

# Lower Minnesota River Oxygen Dynamics Assessments

## Appendix A

### Reaeration Rate Coefficients



Table A1  
 Reaeration Rate Coefficients  
 Minnesota River  
 Minneapolis - St Paul, Minnesota  
 July 17-18, 2006

STATION	[DYE VAT] PPB	DYE INJECTION ML/SEC	STA [DYE] PPB	FLOW CFS	MILEPOINT	CUMULATIVE TRAVEL TIME HOURS	TEMP DEG C	KR/AR RATIOS
MR1	23700000000	1.21	4.35	2220.0	19.8	0.00	28.4	0.01125
MR2			3.80	2220.0	17.4	4.67	28.7	0.01108
MR3			3.65	2220.0	2.6	23.92	27.6	0.00561
MR4			3.65	2265.0	0.0	28.89	27.5	0.00485

Flows were determined from USGS gage at Jordan with flow from Blue Lake accrued.

REACH	DISTANCE MILES	TRAVEL TIME HOURS	VELOCITY FT/SEC	UPSTREAM FLOW CFS	UPSTREAM KR/AR RATIO CONC (UG/L)	DOWNSTREAM FLOW CFS	DOWNSTREAM KR/AR RATIO CONC (UG/L)	UPSTREAM TEMP DEG C	DOWNSTREAM TEMP DEG C	Kr DESORP RATE 1/DAY	Ka @ AMBIENT T 1/DAY	Ka @ 20 C 1/DAY
MR1-MR2	2.4	4.7	0.75	2220	0.01125	2220	0.011080	28.4	28.7	0.08	0.10	0.08
MR1-MR3	17.2	23.9	1.05	2220	0.01125	2220	0.005610	28.4	27.6	0.70	0.84	0.70
MR1-MR4	19.8	28.9	1.01	2220	0.01125	2265	0.004846	28.4	27.5	0.68	0.82	0.68
MR2-MR3	14.8	19.3	1.13	2220	0.01108	2220	0.005610	28.7	27.6	0.85	1.02	0.84
MR2-MR4	17.4	24.2	1.05	2220	0.01108	2265	0.004846	28.7	27.5	0.80	0.96	0.79
MR3-MR4	2.6	5.0	0.77	2220	0.00561	2265	0.004846	27.6	27.5	0.61	0.73	0.61

Ka value is not considered usable since the gas loss between MR1 to MR2 is not large enough.

$$[1] \quad Kr = 1/tt \ln ( (Qup * Kr/Ar up) / (Qdown * Kr/Ar down) ) = \text{day}^{-1}$$

$$[2] \quad Ka @ t = Kr / 0.83 = \text{day}^{-1}$$

$$[3] \quad Ka @ 20\text{deg C} = Ka @ t * ( 1.0241 ^ ( 20C - ( Tup + Tdown/2) ) )$$

Kr = desorption rate = 1/day

tt = travel time = days

Qup = flow at upstream station = cfs

Qdown = flow at downstream station = cfs

Kr/Ar up = krypton:argon ratio upstream= unitless

Kr/Ar down = krypton:argon ratio downstream= unitless

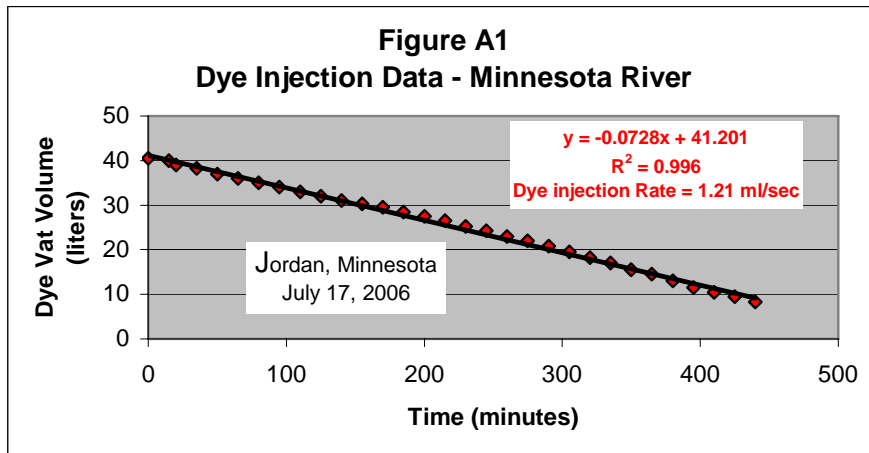
Ka @ t = reaeration rate coefficient at ambient temperature = 1/day

Ka @ 20 deg C = reaeration rate coefficient corrected to 20 degrees C = 1/day



Table A2  
Dye Injection Data  
Minnesota River  
17-Jul-06

DATE	TIME	CUM TIME (MIN)	DYE VOL (LITERS)
7/17/06	1040	0	40.5
	1055	15	40
	1100	20	39
	1115	35	38.25
	1130	50	37
	1145	65	36
	1200	80	35
	1215	95	34
	1230	110	33
	1245	125	32
	1300	140	31
	1315	155	30.25
	1330	170	29.5
	1345	185	28.5
	1400	200	27.5
	1415	215	26.5
	1430	230	25.25
	1445	245	24.25
	1500	260	23
	1515	275	22
	1530	290	20.75
	1545	305	19.5
	1600	320	18.25
	1615	335	17
	1630	350	15.5
	1645	365	14.5
	1700	380	13
	1715	395	11.5
	1730	410	10.5
	1745	425	9.5
	1800	440	8.25

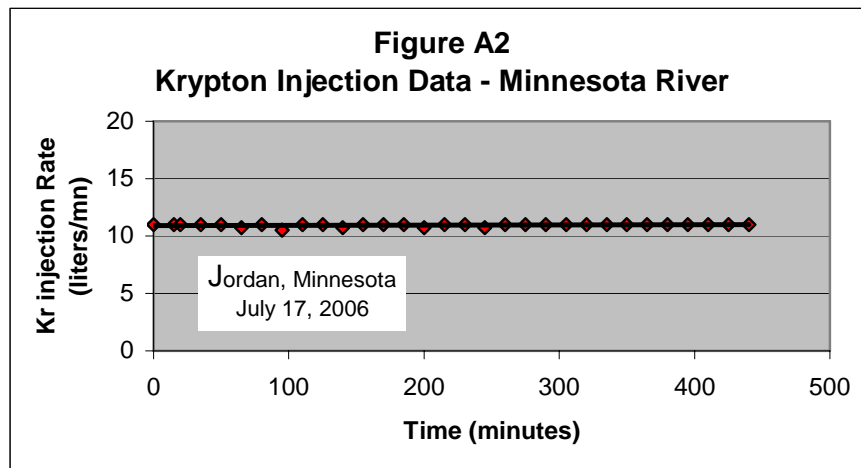


Rhodamine Wt Dye Injection Rate

1.21 ml/sec

Table A3  
 Noble Gas Krypton Injection Data  
 Minnesota River  
 17-Jul-06

DATE	TIME	Cumulative Time (minutes)	Krypton Injection (liters/min)
7/17/06	1040	0	11
	1055	15	11
	1100	20	11
	1115	35	11
	1130	50	11
	1145	65	10.75
	1200	80	11
	1215	95	10.5
	1230	110	11
	1245	125	11
	1300	140	10.75
	1315	155	11
	1330	170	11
	1345	185	11
	1400	200	10.75
	1415	215	11
	1430	230	11
	1445	245	10.75
	1500	260	11
	1515	275	11
	1530	290	11
	1545	305	11
	1600	320	11
	1615	335	11
	1630	350	11
	1645	365	11
	1700	380	11
	1715	395	11
	1730	410	11
	1745	425	11
	1800	440	11



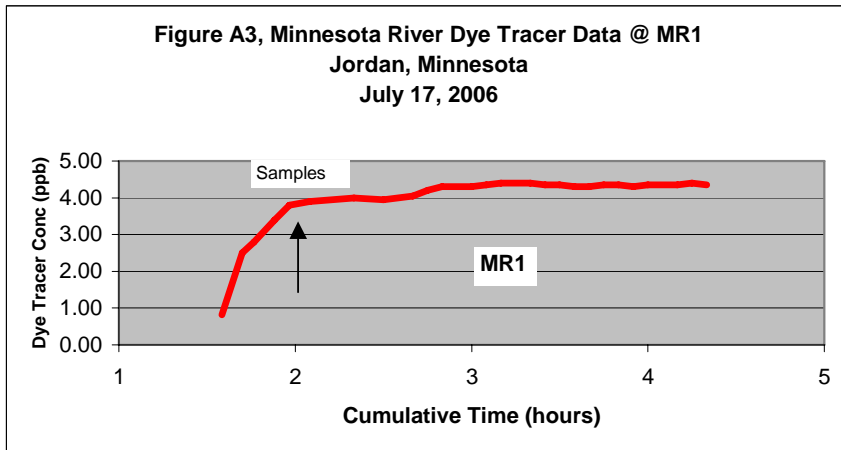
**Table A4, Krypton & Argon Analytical Results, Minnesota River Project, Minneapolis, Minnesota**

Date meas run letter		Ar	Kr	Ar/Kr		
38932 E	STD7	34595854	6373283	<b>5.43</b>		
38932 G	STD8	32819350	6236965	<b>5.26</b>		
38932 H	STD9	32829897	6193974	<b>5.30</b>		
38933 A	STD10	29719523	6455734	<b>4.60</b>		
38933 B	STD11	33356934	6012368	<b>5.55</b>		
38936 A	STD12	32428984	5528996	<b>5.87</b>		
38936 B	STD13	32343256	5431225	<b>5.96</b>		
38937 A	STD14	31013395	6443130	<b>4.81</b>		
38937 B	STD15	33757622	5872760	<b>5.75</b>	<b>AVG</b>	<b>SD</b>
38937 C	STD16	32499091	5764346	<b>5.64</b>	<b>5.42</b>	<b>0.44</b>

38931 H	MR-BKG-A	46904052	74124448						
38931 I	MR-BKG-B	46854066	71452813						
38932 I	MR-BKG-C	37682586	0						
38932 J	MR-BKG-D	68428103	68144	<b>1004.17</b>	<b>AVG</b>	<b>SD</b>	<b>AVG</b>	<b>SD</b>	<b>z=1.5 for n=4</b>
38932 K	MR-1-1430-A	41961435	510533	<b>82.19</b>	<b>86.92</b>	<b>5.16</b>			0.9
38932 L	MR-1-1430-B	38725688	416697	<b>92.93</b>					1.2
38932 M	MR-1-1430-C	40164561	483454	<b>83.08</b>					0.7
38932 N	MR-1-1430-D	44069101	492516	<b>89.48</b>					0.5
38932 O	MR-1-1500-A	64383386	437692	<b>147.10</b>	<b>104.88</b>	<b>28.38</b>	<b>90.81</b>	<b>4.50</b>	<b>1.5</b>
38932 P	MR-1-1500-B	40188256	457850	<b>87.78</b>					0.6
38932 Q	MR-1-1500-C	39102762	441014	<b>88.67</b>					0.6
38932 R	MR-1-1500-D	40294749	419804	<b>95.98</b>					0.3
38933 C	MR-2-1800-A	39741319	505150	<b>78.67</b>	<b>91.25</b>	<b>15.02</b>	<b>83.98</b>	<b>4.69</b>	0.8
38933 D	MR-2-1800-B	35138543	401306	<b>87.56</b>					0.2
38933 E	MR-2-1800-C	44773492	522372	<b>85.71</b>					0.4
38933 F	MR-2-1800-D	46503678	411399	<b>113.04</b>					<b>1.5</b>
38933 G	MR-2-1830-A	41658738	443155	<b>94.00</b>	<b>96.43</b>	<b>3.81</b>			0.6
38933 H	MR-2-1830-B	42281366	416520	<b>101.51</b>					1.3
38933 I	MR-2-1830-C	44361513	456631	<b>97.15</b>					0.2
38933 J	MR-2-1830-D	40680115	437171	<b>93.05</b>					0.9
38933 K	MR-3-1300-A	38414981	228211	<b>168.33</b>	<b>164.26</b>	<b>16.52</b>			0.2
38933 L	MR-3-1300-B	39679379	213674	<b>185.70</b>					1.3
38933 M	MR-3-1300-C	36083497	242839	<b>148.59</b>					0.9
38933 N	MR-3-1300-D	38285811	247937	<b>154.42</b>					0.6
38936 C	MR-3-1330-A	45302094	213739	<b>211.95</b>	<b>192.14</b>	<b>19.37</b>			1.0
38936 D	MR-3-1330-B	44817712	225996	<b>198.31</b>					0.3
38936 E	MR-3-1330-C	45140202	234490	<b>192.50</b>					0.0
38936 F	MR-3-1330-D	38056739	229569	<b>165.77</b>					1.4
38936 G	MR-4-1745-A	43815522	199912	<b>219.17</b>	<b>216.77</b>	<b>6.75</b>			0.4
38936 H	MR-4-1745-B	43862883	196797	<b>222.88</b>					0.9
38936 I	MR-4-1745-C	40061386	193383	<b>207.16</b>					1.4
38936 J	MR-4-1745-D	44061082	202227	<b>217.88</b>					0.2
38937 D	MR-4-1800-A	36464340	229951	<b>158.57</b>	<b>195.94</b>	<b>27.12</b>			1.4
38937 E	MR-4-1800-B	40758564	202168	<b>201.61</b>					0.2
38937 F	MR-4-1800-C	42464211	189955	<b>223.55</b>					1.0
38937 G	MR-4-1800-D	42973997	214852	<b>200.02</b>					0.2

**Table A5**  
**MR1 Dye Tracer Data for Minnesota River**  
**Jordan, Minnesota**  
**July 17, 2006**

Date	Time hrs	Cum Time min	Cum Time hrs	MR1
				Dye Tracer ppb
7/17/2006	1215	95	<b>1.58</b>	0.82
	1222	102	<b>1.70</b>	2.50
	1226	106	<b>1.77</b>	2.80
	1233	113	<b>1.88</b>	3.40
	1238	118	<b>1.97</b>	3.80
	<b>1245</b>	<b>125</b>	<b>2.08</b>	<b>3.90</b>
	1300	140	<b>2.33</b>	4.00
	1310	150	<b>2.50</b>	3.95
	1320	160	<b>2.67</b>	4.05
	1325	165	<b>2.75</b>	4.20
	1330	170	<b>2.83</b>	4.30
	1340	180	<b>3.00</b>	4.30
	1345	185	<b>3.08</b>	4.35
	1350	190	<b>3.17</b>	4.40
	1355	195	<b>3.25</b>	4.40
	1400	200	<b>3.33</b>	4.40
	1405	205	<b>3.42</b>	4.35
	1410	210	<b>3.50</b>	4.35
	1415	215	<b>3.58</b>	4.30
	1420	220	<b>3.67</b>	4.30
	1425	225	<b>3.75</b>	4.35
	1430	230	<b>3.83</b>	4.35
	1435	235	<b>3.92</b>	4.30
	1440	240	<b>4.00</b>	4.35
	1445	245	<b>4.08</b>	4.35
	1450	250	<b>4.17</b>	4.35
1455	255	<b>4.25</b>	4.40	
1500	260	<b>4.33</b>	4.35	



**Table A6**  
**MR2 Dye Tracer Data for Minnesota River**  
**Jordan, Minnesota**  
**July 17, 2006**

Date	Time hrs	Cum Time min	Cum Time hrs	MR2
				Dye Tracer ppb
7/17/2006	1545	305	<b>5.08</b>	1.80
	1550	310	<b>5.17</b>	2.20
	1555	315	<b>5.25</b>	2.40
	1600	320	<b>5.33</b>	2.65
	1605	325	<b>5.42</b>	2.65
	1610	330	<b>5.50</b>	2.80
	1615	335	<b>5.58</b>	3.05
	1620	340	<b>5.67</b>	3.05
	1625	345	<b>5.75</b>	3.10
	1630	350	<b>5.83</b>	3.20
	1635	355	<b>5.92</b>	3.30
	1640	360	<b>6.00</b>	3.35
	1645	365	<b>6.08</b>	3.35
	1650	370	<b>6.17</b>	3.40
	1655	375	<b>6.25</b>	3.50
	1700	380	<b>6.33</b>	3.55
	1705	385	<b>6.42</b>	3.60
	1710	390	<b>6.50</b>	3.60
	1715	395	<b>6.58</b>	3.65
	1720	400	<b>6.67</b>	3.70
	<b>1725</b>	<b>405</b>	<b>6.75</b>	<b>3.75</b>
	1730	410	<b>6.83</b>	3.80
	1735	415	<b>6.92</b>	3.80
	1740	420	<b>7.00</b>	3.80
	1745	425	<b>7.08</b>	3.80
	1750	430	<b>7.17</b>	3.80
	1755	435	<b>7.25</b>	3.80
	1800	440	<b>7.33</b>	3.80
	1805	445	<b>7.42</b>	3.80
	1810	450	<b>7.50</b>	3.80
1815	455	<b>7.58</b>	3.75	
1820	460	<b>7.67</b>	3.75	
1825	465	<b>7.75</b>	3.80	
1830	470	<b>7.83</b>	3.80	

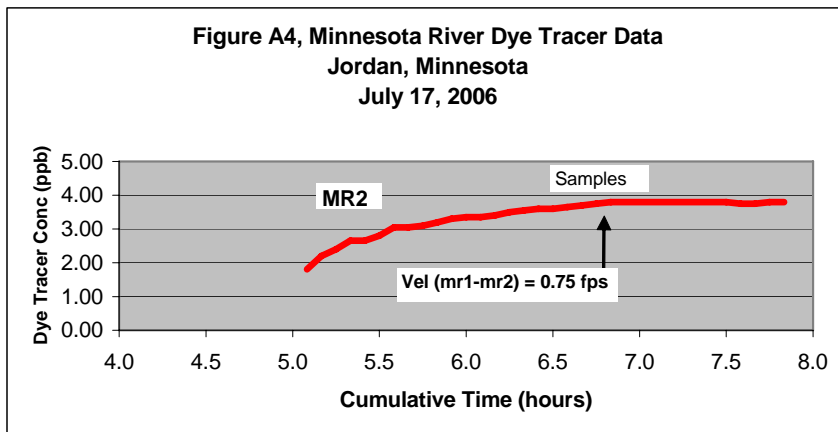
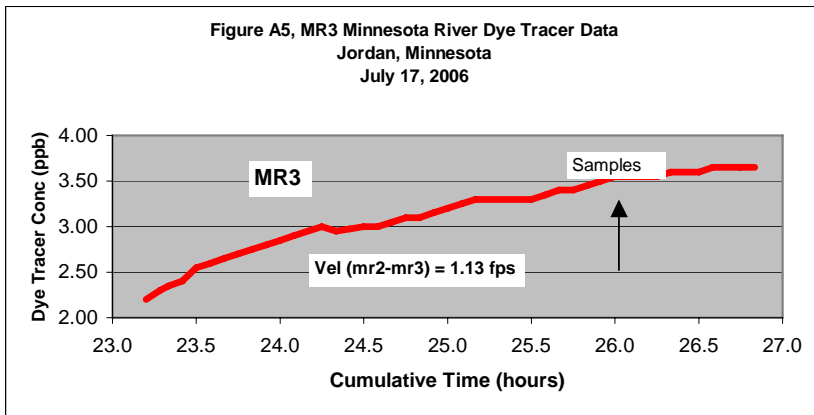


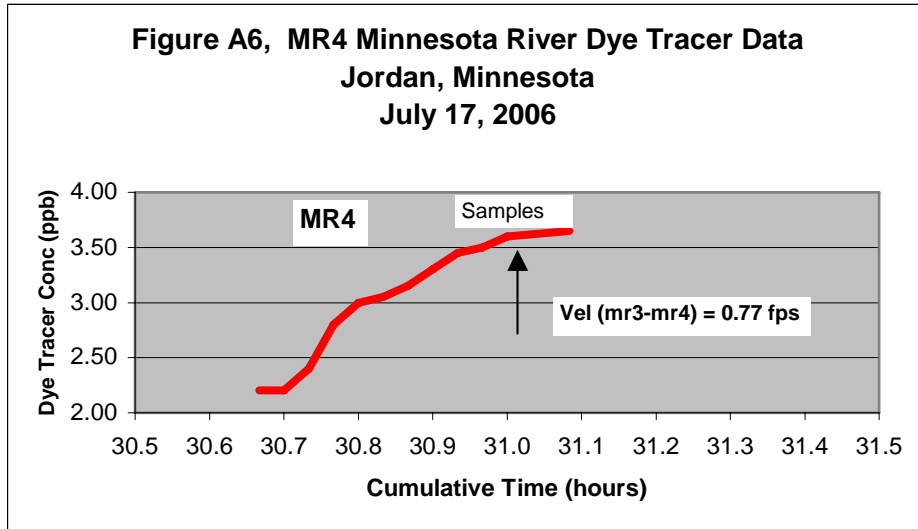
Table A7  
 MR3 Dye Tracer Data for Minnesota River  
 Jordan, Minnesota  
 July 18, 2006

Date	Time hrs	Cum Time min	Cum Time hrs	MR3
				Dye Tracer ppb
7/18/2006	952	1392	23.20	2.20
	957	1397	23.28	2.30
	1000	1400	23.33	2.35
	1005	1405	23.42	2.40
	1010	1410	23.50	2.55
	1015	1415	23.58	2.60
	1020	1420	23.67	2.65
	1025	1425	23.75	2.70
	1030	1430	23.83	2.75
	1035	1435	23.92	2.80
	1040	1440	24.00	2.85
	1045	1445	24.08	2.90
	1050	1450	24.17	2.95
	1055	1455	24.25	3.00
	1100	1460	24.33	2.95
	1105	1465	24.42	2.98
	1110	1470	24.50	3.00
	1115	1475	24.58	3.00
	1120	1480	24.67	3.05
	1125	1485	24.75	3.10
	1130	1490	24.83	3.10
	1135	1495	24.92	3.15
	1140	1500	25.00	3.20
	1145	1505	25.08	3.25
	1150	1510	25.17	3.30
	1155	1515	25.25	3.30
	1200	1520	25.33	3.30
	1205	1525	25.42	3.30
	1210	1530	25.50	3.30
	1215	1535	25.58	3.35
	1220	1540	25.67	3.40
	1225	1545	25.75	3.40
	1230	1550	25.83	3.45
	1235	1555	25.92	3.50
	1240	1560	26.00	3.55
	1245	1565	26.08	3.55
	1250	1570	26.17	3.55
	1255	1575	26.25	3.55
	1300	1580	26.33	3.60
	1305	1585	26.42	3.60
	1310	1590	26.50	3.60
	1315	1595	26.58	3.65
	1320	1600	26.67	3.65
	1325	1605	26.75	3.65
	1330	1610	26.83	3.65



**Table A8**  
**MR4 Dye Tracer Data for Minnesota River**  
**Jordan, Minnesota**  
**July 18,2006**

<b>MR4</b>				
Date	Time hrs	Cum Time min	Cum Time hrs	Dye Tracer ppb
7/18/2006	1720	1840	<b>30.67</b>	2.20
	1722	1842	<b>30.70</b>	2.20
	1724	1844	<b>30.73</b>	2.40
	1726	1846	<b>30.77</b>	2.80
	1728	1848	<b>30.80</b>	3.00
	1730	1850	<b>30.83</b>	3.05
	1732	1852	<b>30.87</b>	3.15
	1734	1854	<b>30.90</b>	3.30
	1736	1856	<b>30.93</b>	3.45
	<b>1738</b>	<b>1858</b>	<b>30.97</b>	<b>3.50</b>
	1740	1860	<b>31.00</b>	3.60
	1745	1865	<b>31.08</b>	3.65





**Table A9**  
**Reaeration Rate Coefficient Measurements**  
**Diffusion Dome Technique**  
**Minnesota River**  
**Minneapolis, Minnesota**  
**July 18-23, 2006**

**TEST CONDITIONS**

<u>TEST</u>	<u>SYSTEM</u>	<u>LOCATION</u>	<u>DATE</u>	<u>TEST</u>	<u>DOME</u>	<u>DOME</u>	<u>DEPTH</u>	<u>SALINITY</u>	<u>ALTITUDE</u>
<u>TEST</u>	TYPE			DURATION	VOLUME	CANTACT AREA	OF WATER	OF WATER	ABOVE SEALEVEL
				MINUTES	LITERS	SQUARE METERS	METERS	PPT	FEET
Float # 1	stream	20.0 to 18.7	7/18/2006	75	7	0.089	3.23	0	700
Float # 2	stream	15.5 to 14.6	7/20/2006	75	7	0.089	4.23	0	700
Float # 3	stream	12.0 to 10.0	7/20/2006	145	7	0.089	3.93	0	700
Float # 4	stream	8.8 to 8.6	7/21/2006	80	7	0.089	4.42	0	700
Float # 5	stream	7.4 to 6.5	7/21/2006	115	7	0.089	4.04	0	700
Float # 6	stream	21.0 to 18.7	7/22/2006	140	7	0.089	3.04	0	700
Float # 7	stream	5.0 to 0.0	7/23/2006	260	7	0.089	4.23	0	700

**FIELD DATA**

<u>TEST</u>	<u>DOME</u>	<u>DOME</u>	<u>DOME</u>	<u>DOME</u>	<u>DOME</u>	<u>DOME</u>	<u>AMBIENT</u>	<u>AMBIENT</u>	<u>AMBIENT</u>
	DO	DO	TEMP	TEMP	DO SATURATION	DO SATURATION	DO	TEMP	DO
<u>TEST</u>	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	AVERAGE	AVERAGE	SATURATION
	MG/L	MG/L	DEG C	DEG C	MG/L	MG/L	MG/L	DEG C	MG/L
Float # 1	5.75	5.87	27.70	27.70	7.67	7.67	9.51	27.54	7.69
Float # 2	4.50	4.56	25.00	25.80	8.05	7.93	6.33	25.63	7.96
Float # 3	4.72	5.32	27.30	26.30	7.72	7.86	7.49	26.80	7.79
Float # 4	5.47	5.72	26.20	26.00	7.87	7.90	7.33	26.00	7.90
Float # 5	5.65	5.76	26.40	26.50	7.85	7.83	7.63	26.57	7.82
Float # 6	5.69	5.77	24.30	25.10	8.16	8.04	7.90	24.80	8.08
Float # 7	6.54	7.02	25.40	27.20	7.99	7.73	8.91	26.53	7.83

**CALCULATIONS**

<u>TEST</u>	"V"	"D"	"K"	"K2"
	VOLUME OF OXYGEN	DIFFUSION	REAERATION	REAERATION RATE
<u>TEST</u>	ACCRUED IN DOME	RATE	CONSTANT	DOME METHOD
	LITERS	GM/M3/HR	GMM3/HR	/DAY (Base e)
Float # 1	0.0201	0.0798	0.21	<b>0.64</b>
Float # 2	0.0186	0.0564	0.20	<b>0.60</b>
Float # 3	0.0870	0.1470	0.45	<b>1.37</b>
Float # 4	0.0382	0.1042	0.44	<b>1.34</b>
Float # 5	0.0195	0.0404	0.16	<b>0.49</b>
Float # 6	0.0241	0.0545	0.20	<b>0.59</b>
Float # 7	0.1085	0.0950	0.40	<b>1.22</b>



**Table A9**  
**Reaeration Rate Coefficient Measurements**  
**Diffusion Dome Technique**  
**Minnesota River**  
**Minneapolis, Minnesota**  
**July 18-23, 2006**

**TEST CONDITIONS**

	<b>SYSTEM</b>	<b>LOCATION</b>	<b>DATE</b>	<b>TEST</b>	<b>DOME</b>	<b>DOME</b>	<b>DEPTH</b>	<b>SALINITY</b>	<b>ALTITUDE</b>
<b>TEST</b>	TYPE			DURATION	VOLUME	CANTACT AREA	OF WATER	OF WATER	ABOVE SEALEVEL
				MINUTES	LITERS	SQUARE METERS	METERS	PPT	FEET
Float # 1	stream	20.0 to 18.7	7/18/2006	75	7	0.089	3.23	0	700
Float # 2	stream	15.5 to 14.6	7/20/2006	75	7	0.089	4.23	0	700
Float # 3	stream	12.0 to 10.0	7/20/2006	145	7	0.089	3.93	0	700
Float # 4	stream	8.8 to 8.6	7/21/2006	80	7	0.089	4.42	0	700
Float # 5	stream	7.4 to 6.5	7/21/2006	115	7	0.089	4.04	0	700
Float # 6	stream	21.0 to 18.7	7/22/2006	140	7	0.089	3.04	0	700
Float # 7	stream	5.0 to 0.0	7/23/2006	260	7	0.089	4.23	0	700

**FIELD DATA**

	<b>DOME</b>	<b>DOME</b>	<b>DOME</b>	<b>DOME</b>	<b>DOME</b>	<b>DOME</b>	<b>AMBIENT</b>	<b>AMBIENT</b>	<b>AMBIENT</b>
	DO	DO	TEMP	TEMP	DO SATURATION	DO SATURATION	DO	TEMP	DO
<b>TEST</b>	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	AVERAGE	AVERAGE	SATURATION
	MG/L	MG/L	DEG C	DEG C	MG/L	MG/L	MG/L	DEG C	MG/L
Float # 1	5.75	5.87	27.70	27.70	7.67	7.67	9.51	27.54	7.69
Float # 2	4.50	4.56	25.00	25.80	8.05	7.93	6.33	25.63	7.96
Float # 3	4.72	5.32	27.30	26.30	7.72	7.86	7.49	26.80	7.79
Float # 4	5.47	5.72	26.20	26.00	7.87	7.90	7.33	26.00	7.90
Float # 5	5.65	5.76	26.40	26.50	7.85	7.83	7.63	26.57	7.82

**Figure A7, Diffusion Dome - Float #1**  
**Minnesota River**  
**Minneapolis, MN**

$y = 0.0197x + 74.791$   
 $R^2 = 0.9579$

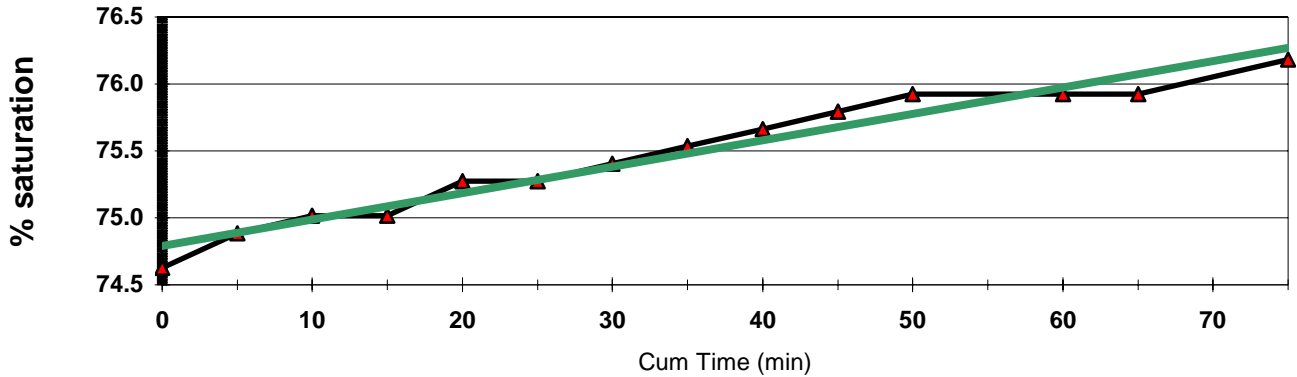


Table A11  
 Diffusion Dome Data - Float #2  
 Minnesota River  
 Minneapolis, Mn  
 20-Jul-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet	
7/20/2006	0	1000	4.54	8.27	54.89	24.1	5.94	25.5	0.1	14	
7/20/2006	5	1005	4.44	8.13	54.65	25.0	6.00	25.5			
7/20/2006	10	1010	4.38	7.98	54.87	25.9	6.08	25.5	1.0	15	
7/20/2006	15	1015	4.36	7.95	54.84	26.1	6.10	25.6			
7/20/2006	20	1020	4.39	7.98	55.00	25.9	6.23	25.5	0.5	12	
7/20/2006	25	1025	4.48	8.09	55.36	25.2	6.22	25.6			
7/20/2006	30	1030	4.51	8.14	55.40	24.9	6.18	25.6	0.2	12	
7/20/2006	35	1035	4.50	8.13	55.38	25.0	6.20	25.6			
7/20/2006	40	1040	4.46	8.05	55.44	25.5	6.11	25.5	0.1	12	
7/20/2006	45	1045	4.44	8.01	55.41	25.7	6.17	25.5			
7/20/2006	50	1050	4.44	8.01	55.41	25.7	6.16	25.5	0.8	11	
7/20/2006	60	1100	4.48	8.05	55.68	25.5	6.23	25.6			
7/20/2006	65	1105	4.48	8.03	55.79	25.6	6.29	25.6	1.2	13	
7/20/2006	70	1110	4.47	8.00	55.89	25.8	6.55	25.7			
7/20/2006	75	1115	4.47	8.01	55.78	25.7	6.39	25.6	2.0	10	
7/20/2006	80	1120	4.51	8.01	56.28	25.7	6.36	25.7			
7/20/2006	85	1125	4.52	8.01	56.40	25.7	6.25	25.6	0.1	15	
7/20/2006	90	1130	4.52	8.01	56.40	25.7	6.25	25.6			
7/20/2006	100	1140	4.53	8.01	56.53	25.7	6.46	25.7	0.8	24	
7/20/2006	105	1145	4.53	8.00	56.64	25.8	6.56	25.7			
7/20/2006	110	1150	4.56	8.00	57.02	25.8	6.65	25.9	0.5	12	
						Averages	25.6	6.33	25.6	0.8	13.9

Averages

Shaded area represents the data used for the calculation

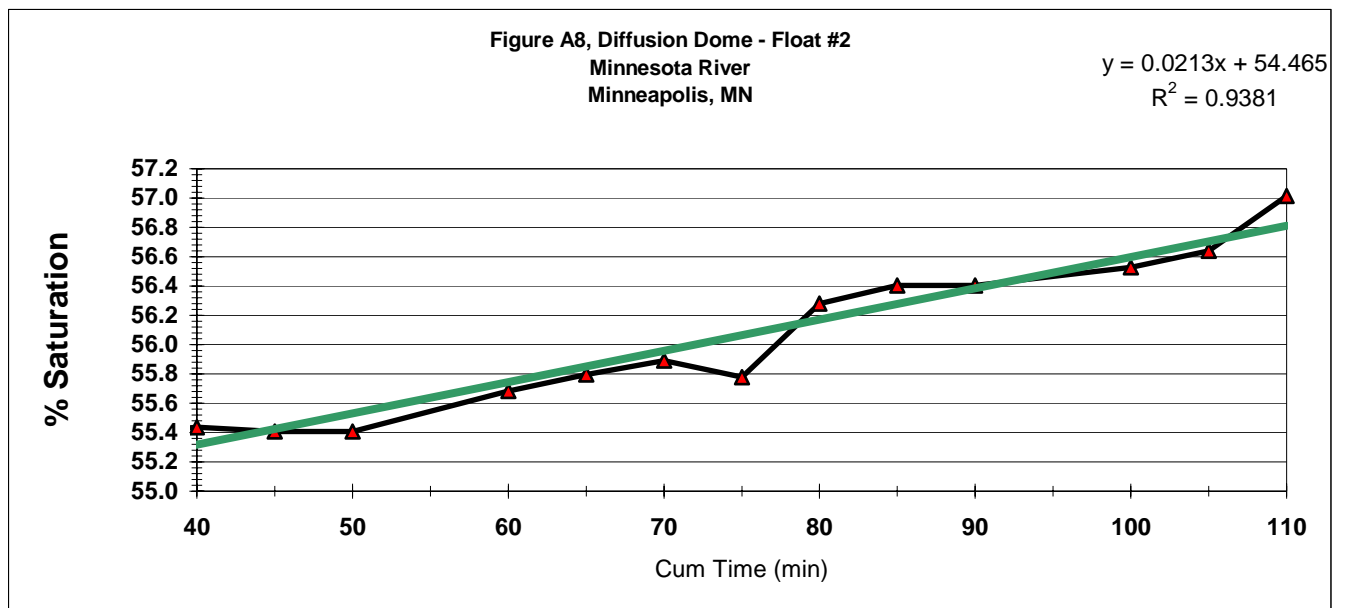


Table A12  
 Diffusion Dome Data - Float #3  
 Minnesota River  
 Minneapolis, Mn  
 20-Jul-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
7/20/2006	0	1250	4.99	7.98	62.51	25.9	6.56	26.2	1.5	13
7/20/2006	5	1255	4.76	7.74	61.54	27.5	6.52	26.3		
7/20/2006	10	1300	4.72	7.77	60.78	27.3	6.59	26.4	1.2	10
7/20/2006	15	1305	4.81	7.86	61.21	26.7	6.72	26.3		
7/20/2006	20	1310	4.94	7.94	62.25	26.2	6.71	26.2	0.3	13
7/20/2006	25	1315	4.96	7.95	62.38	26.1	6.92	26.4		
7/20/2006	30	1320	4.94	7.89	62.62	26.5	6.97	26.5	1.1	13
7/20/2006	35	1325	4.89	7.83	62.48	26.9	6.93	26.4		
7/20/2006	40	1330	4.91	7.86	62.49	26.7	7.14	26.4	0.4	12
7/20/2006	45	1335	4.91	7.84	62.61	26.8	7.11	26.4		
7/20/2006	50	1340	4.91	7.81	62.86	27.0	7.54	26.8	1.8	12
7/20/2006	55	1345	4.87	7.75	62.83	27.4	7.69	27.1		8
7/20/2006	60	1350	4.86	7.75	62.70	27.4	7.45	26.9	0.4	13
7/20/2006	65	1355	4.92	7.80	63.11	27.1	7.56	26.7		8
7/20/2006	70	1400	5.01	7.90	63.38	26.4	7.71	26.7	0.2	12
7/20/2006	75	1405	5.10	7.98	63.89	25.9	7.69	26.6		
7/20/2006	80	1410	5.07	7.90	64.14	26.4	7.83	26.8	0.5	15
7/20/2006	85	1415	5.00	7.81	64.01	27.0	7.84	26.7		
7/20/2006	90	1420	4.98	7.81	63.75	27.0	7.52	26.7	1.5	16
7/20/2006	100	1430	5.04	7.80	64.65	27.1	8.00	27.0		
7/20/2006	105	1435	5.08	7.84	64.78	26.8	7.79	27.1	0.1	17
7/20/2006	110	1440	5.16	7.89	65.41	26.5	7.61	27.0		
7/20/2006	115	1445	5.15	7.89	65.28	26.5	8.01	27.1	1.1	14
7/20/2006	120	1450	5.11	7.81	65.42	27.0	8.08	27.4		
7/20/2006	125	1455	5.08	7.78	65.29	27.2	7.68	27.1	1.1	13
7/20/2006	130	1500	5.10	7.81	65.29	27.0	7.59	26.8		
7/20/2006	135	1505	5.23	7.87	66.43	26.6	7.32	26.8	2.0	18
7/20/2006	140	1510	5.26	7.92	66.42	26.3	7.58	26.8		
7/20/2006	145	1515	5.28	7.95	66.41	26.1	7.60	26.9	0.2	13
7/20/2006	150	1520	5.35	8.00	66.89	25.8	8.06	27.0		
7/20/2006	155	1525	5.32	7.92	67.17	26.3	7.87	27.0	2.1	
							7.49	26.8	0.9	12.9

Averages

Shaded area represents the data used for the calculation

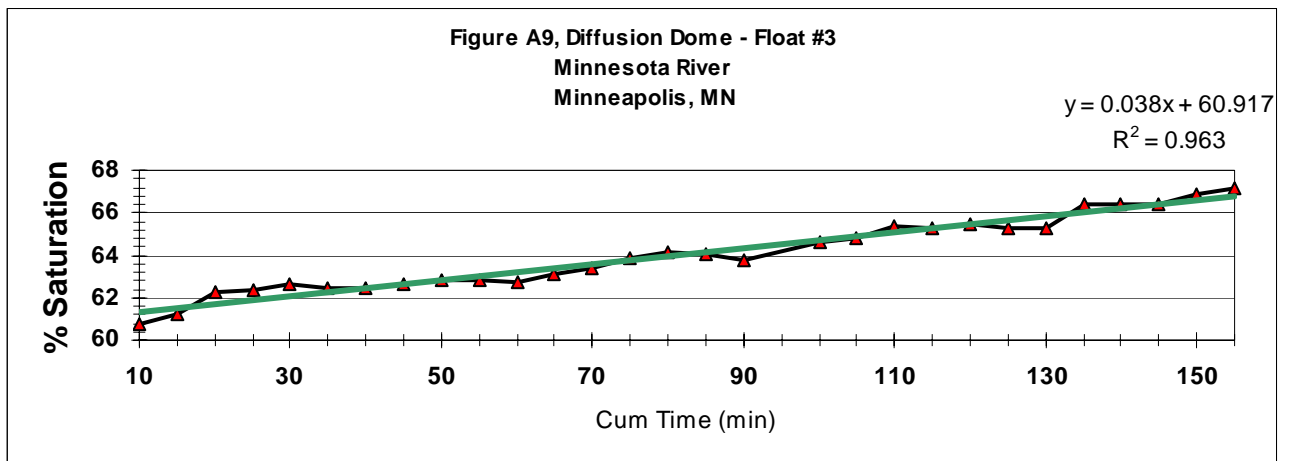


Table A13  
 Diffusion Dome Data - Float #4  
 Minnesota River  
 Minneapolis, Mn  
 21-Jul-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
7/21/2006	0	1140	5.42	7.94	68.30	26.2	7.10	26.0	3.9	12
7/21/2006	5	1145	5.47	7.94	68.93	26.2	6.83	25.9		
7/21/2006	10	1150	5.46	7.92	68.94	26.3	6.98	25.9	2.4	14
7/21/2006	15	1155	5.50	7.94	69.31	26.2	7.14	26.0		
7/21/2006	20	1200	5.50	7.92	69.45	26.3	7.32	26.0	2.2	15
7/21/2006	25	1205	5.54	7.95	69.68	26.1	7.40	26.0		
7/21/2006	30	1210	5.55	7.94	69.94	26.2	7.32	26.0	2.2	13
7/21/2006	35	1215	5.55	7.94	69.94	26.2	7.49	26.0		
7/21/2006	40	1220	5.55	7.92	70.08	26.3	7.55	26.1	3	12
7/21/2006	45	1225	5.58	7.95	70.18	26.1	7.30	26.0		
7/21/2006	50	1230	5.61	7.95	70.56	26.1	7.32	26.0	2.8	14
7/21/2006	60	1240	5.64	7.95	70.94	26.1	7.50	26.0		
7/21/2006	65	1245	5.65	7.95	71.06	26.1	7.58	26.0	2.9	16
7/21/2006	70	1250	5.68	7.98	71.16	25.9	7.37	26.0		
7/21/2006	75	1255	5.70	7.97	71.55	26.0	7.35	26.0	2.3	13
7/21/2006	80	1300	5.70	7.97	71.55	26.0	7.22	26.1		
7/21/2006	85	1305	5.72	7.97	71.80	26.0	7.54	26.0	2.9	19
Averages							7.33	26.0	2.6	14.5

Shaded area represents the data used for the calculation

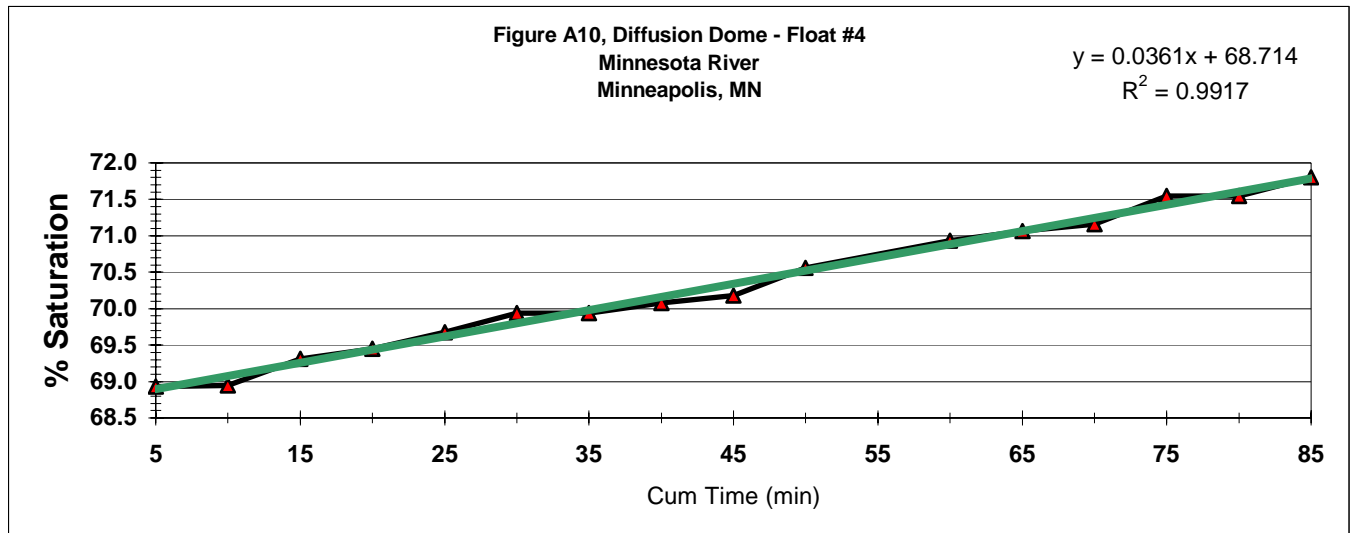


Table A14  
 Diffusion Dome Data - Float #5  
 Minnesota River  
 Minneapolis, Mn  
 21-Jul-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
7/21/2006	0	1320	6.13	8.29	73.96	24.0	7.11	26.6	1.3	13
7/21/2006	5	1325	5.80	8.06	71.95	25.4	7.13	26.7		
7/21/2006	10	1330	5.70	7.97	71.55	26.0	7.24	26.6	0.2	12
7/21/2006	15	1335	5.65	7.90	71.48	26.4	7.22	26.7		
7/21/2006	20	1340	5.64	7.89	71.50	26.5	7.32	26.7	2.2	13
7/21/2006	25	1345	5.63	7.87	71.51	26.6	7.35	26.5		
7/21/2006	30	1350	5.64	7.89	71.50	26.5	7.33	26.5	1.8	13
7/21/2006	35	1355	5.64	7.87	71.64	26.6	7.43	26.4		
7/21/2006	40	1400	5.66	7.89	71.75	26.5	7.43	26.5	1.8	13
7/21/2006	45	1405	5.67	7.89	71.88	26.5	7.49	26.6		
7/21/2006	50	1410	5.67	7.87	72.02	26.6	7.61	26.6	1.2	13
7/21/2006	55	1415	5.66	7.86	72.03	26.7	7.53	26.7		
7/21/2006	60	1420	5.66	7.84	72.17	26.8	7.61	26.7	1.3	13
7/21/2006	65	1425	5.65	7.84	72.04	26.8	7.62	26.7		
7/21/2006	70	1430	5.66	7.84	72.17	26.8	7.66	26.6	1.5	13
7/21/2006	75	1435	5.66	7.84	72.17	26.8	7.64	26.6		
7/21/2006	80	1440	5.68	7.86	72.29	26.7	7.66	26.5	0.6	14
7/21/2006	85	1445	5.68	7.84	72.43	26.8	7.82	26.6		
7/21/2006	90	1450	5.67	7.83	72.44	26.9	7.49	26.5	0.4	14
7/21/2006	95	1455	5.73	7.89	72.64	26.5	8.12	26.5		
7/21/2006	100	1500	5.73	7.89	72.64	26.5	8.12	26.6	0.1	13
7/21/2006	105	1505	5.71	7.84	72.81	26.8	8.26	26.6		
7/21/2006	110	1510	5.70	7.84	72.68	26.8	7.91	26.5	0.3	14
7/21/2006	115	1515	5.73	7.89	72.64	26.5	7.83	26.5		
7/21/2006	125	1525	5.78	7.90	73.13	26.4	7.72	26.6	0.5	13
7/21/2006	130	1530	5.76	7.89	73.02	26.5	7.37	26.4	0.8	13
							7.63	26.6	1.0	13.25

Averages

Shaded area represents the data used for the calculation

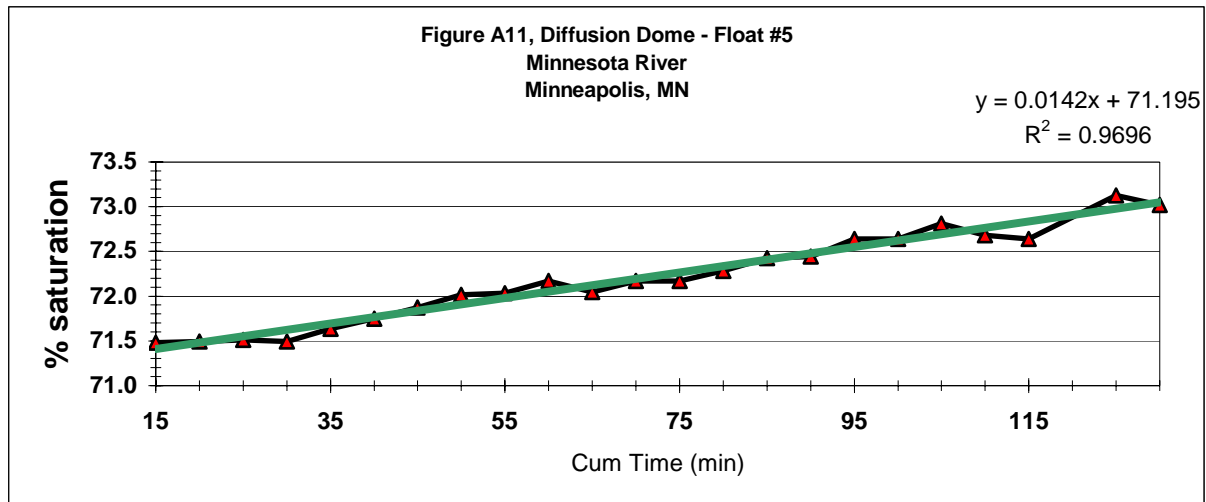


Table A15  
 Diffusion Dome Data - Float #6  
 Minnesota River  
 Minneapolis, Mn  
 22-Jul-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
7/22/2006	0	910	6.40	8.47	75.54	22.9	7.61	24.6		
7/22/2006	5	915	6.29	8.37	75.14	23.5	7.50	24.7	0.1	8
7/22/2006	10	920	6.60	9.16	72.05	19.1	7.41	24.7		
7/22/2006	15	925	6.10	8.72	69.99	21.5	7.52	24.7	0.8	6.0
7/22/2006	20	930	5.87	8.46	69.43	23.0	7.48	24.7		
7/22/2006	25	935	5.74	8.30	69.12	23.9	7.46	24.7	1.2	7
7/22/2006	30	940	5.69	8.24	69.07	24.3	7.59	24.7		
7/22/2006	35	945	5.68	8.21	69.22	24.5	7.57	24.7		
7/22/2006	40	950	5.68	8.19	69.36	24.6	7.68	24.8	1.8	7
7/22/2006	45	955	5.67	8.17	69.37	24.7	7.66	24.8		
7/22/2006	50	1000	5.68	8.17	69.49	24.7	7.66	24.8		
7/22/2006	55	1005	5.68	8.16	69.63	24.8	7.63	24.8	0.2	10
7/22/2006	60	1010	5.68	8.16	69.63	24.8	7.68	24.8		
7/22/2006	65	1015	5.68	8.16	69.63	24.8	7.85	24.8	0.0	15
7/22/2006	70	1020	5.70	8.16	69.88	24.8	7.66	24.7		
7/22/2006	75	1025	5.71	8.17	69.86	24.7	7.70	24.7	0.3	13
7/22/2006	80	1030	5.70	8.14	70.02	24.9	8.22	25.0		
7/22/2006	85	1035	5.69	8.14	69.89	24.9	7.82	24.8	0.1	8
7/22/2006	90	1040	5.74	8.17	70.23	24.7	7.75	24.8		
7/22/2006	95	1045	5.76	8.21	70.19	24.5	7.86	24.8	0.2	8
7/22/2006	100	1050	5.74	8.17	70.23	24.7	7.86	24.8		
7/22/2006	105	1055	5.72	8.16	70.12	24.8	7.74	24.8		
7/22/2006	110	1100	5.73	8.14	70.38	24.9	7.94	24.8	1.2	8
7/22/2006	115	1105	5.72	8.14	70.26	24.9	7.93	24.8		
7/22/2006	120	1110	5.72	8.14	70.26	24.9	7.96	24.9	0.2	10
7/22/2006	125	1115	5.72	8.14	70.26	24.9	7.96	24.8		
7/22/2006	130	1120	5.74	8.14	70.51	24.9	7.97	24.8	0.2	10
7/22/2006	135	1125	5.72	8.11	70.54	25.1	8.08	24.9		
7/22/2006	140	1130	5.82	8.21	70.93	24.5	8.14	24.9	0.6	9
7/22/2006	145	1135	5.77	8.16	70.73	24.8	8.16	24.9		
7/22/2006	150	1140	5.75	8.13	70.77	25.0	8.20	25.0	0.3	8
7/22/2006	155	1145	5.74	8.11	70.79	25.1	8.19	24.9		
7/22/2006	160	1150	5.75	8.11	70.91	25.1	8.22	25.0	1.6	14
7/22/2006	165	1155	5.76	8.11	71.03	25.1	8.15	25.0		
7/22/2006	170	1200	5.77	8.11	71.16	25.1	8.21	25.0		
							7.90	24.8	0.6	10.0

Averages

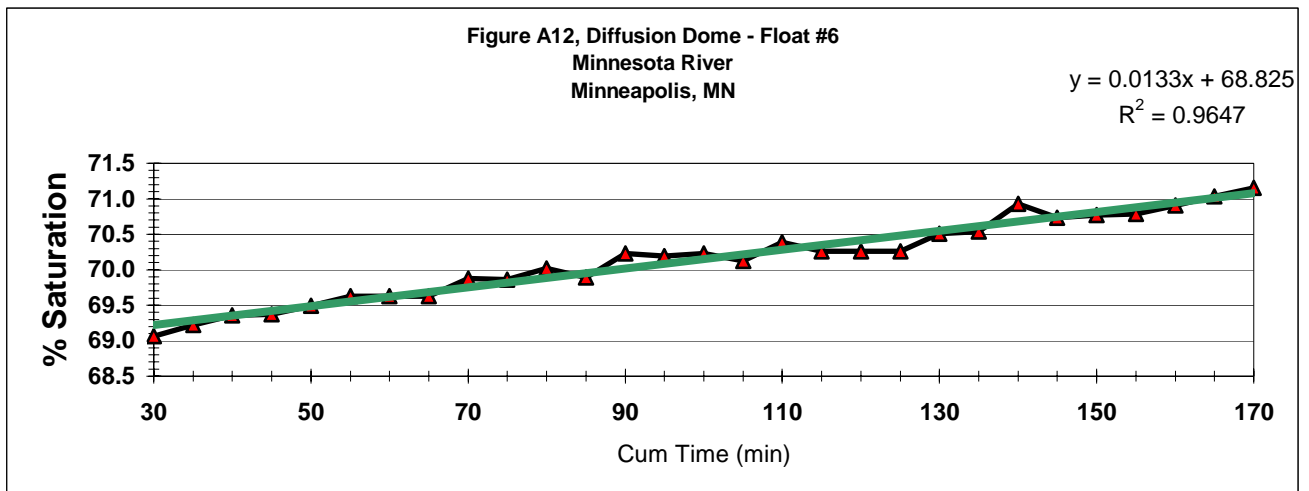
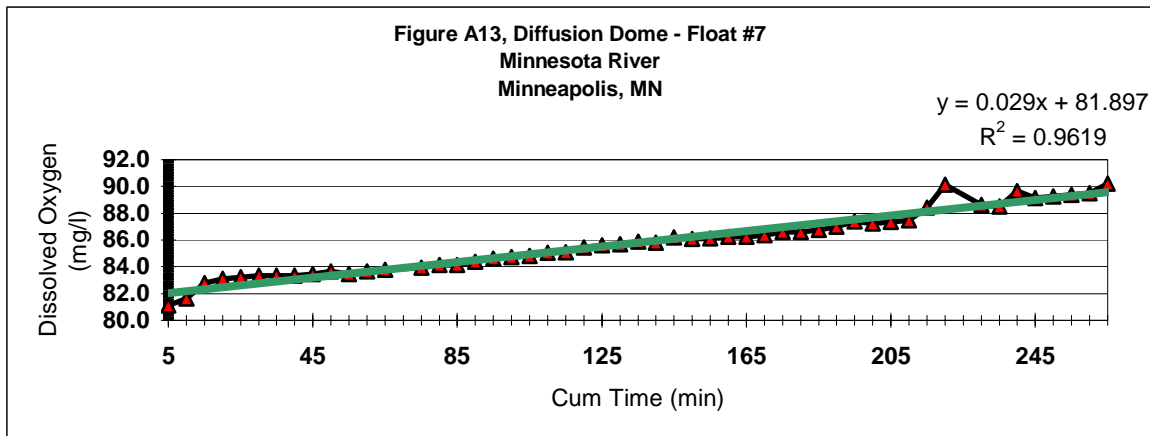


Table A16  
 Diffusion Dome Data - Float #7  
 Minnesota River  
 Minneapolis, Mn  
 23-Jul-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
7/23/2006	0	1000	6.86	8.35	82.12	23.6	8.54	25.9	1	10
7/23/2006	5	1005	6.54	8.06	81.13	25.4	8.83	26.3		
7/23/2006	10	1010	6.54	8.01	81.61	25.7	8.95	26.3	0.4	12
7/23/2006	15	1015	6.62	8.00	82.77	25.8	8.33	26.0		
7/23/2006	20	1020	6.62	7.97	83.10	26.0	8.94	26.2		
7/23/2006	25	1025	6.63	7.97	83.22	26.0	8.36	26.2	0.5	15
7/23/2006	30	1030	6.64	7.97	83.35	26.0	8.41	26.0		
7/23/2006	35	1035	6.64	7.97	83.35	26.0	8.18	26.0	0.5	18
7/23/2006	40	1040	6.64	7.97	83.35	26.0	8.18	26.0		
7/23/2006	45	1045	6.65	7.97	83.47	26.0	8.34	26.0	0.9	14
7/23/2006	50	1050	6.65	7.95	83.64	26.1	8.35	26.1		
7/23/2006	55	1055	6.65	7.97	83.47	26.0	8.52	26.1	1.3	15
7/23/2006	60	1100	6.65	7.95	83.64	26.1	8.40	26.3		
7/23/2006	65	1105	6.66	7.95	83.76	26.1	8.56	26.3	1	14
7/23/2006	75	1115	6.66	7.94	83.93	26.2	8.76	26.4		
7/23/2006	80	1120	6.65	7.90	84.13	26.4	8.50	26.4	1.9	13
7/23/2006	85	1125	6.65	7.90	84.13	26.4	8.68	26.3		
7/23/2006	90	1130	6.67	7.90	84.39	26.4	8.54	26.3	1.4	12
7/23/2006	95	1135	6.66	7.87	84.59	26.6	9.23	26.5		
7/23/2006	100	1140	6.67	7.87	84.72	26.6	9.09	26.4	1	16
7/23/2006	105	1145	6.69	7.89	84.81	26.5	8.70	26.4		
7/23/2006	110	1150	6.71	7.89	85.06	26.5	7.94	26.1	0.2	17
7/23/2006	115	1155	6.74	7.92	85.10	26.3	8.03	26.1	0.2	15
7/23/2006	120	1200	6.78	7.94	85.44	26.2	8.47	26.0	1.1	12
7/23/2006	125	1205	6.78	7.92	85.61	26.3	8.37	26.3		
7/23/2006	130	1210	6.80	7.94	85.69	26.2	8.45	26.2	0.5	13
7/23/2006	135	1215	6.80	7.92	85.86	26.3	9.16	26.5		
7/23/2006	140	1220	6.81	7.94	85.82	26.2	9.14	26.8	0.2	10
7/23/2006	145	1225	6.80	7.89	86.20	26.5	9.30	26.7		
7/23/2006	150	1230	6.79	7.89	86.07	26.5	9.14	26.7	0.6	8
7/23/2006	155	1235	6.78	7.87	86.12	26.6	8.72	26.5		
7/23/2006	160	1240	6.79	7.87	86.24	26.6	9.30	26.7	0.2	15
7/23/2006	165	1245	6.79	7.87	86.24	26.6	9.08	26.8		
7/23/2006	170	1250	6.80	7.87	86.37	26.6	9.27	26.8		
7/23/2006	175	1255	6.83	7.89	86.58	26.5	9.27	26.8	1.7	17
7/23/2006	180	1300	6.83	7.89	86.58	26.5	9.14	26.8		
7/23/2006	185	1305	6.83	7.87	86.75	26.6	9.49	27.0	2.3	16





**Table A17**  
**Reaeration Rate Coefficient Measurements**  
**Diffusion Dome Technique**  
**Minnesota River**  
**Minneapolis, Minnesota**  
**August 31- September 4, 2006**

**CONDITIONS**

	<b>SYSTEM</b>	<b>LOCATION</b>	<b>DATE</b>	<b>TEST</b>	<b>DOME</b>	<b>DOME</b>	<b>DEPTH</b>	<b>SALINITY</b>	<b>ALTITUDE</b>
<b>TEST</b>	TYPE	milepoint		DURATION	VOLUME	CANTACT AREA	OF WATER	OF WATER	ABOVE SEALEVEL
				MINUTES	LITERS	SQUARE METERS	METERS	PPT	FEET
Float # 1	stream	4.5 to 2.8	8/31/2006	155	7	0.089	4.15	0	700
Float # 2	stream	1.1 to 0.9	8/31/2006	105	7	0.089	4.03	0	700
Float # 3	stream	16.0 to 15.7	9/01/2006	75	7	0.089	4.03	0	700
Float # 4	stream	10.4 to 10.3	9/02/2006	100	7	0.089	3.57	0	700
Float # 5	stream	9.4 to 9.2	9/02/2006	90	7	0.089	3.55	0	700
Float # 6	stream	39.6 to 38.7	9/03/2006	60	7	0.089	1.70	0	700
Float # 7	stream	19.2 to 15.9	9/04/2006	225	7	0.089	3.50	0	700

**FIELD DATA**

	<b>DOME</b>	<b>DOME</b>	<b>DOME</b>	<b>DOME</b>	<b>DOME</b>	<b>DOME</b>	<b>AMBIENT</b>	<b>AMBIENT</b>	<b>AMBIENT</b>
	DO	DO	TEMP	TEMP	DO SATURATION	DO SATURATION	DO	TEMP	DO
<b>TEST</b>	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	AVERAGE	AVERAGE	SATURATION
	MG/L	MG/L	DEG C	DEG C	MG/L	MG/L	MG/L	DEG C	MG/L
Float # 1	4.77	4.82	23.6	25.2	8.26	8.02	7.33	24.31	8.15
Float # 2	5.85	5.97	25.0	25.4	8.05	7.99	7.99	25.29	8.01
Float # 3	5.51	5.57	22.8	23.4	8.39	8.29	8.10	26.74	7.80
Float # 4	3.55	3.62	22.4	23.6	8.45	8.26	7.30	23.30	8.31
Float # 5	6.95	7.08	23.9	23.5	8.22	8.28	7.52	23.42	8.29
Float # 6	4.83	4.92	20.8	21.1	8.72	8.67	7.28	21.21	8.65
Float # 7	2.42	2.59	20.5	20.9	8.77	8.70	6.27	20.23	8.82

**CALCULATIONS**

		<b>"V"</b>			<b>"D"</b>	<b>"K"</b>			<b>"K2"</b>
		VOLUME OF OXYGEN			DIFFUSION	REAERATION			REAERATION RATE
<b>TEST</b>		ACCRUED IN DOME			RATE	CONSTANT			DOME METHOD
		LITERS			GM/M3/HR	GM/M3/HR			/DAY (Base e)
Float # 1		0.0268			0.0401	0.12			<b>0.34</b>
Float # 2		0.0252			0.0574	0.22			<b>0.66</b>
Float # 3		0.0175			0.0557	0.18			<b>0.54</b>
Float # 4		0.0216			0.0582	0.11			<b>0.33</b>
Float # 5		0.0138			0.0415	0.62			<b>1.79</b>
Float # 6		0.0174			0.1639	0.50			<b>1.38</b>
Float # 7		0.0284			0.0347	0.06			<b>0.16</b>



Table A18  
 Diffusion Dome Data - Float #1  
 Minnesota River  
 Minneapolis, Mn  
 31-Aug-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
8/31/2006	0	935	4.91	8.44	58.19	23.1	6.60	23.80	1.8	13
8/31/2006	10	945	4.80	8.39	57.23	23.4	6.59	23.90		
8/31/2006	15	950	4.77	8.35	57.10	23.6	7.22	23.90	3.6	15
8/31/2006	20	955	4.77	8.32	57.33	23.8	7.32	24.00		
8/31/2006	25	1000	4.77	8.32	57.33	23.8	6.91	23.90	1.4	12
8/31/2006	30	1005	4.77	8.29	57.55	24.0	7.32	24.00		
8/31/2006	35	1010	4.71	8.19	57.51	24.6	6.84	23.90	1.6	11
8/31/2006	40	1015	4.71	8.22	57.28	24.4	6.96	24.00		
8/31/2006	45	1020	4.72	8.22	57.41	24.4	6.86	23.90	2.8	13
8/31/2006	50	1025	4.75	8.25	57.54	24.2	7.06	24.10		
8/31/2006	55	1030	4.76	8.25	57.66	24.2	6.93	24.20	1.6	13
8/31/2006	60	1035	4.77	8.25	57.78	24.2	7.19	24.20		
8/31/2006	65	1040	4.79	8.22	58.26	24.4	6.59	24.10		
8/31/2006	70	1045	4.74	8.22	57.65	24.4	6.71	24.10	0.4	12
8/31/2006	75	1050	4.76	8.24	57.78	24.3	6.78	24.30		
8/31/2006	80	1055	4.78	8.24	58.02	24.3	7.68	24.40	1.0	13
8/31/2006	85	1100	4.78	8.22	58.14	24.4	7.47	24.30		
8/31/2006	90	1105	4.77	8.21	58.13	24.5	7.40	24.30		
8/31/2006	95	1110	4.77	8.21	58.13	24.5	6.98	24.30	0.3	11
8/31/2006	100	1115	4.79	8.21	58.37	24.5	7.89	24.50		
8/31/2006	110	1125	4.78	8.17	58.48	24.7	7.78	24.50		
8/31/2006	115	1130	4.77	8.14	58.59	24.9	8.17	24.80	0.3	13
8/31/2006	120	1135	4.76	8.14	58.47	24.9	7.40	24.40		
8/31/2006	125	1140	4.78	8.16	58.60	24.8	7.74	24.60	0.4	17
8/31/2006	130	1145	4.78	8.14	58.71	24.9	7.12	24.40		
8/31/2006	140	1155	4.80	8.16	58.84	24.8	7.18	24.50	0.2	19
8/31/2006	145	1200	4.81	8.16	58.97	24.8	7.53	24.70		
8/31/2006	155	1210	4.81	8.14	59.08	24.9	7.50	24.60	0.2	15
8/31/2006	160	1215	4.82	8.14	59.21	24.9	8.04	24.70		
8/31/2006	165	1220	4.82	8.11	59.44	25.1	7.78	24.60	2.4	14
8/31/2006	170	1225	4.82	8.09	59.56	25.2	8.32	24.80		
						24.5	7.33	24.31	1.2	13.7

Averages

Shaded area represents the data used for the calculation

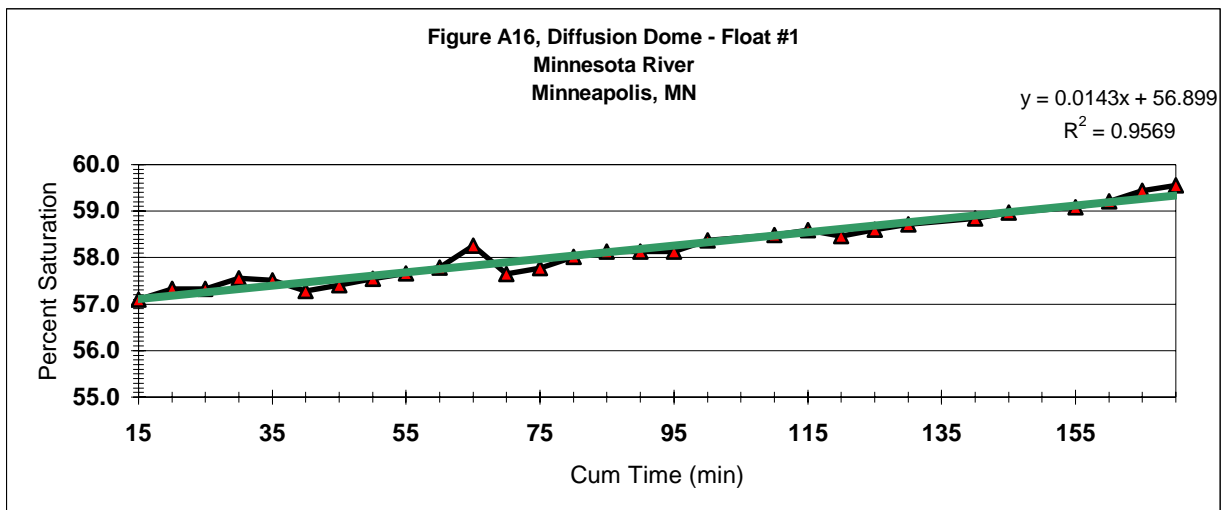


Table A19  
 Diffusion Dome Data - Float #2  
 Minnesota River  
 Minneapolis, Mn  
 31-Aug-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
8/31/2006	0	1310	5.97	8.16	73.19	24.8	7.84	25.0		
8/31/2006	5	1315	5.83	8.05	72.46	25.5	7.02	25.0		
8/31/2006	10	1320	5.73	8.03	71.36	25.6	7.29	24.9	1.5	17
8/31/2006	15	1330	5.88	8.14	72.23	24.9	6.25	24.6		
8/31/2006	20	1335	5.90	8.17	72.19	24.7	6.26	24.6	0.7	14
8/31/2006	30	1340	5.91	8.14	72.59	24.9	7.63	25.4		
8/31/2006	35	1345	5.85	8.13	72.00	25.0	7.46	25.0	1.2	14
8/31/2006	40	1350	5.80	8.08	71.81	25.3	7.48	25.2		
8/31/2006	45	1355	5.81	8.08	71.93	25.3	7.46	25.3	1.4	12
8/31/2006	50	1400	5.80	8.05	72.09	25.5	7.53	25.1		
8/31/2006	55	1405	5.80	8.05	72.09	25.5	7.71	25.3	3.7	12
8/31/2006	65	1415	5.78	8.03	71.99	25.6	7.55	25.3		
8/31/2006	75	1425	5.80	8.00	72.52	25.8	8.46	25.4		
8/31/2006	85	1435	5.81	8.01	72.50	25.7	7.81	25.3	2.8	
8/31/2006	90	1440	5.92	8.08	73.29	25.3	8.19	25.4		
8/31/2006	95	1445	5.90	8.06	73.19	25.4	7.83	25.3	0.4	
8/31/2006	100	1450	5.91	8.06	73.31	25.4	7.90	25.2	1.1	14
8/31/2006	105	1455	5.91	8.05	73.46	25.5	8.26	25.6		
8/31/2006	110	1500	5.89	8.03	73.36	25.6	8.40	25.3	4.0	13
8/31/2006	115	1505	6.02	8.13	74.09	25.0	8.71	25.5		
8/31/2006	120	1510	6.04	8.13	74.34	25.0	8.59	25.4	1.8	11
8/31/2006	125	1515	5.96	8.05	74.08	25.5	8.17	25.4		
8/31/2006	130	1520	5.95	8.05	73.96	25.5	8.07	25.2	2.6	13
8/31/2006	135	1525	5.93	8.03	73.85	25.6	8.02	25.2	2.2	12
8/31/2006	140	1530	5.97	8.06	74.06	25.4	8.13	25.2		
						25.4	7.99	25.3	2.1	12.6

Averages

Shaded area represents the data used for the calculation

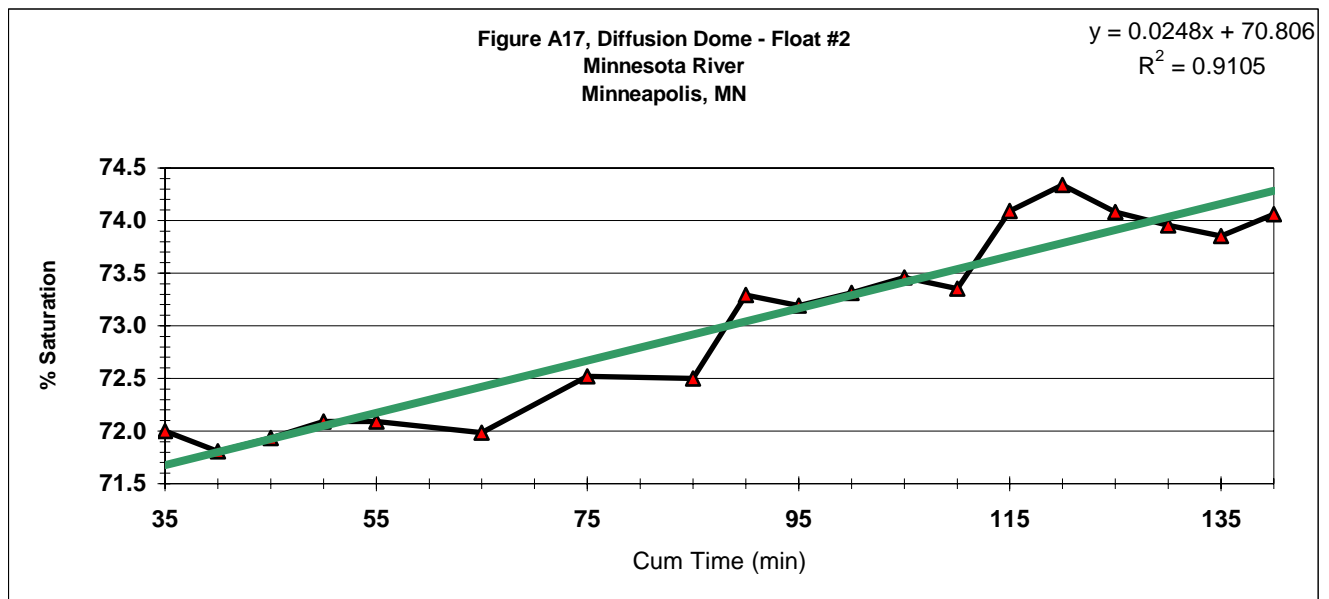


Table A20  
 Diffusion Dome Data - Float #3  
 Minnesota River  
 Minneapolis, Mn  
 1-Sep-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet	
9/1/2006	0	905	6.00	9.01	66.61	19.90	7.21	26.2	0.0	11.5	
9/1/2006	5	910	5.72	8.70	65.76	21.60	7.24	26.3			
9/1/2006	10	915	5.63	8.63	65.26	22.00	7.52	26.4	0.0	14.0	
9/1/2006	15	920	5.57	8.56	65.09	22.40	7.46	26.3			
9/1/2006	20	925	5.54	8.52	65.00	22.60	7.49	26.2	1.1	12.5	
9/1/2006	25	930	5.53	8.51	65.01	22.70	7.71	26.4			
9/1/2006	30	935	5.51	8.49	64.91	22.80	7.73	26.5	0.1	14.0	
9/1/2006	35	940	5.49	8.46	64.93	23.00	7.81	26.4			
9/1/2006	40	945	5.49	8.46	64.93	23.00	8.09	26.4	0.8	13.5	
9/1/2006	45	950	5.50	8.46	65.05	23.00	7.91	26.4			
9/1/2006	50	955	5.51	8.44	65.30	23.10	8.22	26.8	1.6	13.5	
9/1/2006	55	1000	5.51	8.44	65.30	23.10	8.14	27.1			
9/1/2006	60	1005	5.51	8.44	65.30	23.10	8.30	26.9	0.3	14.0	
9/1/2006	65	1010	5.52	8.42	65.55	23.20	8.31	26.7			
9/1/2006	70	1015	5.53	8.42	65.67	23.20	8.28	26.7	1.0	14.0	
9/1/2006	75	1020	5.53	8.40	65.80	23.30	8.64	26.6			
9/1/2006	80	1025	5.54	8.42	65.79	23.20	7.63	26.8	0.2	14.0	
9/1/2006	85	1030	5.55	8.42	65.91	23.20	8.34	26.7			
9/1/2006	90	1035	5.55	8.40	66.04	23.30	8.40	26.7	1.8	14.0	
9/1/2006	95	1040	5.56	8.40	66.16	23.30	8.00	27.0			
9/1/2006	100	1045	5.56	8.40	66.16	23.30	8.23	27.1	1.3	15.0	
9/1/2006	105	1050	5.57	8.39	66.41	23.40	7.59	27.0			
						Averages	23.16	8.10	26.7	0.9	14.0

Averages

Shaded area represents the data used for the calculation

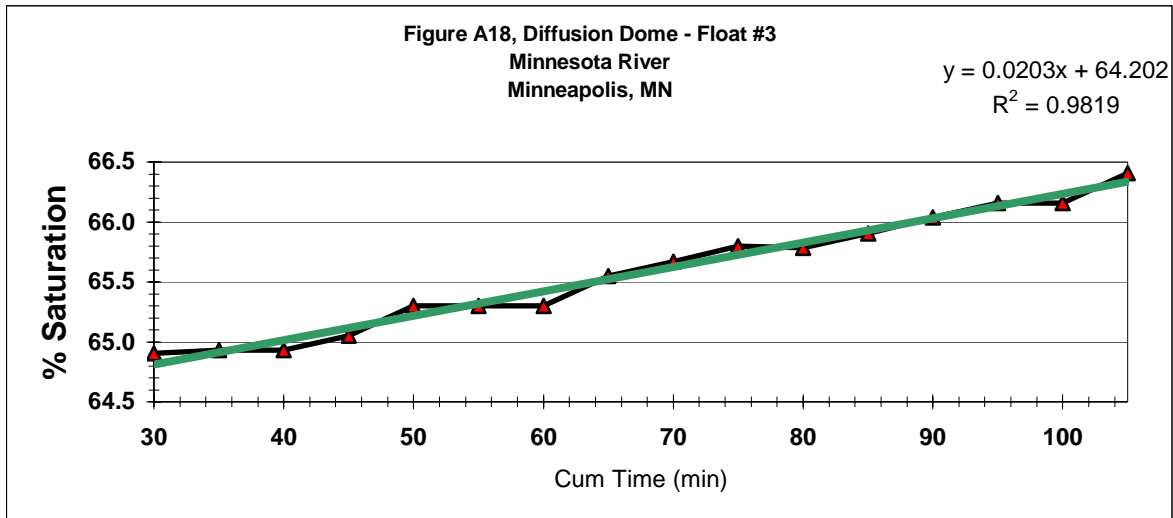


Table A21  
 Diffusion Dome Data - Float #4  
 Minnesota River  
 Minneapolis, Mn  
 2-Sep-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
9/2/2006	0	900	3.74	8.82	42.39	20.9	6.12	22.9	1.1	14.0
9/2/2006	5	905	3.61	8.66	41.67	21.8	6.05	22.9		
9/2/2006	10	910	3.55	8.56	41.48	22.4	6.55	23.0	2.1	9.0
9/2/2006	15	915	3.53	8.51	41.50	22.7	6.57	23.1		
9/2/2006	20	920	3.52	8.47	41.55	22.9	6.75	23.1	2.6	12.0
9/2/2006	25	925	3.51	8.42	41.68	23.2	6.73	23.2		
9/2/2006	30	930	3.51	8.42	41.68	23.2	6.81	23.1	0.2	11.0
9/2/2006	35	935	3.52	8.42	41.80	23.2	6.93	23.2		
9/2/2006	40	940	3.53	8.42	41.92	23.2	7.17	23.1	0.6	12.0
9/2/2006	45	945	3.53	8.42	41.92	23.2	7.30	23.3		
9/2/2006	50	950	3.53	8.40	42.00	23.3	7.10	23.2	0.7	10.0
9/2/2006	55	955	3.54	8.39	42.21	23.4	7.19	23.3		
9/2/2006	60	1000	3.54	8.39	42.21	23.4	7.07	23.2	1.4	9.0
9/2/2006	65	1005	3.55	8.39	42.32	23.4	7.18	23.2		
9/2/2006	70	1010	3.56	8.39	42.44	23.4	7.24	23.3	1.7	9.0
9/2/2006	75	1015	3.57	8.39	42.56	23.4	7.44	23.3		
9/2/2006	80	1020	3.59	8.39	42.80	23.4	7.54	23.4	1.5	13.0
9/2/2006	85	1025	3.59	8.39	42.80	23.4	7.52	23.3		
9/2/2006	90	1030	3.60	8.39	42.92	23.4	7.37	23.2	1.6	12.0
9/2/2006	95	1035	3.61	8.37	43.13	23.5	8.19	23.5		
9/2/2006	100	1040	3.62	8.37	43.25	23.5	8.30	23.6	0.4	11.0
9/2/2006	105	1045	3.62	8.35	43.33	23.6	8.34	23.5		
9/2/2006	110	1050	3.62	8.35	43.33	23.6	8.29	23.5	0.0	9.0
Averages						23.3	7.31	23.3	1.2	10.6

Shaded area represents the data used for the calculation

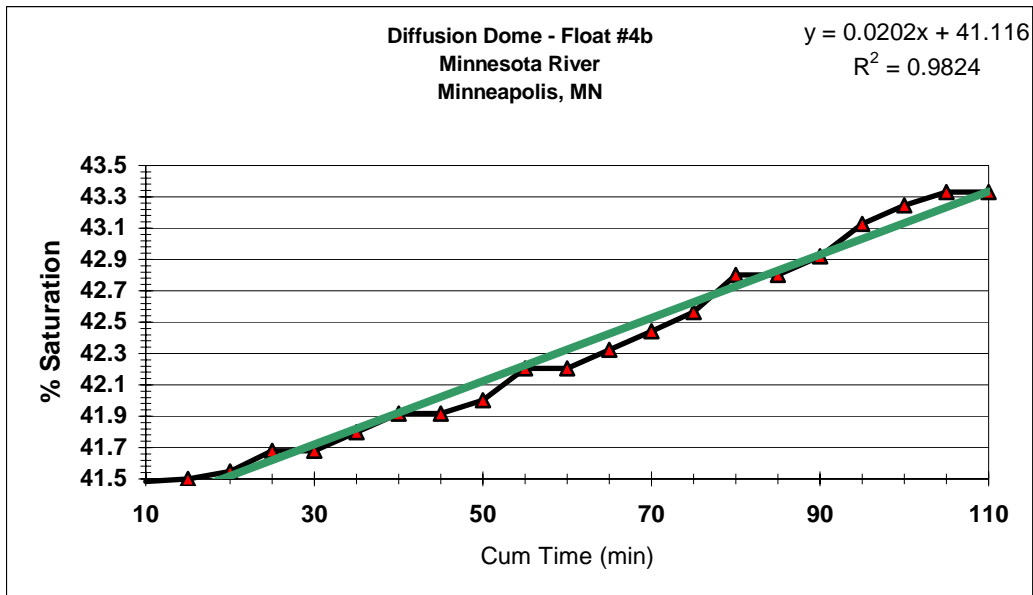


Table A22  
 Diffusion Dome Data - Float #5  
 Minnesota River  
 Minneapolis, Mn  
 2-Sep-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
9/2/2006	0	1120	6.94	8.27	83.90	24.1	7.88	23.4	0.8	11.0
9/2/2006	5	1125	6.95	8.30	83.69	23.9	7.88	23.3		
9/2/2006	10	1130	6.97	8.32	83.77	23.8	7.66	23.4	1.3	10.0
9/2/2006	15	1135	6.98	8.32	83.89	23.8	8.77	23.6		
9/2/2006	20	1140	7.00	8.34	83.96	23.7	6.31	23.0	1.2	11.0
9/2/2006	25	1145	7.02	8.35	84.03	23.6	6.49	23.0		
9/2/2006	30	1150	7.07	8.39	84.29	23.4	7.24	23.4	0.9	11.0
9/2/2006	35	1155	7.07	8.37	84.46	23.5	7.40	23.4		
9/2/2006	40	1200	7.06	8.37	84.34	23.5	7.66	23.5	0.8	11.0
9/2/2006	45	1205	7.06	8.37	84.34	23.5	7.43	23.4		
9/2/2006	50	1210	7.05	8.35	84.39	23.6	7.92	23.6	1.3	13.0
9/2/2006	55	1215	7.05	8.35	84.39	23.6	7.35	23.4		
9/2/2006	60	1220	7.06	8.37	84.34	23.5	7.42	23.5	1.3	12.0
9/2/2006	65	1225	7.08	8.39	84.41	23.4	7.96	23.3		
9/2/2006	70	1230	7.07	8.37	84.46	23.5	7.69	23.5	2.5	13.0
9/2/2006	75	1235	7.05	8.34	84.56	23.7	7.82	23.6		
9/2/2006	80	1240	7.07	8.37	84.46	23.5	6.72	23.3	0.4	13.0
9/2/2006	85	1245	7.08	8.37	84.58	23.5	7.39	23.3		
9/2/2006	90	1250	7.08	8.37	84.58	23.5	7.71	23.7	2.6	11.0
9/2/2006	95	1255	7.08	8.37	84.58	23.5	8.10	23.7		
						23.58	7.52	23.4	1.4	11.7

Averages

Shaded area represents the data used for the calculation

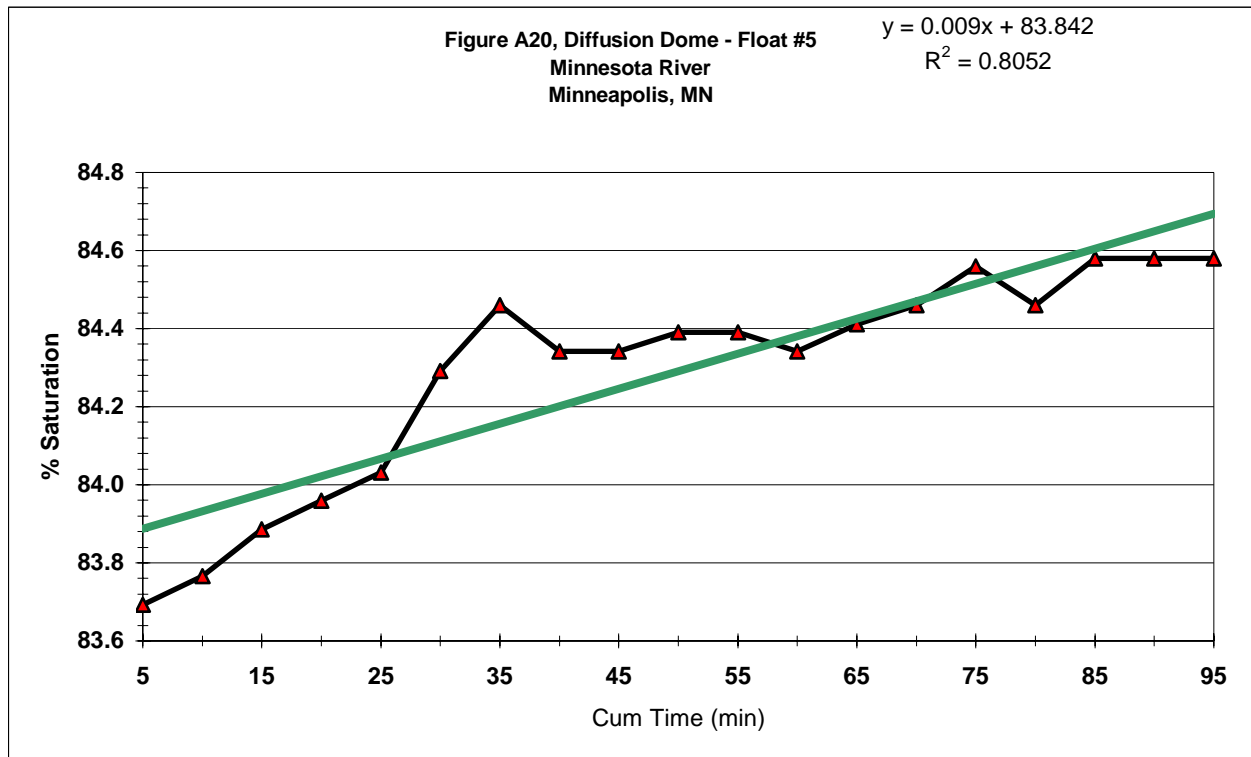


Table A23  
 Diffusion Dome Data - Float #6  
 Minnesota River  
 Minneapolis, Mn  
 3-Sep-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
9/3/2006	0	1115	5.36	9.42	56.91	17.8	7.31	21.3		
9/3/2006	5	1120	5.05	9.12	55.36	19.3	7.32	21.3	0.0	8.0
9/3/2006	10	1125	4.93	8.95	55.07	20.2	7.24	21.3		
9/3/2006	15	1130	4.87	8.88	54.85	20.6	7.24	21.3	0.0	8.0
9/3/2006	20	1135	4.83	8.84	54.63	20.8	7.24	21.2		
9/3/2006	25	1140	4.82	8.82	54.63	20.9	7.22	21.2	0.1	4.0
9/3/2006	30	1145	4.82	8.79	54.85	21.1	7.25	21.3		
9/3/2006	35	1150	4.82	8.79	54.85	21.1	7.31	21.2	0.1	5.0
9/3/2006	40	1155	4.83	8.77	55.08	21.2	7.28	21.2		
9/3/2006	45	1200	4.83	8.77	55.08	21.2	7.29	21.2	0.4	4.0
9/3/2006	50	1205	4.85	8.77	55.31	21.2	7.25	21.2		
9/3/2006	55	1210	4.86	8.77	55.42	21.2	7.32	21.2	0.2	
9/3/2006	60	1215	4.87	8.79	55.42	21.1	7.3	21.2		
9/3/2006	65	1220	4.88	8.79	55.53	21.1	7.19	21.2	0.8	5.0
9/3/2006	70	1225	4.9	8.79	55.76	21.1	7.42	21.2		
9/3/2006	75	1230	4.91	8.79	55.88	21.1	7.17	21.2	0.2	8.0
9/3/2006	80	1235	4.92	8.79	55.99	21.1	7.38	21.2		
Averages						21.1	7.28	21.2	0.3	5.2

Shaded area represents the data used for the calculation

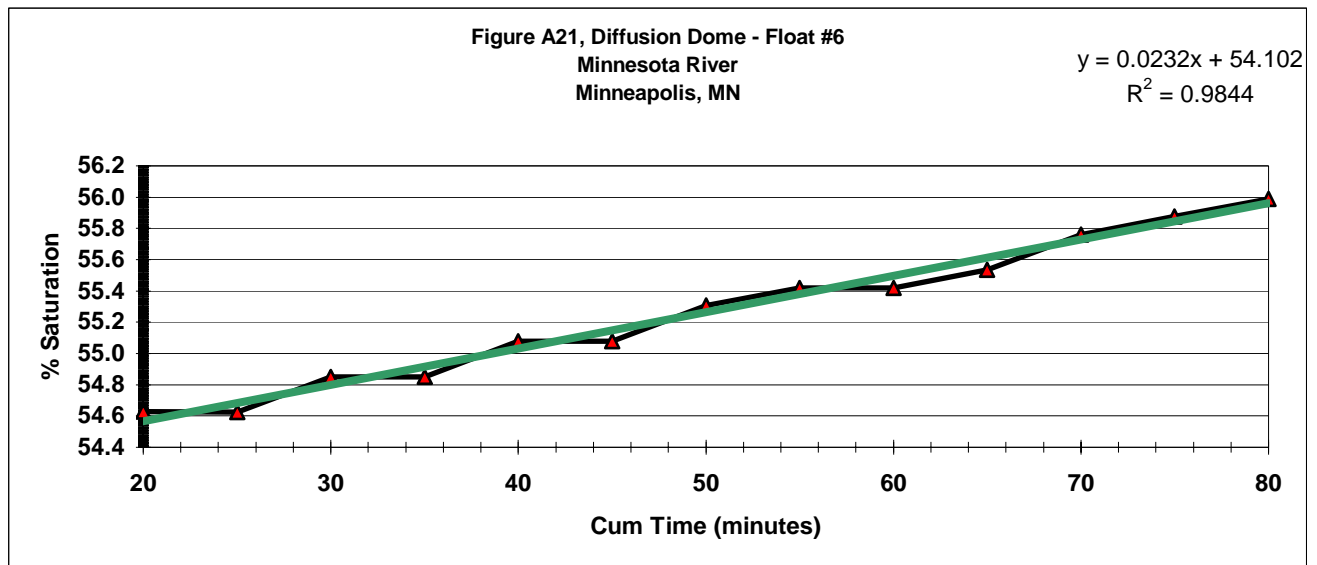


Table A24  
 Diffusion Dome Data - Float #7  
 Minnesota River  
 Minneapolis, Mn  
 4-Sep-06

Date	Cum Time (min)	Clock Time	Dome DO mg/l	Dome DO Saturation mg/l	Dome % Saturation	Dome Temp deg C	Water Col DO mg/l	Water Col Temp deg C	Wind Speed m/sec	Depth feet
9/4/2006	0	825	2.76	9.62	28.68	16.8	5.89	20.0	0.0	13.0
9/4/2006	10	835	2.57	9.24	27.82	18.7	5.91	20.0	0.0	10.0
9/4/2006	15	840	2.49	9.05	27.53	19.7	5.94	20.1	0.0	14.0
9/4/2006	20	845	2.5	9.03	27.36	19.8	5.95	20.0		
9/4/2006	25	850	2.46	8.93	27.54	20.3	5.99	20.1	0.0	12.0
9/4/2006	30	855	2.43	8.88	27.37	20.6	5.88	20.0		
9/4/2006	35	900	2.42	8.90	27.20	20.5	5.93	20.0	0.1	12.0
9/4/2006	40	905	2.43	8.90	27.31	20.5	5.95	20.0		
9/4/2006	45	910	2.43	8.92	27.26	20.4	5.95	20.1	0.0	10.0
9/4/2006	50	915	2.44	8.95	27.26	20.2	6.00	20.1		
9/4/2006	55	920	2.45	8.95	27.37	20.2	5.98	20.1	0.0	10.0
9/4/2006	60	925	2.46	8.95	27.48	20.2	5.89	20.1		
9/4/2006	65	930	2.46	8.95	27.48	20.2	5.91	20.1	0.7	9.0
9/4/2006	70	935	2.47	8.95	27.59	20.2	6.14	20.1		
9/4/2006	75	940	2.46	8.95	27.48	20.2	5.96	20.0	1.0	10.0
9/4/2006	80	945	2.47	8.95	27.59	20.2	5.99	20.1		
9/4/2006	85	950	2.48	8.93	27.76	20.3	5.99	20.1	0.8	9.0
9/4/2006	90	955	2.49	8.93	27.87	20.3	5.99	20.1		
9/4/2006	95	1000	2.48	8.90	27.88	20.5	5.97	20.1	0.4	8.0
9/4/2006	100	1005	2.48	8.90	27.88	20.5	6.00	20.1		
9/4/2006	105	1010	2.47	8.90	27.76	20.5	6.08	20.1	0.2	12.0
9/4/2006	110	1015	2.48	8.92	27.82	20.4	6.11	20.1		
9/4/2006	115	1020	2.48	8.93	27.76	20.3	6.12	20.1	0.8	12.0
9/4/2006	120	1025	2.49	8.95	27.81	20.2	6.09	20.0		
9/4/2006	125	1030	2.5	8.95	27.93	20.2	6.10	20.1	0.6	9.5
9/4/2006	130	1035	2.51	8.93	28.10	20.3	6.17	20.1		
9/4/2006	135	1040	2.5	8.92	28.04	20.4	6.12	20.1	0.1	17.0
9/4/2006	140	1045	2.5	8.92	28.04	20.4	6.10	20.1		
9/4/2006	145	1050	2.51	8.92	28.15	20.4	6.18	20.1	0.1	14.0
9/4/2006	150	1055	2.51	8.92	28.15	20.4	6.28	20.2		
9/4/2006	155	1100	2.51	8.92	28.15	20.4	6.44	20.3	0.0	15.0
9/4/2006	160	1105	2.52	8.90	28.33	20.5	6.41	20.2		
9/4/2006	165	1110	2.51	8.88	28.27	20.6	6.22	20.3	0.1	9.0
9/4/2006	170	1115	2.52	8.90	28.33	20.5	6.56	20.4		
9/4/2006	175	1120	2.52	8.88	28.38	20.6	6.47	20.3	0.4	9.0
9/4/2006	180	1125	2.53	8.88	28.50	20.6	6.43	20.3		
9/4/2006	185	1130	2.53	8.90	28.44	20.5	6.46	20.2	1.0	11.0

