Marlborough Copper
no ND, >10 samples, Lognormal distribution

Date	Cu (ug/L)	Yi lnTemp (°F)	$(y_i - u_y)^2$
2/28/2001	26	3.2581	0.222227
3/31/2001	65	4.1744	1.925711
4/30/2001	15	2.7081	0.006184
5/31/2001	17	2.8332	0.002165
6/30/2001	22	3.0910	0.092632
7/31/2001	23		
8/31/2001	28	3.3322	0.297589
9/30/2001	18	2.8904	0.01075
10/31/2001	22	3.0910	0.092632
11/30/2001	28	3.3322	0.297589
12/31/2001	29	3.3673	0.337106
1/31/2002	23	3.1355	0.121666
2/28/2002	13	2.5649	0.049168
3/31/2002	36	3.5835	0.63494
4/30/2002	16	2.7726	0.000199
5/31/2002	35	3.5553	0.590839
6/30/2002	13	2.5649	0.049168
7/31/2002	33	3.4965	0.503845
8/31/2002	29	3.3673	0.337106
9/30/2002	30	3.4012	0.377622
10/31/2002	14	2.6391	0.021795
11/30/2002	17	2.8332	0.002165
12/31/2002	14	2.6391	0.021795
1/31/2003	60	4.0943	1.709967
2/28/2003	26	3.2581	0.222227
3/31/2003	12	2.4849	0.091072

Copper - Marlborough (Lognormal distribution, no ND)

Daily Maximum Limit Derivation

u_y = Avg of Nat. Log of daily Discharge (lbs/day) =	2.78669
σ_y = Std Dev. of Nat Log of daily discharge =	0.57524
$\Sigma (y_i - u_y)^2$ =	25.14832
k = number of daily samples =	78
σ_y^2 = estimated variance = $(\Sigma[(y_i - u_y)^2]) / (k-1)$ =	0.32660

Daily Max Limit = $\exp(u_y + 2.326*\sigma_y)$

Daily Max Limit = 61.85
(Lognormal distribution, 99th percentile)

Average Monthly Limit Derivation

Number of samples per month, n =	1
E(x) = Daily Avg = $\exp(u_y + 0.5\,\sigma_y^2)$ =	19.10573
V(x) = Daily Variance = $\exp(2u_y + \sigma_y^2) * [\exp(\sigma_y^2) - 1]$ =	140.99207
σ_n^2 = Monthly Average variance = $\ln\{ V(x) / (n[E(x)]^2) + 1\}$ =	0.32660
σ_n = Monthly Average standard deviation = σ_n^2^(0.5) =	0.57149
u_n = n-day monthly average = $\ln(E(x)) - 0.5\sigma_n^2$ =	2.78669

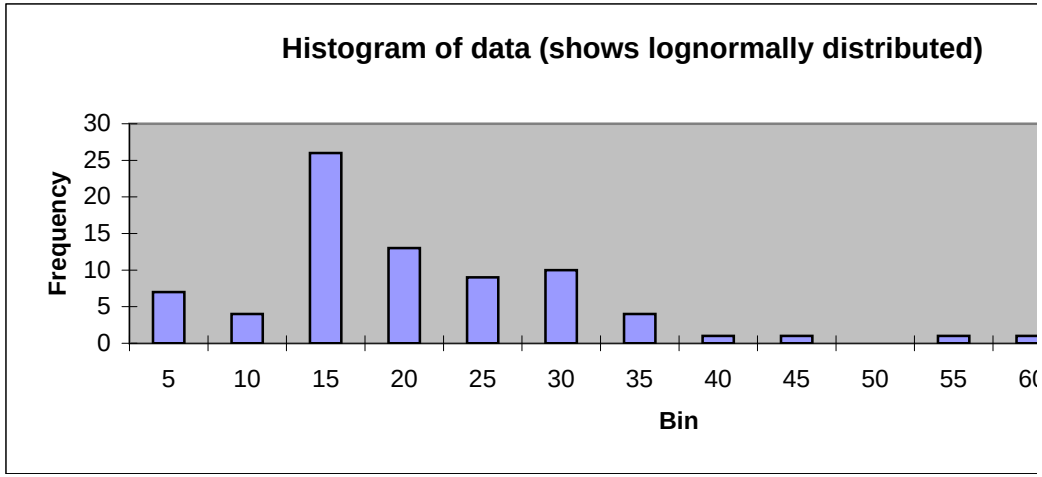
4/30/2003	5	1.6094	1.385917
5/31/2003	11	2.3979	0.151159
6/30/2003	5	1.6094	1.385917
7/31/2003	10	2.3026	0.234355
8/31/2003	16	2.7726	0.000199
9/30/2003	19	2.9444	0.024886
10/31/2003	34	3.5264	0.547116
11/30/2003	21	3.0445	0.066479
12/31/2003	32	3.4657	0.461107
1/31/2004	20	2.9957	0.0437
2/29/2004	23	3.1355	0.121666
3/31/2004	52	3.9512	1.356191
4/30/2004	11	2.3979	0.151159
5/31/2004	14	2.6391	0.021795
6/30/2004	13	2.5649	0.049168
7/31/2004	15	2.7081	0.006184
8/31/2004	14	2.6391	0.021795
9/30/2004	21	3.0445	0.066479
10/31/2004	12	2.4849	0.091072
11/30/2004	21	3.0445	0.066479
12/31/2004	14	2.6391	0.021795
1/31/2005	13	2.5649	0.049168
2/28/2005	12	2.4849	0.091072
3/31/2005	18	2.8904	0.01075
4/30/2005	8	2.0794	0.500197
5/31/2005	16	2.7726	0.000199
6/30/2005	21	3.0445	0.066479
12/31/2005	12	2.4849	0.091072
1/31/2006	26	3.2581	0.222227
2/28/2006	19	2.9444	0.024886
3/31/2006	16	2.7726	0.000199
4/30/2006	42	3.7377	0.904367
5/31/2006	10	2.3026	0.234355
6/30/2006	28	3.3322	0.297589
7/31/2006	5	1.6094	1.385917
8/31/2006	5	1.6094	1.385917

Monthly Average Limit = exp (u_n + 1.645*σ_n)

Monthly Avg Limit* = 41.55

(Lognormal distribution, 95th percentile of average monthly values)

*Based on sampling frequency of 1 time per month



	Bin	Frequency
5		
10	5	7
15	10	4
20	15	26
25	20	13
30	25	9
35	30	10
40	35	4

9/30/2006	5	1.6094	1.385917
10/31/2006	12	2.4849	0.091072
11/30/2006	5	1.6094	1.385917
12/31/2006	11	2.3979	0.151159
1/31/2007	5	1.6094	1.385917
2/28/2007	12	2.4849	0.091072
3/31/2007	16	2.7726	0.000199
4/30/2007	14	2.6391	0.021795
5/31/2007	11	2.3979	0.151159
6/30/2007	12	2.4849	0.091072
7/31/2007	9	2.1972	0.347467
8/31/2007	12	2.4849	0.091072
9/30/2007	17	2.8332	0.002165
10/31/2007	26	3.2581	0.222227
11/30/2007	14	2.6391	0.021795
12/31/2007	11	2.3979	0.151159

5
65

45	40	1
50	45	1
55	50	0
60	55	1
65	60	1
	65	1
More		0

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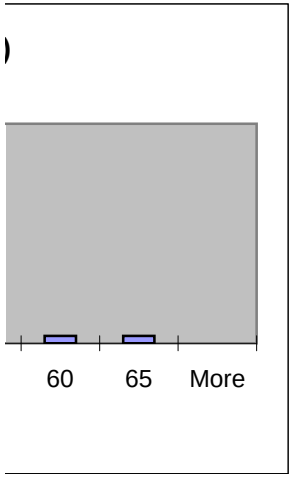
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