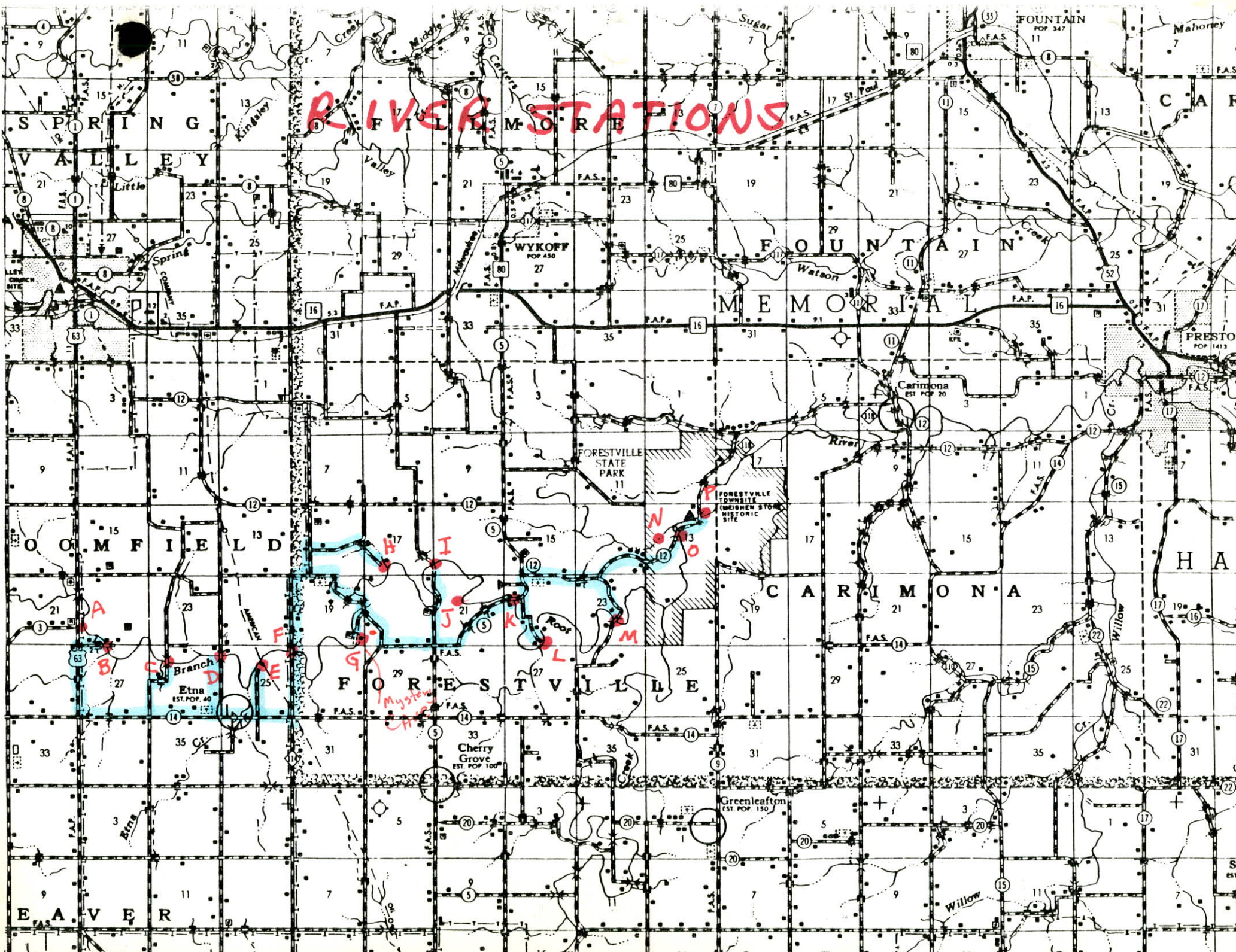


RIVER STATIONS

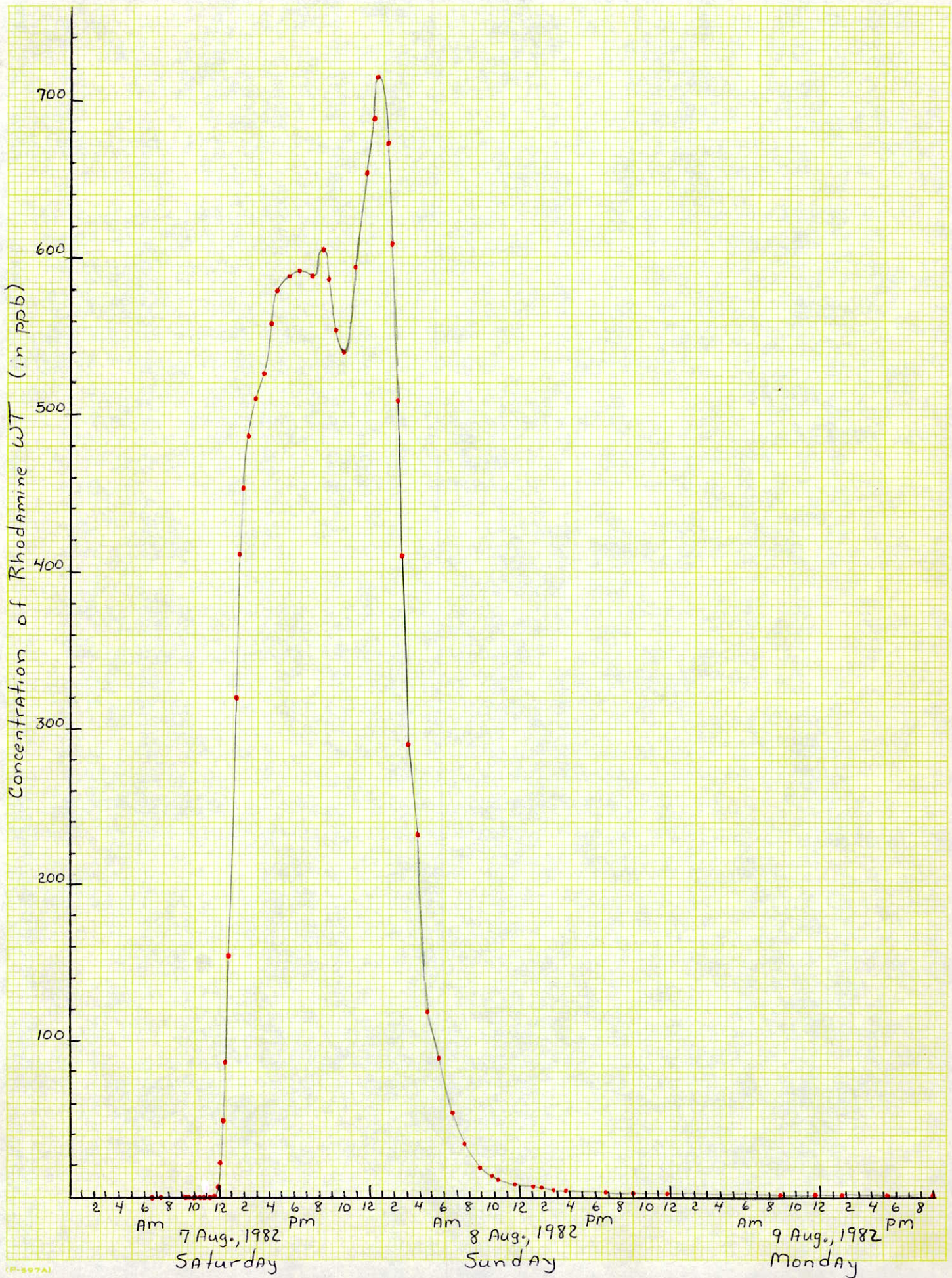


River Station B

UNIVERSITY BOOKSTORES

GRAPH NO. 4

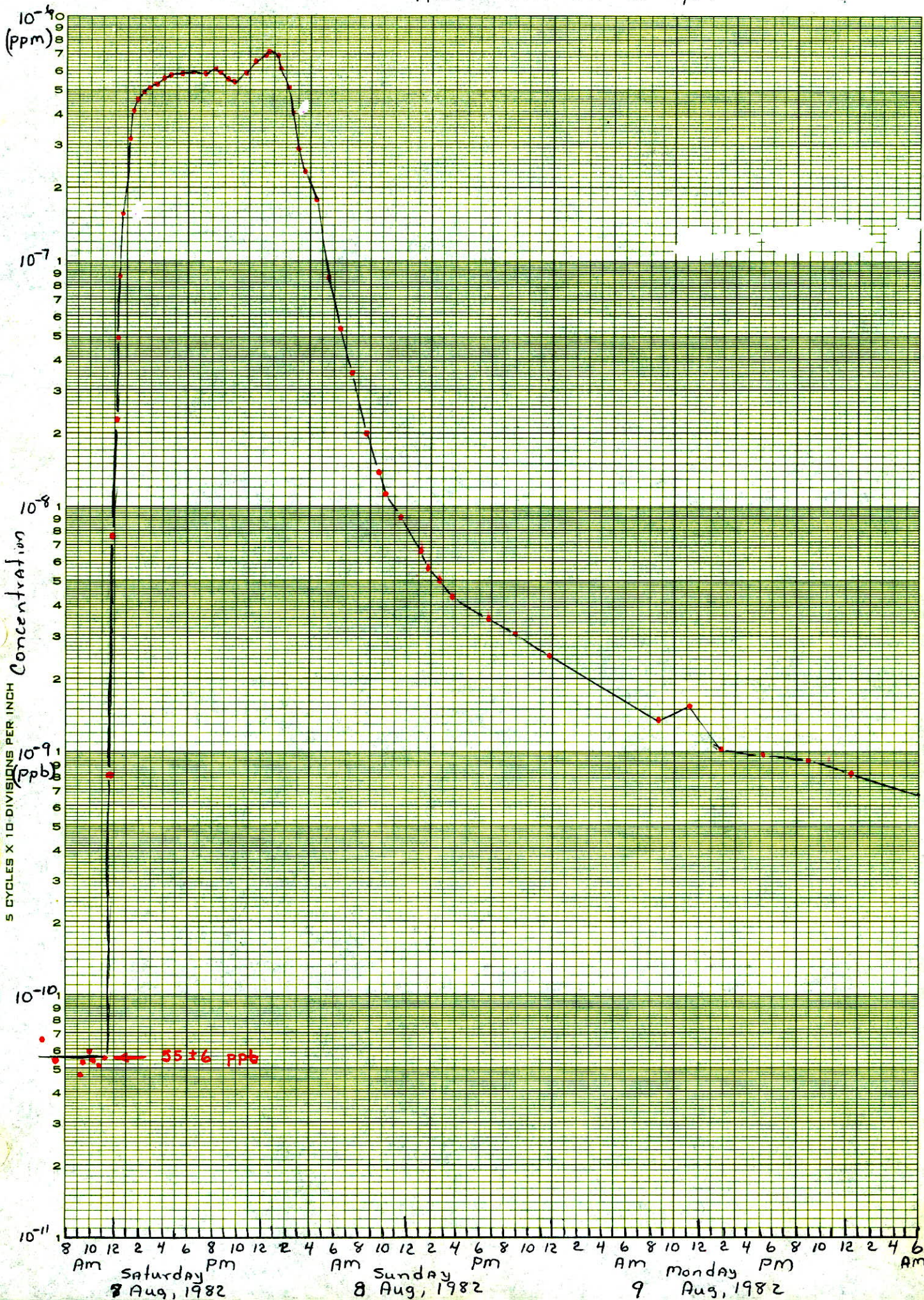
UNIVERSITY OF MINNESOTA



River Station B p. 1

DIETZGEN CORPORATION
MADE IN U.S.A.

NO. 340-LS10 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
5 CYCLES X 10 DIVISIONS PER INCH



1 ppm

100 ppb

10 ppb

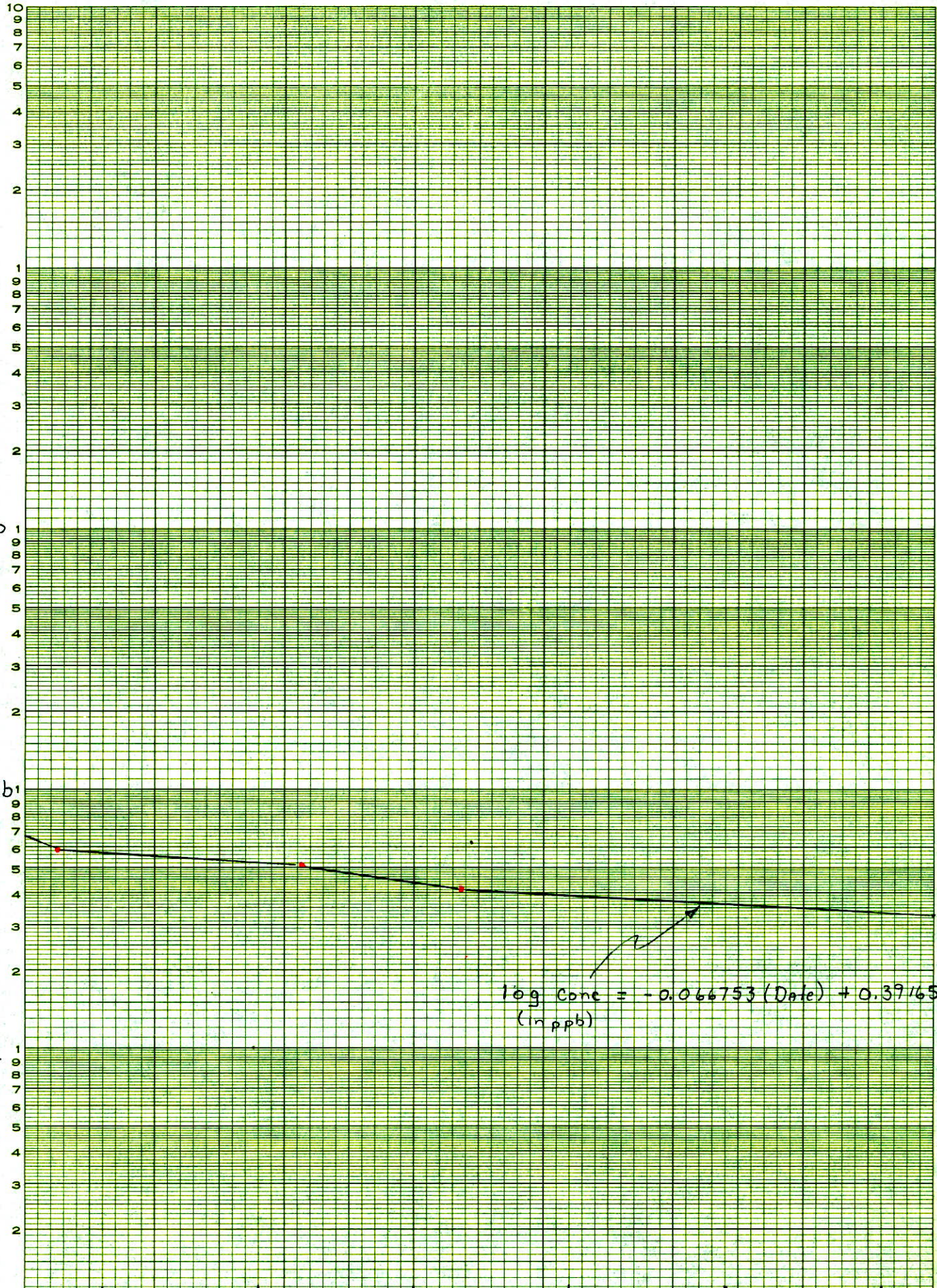
1 ppb

100 ppt

10 ppt

DIETZGEN CORPORATION
MADE IN U.S.A.

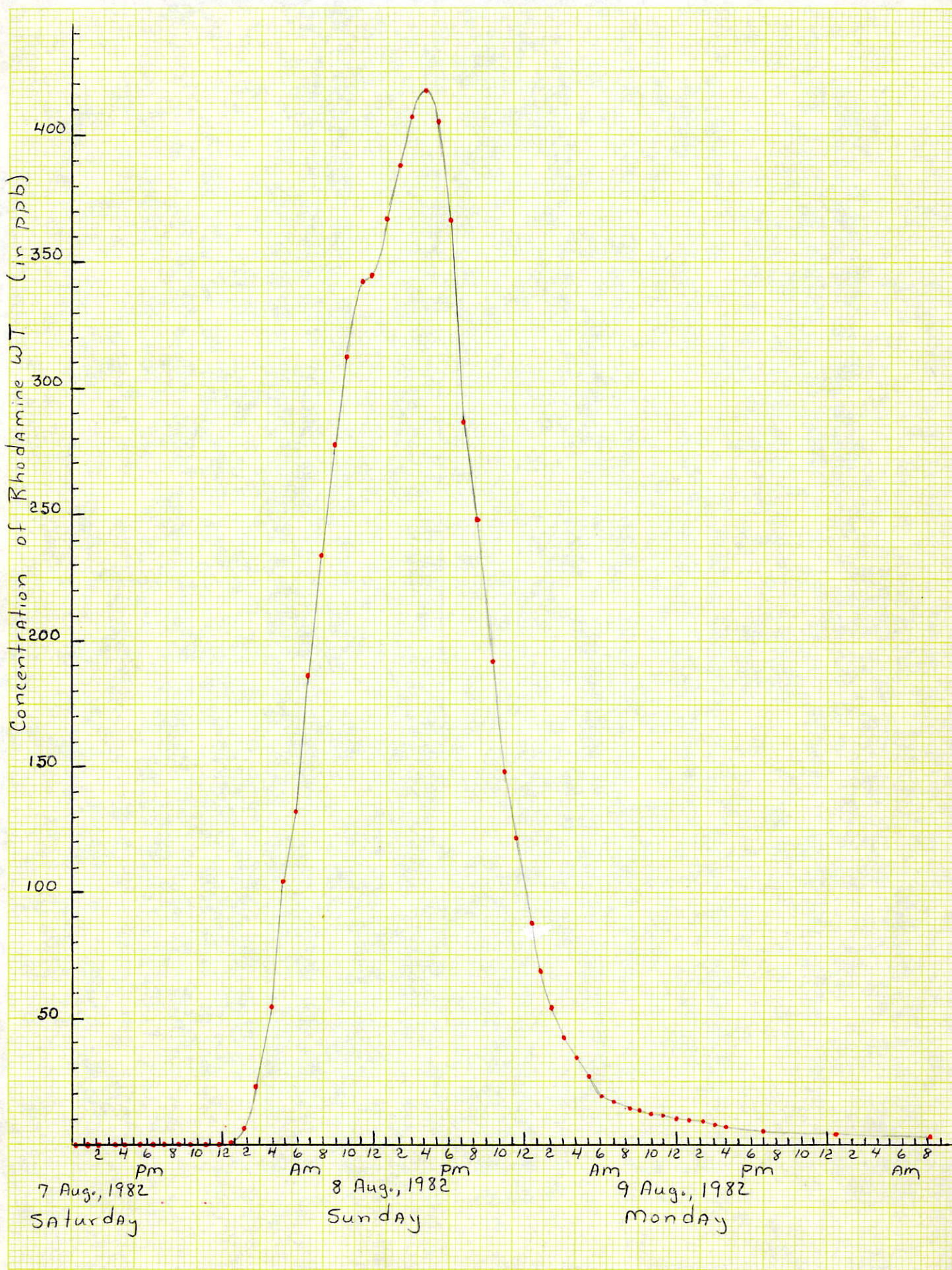
NO. 340-LS10 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
5 CYCLES X 10 DIVISIONS PER INCH



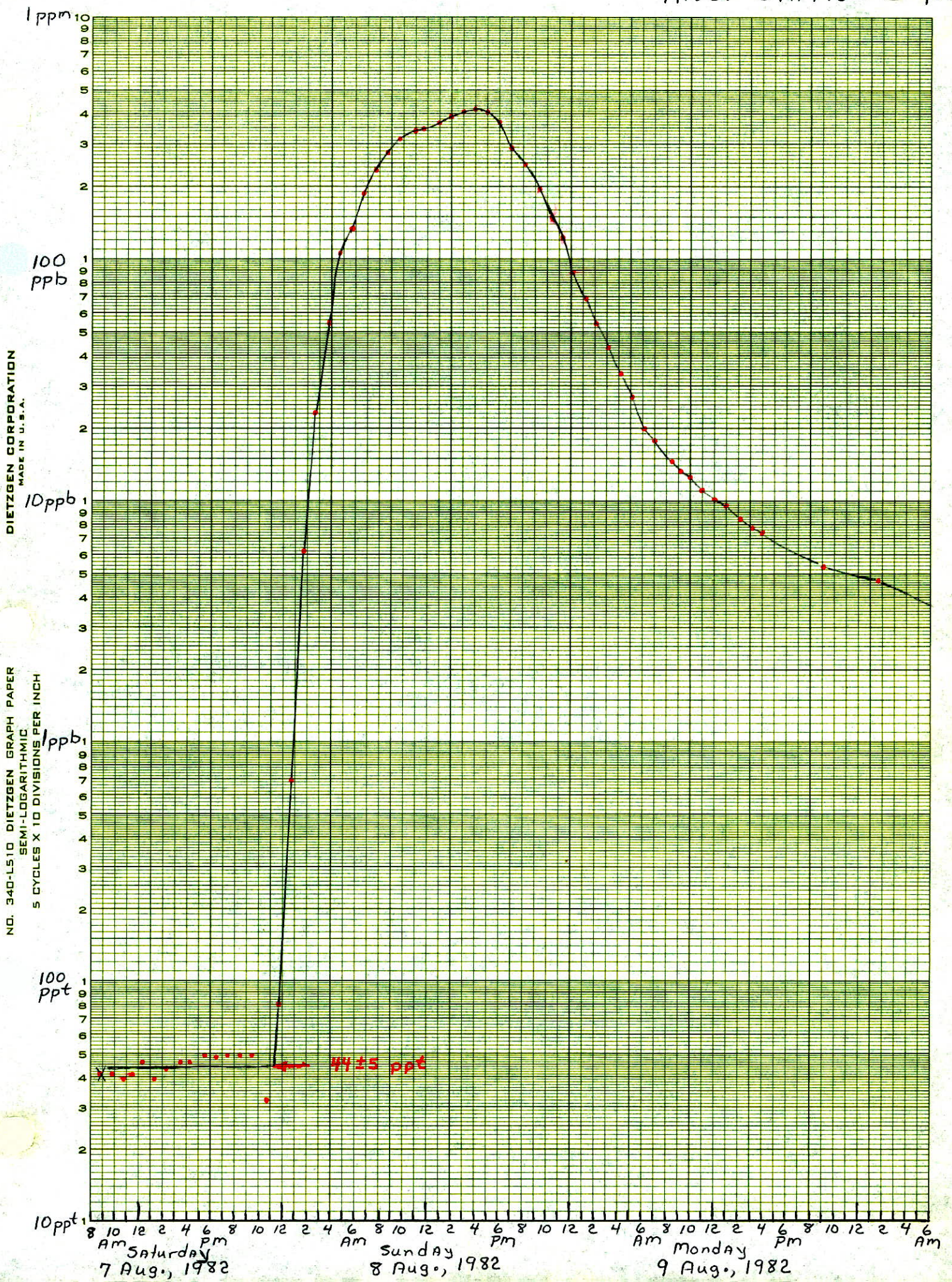
$\log \text{ Conc} = -0.066753 (\text{Date}) + 0.371658$
(in ppb)

6 8 10 12 2 4 6 8 10 12 2 4 6 8 10 12 2 4 6 8 10 12 2 4
 Am Tuesday PM Am Wednesday PM Am Thursday PM
 10 Aug., 1982 11 Aug., 1982 12 Aug., 1982

River Station C

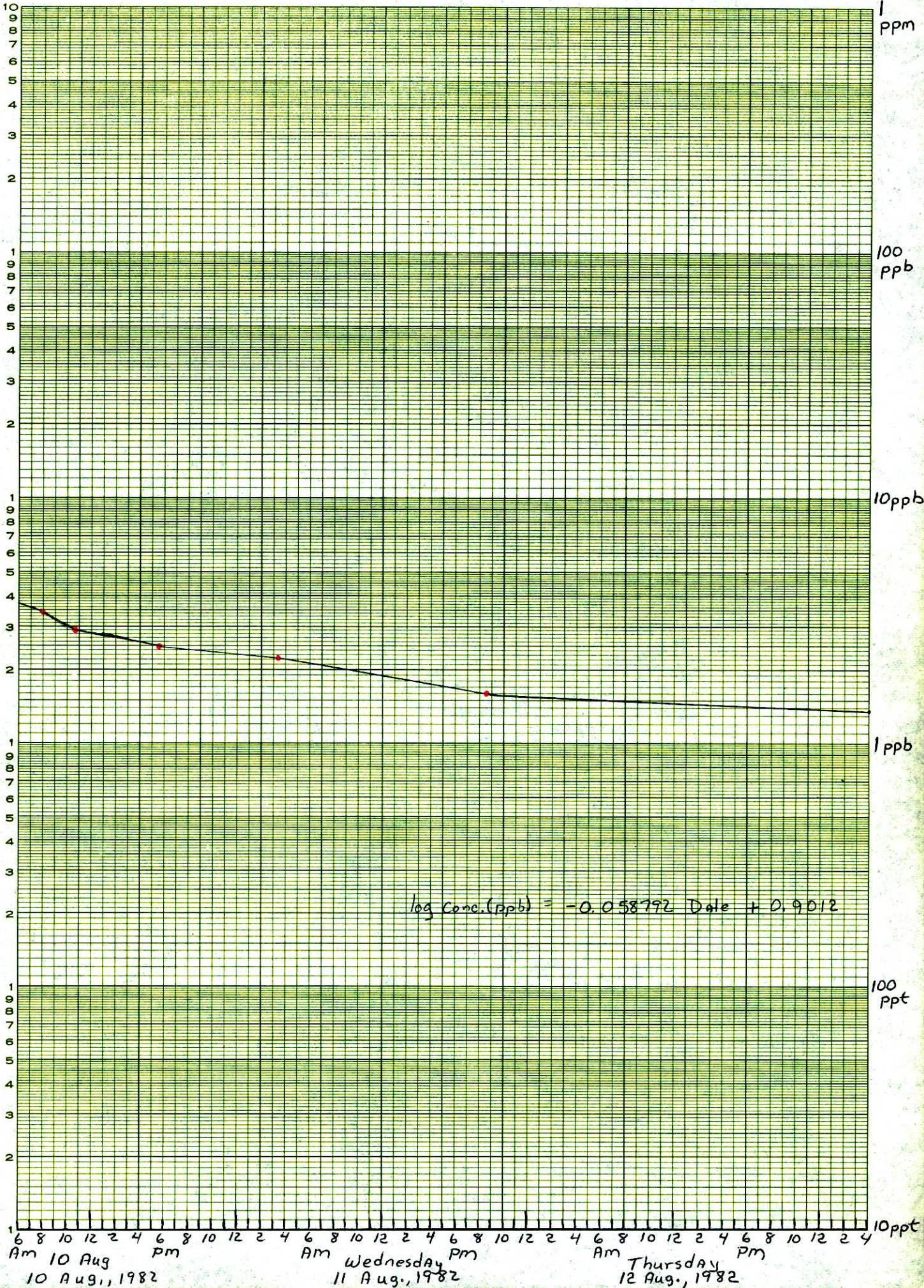


IP-597A



DIETZGEN CORPORATION
MADE IN U.S.A.

NO. 340-L510 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
5 CYCLES X 10 DIVISIONS PER INCH



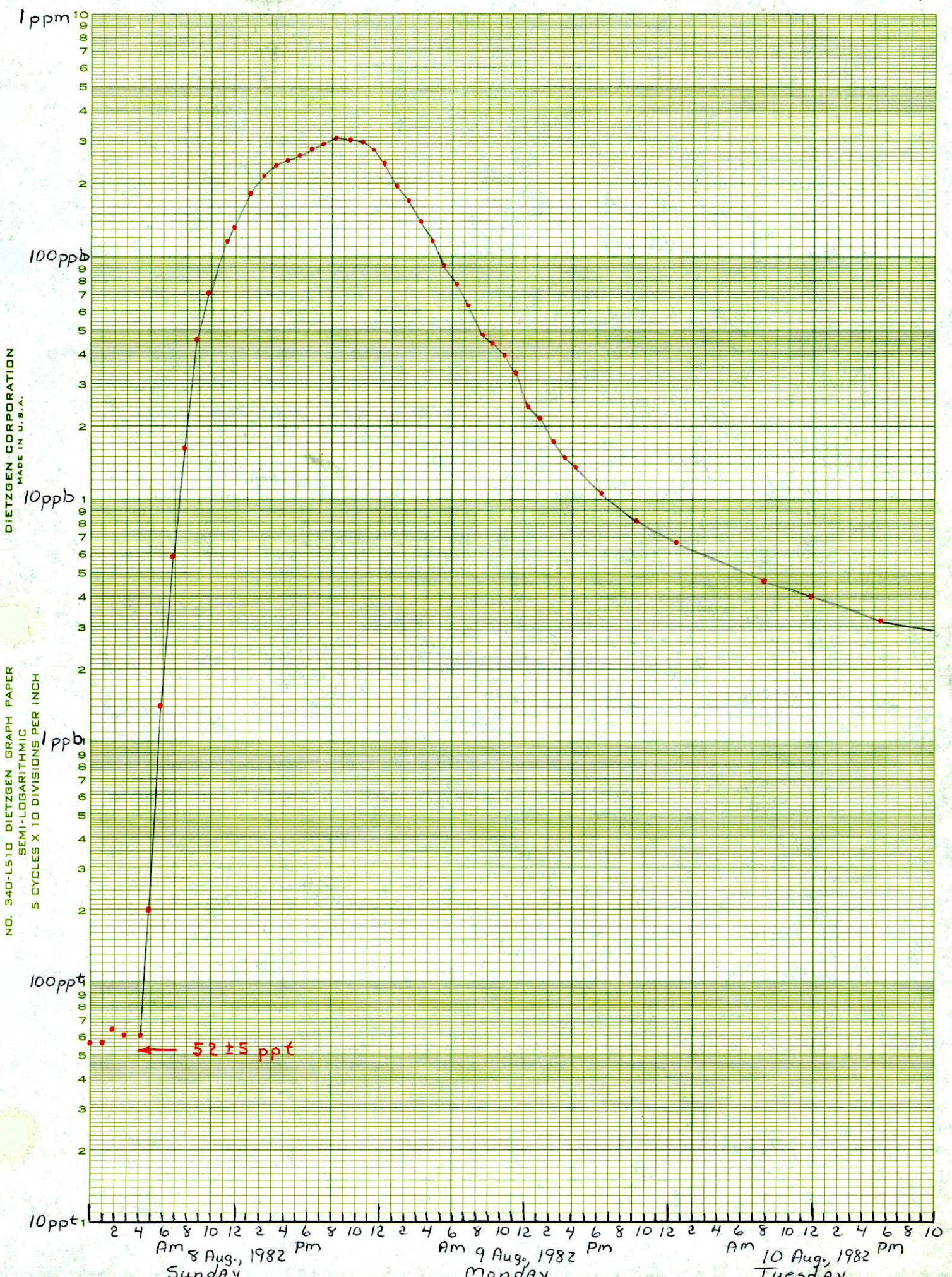
River Station D

UNIVERSITY BOOKSTORES

GRAPH NO. 4

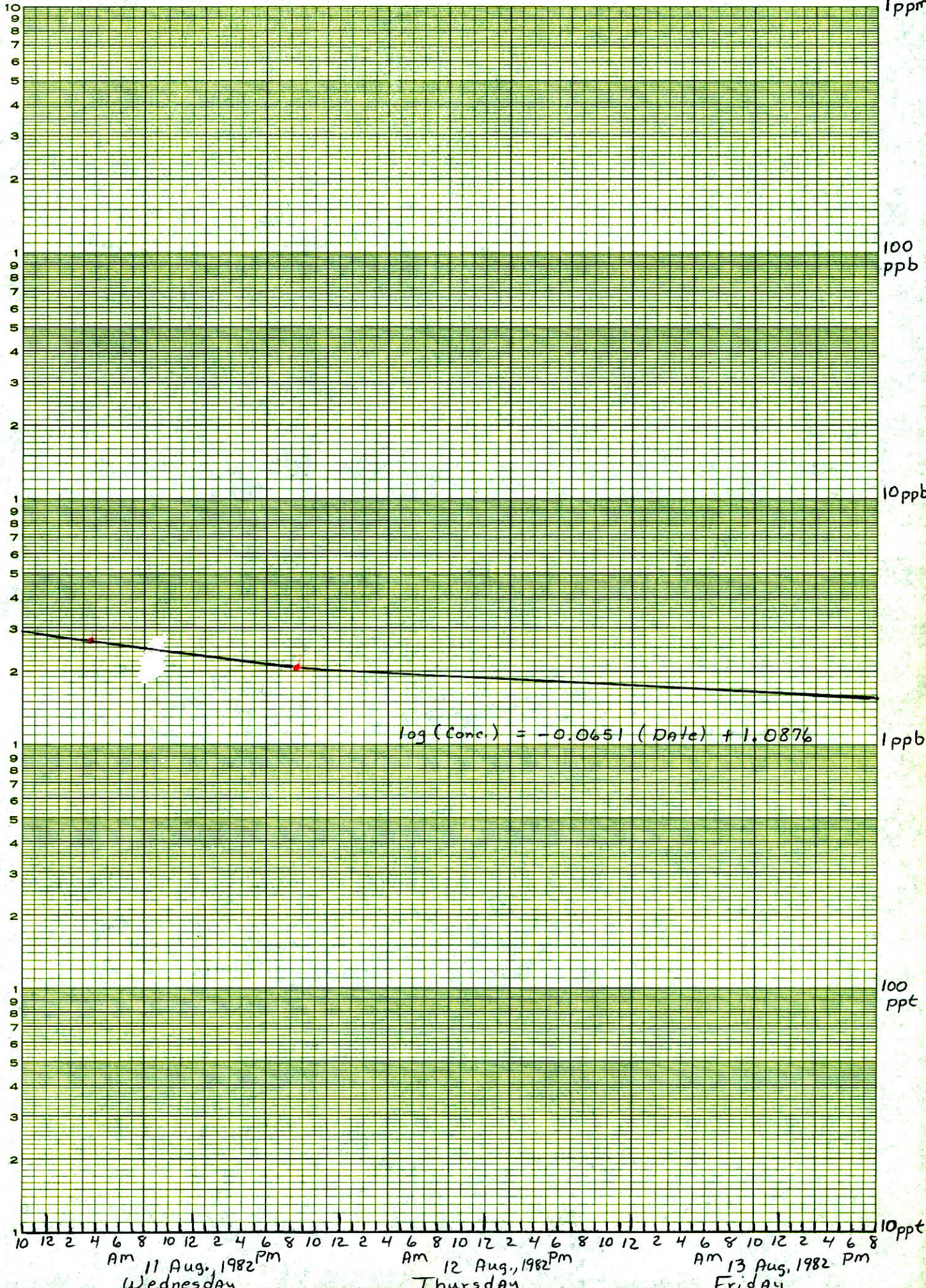
UNIVERSITY OF MINNESOTA





DIETZGEN CORPORATION
MADE IN U.S.A.

NO. 340-L510 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
5 CYCLES X 10 DIVISIONS PER INCH



$\log(\text{Conc}) = -0.0651(\text{Date}) + 1.0876$

Am 11 Aug, 1982 PM
Wednesday

Am 12 Aug, 1982 PM
Thursday

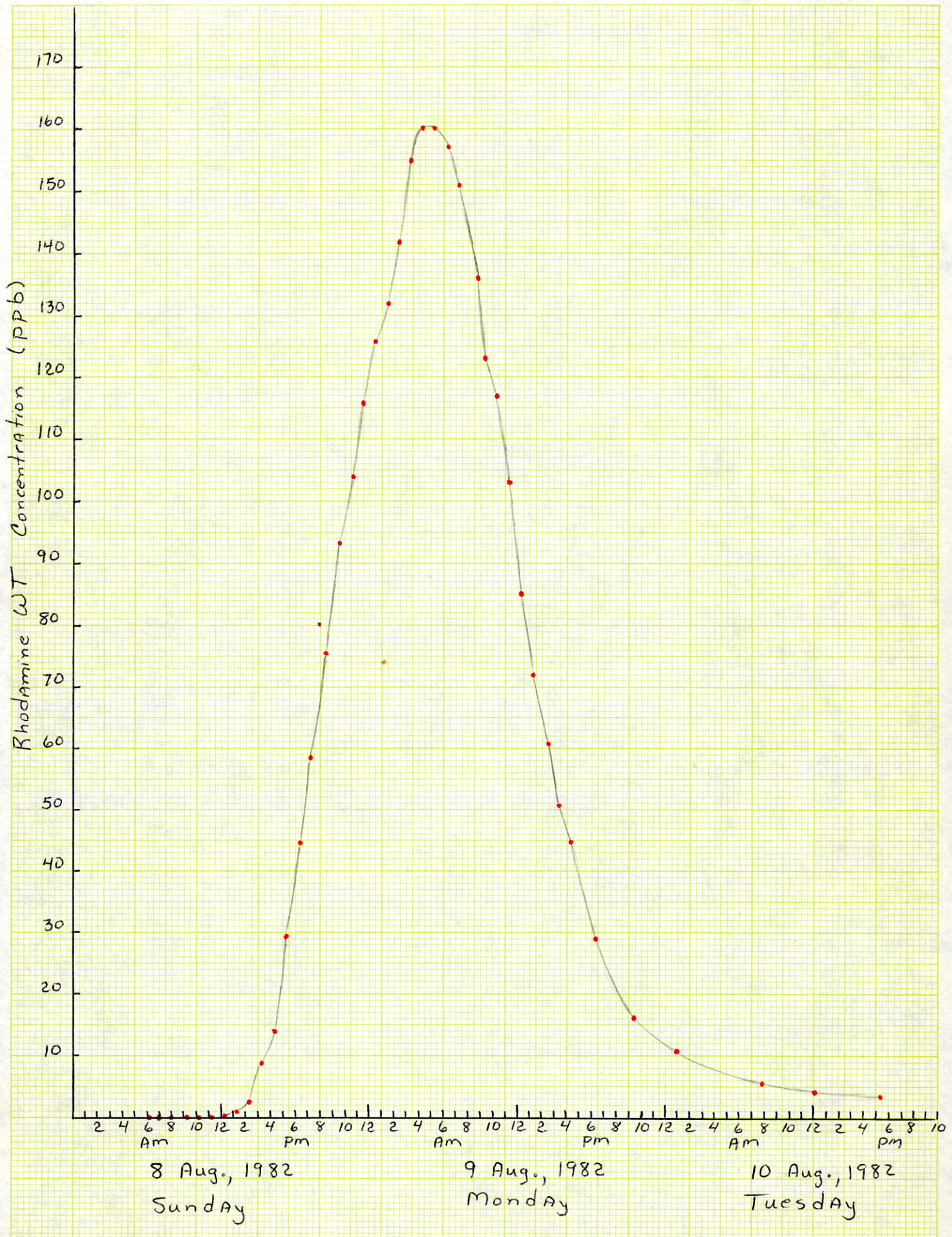
Am 13 Aug, 1982 PM
Friday

River Station E

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GRAPH NO. 4

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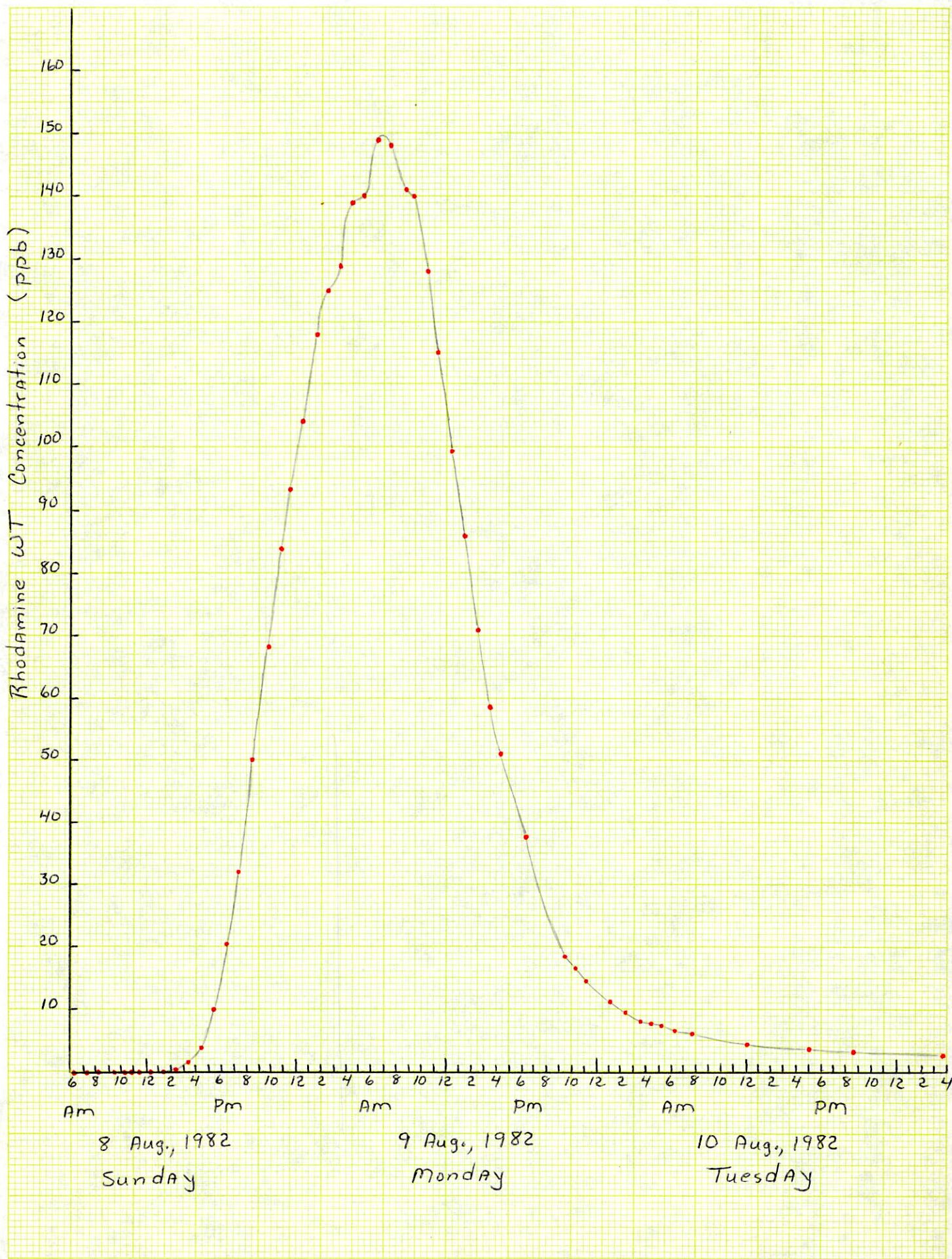


River Station F

UNIVERSITY BOOKSTORES

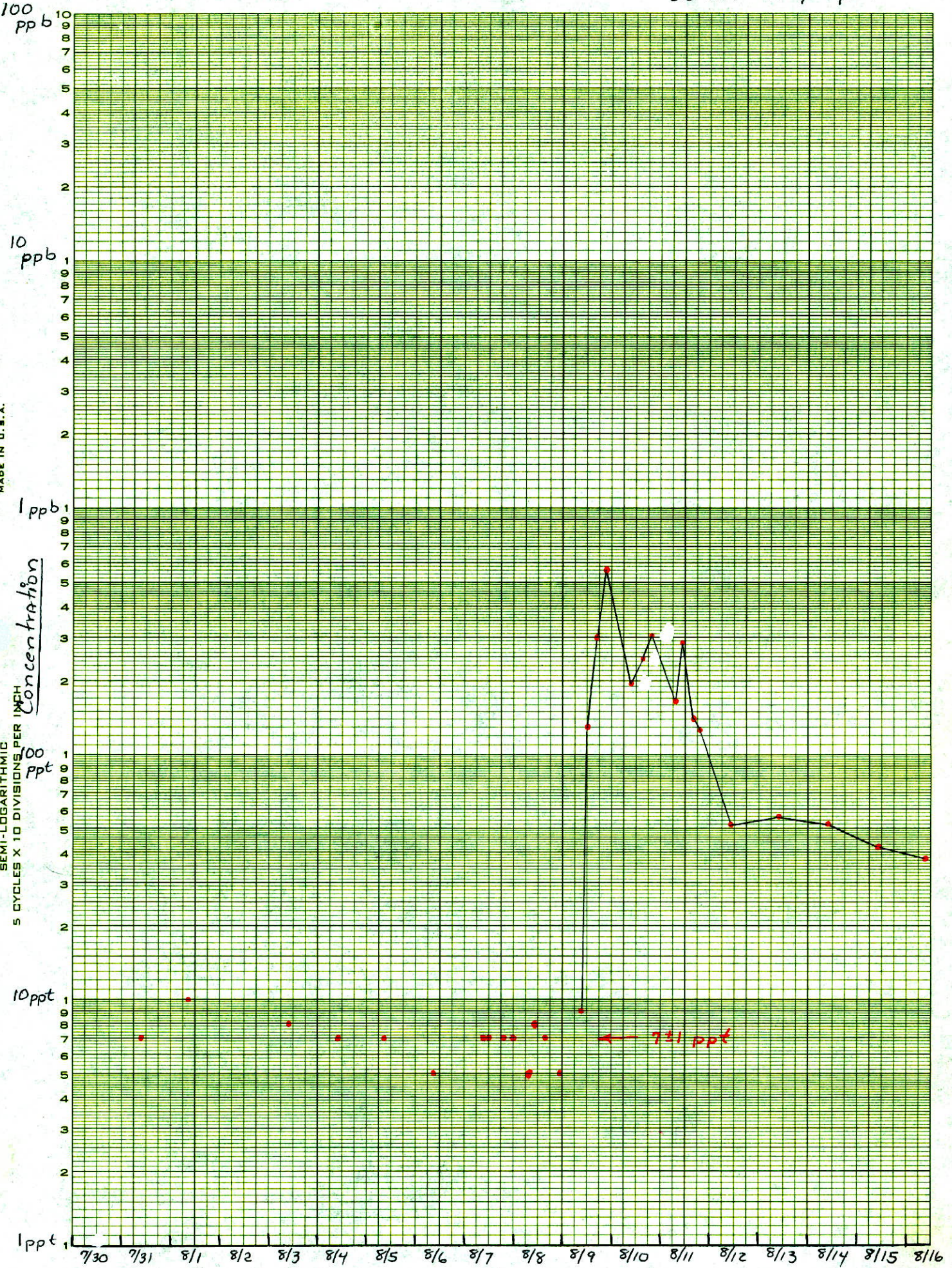
GRAPH NO. 4

UNIVERSITY OF MINNESOTA



DIETZGEN CORPORATION
MADE IN U.S.A.

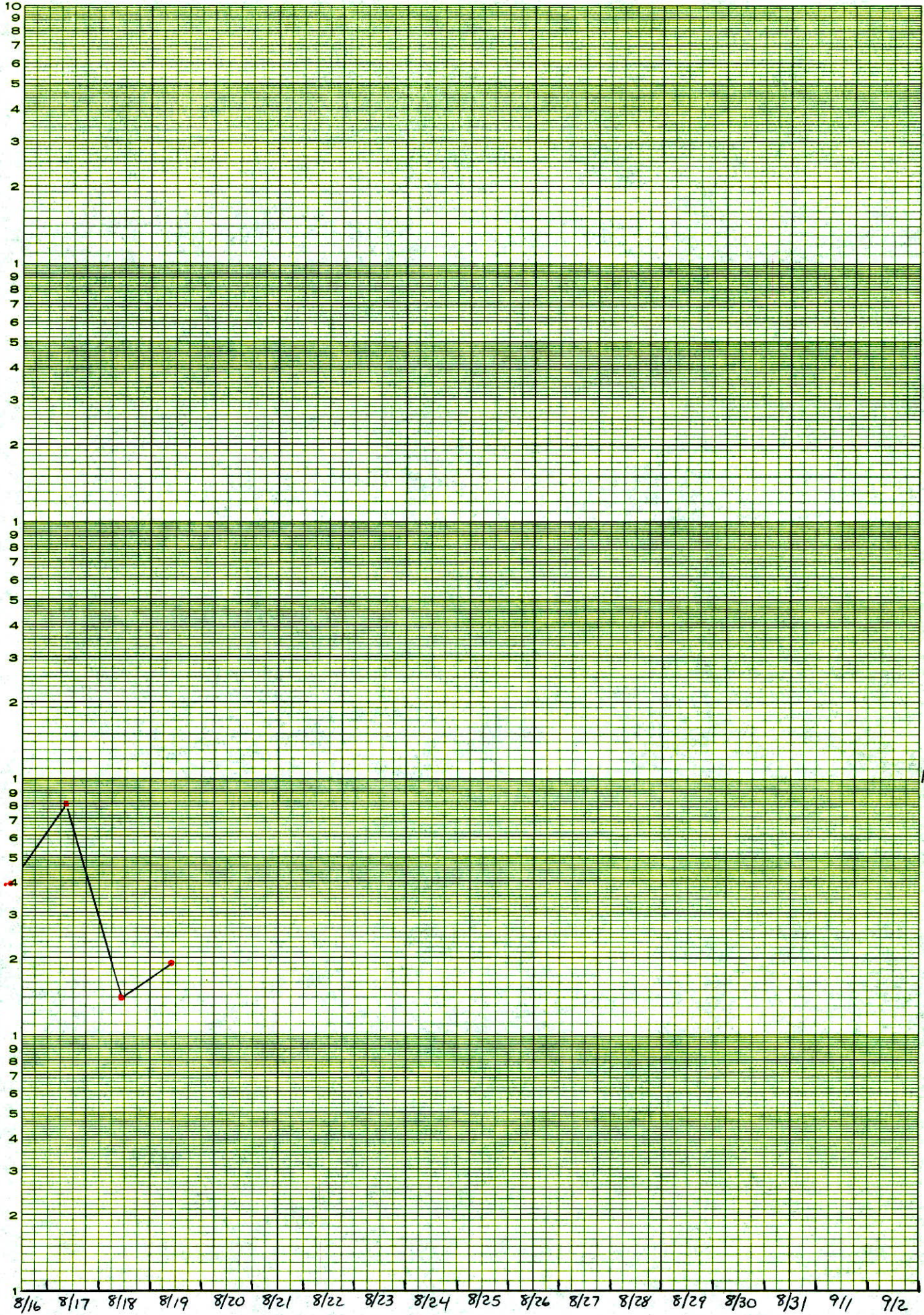
NO. 340-L510 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
5 CYCLES X 10 DIVISIONS PER INCH



100 ppb

DIETZGEN CORPORATION
MADE IN U.S.A.

NO. 340-L510 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
5 CYCLES X 10 DIVISIONS PER INCH



10 ppb

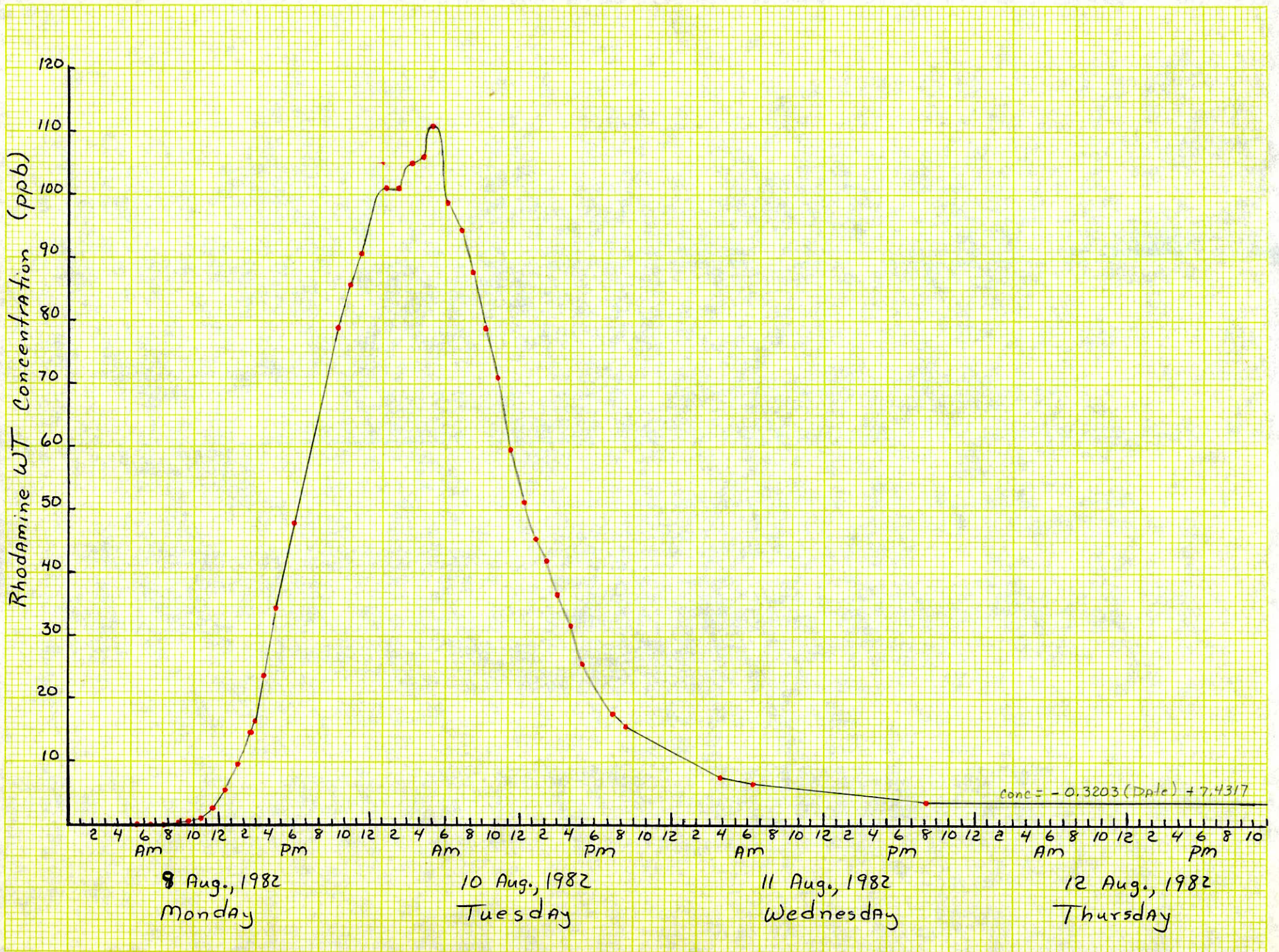
1 ppb

100 ppt

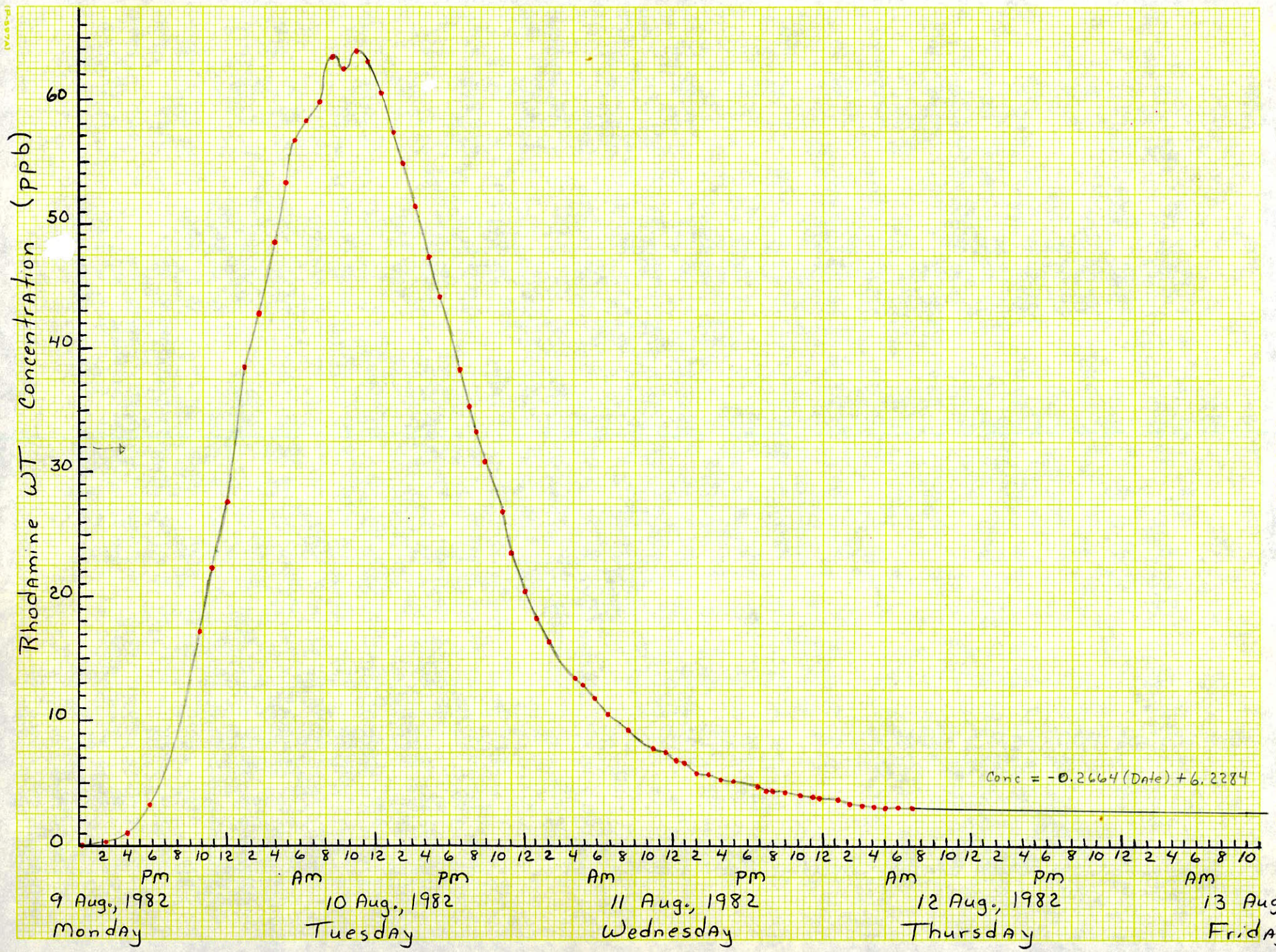
10 ppt

1 ppt

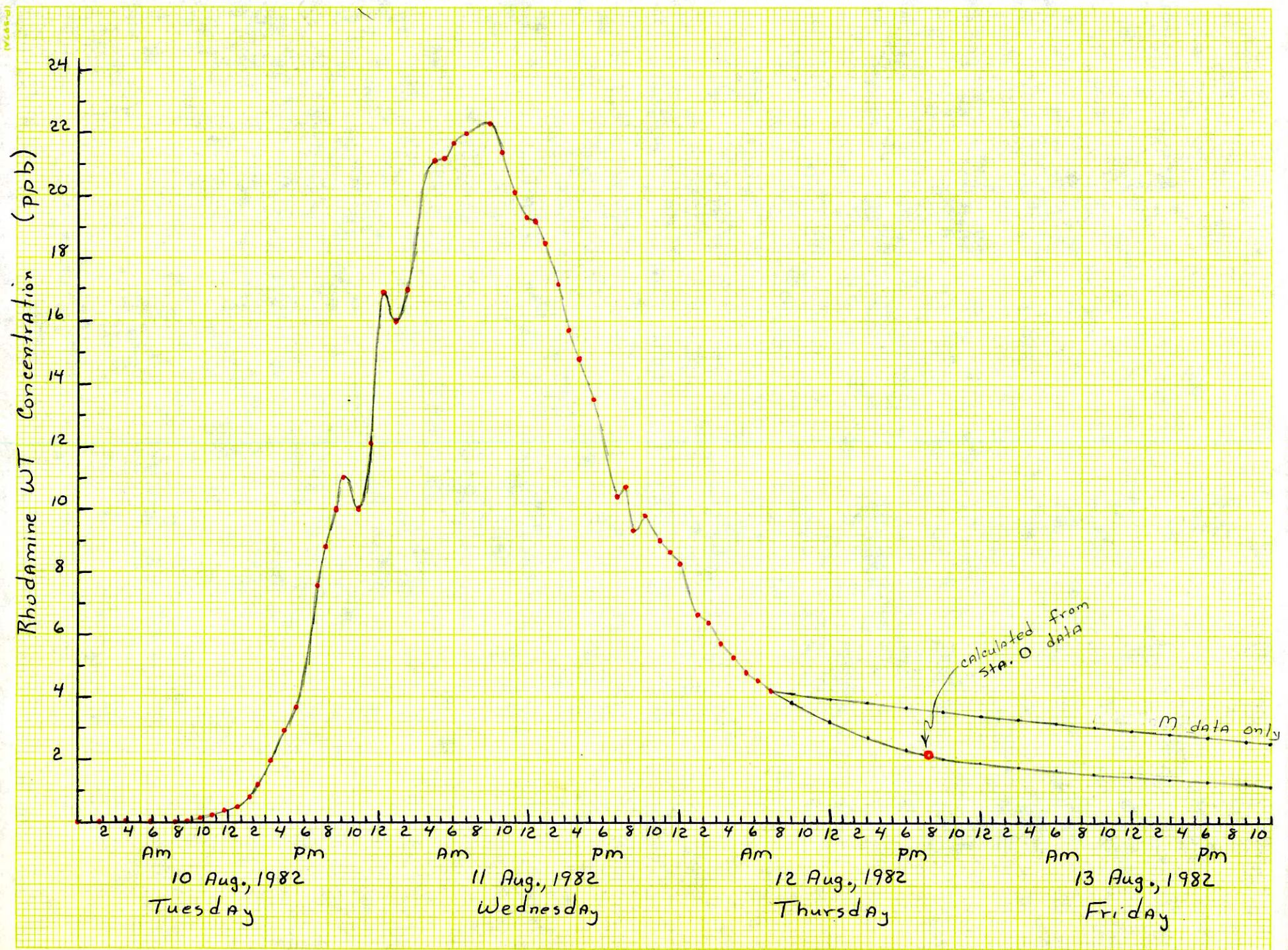
River Station H



River Station K



River Station M

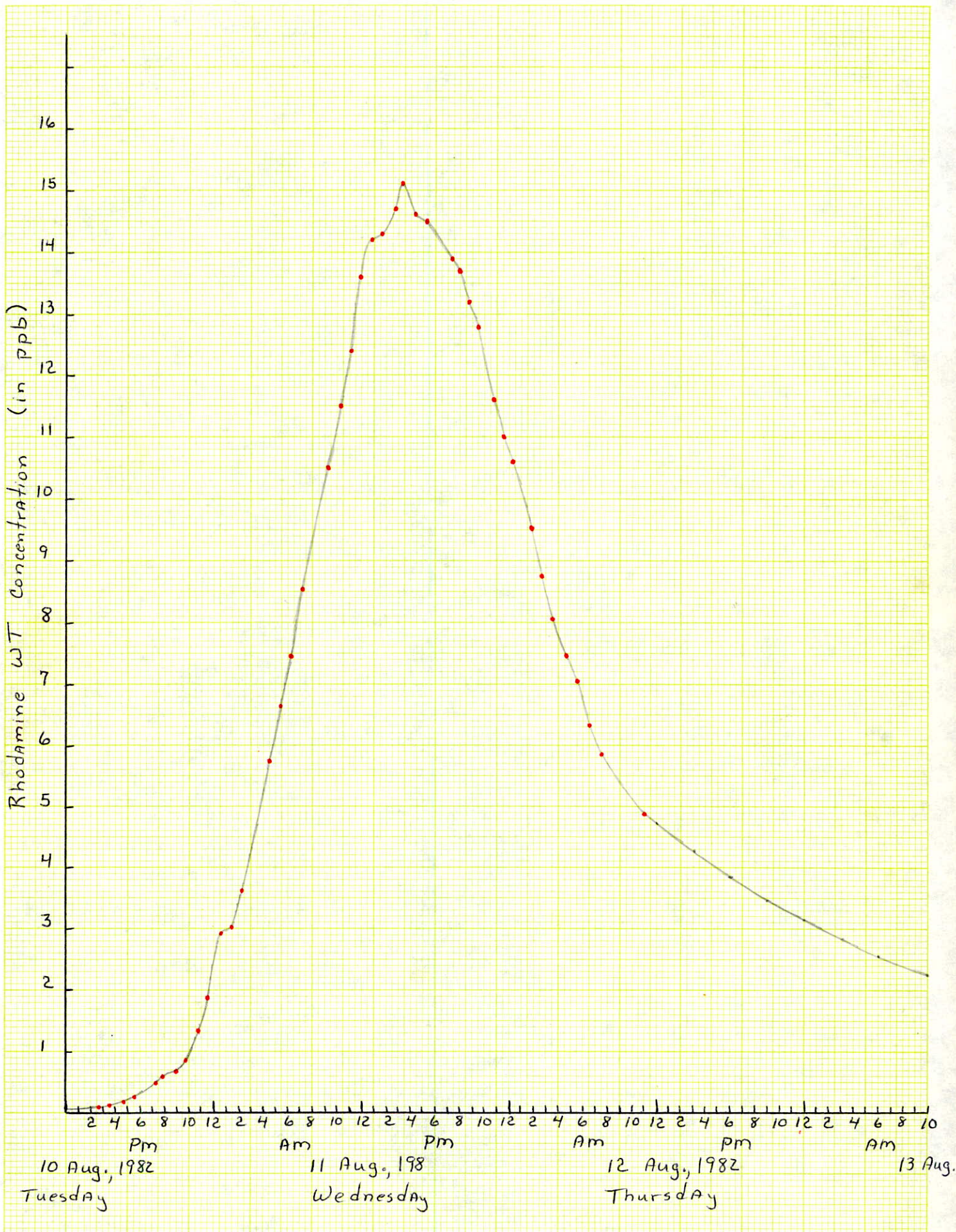


River Station P

UNIVERSITY BOOKSTORES

GRAPH NO. 4

UNIVERSITY OF MINNESOTA



SAMPLE SHEET

Sample River Station B Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/7 6:35A	9	0.085	0.7874	0.067	$* \text{ppb} \cdot d = \left(\frac{c_1 + c_2}{2} - b \right) (t_2 - t_1)$ $\bar{b} = 0.055 \pm 0.006 \quad n=8$ <u>DATE</u> 7.4167
8/7 7:15A	9	0.068	0.7874	0.054	
8/7 9:13A	9	0.060	0.7874	0.047	
8/7 9:30A	9	0.067	0.7874	0.053	
8/7 10:00A	9	0.075	0.7874	0.059	
8/7 10:19A	9	0.068	0.7874	0.054	
8/7 10:45A	9	0.065	0.7874	0.051	
8/7 11:15A	9	0.070	0.7874	0.055	
8/7 11:35A	9	1.02	0.7874	0.803	
8/7 11:52A	9	9.6	0.7874	7.56	
8/7 12:02P	9	28.6	0.7874	22.5	7.4299
8/7 12:14P	9	61.5	0.7874	48.4	7.4479 PPB·d* Σ PPB·d
8/7 12:25P	9	110	0.7874	86.6	7.4688
8/7 12:40P	9	192	0.7874	151 x 1.023	154 7.4826 0.0052 0.0052
8/7 1:10P	9	364	0.7874	287 x 1.112	319 7.4944 0.0487 0.0539
8/7 1:30P	9	448	0.7874	353 x 1.164	411 7.5014 0.1048 0.1587
8/7 1:50P	9	485	0.7874	382 x 1.185	453 7.5097 0.2938 0.4525
8/7 2:15P	9	512	0.7874	403 x 1.205	486 7.5174 0.5193 0.9718
8/7 2:50P	9	532	0.7874	419 x 1.217	510 7.5278 1.2505 2.2223
8/7 3:25P	9	545	0.7874	429 x 1.226	526 7.5486 4.9181 7.1404
8/7 4:00P	9	570	0.7874	449 x 1.242	558 7.5625 5.0727 12.2131
8/7 4:30P	9	586	0.7874	461 x 1.255	579 7.5764 6.0040 18.2172
8/7 5:30P	9	593	0.7874	467 x 1.260	588 7.5938 8.1283 26.3856
8/7 6:13P	9	595	0.7874	469 x 1.262	592 7.6181 12.1001 38.4856
8/7 7:22P	10	593	0.7874	467 x 1.260	588 7.6424 12.5861 51.0716
8/7 8:05P	10	605	0.7874	476 x 1.270	605 7.6667 13.1693 64.2409
8/7 8:35P	10	590	0.7874	465 x 1.259	585 7.6875 11.8237 76.0645
8/7 9:10P	12	555	0.8032	446 x 1.241	553 7.7292 24.3297 100.3942
8/7 9:50P	12	545	0.8032	438 x 1.232	540 7.7590 17.5804 117.9746
8/7 10:40P	12	585	0.8032	470 x 1.264	594 7.7809 28.2584 146.2329
8/7 11:35P	12	627	0.8032	504 x 1.300	655 7.8069 17.8337 164.0666
8/8 12:15A	12	650	0.8032	522 x 1.318	688 7.8576 12.3749 176.4415
8/8 12:30A	12	667	0.8032	536 x 1.333	714 7.8819 13.8254 190.2669
8/8 1:15A	12	652	0.8032	524 x 1.320	692 7.9097 15.1912 205.4580
8/8 1:35A	12	595	0.8032	478 x 1.272	608 7.9444 19.6730 225.1310
8/8 2:05A	12	521	0.8032	418 x 1.216	508 7.9826 23.8538 248.9848
					8.0104 18.6662 267.6510
					8.0208 7.2898 274.9408
					8.0521 22.0022 296.9430
					8.0660 9.0342 305.9772
					8.0868 11.6053 317.5825

River Station B - calculations 820905 ca

$$\Sigma \text{ppb} \cdot \text{d} = 362.5536 \quad (\text{thru } 8/11.6528)$$

<u>data</u> :	11.6528	0.411	$\bar{b} = 0.055$
	19.7705	0.188	
	21.5306	0.161	

Assuming an exponential decay after 8/11.6528 ($N = N_0 e^{-\lambda t}$)

1. From 8/11.6528 to 8/19.7705

$$\begin{aligned} 0.188 &= 0.411 e^{-\lambda(19.7705 - 11.6528)} \\ \lambda &= \frac{1}{-8.1177} \ln\left(\frac{0.188}{0.411}\right) \\ &= 0.09635 \text{ d}^{-1} \end{aligned}$$

$$\begin{aligned} \int_0^{8.1177} 0.411 e^{-0.09635 t} dt &= 0.411 \int_0^{8.1177} e^{-0.09635 t} dt \\ &= 0.411 \left(\frac{1}{-0.09635} \left[e^{-0.09635 t} \right]_0^{8.1177} \right) \\ &= 0.411 \left(\frac{1}{-0.09635} [0.4574 - 1] \right) \\ &= 2.3144 \end{aligned}$$

$$\text{background} = 0.055(8.1177) = \frac{0.4465}{1.8679} \text{ ppb} \cdot \text{d}$$

2. From 8/19.7705 to 8/21.5306 to background

$$\begin{aligned} 0.161 &= 0.188 e^{-\lambda(21.5306 - 19.7705)} \\ \lambda &= \frac{1}{-1.7601} \ln\left(\frac{0.161}{0.188}\right) \\ &= 0.08808 \text{ d}^{-1} \end{aligned}$$

time necessary to reach background is:

$$\begin{aligned} 0.055 &= 0.188 e^{-0.08808 t} \\ t &= \frac{1}{-0.08808} \ln\left(\frac{0.055}{0.188}\right) \\ &= 13.9545 \text{ days} \end{aligned}$$

$$\begin{aligned} \therefore \int_0^{13.9545} 0.188 e^{-0.08808t} dt &= 0.188 \int_0^{13.9545} e^{-0.08808t} dt \\ &= 0.188 \left(\frac{1}{-0.08808} \left[e^{-0.08808t} \right]_0^{13.9545} \right) \\ &= 0.188 \left(\frac{1}{-0.08808} \left[0.2926 - 1 \right] \right) \\ &= 1.5100 \end{aligned}$$

$$\text{background} = 0.055(13.9545) = \frac{-0.7675}{0.7425} \text{ ppb}\cdot\text{d}$$

$$\begin{aligned} 3. \quad \text{Total ppb}\cdot\text{d} &= 362.5536 + 1.8679 + 0.7425 \\ &= \underline{365.1640} \text{ ppb}\cdot\text{d} \end{aligned}$$

4. Assuming No dye loss

$$\text{wt of dye} = \text{ppb}\cdot\text{d} \times \text{flow}$$

$$\text{flow} = \text{wt. of dye} / \text{ppb}\cdot\text{d}$$

$$= 4.539 \text{ kg} / 365.164 \times 10^{-9} \frac{\text{kg}\cdot\text{d}}{\text{kg}}$$

$$= 1.243 \times 10^7 \text{ kg/d}$$

$$= 1.243 \times 10^7 \text{ liter/d}$$

$$= \underline{143.9 \text{ l/s}}$$

$$= 5.081 \text{ ft}^3/\text{sec}$$

$$(1 \text{ ft}^3/\text{sec} = 28.32 \text{ l/s})$$

5. Assuming MPCA flow measurements

$$\text{flow} = 3.54 \text{ ft}^3/\text{sec}$$

$$\text{wt. of dye} = \text{ppb}\cdot\text{d} \times \text{flow}$$

$$= (365.1640 \times 10^{-9} \frac{\text{kg}\cdot\text{d}}{\text{kg}}) (8.662 \times 10^6 \text{ kg/d})$$

$$= 3.163 \text{ kg} = 69.68\%$$

SAMPLE SHEET

Sample River Station C Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes	
8/7 9:50 A	9	0.052	0.7874	0.041	} $\bar{b} 0.0441 \pm 0.0051 \quad n=14$	
8/7 10:50 A	9	0.050	↑	0.039		
8/7 11:25 A	9	0.052	↑	0.041		
8/7 12:15 P	10	0.058	↑	0.046		
8/7 1:15 P	9	0.050	↓	0.039		
8/7 2:10 P	10	0.055	↓	0.043		
8/7 3:30 P	10	0.058	↓	0.046		
8/7 4:10 P	10	0.059	0.7874	0.046		
8/7 5:30 P	11	0.061	0.7937	0.049		
8/7 6:30 P	11	0.060	↑	0.048		Date
8/7 7:25 P	11	0.061	↑	0.049		7.8090
8/7 8:30 P	11	0.061	↓	0.049		7.8542
8/7 9:30 P	11	0.062	0.7937	0.049		7.8958 ppb.d* Σ ppb.d
8/7 10:40 P	12	0.040	0.8032	0.032		7.9444
8/7 11:50 P	12	0.100	↑	0.080	7.9931 0.0006 0.0006	
8/8 12:40 A	12	0.86	↑	0.691	8.0278 0.0118 0.0124	
8/8 1:45 A	12	7.75	↓	6.22	8.0729 0.1539 0.1663	
8/8 2:40 A	12	28.7	0.8032	23.1	8.1111 0.5583 0.7246	
8/8 3:52 A	13	67.3	0.8065	54.3	8.1611 1.9328 2.6574	
8/8 4:46 A	13	129	↑	104 x 1.002	104 8.1986 2.9665 5.6239	
8/8 5:41 A	13	163	↑	131 x 1.011	132 8.2368 4.5059 10.1298	
8/8 6:42 A	13	222	↑	179 x 1.038	186 8.2792 6.7397 16.8695	
8/8 7:43 A	13	271	↑	219 x 1.062	233 8.3215 8.8600 25.7295	
8/8 8:45 A	13	315	↓	254 x 1.090	277 8.3646 10.9886 36.7181	
8/8 9:45 A	13	348	0.8065	281 x 1.109	312 8.4063 12.2788 48.9969	
8/8 11:00 A	15	368	0.8264	304 x 1.125	342 8.4583 17.0017 65.9986	
8/8 11:45 A	15	370	0.8264	306 x 1.127	345 8.4896 10.7502 76.7488	
8/8 1:00 P	16	409	0.7874	322 x 1.140	367 8.5417 18.5453 95.2941	
8/8 2:00 P	16	428	↑	337 x 1.150	388 8.5833 15.7022 110.9963	
8/8 3:00 P	16	444	0.7874	350 x 1.163	407 8.6250 16.5739 127.5702	
8/8 4:00 P	17	460	0.7782	358 x 1.168	418 8.6667 17.1994 144.7696	
8/8 5:00 P	17	449	↑	349 x 1.161	405 8.7083 17.1166 161.8861	
8/8 6:00 P	17	413	↓	321 x 1.139	366 8.7500 16.0735 177.9597	
8/8 7:00 P	17	335	0.7782	261 x 1.096	286 8.7917 13.5924 191.5520	
8/8 8:07 P	19	290	0.7968	231 x 1.072	248 8.8382 12.4134 203.9655	
8/8 9:23 P	19	232	0.7968	185 x 1.040	192 8.8910 11.6137 215.5791	

River Station C - calculations 820906 CA

$\Sigma \text{ ppb} \cdot \text{d} = 254.0799$ (thru 8/11.8569)

<u>data:</u>	11.8569	1.60	
	19.8125	0.545	$\bar{b} = 0.0441$
	21.5361	0.464	

Assuming an exponential decay after 8/11.8569 ($N = N_0 e^{-\lambda t}$)

1. From 8/11.8569 to 8/19.8125

$$0.545 = 1.60 e^{-\lambda(19.8125 - 11.8569)}$$

$$\lambda = \frac{1}{-7.9556} \ln\left(\frac{0.545}{1.60}\right)$$

$$\lambda = 0.1354 \text{ d}^{-1}$$

$$\int_0^{7.9556} 1.60 e^{-0.1354 t} dt = 1.60 \int_0^{7.9556} e^{-0.1354 t} dt$$

$$= 1.60 \left(\frac{1}{-0.1354} \left[e^{-0.1354 t} \right]_0^{7.9556} \right)$$

$$= 1.60 \left(\frac{1}{-0.1354} [0.3406 - 1] \right)$$

$$= 7.7926$$

$$\text{bkg} = (0.0441)(7.9556) = \frac{-0.3508}{7.4418} \text{ ppb} \cdot \text{d}$$

2. From 8/19.8125 to 8/21.5361 to bkg

$$0.464 = 0.545 e^{-\lambda(21.5361 - 19.8125)}$$

$$\lambda = \frac{1}{-1.7236} \ln\left(\frac{0.464}{0.545}\right)$$

$$= 0.0934 \text{ d}^{-1}$$

time necessary to reach background is:

$$0.0441 = 0.545 e^{-0.0934 t}$$

$$t = \frac{1}{-0.0934} \ln\left(\frac{0.0441}{0.545}\right)$$

$$= 26.9200 \text{ days}$$

$$\begin{aligned}
 \therefore \int_0^{26.9200} 0.545 e^{-0.0934t} dt &= 0.545 \int_0^{26.92} e^{-0.0934t} dt \\
 &= 0.545 \left(\frac{1}{-0.0934} \left[e^{-0.0934t} \right]_0^{26.92} \right) \\
 &= 0.545 \left(\frac{1}{-0.0934} [0.0809 - 1] \right) \\
 &= 5.3630 \\
 \text{background} &= (0.0441)(26.92) = -1.1872 \\
 &= \frac{4.1758}{4.1758} \text{ ppb} \cdot \text{d}
 \end{aligned}$$

$$\begin{aligned}
 3. \text{ Total ppb} \cdot \text{d} &= 254.0799 + 7.4418 + 4.1758 \\
 &= \underline{265.6975} \text{ ppb} \cdot \text{d}
 \end{aligned}$$

4. Assuming no dye loss:

$$\begin{aligned}
 \text{flow} &= \text{wt. of dye} / \text{ppb} \cdot \text{d} \\
 &= 4.539 \text{ kg} / 265.6975 \frac{\text{kg} \cdot \text{d}}{\text{kg}} \\
 &= 1.708 \times 10^7 \text{ kg/d} \\
 &= \underline{197.7} \text{ l/sec.}
 \end{aligned}$$

SAMPLE SHEET

Sample River Station D Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes	
8/7 10:00A	10	0.062	0.7874	0.049	$\bar{b} = 0.0522 \pm 0.0054 \quad n = 19$ $*_{ppb \cdot d} = \left(\frac{c_1 + c_2}{2} - \bar{b}\right)(t_2 - t_1)$	
8/7 11:00A	10	0.060	↑	0.047		
8/7 11:35A	9	0.055	↑	0.043		
8/7 12:35P	10	0.060	↓	0.047		
8/7 1:35P	10	0.058	0.7874	0.046		
8/7 3:00P	10	0.063	0.7874	0.050		
8/7 3:40P	10	0.065	↓	0.051		
8/7 4:30P	10	0.063	0.7874	0.050		
8/7 5:37P	11	0.067	0.7937	0.053		
8/7 6:40P	11	0.065	↑	0.052		
8/7 7:30P	11	0.065	↑	0.052		
8/7 8:35P	11	0.063	↓	0.050		
8/7 9:35P	11	0.062	0.7937	0.049		
8/7 10:50P	12	0.070	0.8032	0.056		
8/7 12:00 ^{m.d.night}	12	0.070	↑	0.056		Date
8/8 1:00A	12	0.070	↑	0.056		8.0417
8/8 1:55A	12	0.080	↓	0.064		8.0799 ppb·d* Σ ppb·d
8/8 2:50A	12	0.075	0.8032	0.060		8.1181
8/8 4:04A	13	0.075	0.8065	0.060		8.1694
8/8 4:58A	13	0.245	↑	0.198	8.2069 0.0029 0.0029	
8/8 5:54A	13	1.75	↑	1.41	8.2458 0.0292 0.0321	
8/8 6:51A	13	7.20	↑	5.81	8.2854 0.1409 0.1730	
8/8 7:52A	13	20.1	↑	16.2	8.3278 0.4644 0.6374	
8/8 8:54A	13	56.0	↓	45.2	8.3708 1.3179 1.9553	
8/8 9:50A	13	88.0	0.8065	71.0	8.4097 2.2581 4.2133	
8/8 11:10A	15	137	0.8264	113 X 1.005	114 8.4653 5.1401 9.3534	
8/8 11:55A	15	159	0.8264	131 X 1.011	132 8.4965 3.8360 13.1894	
8/8 1:10P	16	222	0.7874	175 X 1.038	182 8.5486 8.1770 21.3664	
8/8 2:05P	16	257	↑	202 X 1.052	213 8.5868 7.5425 28.9089	
8/8 3:10P	16	283	0.7874	223 X 1.069	238 8.6319 10.1677 39.0766	
8/8 4:10P	17	298	0.7782	232 X 1.075	249 8.6736 10.1518 49.2284	
8/8 5:10P	17	310	↑	241 X 1.082	261 8.7153 10.6313 59.8597	
8/8 6:10P	17	325	↓	253 X 1.090	276 8.7569 11.1674 71.0271	
8/8 7:10P	17	339	0.7782	264 X 1.099	290 8.7986 11.7989 82.8260	
8/8 8:14P	19	346	0.7968	276 X 1.108	306 8.8431 13.2587 96.0847	

SAMPLE SHEET

Sample River Station D

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/8 9:29P	19	344	0.7968	274 x 1.106	303 8.8951 15.8313 111.9160
8/8 10:29P	19	335	↓	267 x 1.100	294 8.9368 12.4453 124.3613
8/8 11:20P	19	316	0.7968	252 x 1.090	275 8.9722 10.0695 134.4307
8/9 12:13 A	21	285	0.7874	224 x 1.070	240 9.0090 9.4741 143.9048
8/9 1:18 A	21	236	↑	186 x 1.042	194 9.0542 9.8060 153.7108
8/9 2:13 A	21	209		165 x 1.033	170 9.0924 6.9504 160.6612
8/9 3:14 A	21	174		137 x 1.016	139 9.1347 6.5331 167.1944
8/9 4:12 A	21	143		113 x 1.005	114 9.1750 5.0958 172.2902
8/9 5:10 A	21	116		91.3	9.2153 4.1347 176.4249
8/9 6:14 A	21	98	↓	77.2	9.2597 3.7384 180.1633
8/9 7:10 A	21	79.9	0.7874	62.9	9.2986 2.7229 182.8862
8/9 8:35 A	23	59.2	0.8032	47.5	9.3576 3.2537 186.1399
8/9 9:11 A	23	55.0	0.8032	44.2	9.3826 1.1449 187.2849
8/9 10:10 A	26	47.3	0.8264	39.1	9.4236 1.7055 188.9904
8/9 11:05 A	26	40.	↑	33.1	9.4618 1.3770 190.3674
8/9 12:10 P	26	28.7	↓	23.7	9.5069 1.2785 191.6459
8/9 1:10 P	26	25.6	0.8264	21.2	9.5486 0.9340 192.5799
8/9 2:26 P	30	21.2	0.8097	17.2	9.6014 1.0110 193.5909
8/9 3:10 P	30	18.4	↑	14.9	9.6319 0.4879 194.0788
8/9 4:10 P	30	16.6	0.8097	13.4	9.6736 0.5879 194.6667
8/9 6:31 P	31	12.8	0.8130	10.4	9.7715 1.1599 195.8266
8/9 9:11 P	32	10.0	0.8163	8.16	9.8941 1.1313 196.9579
8/10 12:49 A	32	8.18	0.8163	6.68	10.0340 1.0308 197.9887
8/10 7:56 A	41	5.60	0.8197	4.59	10.3306 1.6559 199.6445
8/10 11:52 A	41	4.90	0.8197	4.02	10.4944 0.6966 200.3412
8/10 5:28 P	68	3.40	0.9302	3.16	10.7278 0.8257 201.1669
8/11 3:31 A	91	2.81	0.9346	2.63	11.1465 1.1903 202.3572
8/11 8:27 P	61	2.22	0.9346	2.07	11.8521 1.6213 203.9785
8/19 7:10 P	130	0.670	0.9390	0.629	19.9986
8/21 1:00 P	147	0.55	0.9479	0.521	21.5417

River Station D - calculations 820905 CA

$$\Sigma \text{ppb} \cdot \text{d} = 203.9785 \quad (\text{thru } 8/11.8521)$$

<u>data:</u>	11.8521	2.07	
	19.7986	0.629	$\bar{b} = 0.0522$
	21.5417	0.521	

Assuming an exponential decay after 8/11.8521 ($N = N_0 e^{-\lambda t}$)

1. From 8/11.8521 to 8/19.7986

$$0.629 = 2.07 e^{-\lambda(19.7986 - 11.8521)}$$

$$\lambda = \frac{1}{7.9465} \ln \left(\frac{0.629}{2.07} \right)$$

$$= 0.1499 \text{ d}^{-1}$$

$$\int_0^{7.9465} 2.07 e^{-0.1499 t} dt = 2.07 \int_0^{7.9465} e^{-0.1499 t} dt$$

$$= 2.07 \left(\frac{1}{-0.1499} \left[e^{-0.1499 t} \right]_0^{7.9465} \right)$$

$$= 2.07 \left(\frac{1}{-0.1499} [0.3037 - 1] \right)$$

$$= 9.6131$$

$$\text{background} = (0.0522)(7.9465) = \underline{\underline{0.4148}}$$

$$9.1983 \text{ ppb} \cdot \text{d}$$

2. From 8/19.7986 to 8/21.5417 to background

$$0.521 = 0.629 e^{-\lambda(21.5417 - 19.7986)}$$

$$\lambda = \frac{1}{1.7431} \ln \left(\frac{0.521}{0.629} \right)$$

$$= 0.1081 \text{ d}^{-1}$$

time necessary to reach background is:

$$0.0522 = 0.629 e^{-0.1081 t}$$

$$t = \frac{1}{-0.1081} \ln \left(\frac{0.0522}{0.629} \right)$$

$$t = 23.0254 \text{ days}$$

$$\begin{aligned}
 \int_0^{23.0254} 0.629 e^{-0.1081t} dt &= 0.629 \int_0^{23.0254} e^{-0.1081t} dt \\
 &= 0.629 \left(\frac{1}{-0.1081} \left[e^{-0.1081t} \right]_0^{23.0254} \right) \\
 &= 0.629 \left(\frac{1}{-0.1081} [0.0830 - 1] \right) \\
 &= 5.3358
 \end{aligned}$$

$$\text{background} = \frac{(0.0522)(23.025)}{4.1339} = \frac{-1.2019}{\text{ppb} \cdot \text{d}}$$

$$\begin{aligned}
 3. \text{ Total ppb} \cdot \text{d} &= 203.9785 + 9.1983 + 4.1339 \\
 &= \underline{217.3107} \text{ ppb} \cdot \text{d}
 \end{aligned}$$

4. Assuming no dye loss:

$$\begin{aligned}
 \text{flow} &= \text{wt. of dye} / \text{ppb} \cdot \text{d} \\
 &= 4.539 \text{ kg} / 217.3107 \times 10^{-9} \frac{\text{kg} \cdot \text{d}}{\text{kg}} \\
 &= 2.089 \times 10^7 \text{ kg/d} \\
 &= \underline{241.7 \text{ L/s}} \\
 &= 8.536 \text{ ft}^3/\text{sec.}
 \end{aligned}$$

5. Assuming MPCA flow measurements

$$\begin{aligned}
 \text{wt. of dye} &= \text{ppb} \cdot \text{d} \times \text{flow} & \text{flow} &= 6.19 \text{ ft}^3/\text{sec} \\
 &= (217.3107 \times 10^{-9} \frac{\text{kg} \cdot \text{d}}{\text{kg}}) (1.515 \times 10^7 \text{ kg/d}) \\
 &= 3.291 \text{ kg} = 72.51\%
 \end{aligned}$$

SAMPLE SHEET

Sample River Station E Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/7 10:10A	10	0.040	0.7874	0.031	
8/7 10:20A	10	0.040	↑	0.031	
8/7 11:05A	10	0.046		0.036	
8/7 11:40A	10	0.045		0.035	
8/7 12:50P	10	0.045		0.035	
8/7 1:50P	10	0.039		0.031	
8/7 3:05P	10	0.050		0.039	
8/7 3:50P	10	0.045	↓	0.035	
8/7 4:40P	10	0.050	0.7874	0.039	
8/7 5:45P	11	0.050	0.7937	0.040	} $\bar{b} = 0.0383 \pm 0.0055$ n=20
8/7 6:50P	11	0.055	↑	0.044	
8/7 7:40P	11	0.050		0.040	
8/7 8:45P	11	0.050	↓	0.040	
8/7 9:40P	11	0.060	0.7937	0.048	
8/7 11:05P	12	0.059	0.8032	0.047	* $ppb \cdot d = \left(\frac{c_1+c_2}{2} - \bar{b}\right)(t_2-t_1)$
8/8 6:03A	13	0.055	0.8065	0.044	Date
8/8 6:59A	13	0.050	↑	0.040	8.2910
8/8 8:00A	13	0.052		0.042	8.3333 $ppb \cdot d^*$ $\Sigma ppb \cdot d$
8/8 9:15A	13	0.035	↓	0.028	8.3854
8/8 10:05A	13	0.050	0.8065	0.040	8.4201
8/8 11:02A	15	0.090	0.8264	0.074	8.4597 0.0007 0.0007
8/8 12:15A	15	0.345	0.8264	0.285	8.5104 0.0072 0.0079
8/8 1:20P	16	1.24	0.7874	0.976	8.5556 0.0268 0.0347
8/8 2:15P	16	3.20	↑	2.52	8.5938 0.0653 0.1000
8/8 3:15P	16	11.1	0.7874	8.74	8.6354 0.2326 0.3326
8/8 4:15P	17	18	0.7782	14.0	8.6771 0.4725 0.8051
8/8 5:15P	17	37.5	↑	29.2	8.7188 0.8991 1.7042
8/8 6:20P	17	57.3	↓	44.6	8.7639 1.6625 3.3667
8/8 7:15P	17	75	0.7782	58.4	8.8021 1.9658 5.3325
8/8 8:25P	19	94.8	0.7968	75.5	8.8507 3.2519 8.5845
8/8 9:36P	19	117	↑	93.2	8.8750 2.0488 10.6332
8/8 10:36P	19	130	↓	104 x 1.002	104 8.9417 6.5741 17.2073
8/8 11:28P	19	144	0.7968	115 x 1.005	116 8.9778 3.9696 21.1769
8/9 12:23A	21	159	0.7874	125 x 1.010	126 9.0160 4.6207 25.7976
8/9 1:26A	21	165	↑	130 x 1.012	132 9.0597 5.6356 31.4333
8/9 2:21A	21	178	0.7874	140 x 1.015	142 9.0979 5.2319 36.6652

River Station E - calculations 820906 CA

$$\Sigma \text{ ppb} \cdot \text{d} = 118.7487 \quad (\text{thru } 8/11.8472)$$

<u>data:</u>	11.8472	1.69	
	19.8028	0.465	$\bar{b} = 0.0383$
	21.5465	0.370	

Assuming an exponential decay after 8/11.8472 ($N = N_0 e^{-\lambda t}$)

1. From 8/11.8472 to 8/19.8028

$$0.465 = 1.69 e^{-\lambda(19.8028 - 11.8472)}$$

$$\lambda = \frac{1}{-7.9556} \ln\left(\frac{0.465}{1.69}\right)$$

$$= 0.1622$$

$$\int_0^{7.9556} 1.69 e^{-0.1622 t} dt = 1.69 \int_0^{7.9556} e^{-0.1622 t} dt$$

$$= 1.69 \left(\frac{-1}{-0.1622} \left[e^{-0.1622 t} \right]_0^{7.9556} \right)$$

$$= 1.69 \left(\frac{1}{-0.1622} [0.2751 - 1] \right)$$

$$= 7.5524$$

$$\text{background} = (7.9556)(0.0383) = \frac{-0.3047}{7.2477 \text{ ppb} \cdot \text{d}}$$

2. From 8/19.8028 to 8/21.5465 to background

$$0.370 = 0.465 e^{-\lambda(21.5465 - 19.8028)}$$

$$\lambda = \frac{1}{-1.7437} \ln\left(\frac{0.370}{0.465}\right)$$

$$\lambda = 0.1311 \text{ d}^{-1}$$

time necessary to reach background is:

$$0.0383 = 0.465 e^{-0.1311 t}$$

$$t = \frac{1}{-0.1311} \ln\left(\frac{0.0383}{0.465}\right)$$

$$t = 19.0434$$

$$\begin{aligned} \therefore \int_0^{19.0434} 0.465 e^{-0.1311t} dt &= 0.465 \int_0^{19.0434} e^{-0.1311t} dt \\ &= 0.465 \left(\frac{1}{-0.1311} \left[e^{-0.1311t} \right]_0^{19.0434} \right) \\ &= 0.465 \left(\frac{1}{-0.1311} [0.0824 - 1] \right) \end{aligned}$$

$$= 3.2548$$

$$\text{background} = (19.0434)(0.0383) = \frac{-0.7294}{2.5254} \text{ ppb} \cdot \text{d}$$

$$3. \text{ Total ppb} \cdot \text{d} = 118.7487 + 7.2477 + 2.5254$$

$$= \underline{128.5218} \text{ ppb} \cdot \text{d}$$

4. Assuming NO dye loss:

$$\text{flow} = \text{wt. of dye} / \text{ppb} \cdot \text{d}$$

$$= 4.539 \text{ kg} / 128.5218 \times 10^{-9} \frac{\text{kg} \cdot \text{d}}{\text{kg}}$$

$$= 3.532 \times 10^7 \text{ kg/d}$$

$$\Rightarrow \underline{408.8} \text{ l/s}$$

$$= 14.43 \text{ ft}^3/\text{sec}$$

SAMPLE SHEET

Sample River Station F

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/7 11:15 A	10	0.042	0.7874	0.033	
8/7 11:50 A	10	0.046	↑	0.036	
8/7 1:00 P	10	0.048	↓	0.038	
8/7 1:55 P	10	0.035	0.7874	0.028	
8/7 3:15 P	11	0.050	0.7937	0.040	
8/7 4:00 P	10	0.048	0.7874	0.038	
8/7 4:50 P	11	0.050	0.7937	0.040	
8/7 5:55 P	11	0.050	↑	0.040	
8/7 6:55 P	11	0.047	↓	0.037	
8/7 7:50 P	11	0.053		0.042	} $\bar{b} = 0.0384 \pm 0.0039$ n=21
8/7 9:05 P	11	0.050	↓	0.040	
8/7 9:50 P	11	0.050	0.7937	0.040	
8/7 11:15 P	12	0.060	0.8032	0.048	
8/8 6:13 A	13	0.048	0.8065	0.039	* $ppb \cdot d = \left(\frac{c_1 + c_2}{2} - \bar{b} \right) (t_2 - t_1)$
8/8 7:11 A	13	0.050	↑	0.040	
8/8 8:10 A	13	0.047	↓	0.038	
8/8 9:30 A	13	0.047		0.038	Date
8/8 10:15 A	13	0.047	0.8065	0.038	8.4271
8/8 10:51 A	15	0.048	0.8264	0.040	8.4521 ppb·d* Σ ppb·d
8/8 11:30 A	15	0.048	↓	0.040	8.4792
8/8 12:25 P	15	0.040	0.8264	0.033	8.5174
8/8 1:30 P	16	0.105	0.7874	0.083	8.5625 0.0009 0.0009
8/8 2:25 P	16	0.40	↓	0.315	8.6007 0.0061 0.0070
8/8 3:25 P	16	1.77	0.7874	1.39	8.6424 0.0339 0.0410
8/8 4:25 P	17	4.85	0.7782	3.77	8.6840 0.1057 0.1467
8/8 5:25 P	17	12.8	↑	9.96	8.7257 0.2847 0.4314
8/8 6:25 P	17	26	↓	20.2	8.7674 0.6272 1.0586
8/8 7:20 P	17	41	0.7782	31.9	8.8056 0.9936 2.0522
8/8 8:30 P	19	62.8	0.7968	50.0	8.8542 1.9883 4.0405
8/8 9:43 P	19	85.5	↑	68.1	8.9049 2.9919 7.0324
8/8 10:42 P	19	105	↓	83.7	8.9458 3.1027 10.1352
8/8 11:30 P	19	117	0.7968	93.2	8.9792 2.9529 13.0881
8/9 12:32 A	21	132	0.7874	104 x 1.002	104 9.0222 4.2381 17.3263
8/9 1:36 A	21	149	0.7874	117 x 1.008	118 9.0667 4.9378 22.2641
8/9 2:28 A	22	156	0.7937	124 x 1.010	125 9.1028 4.3848 26.6488
8/9 3:29 A	22	161	0.7937	128 x 1.011	129 9.1451 5.3705 32.0193

SAMPLE SHEET

Sample River Station F

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/9 4:28A	22	173	0.7937	137 x 1.014	139 9.1861 5.4924 37.5117
8/9 5:23A	22	174	↑	138 x 1.015	140 9.2243 5.3274 42.8392
8/9 6:30A	22	184	↓	146 x 1.020	149 9.2708 6.7175 49.5566
8/9 7:25A	22	183	0.7937	145 x 1.019	148 9.3090 5.6712 55.2279
8/9 8:47A	23	173	0.8032	139 x 1.016	141 9.3660 8.2343 63.4622
8/9 9:23A	23	172	0.8032	138 x 1.015	140 9.3910 3.5115 66.9737
8/9 10:30A	26	154	0.8264	127 x 1.010	128 9.4375 6.2292 73.2029
8/9 11:20A	26	138	↑	114 x 1.005	115 9.4722 4.2147 77.4176
8/9 12:25 P	26	120	↓	99.2	9.5174 4.8392 82.2568
8/9 1:25 P	26	104	0.8264	85.9	9.5590 3.8485 86.1053
8/9 2:35 P	30	87.3	0.8097	70.7	9.6076 3.8035 89.9088
8/9 3:25 P	30	72.4	↑ ↓	58.6	9.6424 2.2485 92.1573
8/9 4:20 P	30	63.0	0.8097	51.0	9.6806 2.0919 94.2492
8/9 6:17 P	31	46.0	0.8130	37.4	9.7618 3.5859 97.8351
8/9 9:30 P	32	22.4	0.8163	18.3	9.8958 3.7268 101.5619
8/9 10:10 P	32	20.1	↑	16.4	9.9236 0.4813 102.0431
8/9 11:05 P	32	17.4		14.2	9.9618 0.5830 102.6261
8/10 1:03 A	32	13.5		11.0	10.0438 1.0301 103.6562
8/10 2:20 A	32	11.3		9.22	10.0972 0.5378 104.1940
8/10 3:30 A	32	9.80		8.00	10.1458 0.4166 104.6106
8/10 4:23 A	32	9.30		7.59	10.1826 0.2854 104.8960
8/10 5:10 A	32	8.73	↓	7.13	10.2153 0.2394 105.1354
8/10 6:13 A	32	7.75	0.8163	6.33	10.2590 0.2924 105.4279
8/10 7:44 A	41	7:30	0.8197	5.98	10.3222 0.3866 105.8144
8/10 12:08 P	41	5.15	0.8197	4.22	10.5056 0.9283 106.7427
8/10 5:02 P	68	3.85	0.9302	3.58	10.7097 0.7882 107.5309
8/10 8:38 P	91	3.32	0.9346	3.10	10.8597 0.4952 108.0261
8/11 3:46 A	91	2.75	↓	2.57	11.1569 0.8311 108.8573
8/11 8:14 P	61	1.78	0.9346	1.66	11.8431 1.4250 110.2822
8/19 7:23 P	130	0.50	0.9390	0.470	19.8076
8/21 1:13 P	147	0.40	0.9479	0.379	21.5507

River Station F - calculations 820906 CA

$$\sum \text{ppb} \cdot d = 110.2822 \quad (\text{thru } 8/11.8431)$$

<u>data:</u>	11.8431	1.66	
	19.8076	0.470	$\bar{b} = 0.0384$
	21.5507	0.379	

Assuming AN exponential decay after 8/11.8431 ($N = N_0 e^{-\lambda t}$)

1. From 8/11.8431 to 8/19.8076

$$0.470 = 1.66 e^{-\lambda(19.8076 - 11.8431)}$$

$$\lambda = \frac{1}{-7.9645} \ln\left(\frac{0.470}{1.66}\right)$$

$$\lambda = 0.1584$$

$$\int_0^{7.9645} 1.66 e^{-0.1584 t} dt = 1.66 \int_0^{7.9645} e^{-0.1584 t} dt$$

$$= 1.66 \left(\frac{1}{-0.1584} \left[e^{-0.1584 t} \right]_0^{7.9645} \right)$$

$$= 1.66 \left(\frac{1}{-0.1584} [0.2831 - 1] \right)$$

$$= 7.5126$$

$$\text{background} = (7.9645)(0.0384) = \frac{-0.3058}{7.2068} \text{ ppb} \cdot d$$

2. From 8/19.8076 to 8/21.5507 to background

$$0.379 = 0.470 e^{-\lambda(21.5507 - 19.8076)}$$

$$\lambda = \frac{1}{-1.7428} \ln\left(\frac{0.379}{0.470}\right)$$

$$\lambda = 0.1235$$

time necessary to reach background is:

$$0.0384 = 0.470 e^{-0.1235 t}$$

$$t = \frac{1}{-0.1235} \ln\left(\frac{0.0384}{0.470}\right)$$

$$t = 20.2808$$

$$\begin{aligned} \therefore \int_0^{20.2808} 0.470 e^{-0.1235t} dt &= 0.470 \int_0^{20.2808} e^{-0.1235t} dt \\ &= 0.470 \left(\frac{1}{-0.1235} \left[e^{-0.1235t} \right]_0^{20.2808} \right) \\ &= 0.470 \left(\frac{1}{-0.1235} \left[0.0817 - 1 \right] \right) \\ &= 7.4356 \end{aligned}$$

$$\text{background} = (20.2808)(0.0384) = \frac{-0.7788}{6.6568} \text{ ppb} \cdot \text{d}$$

$$\begin{aligned} 3. \text{ Total ppb} \cdot \text{d} &= 110.2822 + 7.2068 + 6.6568 \\ &= \underline{124.1458} \text{ ppb} \cdot \text{d} \end{aligned}$$

4. Assuming NO dye loss:

$$\begin{aligned} \text{flow} &= \text{wt. of dye} / \text{ppb} \cdot \text{d} \\ &= 4.539 \text{ kg} / 124.1458 \times 10^{-9} \frac{\text{kg} \cdot \text{d}}{\text{kg}} \\ &= 3.656 \times 10^7 \text{ kg/d} \\ &= \underline{423.2} \text{ l/s} \end{aligned}$$

5.) Assuming MPCA flow measurements

$$\begin{aligned} \text{flow} &= 11.49 \text{ ft}^3/\text{sec} \\ \text{wt of dye} &= \text{ppb} \cdot \text{d} \times \text{flow} \\ &= (124.1458 \times 10^{-9} \frac{\text{kg} \cdot \text{d}}{\text{kg}}) (2.811 \times 10^7 \text{ kg/d}) \\ &= 3.490 \text{ kg} = 76.90 \% \end{aligned}$$

SAMPLE SHEET

Sample River Station 9

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/7 2:30 P	18	0.060	0.7782	0.047	}
8/7 4:30 P	18	0.050	↑	0.039	
8/7 6:30 P	18	0.058		0.045	
8/7 7:30 P	18	0.057		0.044	
8/7 8:30 P	18	0.060		0.047	
8/7 9:30 P	18	0.050		0.039	
8/7 10:30 P	18	0.050		0.039	
8/7 11:30 P	18	0.055		0.043	
8/8 12:30 A	18	0.050		0.039	
8/8 1:30 A	18	0.050		0.039	
8/8 2:30 A	18	0.057		0.044	
8/8 3:30 A	18	0.055		0.043	
8/8 4:30 A	18	0.050		0.039	
8/8 5:30 A	18	0.060		0.047	
8/8 6:30 A	18	0.060		0.047	
8/8 7:30 A	18	0.061		0.047	
8/8 8:30 A	18	0.057		0.044	
8/8 9:30 A	18	0.058		0.045	
8/8 11:00 A	18	0.060		0.047	
8/8 12:30 P	18	0.040	↓	0.031	
8/8 2:30 P	18	0.050	0.7782	0.039	
8/8 4:30 P	63	0.038	0.9259	0.035	
8/8 5:30 P	19	0.049	0.7968	0.039	
8/8 6:30	19	0.035		0.028	
8/8 7:30 P	19	0.038		0.030	
8/8 8:30 P	19	0.035		0.028	
8/8 9:30 P	19	0.050		0.040	
8/8 10:30 P	19	0.123		0.098	
8/8 11:30 P	19	0.530		0.422	
8/9 12:30 A	19	1.48		1.18	
8/9 1:30 A	19	4.83	↓	3.85	
8/9 2:30 A	19	9.15	0.7968	7.29	
8/9 3:30 A	20	18.5	0.7874	14.6	
8/9 4:30 A	20	29.3	↑	23.1	
8/9 5:30 A	20	43.2	↓	34.0	
8/9 6:25 A	20	57.4	0.7874	45.2	
8/9 7:30 A	27	75.0	0.8130	61.0	

$\bar{b} = 0.0405 \pm 0.0059 \quad n=27$

* $ppb \cdot d = \left(\frac{c_1 + c_2}{2} - \bar{b} \right) (t_2 - t_1)$

	Date		
	8.7708		
	8.8125	ppb · d *	Σ ppb · d
	8.8542		
	8.8958		
	8.9375	0.0012	0.0012
	8.9792	0.0092	0.0103
	9.0208	0.0316	0.0420
	9.0625	0.1032	0.1452
	9.1042	0.2306	0.3757
	9.1458	0.4536	0.8294
	9.1875	0.7844	1.6137
	9.2292	1.1888	2.8026
	9.2674	1.5112	4.3137
	9.3125	2.3930	6.7067

River Station G - calculations 820906 CA

$$\sum \text{ppb} \cdot \text{d} = 98.1272 \quad (\text{thru } 8/11.5833)$$

data:

11.5833	2.59	$\bar{b} = 0.0405 \text{ ppb}$
21.5590	0.455	

Assuming AN exponential decay after 8/11.5833 ($N = N_0 e^{-\lambda t}$)

1. From 8/11.5833 to 8/21.5590 to background

$$0.455 = 2.59 e^{-\lambda(21.5590 - 11.5833)}$$

$$\lambda = \frac{1}{-9.9757} \ln\left(\frac{0.455}{2.59}\right)$$

$$\lambda = 0.1743$$

time necessary to reach background is:

$$0.0405 = 2.59 e^{-0.1743 t}$$

$$t = \frac{1}{-0.1743} \ln\left(\frac{0.0405}{2.59}\right)$$

$$= 23.8561$$

$$\int_0^{23.8561} 2.59 e^{-0.1743 t} dt = 2.59 \int_0^{23.8561} e^{-0.1743 t} dt$$

$$= 2.59 \left(\frac{1}{-0.1743} \left[e^{-0.1743 t} \right]_0^{23.8561} \right)$$

$$= 2.59 \left(\frac{1}{-0.1743} [0.0156 - 1] \right)$$

$$= 14.6271$$

$$\text{background} = (23.8561)(0.0405) = \frac{0.9662}{13.6609}$$

2. Total ppb · d = 98.1272 + 13.6609

$$= \underline{111.7881} \text{ ppb} \cdot \text{d}$$

3. Assuming NO dye loss:

$$\begin{aligned}
 \text{flow} &= \text{wt. of dye} / \text{ppb} \cdot d \\
 &= 4.539 \text{ kg} / 111.7881 \times 10^{-9} \frac{\text{kg} \cdot d}{\text{kg}} \\
 &= 4.060 \times 10^7 \text{ kg/d} \\
 &= 469.9 \text{ l/s.}
 \end{aligned}$$

4. Assuming MPCA flow measurements

$$\text{flow} = 12.25 \text{ ft}^3/\text{sec}$$

$$\text{wt. of dye} = \text{ppb} \cdot d \times \text{flow}$$

$$= (111.7881 \times 10^{-9} \frac{\text{kg} \cdot d}{\text{kg}}) (2.997 \times 10^7 \text{ kg/d})$$

$$= 3.351 \text{ kg} = 73.82 \%$$

SAMPLE SHEET

Sample River Station H

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/8 11:05A	15	0.055	0.8264	0.045	$\bar{b} = 0.0593 \pm 0.0115 \quad n=4$ Date
8/9 5:34A	23	0.080	0.8032	0.064	
8/9 6:38A	23	0.070	↑	0.056	
8/9 7:35A	23	0.090	↑	0.072	
8/9 8:53A	23	0.280	↓	0.225	
8/9 9:34A	23	0.510	0.8032	0.410	
8/9 10:35A	26	1.33	0.8264	1.10	
8/9 11:30A	26	3.37	↑	2.78	
8/9 12:35P	26	6.75	↓	5.58	
8/9 1:35P	26	11.6	0.8264	9.59	
8/9 2:35P	28	18.2	0.8097	14.7	
8/9 2:50 P 2:50 P	30	20.4	↑	16.5	
8/9 3:35P	30	29.3	↓	23.7	
8/9 4:35P	30	42.5	0.8097	34.4	
8/9 5:56P	31	59.0	0.8130	48.0	
8/9 9:35P	32	96.8	0.8163	79.0	
8/9 10:25P	32	105	↑	85.7	
8/9 11:18P	32	111	↑	90.6	
8/10 1:13A	32	123		100.4 x 1.001	101
8/10 2:10A	32	124		101 x 1.001	101
8/10 3:21A	32	127		104 x 1.008	105
8/10 4:13A	32	128	↓	105 x 1.010	106
8/10 4:58A	32	133	0.8163	109 x 1.020	111
8/10 6:05A	33	120	0.8230	98.8	
8/10 7:10A	38	116	0.8130	94.3	
8/10 8:05A	38	108	↑	87.8	
8/10 9:05A	38	97	↓	78.9	
8/10 10:05A	38	87.5	↓	71.1	
8/10 11:05A	38	73.2	0.8130	59.5	
8/10 12:10P	41	62.5	0.8197	51.2	
8/10 1:05P	41	55.5	0.8197	45.5	
8/10 1:58P	91	44.9	0.9346	42.0	
8/10 2:58P	71	39.0	↓	36.4	
8/10 4:02P	↓	33.7	↓	31.5	
8/10 4:55P	↓	27.2	↓	25.4	
8/10 7:23P	91	18.8	0.9346	17.6	

61
68

SAMPLE SHEET

50.3332

29,1420

Sample River Station K

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	$b = 0.033$ Notes	$(C_2 + C_1) \cdot t_2 - t_1$ ppb	ppb · days
8/8 11:20A	15	0.035	0.8264	0.029	8.4722		
8/9 8:15A	23	0.045	0.8032	0.036	9.3438		
8/9 12:12P	27	0.060	0.8130	0.049	9.5083	0.0889	0.130 0.0116
8/9 2:20P	28	0.342	0.8097	0.277	9.5972	0.0695	0.6555 0.0456
8/9 4:00P	28	1.36	0.8097	1.10	9.6667	0.0729	2.137 0.1558
8/9 5:45P	31	3.99	0.8130	3.24	9.7396	0.1701	10.1870 1.7328
8/9 9:50P	33	20.9	0.8230	17.2	9.9097	0.0347	19.717 68418
8/9 10:40P	33	27.1	↑	22.3	9.9444	0.0348	24.917 86771
8/9 11:30P	33	33.5		27.6	9.9792	0.0784	33.017 25885
8/10 1:23A	33	46.8		38.5	10.0576	0.0479	40.617 19456
8/10 2:32A	33	52.0		42.8	10.1055	0.0494	45.65 22535
8/10 3:43A	33	58.9		48.5	10.1549	0.0360	50.85 18294
8/10 4:35A	33	64.7		53.2	10.1909	0.0327	54.95 18306
8/10 5:22A	33	68.9	↓	56.7	10.2236	0.0424	57.5 17958
8/10 6:23A	33	70.8	0.8230	58.3	10.2460	0.0430	59.05 24366
8/10 7:25A	41	73.0	0.8197	59.8	10.3090	0.0382	61.65 25377
8/10 8:20A	41	77.5	↑	63.5	10.3472	0.0417	63.0 25391
8/10 9:20A	41	76.3		62.5	10.3889	0.0417	63.25 23538
8/10 10:20A	41	78.1		64.0	10.4306	0.0416	63.55 26257
8/10 11:20A	41	77.0		63.1	10.4722	0.0452	61.8 26271
8/10 12:25P	41	73.8	↓	60.5	10.5174	0.0381	58.95 26361
8/10 1:20P	41	70.0	0.8197	57.4	10.5555	0.0320	56.15 26375
8/10 2:06P	91	58.7	0.9346	54.9	10.5875	0.0424	53.15 26423
8/10 3:07P		55.0		51.4	10.6299	0.0444	49.4 26437
8/10 4:11P	↓	50.7		47.4	10.6743	0.0368	45.75 27919
8/10 5:04P	91	47.2		44.1	10.7111	0.0702	41.20 27934
8/10 6:45P	66	41.0		38.3	10.7813	0.0312	36.8 22447
8/10 7:30P		38.0		35.3	10.8125	0.0243	34.25 17957
8/10 8:05P		35.5		33.2	10.8368	0.0278	32.0 17960
8/10 8:45P		33.0		30.8	10.8646	0.0555	29.85 22522
8/10 10:05P	↓	28.8		26.9	10.9201	0.0348	25.2 21919
8/10 10:55P	66	25.1		23.5	10.9549	0.0451	21.9 1934
8/11 12:00A	92	21.7		20.3	11.000	0.0417	19.3 16824
8/11 1:00A		19.6		18.3	11.0417	0.0416	17.35 16836
8/11 2:00A	↓	17.5	↓	16.4	11.0833	0.0875	14.9 28899
8/11 4:06A	92	14.3	0.9346	13.4	11.1708	0.0285	13.15 28922

SAMPLE SHEET

Sample River Station K

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes	days $t_2 - t_1$	PPB $\frac{(c_2 + c_1)}{2} - b$	ppb. days
8/11 4:47A	92	13.8	0.9346	12.9	11.1993	.0375	12.3	4600 4612
8/11 5:41A	92	12.5	0.9346	11.7	11.2368	.0423	11.1	4681 4693
8/11 6:42A	68	11.3	0.9302	10.5 10.46	11.2791	.0744	9.875	7322 7347
8/11 8:29A	92	9.9	0.9346	9.25 9.27	11.3535	.0437	8.842	3863
8/11 9:32A		9.10		8.50 8.46	11.3972	.0409	8.087	3306
8/11 10:31A	↓	8.28	↓	7.74 7.70	11.4381	.0382	7.577	2894
8/11 11:26A	92	8.00	0.9346	7.48 7.47	11.4763	.0306	7.137	2184
8/11 12:10P	96	7.20	0.9524	6.86 6.82	11.5069	.0348	6.707	2334
8/11 1:00P		6.95		6.62 6.58	11.5417	.0451	6.157	2777
8/11 2:05P		6.05		5.76 5.72	11.5868	.0313	5.702	1784
8/11 2:50P		6.00		5.71 5.67	11.6181	.0416	5.442	2264
8/11 3:50P		5.50		5.24 5.20	11.6597	.0417	5.137	2142
8/11 4:50P		5.35		5.10 5.06	11.7014	.0833	4.827	4021
8/11 6:50P		4.85		4.62 4.58	11.7847	.0257	4.442	1141
8/11 7:27P		4.55		4.33 4.29	11.8104	.0229	4.297	09840
8/11 8:00P	↑	4.55	↓	4.33 4.29	11.8333	.0417	4.237	1769
8/11 9:00P	96	4.42	0.9524	4.21 4.17	11.8750	.0521	4.072	2125
8/11 10:15P	61	4.28	0.9346	4.00 3.96	11.9271	.0347	3.892	1350
8/11 11:05P		4.12		3.85 3.81	11.9618	.0292	3.767	1100 1010
8/11 11:47P		4.01		3.75 3.71	11.9910	.0604	3.632	2193
8/12 1:14A		3.83		3.58 3.54	12.0514	.0347	3.402	1180
8/12 2:04A		3.52		3.29 3.25	12.0861	.0403	3.222	1298
8/12 3:02A		3.45		3.22 3.18	12.1264	.0403	3.132	1262
8/12 4:00A	↓	3.33	↓	3.11 3.07	12.1667	.0451	3.047	1374
8/12 5:05A	61	3.26	0.9346	3.05 3.01	12.2118	.0417	3.017	12580
8/12 6:05A	96	3.20	0.9524	3.05 3.01	12.2535	.0521	2.967	1546
8/12 7:20A	96	3.10	0.9524	2.95 2.91	12.3056			Σ 59.4800
8/21 3:01P	147	0.49	0.9479	0.467 0.43	21.6257			60.7933
10 lbs = 4.536 Kg								

River Station K - calculations 820902 CA

$$\Sigma = 60.7933 \text{ ppb}\cdot\text{d} \quad (\text{thru } 8/12.3056)$$

<u>data:</u>	12.3056	2.95	$\bar{b} = 0.033$
	21.6257	0.467	

Assuming an exponential decay after 8/12.3056 ($N = N_0 e^{-\lambda t}$)

1. From 8/12.3056 to 8/21.6257 to background

$$0.467 = 2.95 e^{-\lambda(21.6257 - 12.3056)}$$

$$\lambda = \frac{1}{-9.3201} \ln\left(\frac{0.467}{2.95}\right)$$

$$\lambda = 0.1978 \text{ d}^{-1}$$

time necessary to reach background:

$$0.033 = 2.95 e^{-0.1978t}$$

$$t = \frac{1}{-0.1978} \ln\left(\frac{0.033}{2.95}\right)$$

$$t = 22.7151 \text{ d}$$

$$\begin{aligned} \int_0^{22.7151} 2.95 e^{-0.1978t} dt &= 2.95 \int_0^{22.7151} e^{-0.1978t} dt \\ &= 2.95 \left(\frac{1}{-0.1978} \left[e^{-0.1978t} \right]_0^{22.7151} \right) \\ &= 2.95 \left(\frac{1}{-0.1978} [0.0112 - 1] \right) \end{aligned}$$

$$= 14.747$$

$$\text{background} = 22.7151(0.033) = -0.750$$

$$13.997 \text{ ppb}\cdot\text{d}$$

2. Total ppb·d = 60.7933 + 13.997

$$= \underline{74.7903} \text{ ppb}\cdot\text{d}$$

3. Assuming MPCA flow measurements:

$$\text{flow} = 7.98 \text{ ft}^3/\text{sec} \quad @ \text{ 12:20 to 12:50 on Aug. 11, 1982}$$

$$\begin{aligned} 1 \text{ ft}^3/\text{sec} &= 1699 \text{ l/min.} \\ &= 2.447 \times 10^6 \text{ l/day} \end{aligned}$$

using $1 \text{ l} = 1 \text{ kg of H}_2\text{O}$

$$7.98 \text{ ft}^3/\text{sec} = 1.952 \times 10^7 \text{ kg/d}$$

$$\begin{aligned} \text{wt of dye} &= \text{flow} \times \text{ppb} \cdot \text{d} \\ &= (1.952 \times 10^7 \text{ kg/d}) (74.7903 \times 10^{-9} \frac{\text{kg} \cdot \text{d}}{\text{kg}}) \\ &= \underline{1.460 \text{ kg}} \text{ of dye} \end{aligned}$$

$$1.460 \text{ kg} / 4.539 = 0.3216 \quad \text{or} \quad \underline{32.16\%}$$

(corrected to 8.54 cfs \rightarrow 34.42%)

E.M.

SAMPLE SHEET

Sample River Station L

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/8 11:35 A	15	0.025	0.8264	0.021	
8/9 8:19 A	23	0.030	0.8032	0.024	* ppb.d = $(\frac{c_1+c_2}{2} - b)(t_2 - t_1)$
8/9 12:06 P	27	0.023	0.8130	0.019	$\bar{b} = 0.0197 \pm 0.0034$
8/9 4:05 P	28	0.025	0.8097	0.020	Date
8/9 5:39 P	31	0.019	0.8130	0.015	9.7354 n=7
8/9 9:55 P	34	0.020	0.8163	0.016	9.9132 ppb.d* Σ ppb.d
8/9 10:48 P	34	0.028	↑	0.023	9.9500
8/9 11:35 P	34	0.045	↑	0.037	9.9826
8/10 1:28 A	34	0.160	↑	0.131	10.0611 0.0050 0.0050
8/10 2:37 A	34	0.365	↑	0.298	10.1090 0.0093 0.0144
8/10 3:48 A	34	0.795	↑	0.649	10.1583 0.0224 0.0368
8/10 4:43 A	34	1.40	↑	1.14	10.1965 0.0334 0.0702
8/10 5:27 A	34	2.5	↓	2.04	10.2271 0.0481 0.1182
8/10 6:27 A	34	3.30	0.8163	2.69	10.2688 0.0978 0.2160
8/10 7:30 A	41	5.40	0.8197	4.43	10.3125 0.1547 0.3707
8/10 8:25 A	41	7.60	↑	6.23	10.3507 0.2029 0.5736
8/10 9:25 A	41	9.00	↑	7.38	10.3924 0.2829 0.8565
8/10 10:25 A	41	10.4	↑	8.53	10.4340 0.3301 1.1866
8/10 11:25 A	41	14.0	↑	11.5	10.4757 0.4168 1.6034
8/10 12:30 A	41	16.0	↓	13.1	10.5208 0.5538 2.1573
8/10 1:25 P	41	19.2	0.8197	15.7	10.5590 0.5493 2.7066
8/10 2:15 P	96	16.3	0.9524	15.5	10.5938 0.5422 3.2488
8/10 3:13 P		18.6		17.7	10.6340 0.6665 3.9153
8/10 4:16 P	↓	20.4	↓	19.4	10.6778 0.8116 4.7270
8/10 5:10 P	96	20.7	0.9524	19.7	10.7153 0.7324 5.4593
8/10 6:50 P	66	27.2	0.9346	25.4	10.7847 1.5636 7.0230
8/10 7:35 P		28.0		26.2	10.8160 0.8069 7.8299
8/10 8:10 P		28.3		26.4	10.8403 0.6386 8.4685
8/10 8:52 P		28.8		26.9	10.8694 0.7749 9.2434
8/10 10:10 P	↓	22.9	↓	21.4	10.9234 1.3030 10.5465
8/10 11:07 P	66	20.2	0.9346	18.9	10.9632 0.8012 11.3476
8/11 12:05 A	96	25.9	0.9524	24.7	11.0035 0.8777 12.2254
8/11 1:05 A		24.9		23.7	11.0451 1.0059 13.2313
8/11 2:05 A		22.6		21.5	11.0868 0.9416 14.1729
8/11 4:11 A	↓	21.2	↓	20.2	11.1743 1.8227 15.9955
8/11 4:56 A	96	20.0	0.9524	19.0	11.2056 0.6129 16.6084

River Station L - calculations 820912 CA

$$\Sigma \text{ppb} \cdot \text{d} = 24.8010 \quad (\text{thru } 8/12.2965)$$

<u>data:</u>	12.2965	2.74	
	21.6368	0.246	$\bar{b} = 0.0197$
	(14.8333	0.754)*	

* Calculated from Sta. O data.

Assuming AN exponential decay after 8/12.2965 ($N = N_0 e^{-\lambda t}$)

1. From 8/12.2965 to 8/14.8333

$$0.754 = 2.74 e^{-\lambda (14.8333 - 12.2965)}$$

$$\lambda = \frac{1}{-2.5368} \ln \left(\frac{0.754}{2.74} \right)$$

$$\lambda = 0.5086$$

$$\int_0^{2.5368} 2.74 e^{-0.5086 t} dt = 2.74 \int_0^{2.5368} e^{-0.5086 t} dt$$

$$= 2.74 \left(\frac{1}{-0.5086} \left[e^{-0.5086 t} \right]_0^{2.5368} \right)$$

$$= 2.74 \left(\frac{1}{-0.5086} \left[0.2752 - 1 \right] \right)$$

$$= 3.9045$$

$$\text{background} = 2.5368 (0.0197) = \frac{-0.0500}{3.8545} \text{ ppb} \cdot \text{d}$$

2. From 8/14.8333 to 8/21.6368 to background

$$0.246 = 0.754 e^{-\lambda (21.6368 - 14.8333)}$$

$$\lambda = \frac{1}{-6.8035} \ln \left(\frac{0.246}{0.754} \right)$$

$$\lambda = 0.1646$$

time to background is:

$$0.0197 = 0.754 e^{-0.1646 t}$$

$$t = \frac{1}{-0.1646} \ln \left(\frac{0.0197}{0.754} \right)$$

$$t = 22.1392 \text{ d.}$$

$$\int_0^{22,1392} 0.754 e^{-0.1646t} dt = 0.754 \int_0^{22,1392} e^{-0.1646t} dt$$

$$= 0.754 \left(\frac{1}{-0.1646} \left[e^{-0.1646t} \right]_0^{22,1392} \right)$$

$$= 0.754 \left(\frac{1}{-0.1646} [0.0261 - 1] \right)$$

$$= 4.4603$$

$$\text{background} = 22,1392(0.0197) = \frac{-0.4361}{4.0242} \text{ ppb} \cdot d$$

$$3. \text{ Total ppb} \cdot d = 24.8010 + 3.8545 + 4.0242$$

$$= \underline{32.6797} \text{ ppb} \cdot d$$

SAMPLE SHEET

Sample River Station M

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/8 11:50 A	15	0.030	0.8264	0.025	
8/9 11:59 A	27	0.040	0.8130	0.033	} $\bar{b} = 0.0406 \pm 0.0131$ $n = 7$ * $ppb \cdot d = (\frac{c_1 + c_2}{2} - \bar{b})(t_2 - t_1)$
8/10 1:39 A	34	0.033	0.8163	0.027	
8/10 3:58 A	34	0.065	↑	0.053	DATE 10.1653
8/10 5:53 A	34	0.050	0.8163	0.041	10.2451 $ppb \cdot d^*$ $\Sigma ppb \cdot d$
8/10 7:45 A	38	0.055	0.8130	0.045	10.3229
8/10 8:40 A	38	0.074	↑	0.060	10.3611
8/10 9:40 A	38	0.170	↓	0.138	10.4028 0.0024 0.0024
8/10 10:40 A	38	0.272	↓	0.221	10.4444 0.0058 0.0082
8/10 11:40 A	38	0.450	0.8130	0.366	10.4861 0.0105 0.0188
8/10 12:40 P	41	0.590	0.8197	0.484	10.5278 0.0160 0.0348
8/10 1:40 P	41	0.970	0.8197	0.795	10.5694 0.0249 0.0597
8/10 2:23 P	99	1.26	0.9390	1.18	10.5993 0.0283 0.0880
8/10 3:22 P	↓	2.09	↓	1.96	10.6403 0.0627 0.1507
8/10 4:26 P	↓	3.10	↓	2.91	10.6847 0.1063 0.2570
8/10 5:19 P	99	3.85	0.9390	3.62	10.7215 0.1187 0.3757
8/10 7:00 P	66	8.10	0.9346	7.57	10.7917 0.3899 0.7656
8/10 7:40 P	↓	9.40	↑	8.79	10.8194 0.2255 0.9911
8/10 8:28 P	↓	10.7	↓	10.0	10.8528 0.3124 1.3035
8/10 9:05 P	↓	11.8	↓	11.0	10.8785 0.2688 1.5723
8/10 10:22 P	↓	10.7	↓	10.0	10.9319 0.5585 2.1308
8/10 11:14 P	66	13.0	0.9346	12.1	10.9681 0.3985 2.5294
8/11 12:15 A	94	18.2	0.9259	16.9	11.0104 0.6116 3.1410
8/11 1:15 A	↓	17.3	↓	16.0	11.0521 0.6843 3.8253
8/11 2:11 A	↓	18.4	↓	17.0	11.0910 0.6403 4.4656
8/11 4:21 A	↓	22.8	↓	21.1	11.1813 1.7165 6.1821
8/11 5:11 A	↓	22.9	↓	21.2	11.2160 0.7325 6.9146
8/11 5:59 A	94	23.4	0.9259	21.7	11.2493 0.7129 7.6275
8/11 6:49 A	69	23.7	0.9302	22.0	11.2840 0.7568 8.3843
8/11 8:49 A	99	23.7	0.9390	22.3	11.3674 1.8439 10.2282
8/11 9:50 A	↓	22.8	↓	21.4	11.4097 0.9225 11.1508
8/11 10:48 A	↓	21.4	↓	20.1	11.4500 0.8346 11.9854
8/11 11:44 A	99	20.6	0.9390	19.3	11.4889 0.7648 12.7501

River Station M - calculations 820912 CA

$$\sum \text{ppb} \cdot \text{d} = 21.1246 \quad (\text{thru } 8/12.3028)$$

<u>data:</u>	12.3028	4.19	$\bar{b} = 0.0406$
	21.6431	0.256	

Assuming an exponential decay after 8/12.3028 ($N = N_0 e^{-\lambda t}$)

1. From 8/12.3028 to 21.6431 to background

$$0.256 = 4.19 e^{-\lambda(21.6431 - 12.3028)}$$

$$\lambda = \frac{1}{-9.3403} \ln\left(\frac{0.256}{4.19}\right)$$

$$= 0.2993 \text{ d}^{-1}$$

time to background is:

$$0.0406 = 4.19 e^{-0.2993 t}$$

$$t = \frac{1}{-0.2993} \ln\left(\frac{0.0406}{4.19}\right)$$

$$t = 15.4918 \text{ d}$$

$$\int_0^{15.4918} 4.19 e^{-0.2993 t} dt = 4.19 \int_0^{15.4918} e^{-0.2993 t} dt$$

$$= 4.19 \left(\frac{1}{-0.2993} \left[e^{-0.2993 t} \right]_0^{15.4918} \right)$$

$$= 4.19 \left(\frac{1}{-0.2993} [0.0097 - 1] \right)$$

$$= 13.8637$$

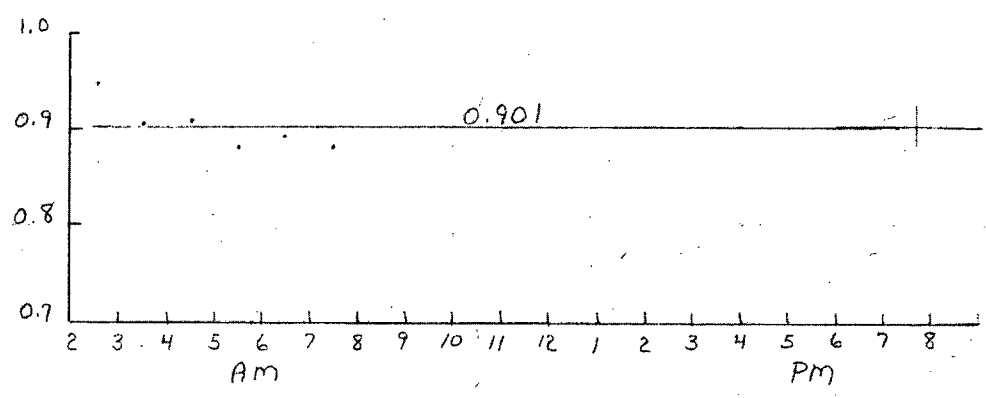
$$\text{background} = 15.4918(0.0406) = \frac{-0.6290}{13.2347} \text{ ppb} \cdot \text{d}$$

2. Total ppb.d = 21.1246 + 13.2347

$$= \underline{34.3593} \text{ ppb} \cdot \text{d}$$

3. This seems to be over estimating the contribution of the tail. See if the data from O can be related to that from M.

M		O		ΔT	M/O
Time	PPM	Time	PPM		
2:19A	6.36	2:32A	6.72	:13	0.946
3:17A	5.70	3:29A	6.32	:12	0.902
4:17A	5.29	4:30A	5.84	:13	0.906
5:19A	4.79	5:29A	5.45	:10	0.879
6:17A	4.52	6:28A	5.07	:11	0.892
7:16A	4.19	7:26A	4.76	:10	0.880
Ave				:115	0.901



At 7:30 P Sta. O read 2.30 ppb. ∴ Sta. M should have been 2.07 ppb at 7:41 PM (12.8201) and

4. From 8/12.3028 to 8/12.8201

$$2.07 = 4.19 e^{-\lambda(12.8201 - 12.3028)}$$

$$\lambda = \frac{1}{-0.5173} \ln\left(\frac{2.07}{4.19}\right)$$

$$= 1.3631$$

$$\int_0^{0.5173} 4.19 e^{-1.3631 t} dt = 4.19 \int_0^{0.5173} e^{-1.3631 t} dt$$

$$= 4.19 \left(\frac{1}{-1.3631} \left[e^{-1.3631 t} \right]_0^{0.5173} \right)$$

$$= 4.19 \left(\frac{1}{-1.3631} [0.4940 - 1] \right)$$

$$= 1.5552$$

$$\text{background} = 0.5173(0.0406) = \frac{-0.0210}{1.5342} \text{ ppb}\cdot\text{d}$$

5. Estimation of a value for 8 PM on Aug 14 at Sta. m.

Sta. 0: 8/14.8333 0.524
8/21.6542 0.171

Sta. m: 8/21.6431 0.256

@ 8/21.6 $m/0 = 1.497$ - assuming this ratio represents the progressive dilution of the tail by the addition of flow then at Sta. m the value would be 0.784 ppb (8/14.8333)

6. From 8/12.8201 to 8/14.8333

$$0.784 = 2.07 e^{-\lambda(14.8333 - 12.8201)}$$

$$\lambda = \frac{1}{-2.0132} \ln \left(\frac{0.784}{2.07} \right)$$

$$= 0.4823$$

$$\begin{aligned} \int_0^{2.0132} 2.07 e^{-0.4823t} dt &= 2.07 \int_0^{2.0132} e^{-0.4823t} dt \\ &= 2.07 \left(\frac{1}{-0.4823} \left[e^{-0.4823t} \right]_0^{2.0132} \right) \\ &= 2.07 \left(\frac{1}{-0.4823} [0.3787 - 1] \right) \end{aligned}$$

$$= 2.6666$$

$$\text{background} = 2.0132 (0.0406) \frac{-0.0817}{2.5849} \text{ ppb} \cdot \text{d}$$

7. From 8/14.8333 to 8/21.6431 to background

$$0.256 = 0.784 e^{\lambda(21.6431 - 14.8333)}$$

$$\lambda = \frac{1}{-6.8098} \ln \left(\frac{0.256}{0.784} \right)$$

$$\lambda = 0.1644$$

time to background is:

$$0.0406 = 0.784 e^{-0.1644t}$$

$$t = \frac{1}{-0.1644} \ln \left(\frac{0.0406}{0.784} \right)$$

$$t = 18.0136 \text{ days}$$

$$\int_0^{18.0136} 0.784 e^{-0.1644t} dt = 0.784 \int_0^{18.0136} e^{-0.1644t} dt$$

$$= 0.784 \left(\frac{1}{-0.1644} \left[e^{-0.1644t} \right]_0^{18.0136} \right)$$

$$= 0.784 \left(\frac{1}{-0.1644} \left[0.0518 - 1 \right] \right)$$

$$= 4.5231$$

$$\text{background} = 18.0136(0.0406) = -0.7314$$

$$3.7918 \text{ ppb}\cdot\text{d}$$

8. Total ppb·d = 21.1246 + 1.5342 + 2.5849 + 3.7918

$$= \underline{29.0355} \text{ ppb}\cdot\text{d}$$

SAMPLE SHEET

Sample River Station N Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes	* $ppb \cdot d = \left(\frac{c_1 + c_2}{2} - \bar{b}\right)(t_2 - t_1)$	
8/8 12:00 ^{Noon}	15	0.032	0.8264	0.026			0.5000
8/9 11:52A	27	0.040	0.8130	0.033	} $\bar{b} = 0.0278 \pm 0.0043$ $n = 4$	Date	$\sum ppb \cdot d$
8/10 11:47A	34	0.028	0.8163	0.023			
8/10 5:37A	34	0.035	0.8163	0.029			
8/10 2:31P	99	0.55	0.9390	0.516		10.6049	0.0908 0.0908
8/10 3:30P		0.76		0.714		10.6458	0.0240 0.1148
8/10 4:30P	↓	1.10	↓	1.03		10.6875	0.0352 0.1500
8/10 5:26P	99	1.49	0.9390	1.40		10.7264	0.0462 0.1962
8/10 7:10P	66	2.77	0.9346	2.59		10.7986	0.1420 0.3382
8/10 7:47P		3.25		3.04		10.8243	0.0716 0.4098
8/10 8:35P		4.00		3.74		10.8576	0.1120 0.5218
8/10 9:10P		4.50		4.21		10.8819	0.0959 0.6177
8/10 10:32P	↓	6.45	↓	6.03		10.9389	0.2903 0.9080
8/10 11:22P	66	7.75	0.9346	7.24		10.9736	0.2293 1.1372
8/11 12:25A	94	9.15	0.9259	8.47		11.0174	0.3428 1.4801
8/11 1:25A		11.0		10.2		11.0590	0.3872 1.8672
8/11 2:17A		12.0		11.1		11.0951	0.3835 2.2507
8/11 4:29A		16.4		15.2		11.1868	1.2033 3.4540
8/11 5:20A		17.3		16.0		11.2222	0.5513 4.0053
8/11 6:07A	↓	19.0	↓	17.6		11.2549	0.5485 4.5537
8/11 7:06A	94	20.2	0.9259	18.7		11.2958	0.7412 5.2949
8/11 8:57A	99	22.3	0.9390	20.9		11.3729	1.5244 5.8193
8/11 10:02A	100	22.8		21.4		11.4181	0.9547 7.7741
8/11 10:58A	↓	23.3		21.9		11.4569	0.8389 8.6130
8/11 11:51A	100	23.7		22.3		11.4938	0.8145 9.4275
8/11 12:40P	103	23.3		21.9		11.5278	0.7505 10.1779
8/11 1:25P		22.4		21.0		11.5590	0.6684 10.8463
8/11 2:35P		22.2		20.9		11.6076	1.0168 11.8631
8/11 3:12P		21.9		20.6		11.6333	0.5326 12.3957
8/11 4:10P		20.7		19.4		11.6736	0.8049 13.2006
8/11 5:10P		19.5		18.3		11.7153	0.7849 13.9854
8/11 7:11P		16.9		15.9		11.7993	1.4341 15.4195
8/11 7:45P	↓	15.8		14.8		11.8229	0.3616 15.7811
8/11 8:30P	103	15.3	↓	14.4		11.8542	0.4561 16.2372
8/11 9:25P	104	14.3	0.9390	13.4		11.8924	0.5299 16.7671

River Station N - calculations 820910 CA

$$\Sigma \text{ppb} \cdot \text{d} = 20.3867 \quad (\text{thru } 8/12.3076)$$

<u>data:</u>	12.3076	5.48	
	12.8125	3.02	$\bar{b} = 0.0278$
	14.8333	0.934	
	21.6507	0.294	

Assuming an exponential decay after 8/12.3076 ($N = N_0 e^{-\lambda t}$)

1. From 8/12.3076 to 12.8125

$$3.02 = 5.48 e^{-\lambda(12.8125 - 12.3076)}$$

$$\lambda = \frac{1}{-0.5049} \ln \left(\frac{3.02}{5.48} \right)$$

$$= 1.1801$$

$$\int_0^{0.5049} 5.48 e^{-1.1801t} dt = 5.48 \int_0^{0.5049} e^{-1.1801t} dt$$

$$= 5.48 \left(\frac{1}{-1.1801} \left[e^{-1.1801t} \right]_0^{0.5049} \right)$$

$$= 5.48 \left(\frac{1}{-1.1801} [0.5511 - 1] \right)$$

$$= 2.0846$$

$$\text{background} = (0.5049)(0.0278) = \frac{-0.0140}{2.0705 \text{ ppb} \cdot \text{d}}$$

2. From 12.8125 to 14.8333

$$0.934 = 3.02 e^{-\lambda(14.8333 - 12.8125)}$$

$$\lambda = \frac{1}{-2.0208} \ln \left(\frac{0.934}{3.02} \right)$$

$$= 0.5807$$

$$\int_0^{2.0208} 3.02 e^{-0.5807t} dt = 3.02 \int_0^{2.0208} e^{-0.5807t} dt$$

$$= 3.02 \left(\frac{1}{-0.5807} \left[e^{-0.5807t} \right]_0^{2.0208} \right)$$

$$= 3.02 \left(\frac{1}{-0.5807} [0.3093 - 1] \right)$$

$$= 3.5919$$

$$\text{background} = (2.0208)(0.0278) = \frac{-0.0562}{3.5357} \text{ ppb} \cdot \text{d}$$

3. From 14.8333 to 21.6507 to background

$$0.294 = 0.934 e^{-\lambda(21.6507 - 14.8333)}$$

$$\lambda = \frac{1}{-6.8174} \ln \left(\frac{0.294}{0.934} \right)$$

$$= 0.1696$$

time necessary to reach background is:

$$0.0278 = 0.934 e^{-0.1696 t}$$

$$t = \frac{1}{-0.1696} \ln \left(\frac{0.0278}{0.934} \right)$$

$$t = 20.7279 \text{ days}$$

$$\begin{aligned} \therefore \int_0^{20.7279} 0.934 e^{-0.1696 t} dt &= 0.934 \int_0^{20.7279} e^{-0.1696 t} dt \\ &= 0.934 \left(\frac{1}{-0.1696} \left[e^{-0.1696 t} \right]_0^{20.7279} \right) \\ &= 0.934 \left(\frac{1}{-0.1696} [0.0298 - 1] \right) \end{aligned}$$

$$= 5.3447$$

$$\text{background} = (20.7279)(0.0278) = \frac{-0.5762}{4.7685} \text{ ppb} \cdot \text{d}$$

4. Total ppb·d = 20.3867 + 2.0705 + 3.5357 + 4.7685

$$= \underline{30.7614} \text{ ppb} \cdot \text{d}$$

SAMPLE SHEET

Sample River Station 0 Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes
8/8 12:07P	15	0.033	0.8264	0.027	* ppb·d = $(\frac{c_1+c_2}{2}-\bar{b})(t_2-t_1)$ $\bar{b} = 0.0262 \pm 0.0041 \quad \eta = 5$
8/9 11:49A	27	0.030	0.8130	0.024	
8/10 1:56A	34	0.028	0.8163	0.023	10.0806
8/10 5:45A	34	0.030	0.8163	0.024	Date ppb·d* Σ ppb·d 10.2396
8/10 2:34P	99	0.035	0.9390	0.033	10.6069
8/10 3:30P		0.045		0.042	10.6458 0.0004 0.0004
8/10 4:36P	↓	0.060	↓	0.056	10.6917 0.0010 0.0015
8/10 5:28P	99	0.090	0.9390	0.085	10.7278 0.0016 0.0031
8/10 7:15P	66	0.265	0.9346	0.248	10.8021 0.0104 0.0135
8/10 7:52P		0.340		0.318	10.8278 0.0066 0.0201
8/10 8:40P	↓	0.460		0.430	10.8611 0.0116 0.0317
8/10 9:15P	66	0.690		0.645	10.8854 0.0124 0.0441
8/10 10:35P	67	1.18	↓	1.10	10.9410 0.0471 0.0912
8/10 11:25P	67	1.62	0.9346	1.51	10.9757 0.0444 0.1355
8/11 12:30A	94	2.28	0.9259	2.11	11.0208 0.0804 0.2160
8/11 1:30A		2.87		2.66	11.0625 0.0984 0.3144
8/11 2:20A		3.55		3.29	11.0972 0.1023 0.4167
8/11 4:38A	↓	5.40		5.00	11.1931 0.3950 0.8117
8/11 5:30A	94	6.30	↓	5.83	11.2292 0.1945 1.0062
8/11 6:14A	95	7.05	0.9259	6.53	11.2597 0.1877 1.1939
8/11 7:14A	69	8.15	0.9302	7.58	11.3014 0.2931 1.4870
8/11 9:01A	100	9.65	0.9390	9.06	11.3757 0.6162 2.1032
8/11 10:08A		10.8		10.14	11.4222 0.4452 2.5484
8/11 11:01A	↓	11.7		11.0	11.4590 0.3880 2.9364
8/11 11:56A	100	12.2		11.5	11.4972 0.4287 3.3652
8/11 12:45P	104	12.4		11.6	11.5313 0.3930 3.7581
8/11 1:30P		12.8		12.0	11.5625 0.3673 4.1255
8/11 2:40P		12.7		11.9	11.6111 0.5795 4.7050
8/11 3:15P		12.9		12.1	11.6354 0.2910 4.9959
8/11 4:12P		12.8		12.0	11.6750 0.4761 5.4721
8/11 5:13P		12.7		11.9	11.7174 0.5056 5.9776
8/11 7:15P		11.6		10.9	11.8021 0.9634 6.9410
8/11 7:50P		11.7		11.0	11.8264 0.2654 7.2065
8/11 8:35P		11.4		10.7	11.8576 0.3377 7.5442
8/11 9:29P	↓	10.8	↓	10.1	11.8951 0.3890 7.9332

River Station 0 - calculations 820912 CA

$$\Sigma \text{ ppb} \cdot \text{d} = 10.8813 \quad (\text{thru } 8/12.3097)$$

<u>data:</u>	12.3097	4.76	
	12.8125	2.30	
	14.8333	0.524	$\bar{b} = 0.0262$
	21.6542	0.171	

Assuming an exponential decay after 8/12.3097 ($N = N_0 e^{-\lambda t}$)

1. From 8/12.3097 to 8/12.8125

$$2.30 = 4.76 e^{-\lambda(12.8125 - 12.3097)}$$

$$\lambda = \frac{1}{-0.5028} \ln\left(\frac{2.30}{4.76}\right)$$

$$= 1.4466 \text{ d}^{-1}$$

$$\int_0^{0.5028} 4.76 e^{-1.4466t} dt = 4.76 \int_0^{0.5028} e^{-1.4466t} dt$$

$$= 4.76 \left(\frac{1}{-1.4466} \left[e^{-1.4466t} \right]_0^{0.5028} \right)$$

$$= 4.76 \left(\frac{1}{-1.4466} \left[0.4832 - 1 \right] \right)$$

$$= 1.7006$$

$$\text{background} = 0.5028(0.0262) = -0.0132$$

$$1.6874 \text{ ppb} \cdot \text{d}$$

(the linear interpolation value for this interval is 1.7617 - 4.40% higher)

2. From 8/12.8125 to 8/14.8333

$$0.524 = 2.30 e^{-\lambda(14.8333 - 12.8125)}$$

$$\lambda = \frac{1}{-2.0208} \ln\left(\frac{0.524}{2.30}\right)$$

$$\lambda = 0.7320 \text{ d}^{-1}$$

$$\int_0^{2.0208} 2.30 e^{-0.7320t} dt = 2.30 \int_0^{2.0208} e^{-0.7320t} dt$$

$$= 2.30 \left(\frac{1}{-0.7320} \left[e^{-0.7320t} \right]_0^{2.0208} \right)$$

$$= 2.30 \left(\frac{1}{-0.7320} [0.2278 - 1] \right)$$

$$= 2.4263$$

$$\text{background} = 2.0208(0.0262) = \frac{-0.0529}{2.3734} \text{ ppb}\cdot\text{d}$$

(the linear interpolation value for this interval is 2.8004 - 17.99% higher)

3. From 8/14.8333 to 8/21.6542 to background

$$0.171 = 0.524 e^{-\lambda(21.6542 - 14.8333)}$$

$$\lambda = \frac{1}{6.8209} \ln \left(\frac{0.171}{0.524} \right)$$

$$= 0.1642 \text{ d}^{-1}$$

time to reach background is:

$$0.0262 = 0.524 e^{-0.1642t}$$

$$t = \frac{1}{-0.1642} \ln \left(\frac{0.0262}{0.524} \right)$$

$$= 18.2471 \text{ d}$$

$$\begin{aligned} \therefore \int_0^{18.2471} 0.524 e^{-0.1642t} dt &= 0.524 \int_0^{18.2471} e^{-0.1642t} dt \\ &= 0.524 \left(\frac{1}{-0.1642} \left[e^{-0.1642t} \right]_0^{18.2471} \right) \\ &= 0.524 \left(\frac{1}{-0.1642} [0.0500 - 1] \right) \end{aligned}$$

$$= 3.0321$$

$$\text{background} = 18.2471(0.0262) = \frac{-0.4781}{2.5540} \text{ ppb}\cdot\text{d}$$

4. Total ppb·d = 10.8813 + 1.6874 + 2.3734 + 2.5540

$$= \underline{17.4961} \text{ ppb}\cdot\text{d}$$

SAMPLE SHEET

Sample River Station P

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Notes	$* \text{ppb.d} = \left(\frac{C_1 + C_2}{2} - \bar{b}\right)(t_2 - t_1)$		
8/8 12:12P	15	0.027	0.8264	0.0223				
8/9 11:45A	27	0.030	0.8130	0.0244	} $\bar{b} = 0.0243 \pm 0.0016$ $n = 49.4836$ Date ppb.d* Σ ppb.d 10.0778			
8/10 1:52A	34	0.030	0.8163	0.0245				
8/10 5:41A	34	0.032	0.8163	0.0261		10.2368		
8/10 2:41P	99	0.095	0.9390	0.0892	10.6118	0.0125	0.0125	
8/10 3:35P		0.130		0.122	10.6493	0.0030	0.0156	
8/10 4:40P	↓	0.185	↓	0.174	10.6944	0.0056	0.0211	
8/10 5:35P	99	0.270	0.9390	0.254	10.7326	0.0072	0.0284	
8/10 7:20P	67	0.500	0.9346	0.467	10.8056	0.0245	0.0529	
8/10 7:55P		0.610		0.570	10.8299	0.0120	0.0649	
8/10 9:00P		0.710		0.664	10.8750	0.0267	0.0917	
8/10 9:40P		0.930		0.869	10.9028	0.0206	0.1123	
8/10 10:40P	↓	1.42	↓	1.33	10.9444	0.0447	0.1570	
8/10 11:30P	67	2.02	0.9346	1.89	10.9792	0.0552	0.2122	
8/11 12:35A	95	3.15	0.9259	2.92	11.0243	0.1074	0.3196	
8/11 1:35A		3.25		3.01	11.0660	0.1226	0.4422	
8/11 2:25A		3.90		3.61	11.1007	0.1140	0.5562	
8/11 4:33A		6.20		5.74	11.1896	0.4134	0.9697	
8/11 5:26A		7.15		6.62	11.2264	0.2265	1.1962	
8/11 6:11A	↓	8.05	↓	7.45	11.2576	0.2187	1.4149	
8/11 7:11A	95	9.20	0.9259	8.52	11.2993	0.3320	1.7469	
8/11 9:11A	100	11.2	0.9390	10.5	11.3826	0.7902	2.5370	
8/11 10:15A		12.3		11.5	11.4271	0.4884	3.0255	
8/11 11:05A	↓	13.2	↓	12.4	11.4618	0.4138	3.4393	
8/11 11:59A	100	14.5	0.9390	13.6	11.4993	0.4866	3.9259	
8/11 12:50P	94	15.3	0.9259	14.2	11.5347	0.4912	4.4171	
8/11 1:35P		15.4		14.3	11.5660	0.4453	4.8623	
8/11 2:45P		15.9		14.7	11.6146	0.7035	5.5659	
8/11 3:18P		16.3		15.1	11.6375	0.3407	5.9065	
8/11 4:20P		15.8		14.6	11.6806	0.6390	6.5455	
8/11 5:17P		15.7		14.5	11.7201	0.5738	7.1193	
8/11 7:20P		15.0		13.9	11.8056	1.2120	8.3313	
8/11 7:52P		14.8		13.7	11.8278	0.3058	8.6371	
8/11 8:40P	↓	14.3	↓	13.2	11.8611	0.4471	9.0842	
8/11 9:35P	94	13.8	0.9259	12.8	11.8993	0.4957	9.5799	

River Station P - calculations 820912 CA

$$\Sigma \text{ ppb} \cdot \text{d} = 13.2900 \quad (\text{thru } 8/12.3132)$$

<u>data</u> :	12.3132	5.86	
	12.4583	4.89	$\bar{b} = 0.0243$
	14.8333	0.689	
	21.6569	0.199	

Assuming an exponential decay after 8/12.3132 ($N = N_0 e^{-\lambda t}$)

1. From 8/12.3132 to 8/12.4583

$$4.89 = 5.86 e^{-\lambda(12.4583 - 12.3132)}$$

$$\lambda = \frac{1}{-0.1451} \ln\left(\frac{4.89}{5.86}\right)$$

$$\lambda = 1.2471 \text{ d}^{-1}$$

$$\begin{aligned} \int_0^{0.1451} 5.86 e^{-1.2471 t} dt &= 5.86 \int_0^{0.1451} e^{-1.2471 t} dt \\ &= 5.86 \left(\frac{1}{-1.2471} \left[e^{-1.2471 t} \right]_0^{0.1451} \right) \\ &= 5.86 \left(\frac{1}{-1.2471} [0.8345 - 1] \right) \\ &= 0.7778 \end{aligned}$$

$$\text{background} = (0.1451)(0.0243) = \frac{-0.0035}{0.7743 \text{ ppb} \cdot \text{d}}$$

(the linear interpolation value for this same interval is 0.7764 - 0.27% higher)

2. From 8/12.4583 to 8/14.8333

$$0.689 = 4.89 e^{-\lambda(14.8333 - 12.4583)}$$

$$\lambda = \frac{1}{-2.3750} \ln\left(\frac{0.689}{4.89}\right)$$

$$\lambda = 0.8251 \text{ d}^{-1}$$

$$\int_0^{2.3750} 4.89 e^{-0.8251 t} dt = 4.89 \int_0^{2.3750} e^{-0.8251 t} dt$$

$$= 4.89 \left(\frac{1}{-0.8251} \left[e^{-0.8251t} \Big|_0^{2.3750} \right] \right)$$

$$= 4.89 \left(\frac{1}{-0.8251} \left[0.1409 - 1 \right] \right)$$

$$= 5.0913$$

$$\text{background} = (0.0243)(2.3750) = \underline{-0.0577}$$

$$5.0335 \text{ ppb} \cdot \text{d}$$

(the linear interpolation value for the same interval is 6.5674 - 30.47% higher)

3. From 8/14.8333 to 8/21.6569 to background

$$0.199 = 0.689 e^{-\lambda(21.6569 - 14.8333)}$$

$$\lambda = \frac{1}{-6.8236} \ln \left(\frac{0.199}{0.689} \right)$$

$$= 0.1820 \text{ d}^{-1}$$

time necessary to reach background is:

$$0.0243 = 0.689 e^{-0.1820t}$$

$$t = \frac{1}{-0.1820} \ln \left(\frac{0.0243}{0.689} \right)$$

$$= 18.3772 \text{ d}$$

$$\therefore \int_0^{18.3772} 0.689 e^{-0.1820t} dt = 0.689 \int_0^{18.3772} e^{-0.1820t} dt$$

$$= 0.689 \left(\frac{1}{-0.1820} \left[e^{-0.1820t} \Big|_0^{18.3772} \right] \right)$$

$$= 0.689 \left(\frac{1}{-0.1820} \left[0.0353 - 1 \right] \right)$$

$$= 3.6521$$

$$\text{background} = 18.3772(0.0243) = \underline{-0.4466}$$

$$3.2055 \text{ ppb} \cdot \text{d}$$

4. Total ppb·d = 13.2900 + 0.7743 + 5.0335 + 3.2055

$$= \underline{22.3033} \text{ ppb} \cdot \text{d}$$

SAMPLE SHEET

$$* \text{ppb} \cdot d = \left(\frac{c_1 + c_2}{2} - \bar{b} \right) (t_2 - t_1)$$

Sample Preston(R)

Location _____

Date/Time collected	Anal Sheet	Uncor PPB	Correction Factor	Corrected PPB	Date Notes	ppb·d*	Σ ppb·d
8/8 12:40 P	16	0.025	0.7874	0.0197	8.5278		
8/12 7:30 A	168	3.25	0.9346	3.04	12.3125		
8/12 10:30 A		4.60		4.30	12.4375		
8/12 1:30 P		5.65		5.28	12.5625		
8/12 5:30 P		6.33		5.92	12.7292		
8/13 7:30 A		3.42		3.20	13.3125		
8/13 10:30 A		3.04		2.84	13.4375		
8/13 1:30 P		2.66		2.49	13.5625		
8/13 5:30 P		2.75		2.57	13.7292		
8/14 7:30 A		2.07		1.93	14.3125		
8/14 10:30 A		2.06		1.93	14.4375		
8/14 1:30 P		2.05		1.92	14.5625		
8/14 4:30 P		2.06		1.93	14.6875		
8/14 8:00 P		1.03		0.963	14.8333		
8/15 7:30 A		0.73		0.682	15.3125		
8/15 1:30 P		0.72		0.673	15.5625		
8/15 4:30 P		0.370		0.346	15.6875		
8/15 8:00 P		0.355		0.332	15.8333		
8/15 10:30 P		0.373		0.349	15.9375		
8/16 7:30 A		0.36		0.336	16.3125		
8/16 10:30 A		0.35		0.327	16.4375		
8/16 1:30 P		0.355		0.332	16.5625		
8/16 4:30 P		0.33		0.308	16.6875		
8/16 8:00 P		0.315		0.294	16.8333		
8/17 7:30 A		0.285		0.266	17.3125		
8/17 11:00 A		0.29		0.271	17.4583		
8/17 1:30 P		0.260		0.243	17.5625		
8/17 4:30 P		0.255		0.238	17.6875		
8/17 7:30 P		0.255		0.238	17.8125		
8/18 7:30 A		0.240		0.224	18.3125		
8/18 10:30 A	↓	0.225		0.210	18.4375		
8/18 1:30 P	168	0.225		0.210	18.5625		
8/18 4:30 P	169	0.225		0.210	18.6875		
8/18 7:30 P		0.23		0.215	18.8125		
8/19 7:30 A	↓	0.20	↓	0.187	19.3125		
8/19 10:30 A	169	0.195	0.9346	0.182	19.4375		

