55	72.34	103.34	141.47	261.71	374.88
500	152	1083.24	519.96		54.02	55.27	157.96	28.03	57.03	81.47	111.53	206.33	295.56
###	760	379.24	182.04		18.91	19.35	55.30	9.81	19.97	28.52	39.05	72.24	103.47
		2 week adj*	0.48										
				flux adjustment	0.1039			0.0539			0.2145		
				app rate multiplier#		1.023	2.924		2.035	2.907		1.85	2.65

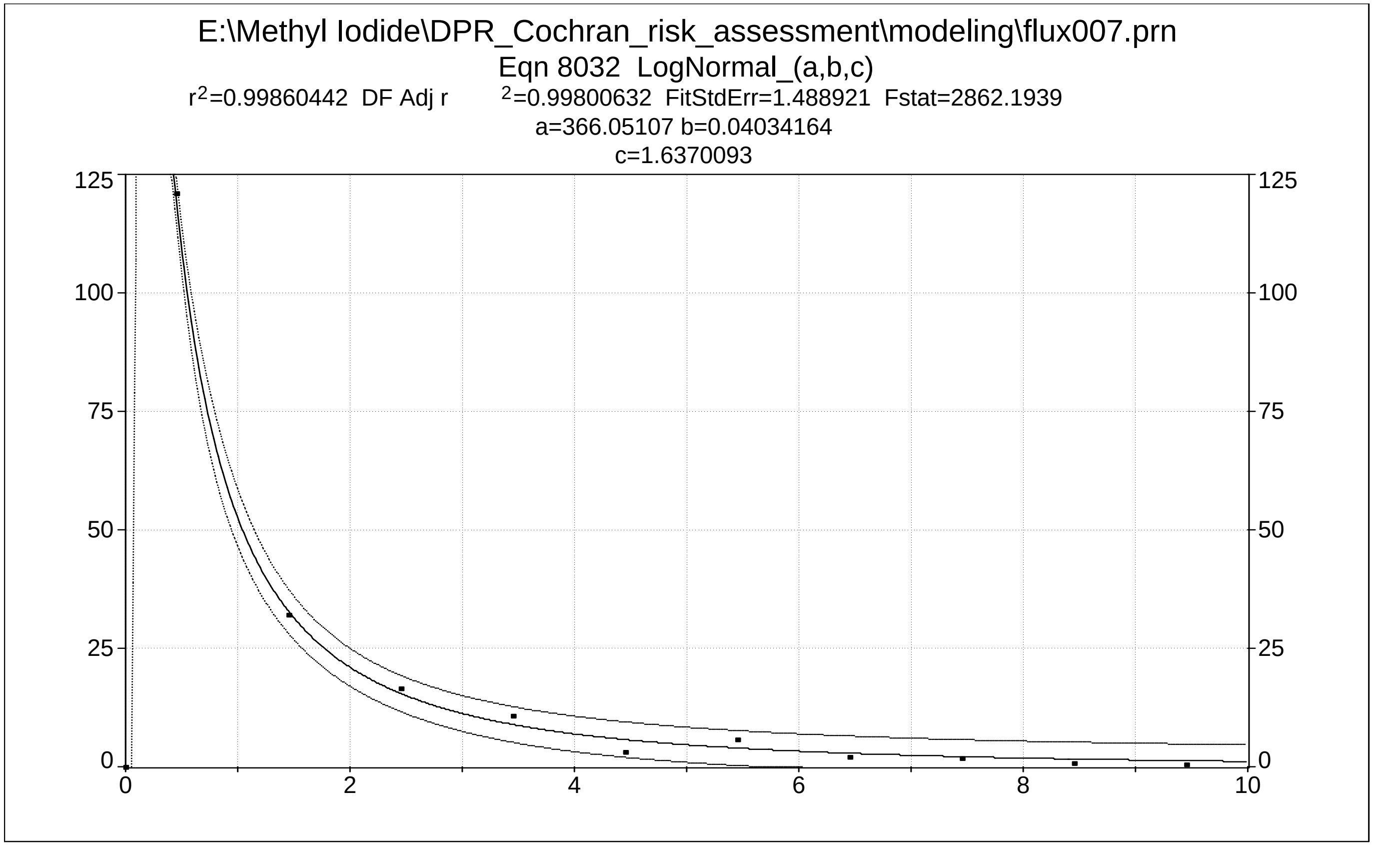
			AZ broad/tarp			WA broad/tarp			FL broad/tarp			CA bed/drip/tarp	
feet	**meters**		**332 lb/ac**	**350 lb/ac**	**500 lb/ac**	**343 lb/ac**	**350 lb/ac**	**500 lb/ac**	**346 lb/ac**	**350 lb/ac**	**500 lb/ac**	**156 lb/ac**	**300 lb/ac**
10	3.04		153.73	162.03	232.14	118.56	120.93	173.10	153.24	155.07	221.42	27.84	53.53
50	15.2		139.58	147.12	210.76	107.65	109.80	157.16	139.13	140.80	201.04	25.28	48.60
100	30.4		119.86	126.34	180.99	92.44	94.29	134.96	119.48	120.91	172.64	21.71	41.74
300	91.2		81.58	85.99	123.19	62.92	64.18	91.86	81.32	82.29	117.50	14.77	28.41
500	152		64.32	67.79	97.12	49.60	50.60	72.42	64.11	64.88	92.64	11.65	22.40
###	760		22.52	23.73	34.00	17.37	17.71	25.35	22.44	22.71	32.43	4.08	7.84
		flux adjustment	0.1237			0.0954			0.1233			0.0224	
		app rate multiplier#		1.054	1.51		1.02	1.46		1.012	1.445		1.923

* this adjustment converts the generic 24hr conc to a generic 2week conc
** this adjustment converts the 2 week generic air concentration (based on 100ug/m2sec) to an air concentration based on average 24hr flux over the 2 week flux profile from the study. e.g. from Table 1: 0.1039=(10.39ug/m2sec)/(100ug/m2sec) and (0.1039)*(1242.78) = 129.3ug/m3
# this multiplier scales the concentrations from the study to the desired application rate e.g.: (1.023)*(129.13) = 132.09
the multiplier is calculated as: 175/171 = 1.023 and scales the application rate up from 171lb/ac to 175lb/ac
Any additional broadcast application rates can be obtained by calculating the app rate multiplier.
Example: bed/tarp 250 app rate multiplier = 250/189 = 1.323
the concentrations in the "bed/tarp 189" column multipled by 1.323 gives estimated concentration for 250lb effective broadcast
this scenario would be 500lbs in the beds and beds 50% of the field area.

Concentrations shown are model results and 4 decimal placed are retained to minimized rounding differenced in calculations
Concentrations should be rounded to 2 significant figures for use in the Exposure Appraisal

Appendix B. Iodomethane 30-Day Flux Profile Development

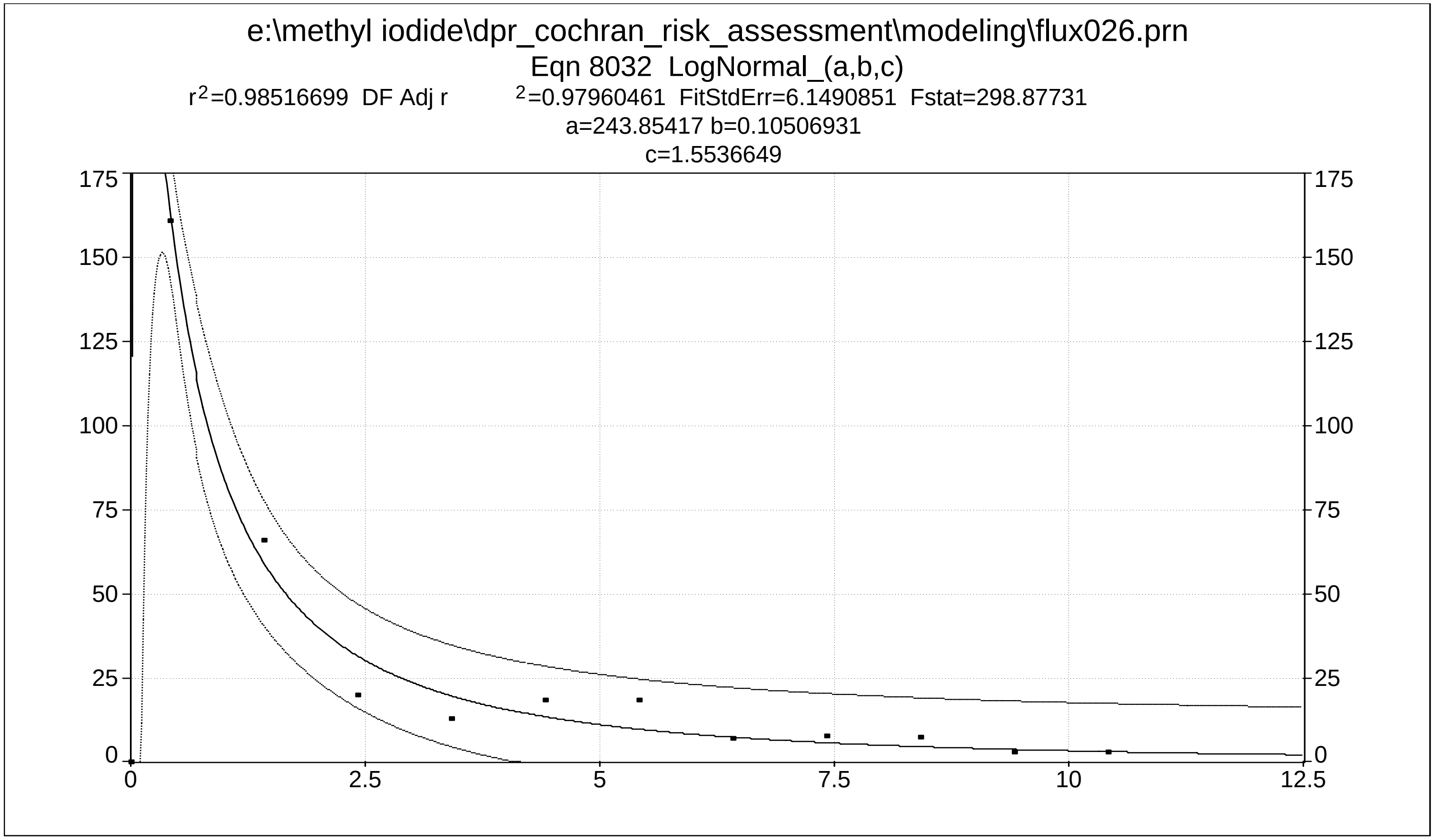
007 Watsonville, California
Broadcast/tarp



Rank 1 Eqn 8032 LogNormal_(a,b,c)

XY	*	X Value	Y Value	Y Predict	Residual	Residual%	95% Confidence Limits		95% Prediction Limits		Weights
1		0.0000000	0.0000000								1
2		0.4600000	121.30000	121.21224	0.0877648	0.0723535	117.77941	124.64506	116.35704	126.06743	1
3		1.4600000	32.200000	33.105312	-0.905312	-2.811529	29.919536	36.291089	28.421531	37.789093	1
4		2.4600000	16.800000	15.645902	1.1540984	6.8696332	13.941254	17.350550	11.812567	19.479237	1
5		3.4600000	11.000000	9.0727609	1.9272391	17.520355	7.5096807	10.635841	5.3002481	12.845274	1
6		4.4600000	3.3000000	5.8797181	-2.579718	-78.17328	4.4127679	7.3466683	2.1460100	9.6134262	1
7		5.4600000	5.9000000	4.0904287	1.8095713	30.670700	2.7560509	5.4248065	0.4067895	7.7740678	1
8		6.4600000	2.3000000	2.9902720	-0.690272	-30.01183	1.7961628	4.1843812	-0.644908	6.6254515	1
9		7.4600000	1.9000000	2.2679552	-0.367955	-19.36606	1.2058527	3.3300576	-1.326025	5.8619355	1
10		8.4600000	1.0000000	1.7698504	-0.769850	-76.98504	0.8259742	2.7137267	-1.790983	5.3306840	1
11		9.4600000	0.5600000	1.4129763	-0.852976	-152.3172	0.5727308	2.2532217	-2.121800	4.9477528	1

026 Manteca
Broadcast/tarp

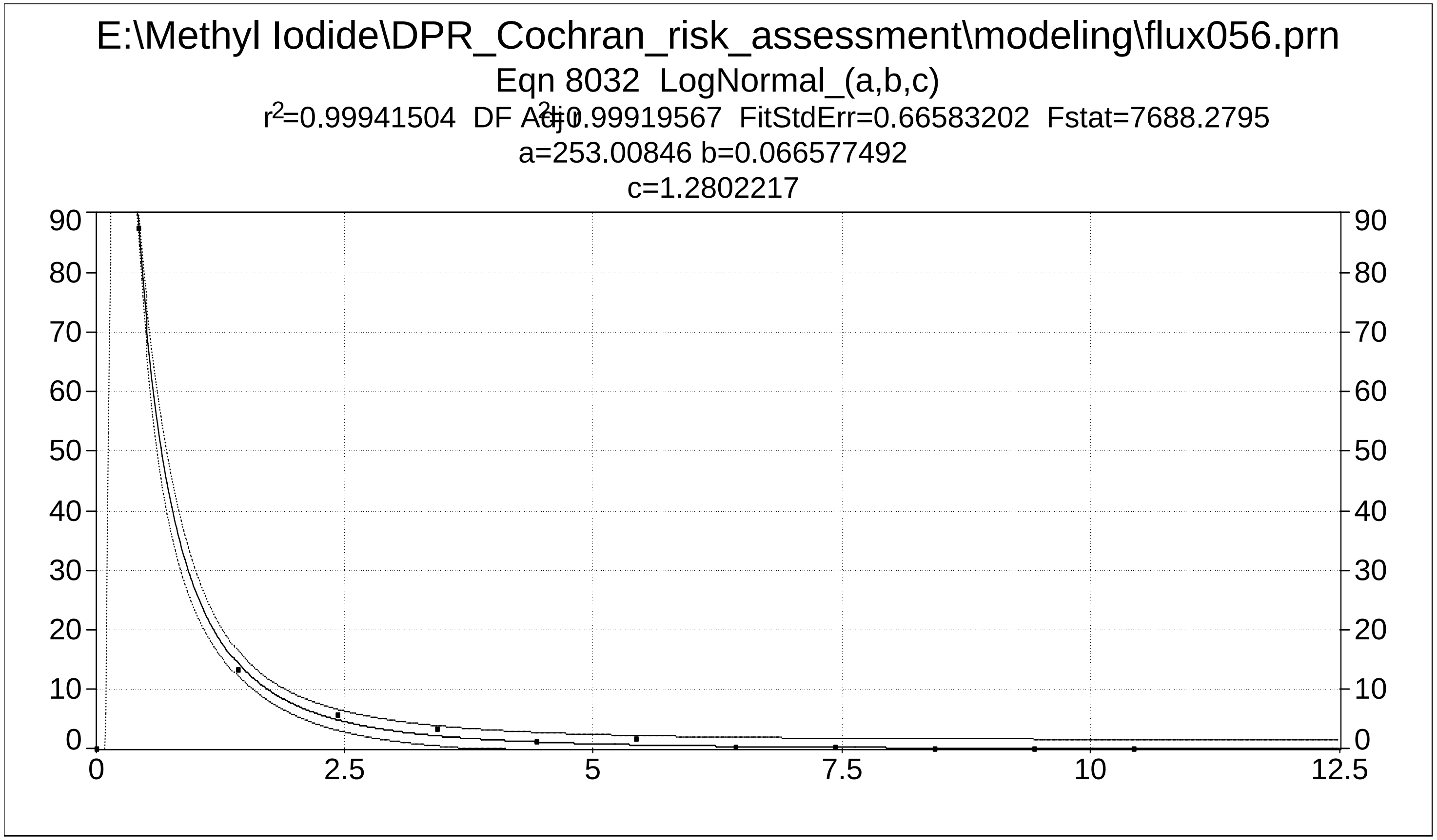


Rank 1 Eqn 8032 LogNormal_(a,b,c)

XY	*	X Value	Y Value	Y Predict	Residual	Residual%	95% Confidence Limits		95% Prediction Limits		Weights
1		0.0000000	0.0000000								1
2		0.4300000	161.20000	161.62053	-0.420527	-0.260873	147.71704	175.52401	141.95328	181.28777	1
3		1.4300000	66.000000	59.422012	6.5779885	9.9666492	46.921775	71.922248	40.720421	78.123602	1
4		2.4300000	20.000000	31.593718	-11.59372	-57.96859	24.755255	38.432182	16.093455	47.093982	1
5		3.4300000	13.000000	19.684956	-6.684956	-51.42274	13.734926	25.634986	4.5556325	34.814280	1
6		4.4300000	18.500000	13.421508	5.0784921	27.451308	7.7227323	19.120284	-1.610778	28.453794	1
7		5.4300000	18.500000	9.7064289	8.7935711	47.532817	4.3461762	15.066682	-5.200814	24.613672	1
8		6.4300000	7.0000000	7.3199966	-0.319997	-4.571380	2.3698197	12.270173	-7.444753	22.084746	1
9		7.4300000	8.0000000	5.6968555	2.3031445	28.789307	1.1713012	10.222410	-8.931002	20.324713	1
10		8.4300000	7.5000000	4.5441430	2.9558570	39.411427	0.4255713	8.6627146	-9.962966	19.051252	1
11		9.4300000	3.0000000	3.6972963	-0.697296	-23.24321	-0.045840	7.4404328	-10.70773	18.102318	1
12		10.430000	3.0000000	3.0578933	-0.057893	-1.929778	-0.345569	6.4613560	-11.26262	17.378408	1

056 LaSelva Beach, California

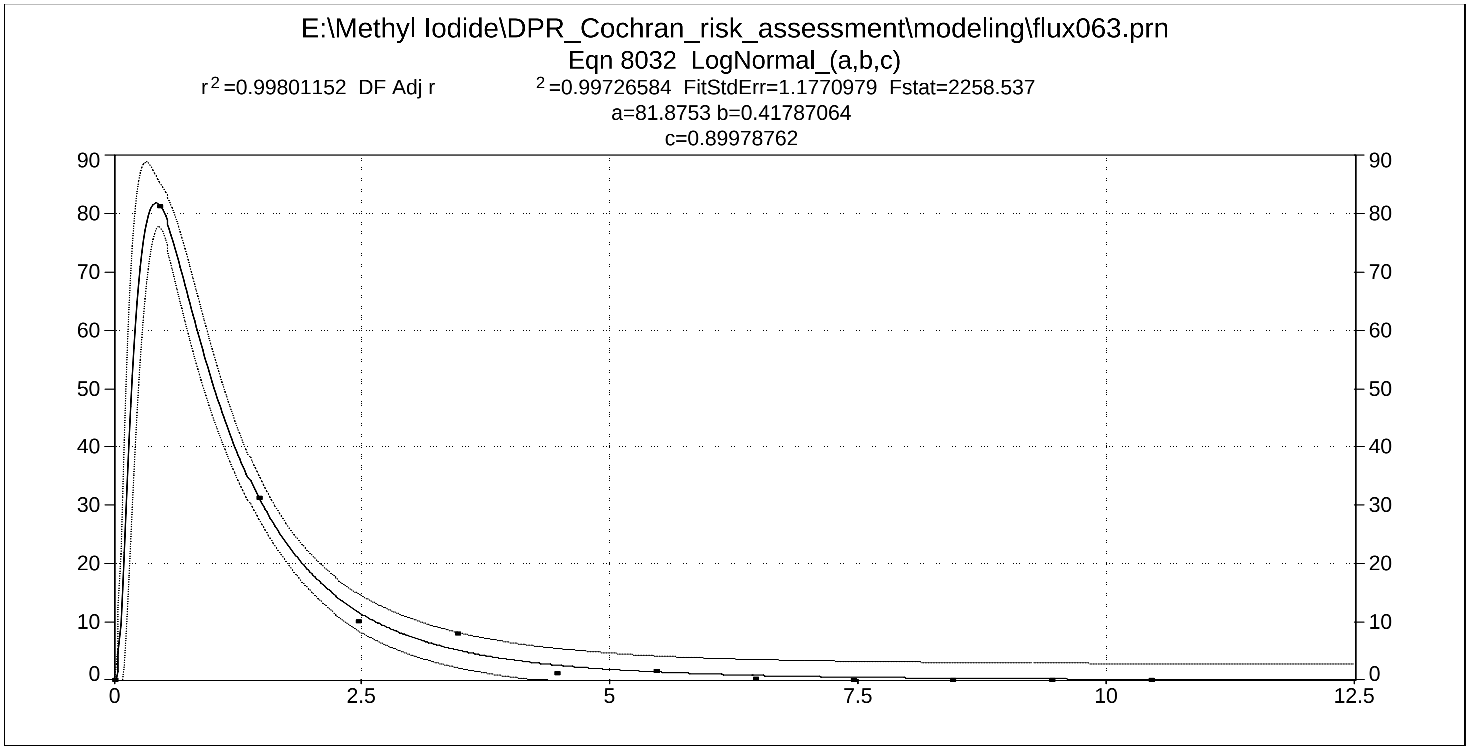
Drip/Tarp



Rank 1 Eqn 8032 LogNormal_(a,b,c)

XY	*	X Value	Y Value	Y Predict	Residual	Residual%	95% Confidence Limits		95% Prediction Limits		Weights
1		0.0000000	0.0000000								1
2		0.4300000	87.600000	87.517959	0.0820408	0.0936539	86.011767	89.024151	85.387864	89.648054	1
3		1.4300000	13.400000	14.348797	-0.948797	-7.080578	12.876518	15.821077	12.242546	16.455049	1
4		2.4300000	5.7000000	4.8826428	0.8173572	14.339599	3.9656399	5.7996458	3.1192419	6.6460438	1
5		3.4300000	3.3500000	2.2099065	1.1400935	34.032641	1.4168010	3.0030120	0.5076418	3.9121712	1
6		4.4300000	1.3700000	1.1707592	0.1992408	14.543124	0.5537230	1.7877954	-0.456945	2.7984638	1
7		5.4300000	1.7000000	0.6863966	1.0136034	59.623728	0.2172734	1.1555199	-0.891185	2.2639787	1
8		6.4300000	0.2500000	0.4321646	-0.182165	-72.86585	0.0742734	0.7900559	-1.115987	1.9803167	1
9		7.4300000	0.2700000	0.2869597	-0.016960	-6.281369	0.0108052	0.5631142	-1.244363	1.8182827	1
10		8.4300000	0.0950000	0.1985869	-0.103587	-109.0388	-0.017364	0.4145373	-1.323032	1.7202055	1
11		9.4300000	0.1120000	0.1420635	-0.030063	-26.84237	-0.029065	0.3131923	-1.373843	1.6579704	1
12		10.430000	0.0500000	0.1044352	-0.054435	-108.8704	-0.032879	0.2417489	-1.408028	1.6168980	1

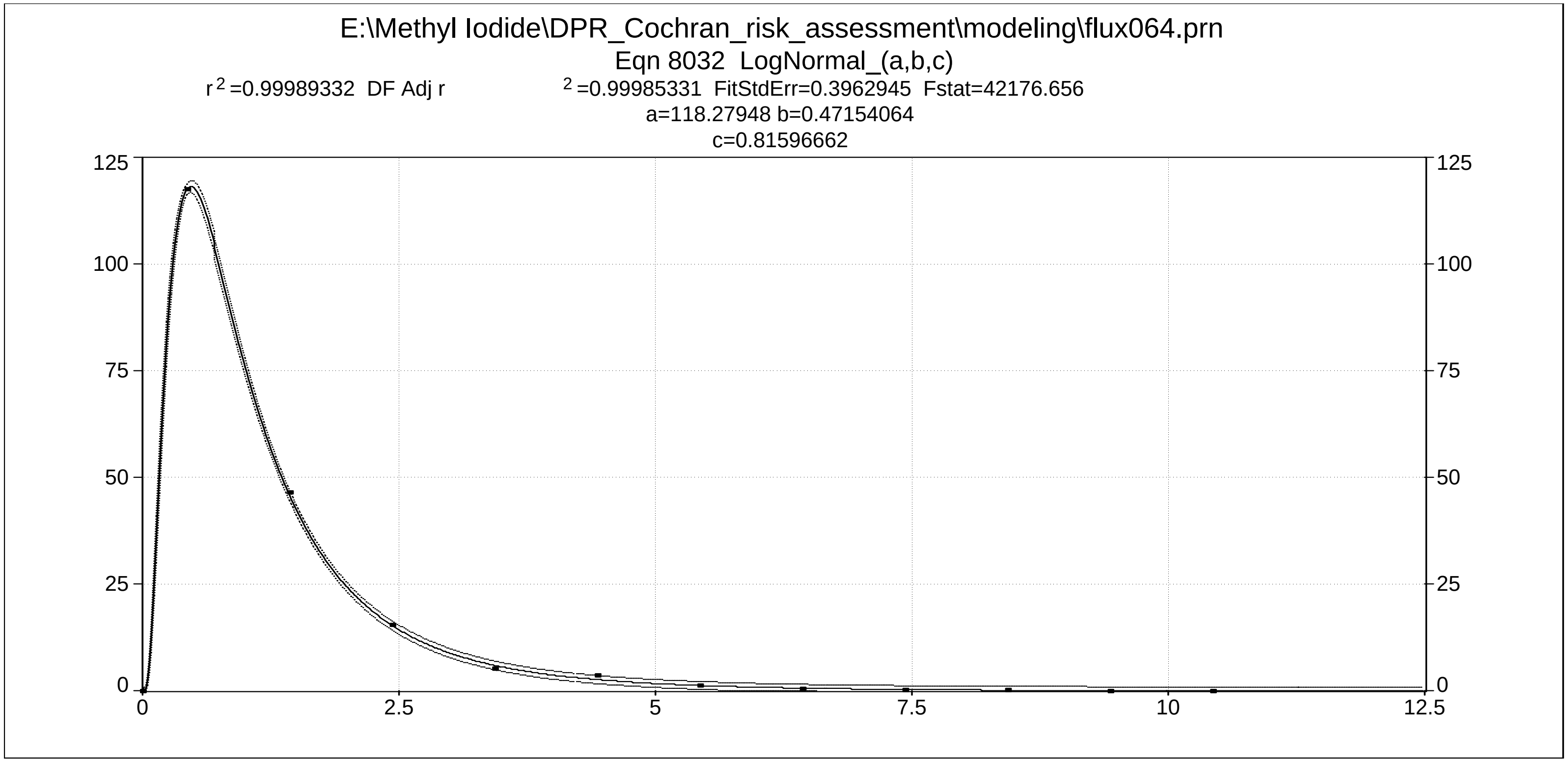
063 Camarillo, California
Drip/Tarp



Rank 1 Eqn 8032 LogNormal_(a,b,c)

XY	*	X Value	Y Value	Y Predict	Residual	Residual%	95% Confidence Limits		95% Prediction Limits		Weights
1		0.0000000	0.0000000								1
2		0.4600000	81.400000	81.410097	-0.010097	-0.012404	78.747555	84.072639	77.644525	85.175668	1
3		1.4600000	31.400000	31.145217	0.2547834	0.8114122	28.544839	33.745594	27.423340	34.867093	1
4		2.4600000	10.200000	11.756312	-1.556312	-15.25796	10.034303	13.478320	8.5852371	14.927386	1
5		3.4600000	8.0000000	5.1843372	2.8156628	35.195785	3.7144208	6.6542536	2.1427828	8.2258916	1
6		4.4600000	1.3000000	2.5676056	-1.267606	-97.50812	1.4893233	3.6458879	-0.305214	5.4404251	1
7		5.4600000	1.7000000	1.3855146	0.3144854	18.499139	0.6268568	2.1441725	-1.383233	4.1542618	1
8		6.4600000	0.3700000	0.7983049	-0.428305	-115.7581	0.2666348	1.3299750	-1.917035	3.5136450	1
9		7.4600000	0.1600000	0.4844065	-0.324407	-202.7541	0.1084439	0.8603691	-2.204784	3.1735973	1
10		8.4600000	0.1100000	0.3065380	-0.196538	-178.6709	0.0371015	0.5759745	-2.369839	2.9829152	1
11		9.4600000	0.0800000	0.2008490	-0.120849	-151.0613	0.0049367	0.3967613	-2.469129	2.8708267	1
12		10.460000	0.0500000	0.1355201	-0.085520	-171.0402	-0.008982	0.2800221	-2.531178	2.8022184	1

064 Guadalupe. California
Bed/Tarp



Rank 1 Eqn 8032 LogNormal_(a,b,c)

XY	*	X Value	Y Value	Y Predict	Residual	Residual%	95% Confidence Limits		95% Prediction Limits		Weights
1		0.0000000	0.0000000								1
2		0.4350000	117.70000	117.70300	-0.003004	-0.002553	116.80657	118.59944	116.43522	118.97079	1
3		1.4350000	46.700000	46.660998	0.0390019	0.0835158	45.776674	47.545322	45.401750	47.920246	1
4		2.4350000	15.600000	15.627740	-0.027740	-0.177821	14.988843	16.266637	14.526892	16.728588	1
5		3.4350000	5.5000000	6.1211787	-0.621179	-11.29416	5.6289493	6.6134080	5.0984535	7.1439039	1
6		4.4350000	3.7000000	2.7200787	0.9799213	26.484361	2.3978679	3.0422894	1.7674523	3.6727050	1
7		5.4350000	1.5000000	1.3299475	0.1700525	11.336832	1.1256154	1.5342796	0.4104755	2.2494195	1
8		6.4350000	0.5500000	0.7001924	-0.150192	-27.30770	0.5698866	0.8304981	-0.205709	1.6060934	1
9		7.4350000	0.3000000	0.3909902	-0.090990	-30.33008	0.3064695	0.4755110	-0.509466	1.2914462	1
10		8.4350000	0.3000000	0.2290643	0.0709357	23.645248	0.1731325	0.2849960	-0.669159	1.1272878	1
11		9.4350000	0.1500000	0.1396659	0.0103341	6.8893972	0.1019019	0.1774299	-0.757610	1.0369414	1
12		10.435000	0.1000000	0.0880843	0.0119157	11.915697	0.0620959	0.1140727	-0.808773	0.9849413	1

Appendix C – Chloropicrin (2-week) and Iodomethane (30-Day) Flux Profiles

Chloropicrin daily integrated flux profiles (ug/m^{2}sec - day)

Day	AZ broad/untarp 171 lb/ac	AZ bed/untarp 86 lb/ac	AZ bed/tarp 189 lb/ac	AZ broad/tarp 332 lb/ac	WA broad/tarp 343 lb/ac	FL broad/tarp 346 lb/ac	CA bed/drip/tarp 156 lb/ac
1	85.700	66.320	79.90	79.450	4.83	16.110	22.250
2	38.470	6.820	91.47	71.960	10.15	24.910	4.770
3	11.300	1.720	59.66	11.600	13.31	25.490	0.980
4	5.970	0.350	29.96	3.500	4.93	17.870	0.350
5	2.380	0.100	14.22	1.125	4.54	17.150	0.550
6	1.050	0.015	6.20	1.580	4.48	17.640	0.130
7	0.195	0.035	3.96	0.910	33.93	20.230	0.064
8	0.165	0.015	3.97	0.920	31.48	18.230	0.036
9	0.035	0.015	6.56	0.560	11.44	10.160	0.050
10	0.095	0.015	2.58	0.520	5.73	2.290	0.970
11	0.015	0.015	0.51	0.595	3.66	0.552	0.520
12	0.000	0.015	0.60	0.160	1.90	0.993	0.240
13	0.020	0.015	0.47	0.175	1.78	0.619	0.240
14	0.030	0.015	0.22	0.170	1.33	0.394	0.240
Proportion Applied Mass Lost	0.6246	0.6138	0.6864	0.6264	0.3379	0.3650	0.1520

007 Watsonville, California
Broadcast/Tarp

Day Midpoint	Proportion of 24hr (day)	Daily integrated flux (ug/m^{2}sec - day)	Daily mass loss (lb/acre)
0.46	0.92	111.596	85.9289
1.46	1.00	32.200	24.7940
2.46	1.00	16.800	12.9360
3.46	1.00	11.000	8.4700
4.46	1.00	3.300	2.5410
5.46	1.00	5.900	4.5430
6.46	1.00	2.300	1.7710
7.46	1.00	1.900	1.4630
8.46	1.00	1.000	0.7700
9.46	1.00	0.560	0.4312
10.46	1.00	1.150	0.8855
11.46	1.00	0.950	0.7315
12.46	1.00	0.790	0.6083
13.46	1.00	0.670	0.5159
14.46	1.00	0.580	0.4466
15.46	1.00	0.500	0.3850
16.46	1.00	0.430	0.3311
17.46	1.00	0.380	0.2926
18.46	1.00	0.330	0.2541
19.46	1.00	0.300	0.2310
20.46	1.00	0.260	0.2002
21.46	1.00	0.240	0.1848
22.46	1.00	0.210	0.1617
23.46	1.00	0.190	0.1463
24.46	1.00	0.170	0.1309
25.46	1.00	0.160	0.1232
26.46	1.00	0.140	0.1078
27.46	1.00	0.130	0.1001
28.46	1.00	0.120	0.0924
29.46	1.00	0.110	0.0847

026 Manteca

Broadcast/tarp

Day Midpoint	Proportion of 24hr (day)	Daily integrated flux (ug/m^{2}sec - day)	Daily mass loss (lb/acre)
0.43	0.86	161.20	106.747
1.43	1.00	66.00	50.820
2.43	1.00	20.00	15.400
3.43	1.00	13.00	10.010
4.43	1.00	18.50	14.245
5.43	1.00	18.50	14.245
6.43	1.00	7.00	5.390
7.43	1.00	8.00	6.160
8.43	1.00	7.50	5.775
9.43	1.00	3.00	2.310
10.43	1.00	3.00	2.310
11.43	1.00	2.56	1.971
12.43	1.00	2.17	1.671
13.43	1.00	1.86	1.432
14.43	1.00	1.61	1.240
15.43	1.00	1.40	1.078
16.43	1.00	1.23	0.947
17.43	1.00	0.00	0.000
18.43	1.00	0.00	0.000
19.43	1.00	0.00	0.000
20.43	1.00	0.00	0.000
21.43	1.00	0.00	0.000
22.43	1.00	0.00	0.000
23.43	1.00	0.00	0.000
24.43	1.00	0.00	0.000
25.43	1.00	0.00	0.000
26.43	1.00	0.00	0.000
27.43	1.00	0.00	0.000
28.43	1.00	0.00	0.000
29.43	1.00	0.00	0.000

056 LaSelva Beach, California
Drip/Tarp

Day Midpoint	Proportion of 24hr (day)	Daily integrated flux (ug/m^{2}sec - day)	Daily mass loss (lb/acre)
0.43	0.86	75.336	58.0087
1.43	1.00	13.400	10.3180
2.43	1.00	5.700	4.3890
3.43	1.00	3.350	2.5795
4.43	1.00	1.370	1.0549
5.43	1.00	1.700	1.3090
6.43	1.00	0.250	0.1925
7.43	1.00	0.270	0.2079
8.43	1.00	0.095	0.0732
9.43	1.00	0.112	0.0862
10.43	1.00	0.050	0.0385
11.43	1.00	0.078	0.0601
12.43	1.00	0.060	0.0462
13.43	1.00	0.047	0.0362
14.43	1.00	0.037	0.0285
15.43	1.00	0.030	0.0231
16.43	1.00	0.024	0.0185
17.43	1.00	0.020	0.0154
18.43	1.00	0.016	0.0123
19.43	1.00	0.014	0.0108
20.43	1.00	0.011	0.0085
21.43	1.00	0.010	0.0077
22.43	1.00	0.008	0.0062
23.43	1.00	0.007	0.0054
24.43	1.00	0.006	0.0046
25.43	1.00	0.005	0.0039
26.43	1.00	0.005	0.0031
27.43	1.00	0.004	0.0031
28.43	1.00	0.003	0.0023
29.43	1.00	0.003	0.0023

063 Camarillo, California
Drip/Tarp

Day Midpoint	Proportion of 24hr (day)	Daily integrated flux (ug/m^{2}sec - day)	Daily mass loss (lb/acre)
0.46	0.92	74.888	57.6638
1.46	1.00	31.400	24.1780
2.46	1.00	10.200	7.8540
3.46	1.00	8.000	6.1600
4.46	1.00	1.300	1.0010
5.46	1.00	1.700	1.3090
6.46	1.00	0.370	0.2849
7.46	1.00	0.160	0.1232
8.46	1.00	0.110	0.0847
9.46	1.00	0.080	0.0616
10.46	1.00	0.050	0.0385
11.46	1.00	0.094	0.0724
12.46	1.00	0.066	0.0508
13.46	1.00	0.048	0.0370
14.46	1.00	0.035	0.0270
15.46	1.00	0.026	0.0200
16.46	1.00	0.020	0.0154
17.46	1.00	0.015	0.0116
18.46	1.00	0.012	0.0092
19.46	1.00	0.009	0.0069
20.46	1.00	0.007	0.0054
21.46	1.00	0.006	0.0046
22.46	1.00	0.005	0.0039
23.46	1.00	0.004	0.0031
24.46	1.00	0.003	0.0023
25.46	1.00	0.002	0.0015
26.46	1.00	0.002	0.0015
27.46	1.00	0.002	0.0015
28.46	1.00	0.001	0.0008
29.46	1.00	0.001	0.0008

90 Guadalupe, California
Drip/Tarp

Day Midpoint	Proportion of 24hr (day)	Daily integrated flux (ug/m^2sec - day)	Daily mass loss (lb/acre)
0.48	0.96	125.856	96.80
1.48	1.00	26.000	20.10
2.48	1.00	9.520	7.34
3.48	1.00	5.700	4.36
4.48	1.00	5.400	4.16
5.48	1.00	4.500	3.46
6.48	1.00	2.100	1.64
7.48	1.00	1.200	0.90
8.48	1.00	0.630	0.49
9.48	1.00	0.210	0.16
10.48	1.00	0.150	0.11
11.48	1.00	0.000	0.00
12.48	1.00	0.000	0.00
13.48	1.00	0.000	0.00
14.48	1.00	0.000	0.00
15.48	1.00	0.000	0.00
16.48	1.00	0.000	0.00
17.48	1.00	0.000	0.00
18.48	1.00	0.000	0.00
19.48	1.00	0.000	0.00
20.48	1.00	0.000	0.00
21.48	1.00	0.000	0.00
22.48	1.00	0.000	0.00
23.48	1.00	0.000	0.00
24.48	1.00	0.000	0.00
25.48	1.00	0.000	0.00
26.48	1.00	0.000	0.00
27.48	1.00	0.000	0.00
28.48	1.00	0.000	0.00
29.48	1.00	0.000	0.00

046 Oxnard, California

Bed/Tarp

Day Midpoint	Proportion of 24hr (day)	Daily integrated flux (ug/m^{2}sec - day)	Daily mass loss (lb/acre)
0.43	0.86	186.4	74.4
1.43	1.00	71.0	53.8
2.43	1.00	29.0	22.4
3.43	1.00	11.0	8.9
4.43	1.00	7.0	5.4
5.43	1.00	8.0	6.3
6.43	1.00	0.0	0.0
7.43	1.00	0.0	0.0
8.43	1.00	0.0	0.0
9.43	1.00	0.0	0.0
10.43	1.00	0.0	0.0
11.43	1.00	0.0	0.0
12.43	1.00	0.0	0.0
13.43	1.00	0.0	0.0
14.43	1.00	0.0	0.0
15.43	1.00	0.0	0.0
16.43	1.00	0.0	0.0
17.43	1.00	0.0	0.0
18.43	1.00	0.0	0.0
19.43	1.00	0.0	0.0
20.43	1.00	0.0	0.0
21.43	1.00	0.0	0.0
22.43	1.00	0.0	0.0
23.43	1.00	0.0	0.0
24.43	1.00	0.0	0.0
25.43	1.00	0.0	0.0
26.43	1.00	0.0	0.0
27.43	1.00	0.0	0.0
28.43	1.00	0.0	0.0
29.43	1.00	0.0	0.0

064 Guadalupe, California

Bed/Tarp

Day Midpoint	Proportion of 24 hr (day)	Daily integrated flux (ug/m^{2}sec - day)	Daily mass loss (lb/acre)
0.435	0.87	78.8472	74.4
1.435	1.00	35.9590	53.8
2.435	1.00	12.0120	22.4
3.435	1.00	4.2350	8.9
4.435	1.00	2.8490	5.4
5.435	1.00	1.1550	6.3
6.435	1.00	0.4235	0.0
7.435	1.00	0.2310	0.0
8.435	1.00	0.2310	0.0
9.435	1.00	0.1155	0.0
10.435	1.00	0.0770	0.0
11.435	1.00	0.0439	0.0
12.435	1.00	0.0293	0.0
13.435	1.00	0.0200	0.0
14.435	1.00	0.0139	0.0
15.435	1.00	0.0100	0.0
16.435	1.00	0.0069	0.0
17.435	1.00	0.0054	0.0
18.435	1.00	0.0039	0.0
19.435	1.00	0.0031	0.0
20.435	1.00	0.0023	0.0
21.435	1.00	0.0015	0.0
22.435	1.00	0.0015	0.0
23.435	1.00	0.0010	0.0
24.435	1.00	0.0008	0.0
25.435	1.00	0.0008	0.0
26.435	1.00	0.0006	0.0
27.435	1.00	0.0005	0.0
28.435	1.00	0.0004	0.0
29.435	1.00	0.0003	0.0