Figure 6C.LOC13.1998.1.Ordered Thickness Readings

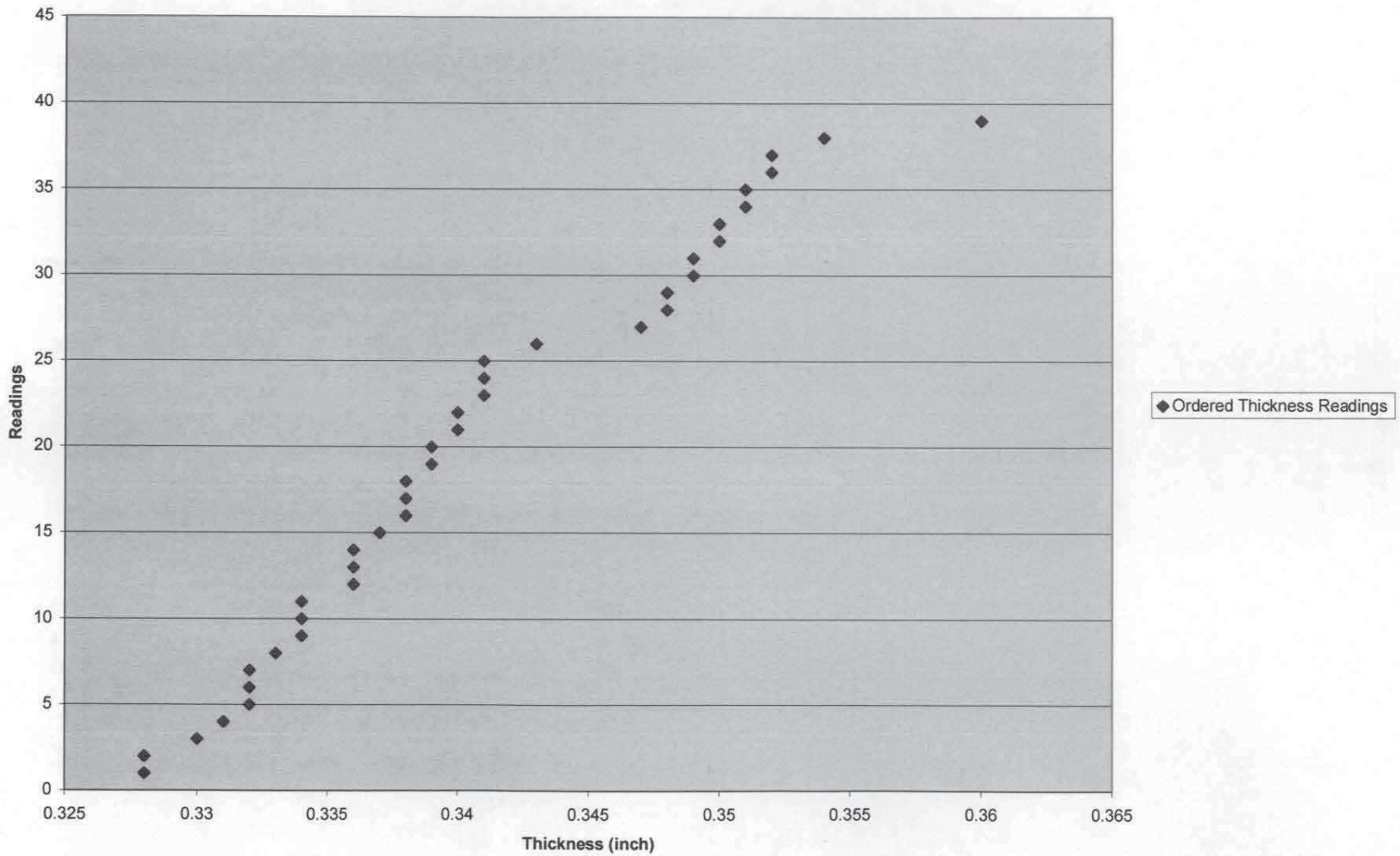


Figure 6C.LOC13.1998.2.Normalized Frequency Distribution

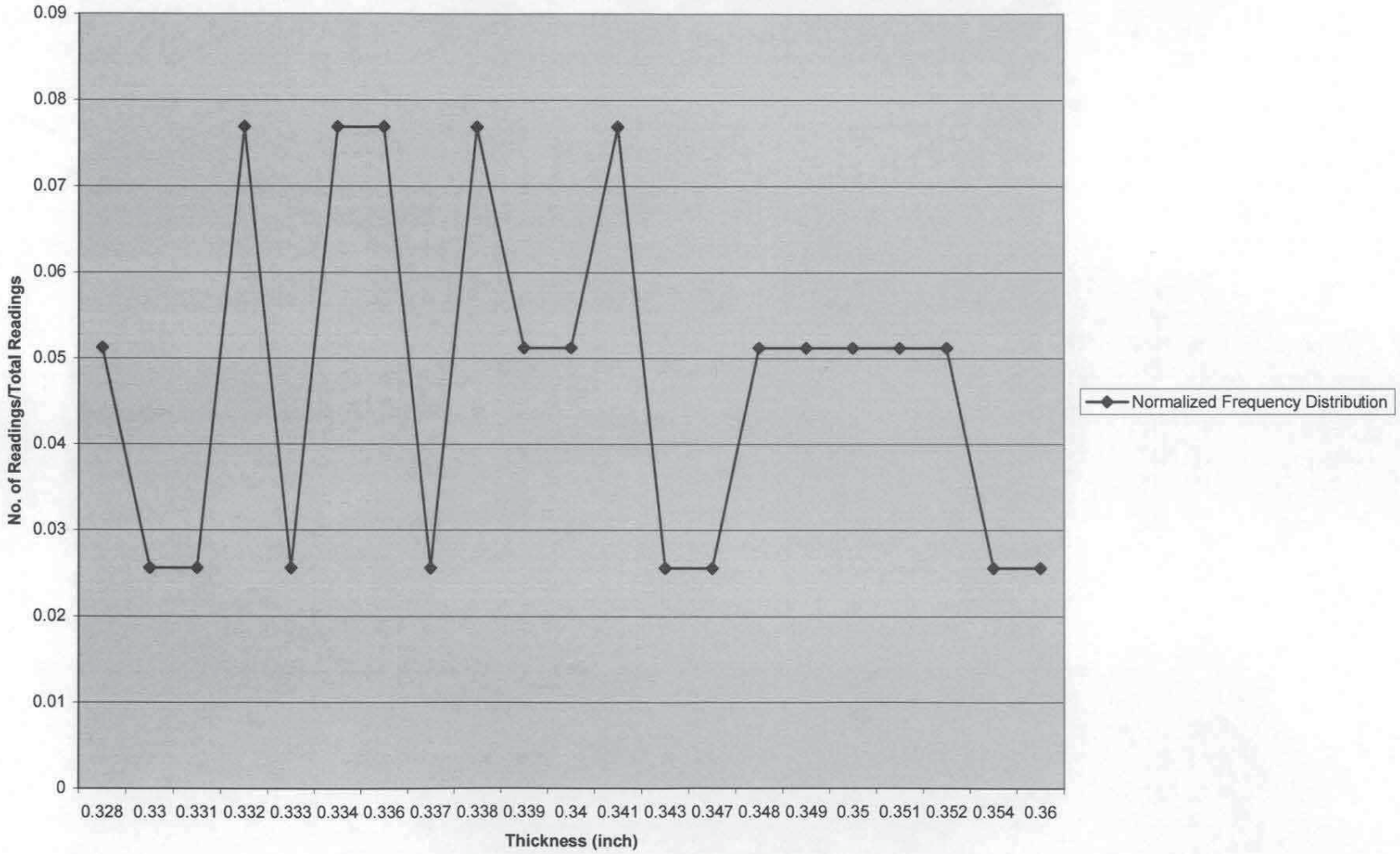


Figure 6C.LOC13.1998.3.Reliability Function

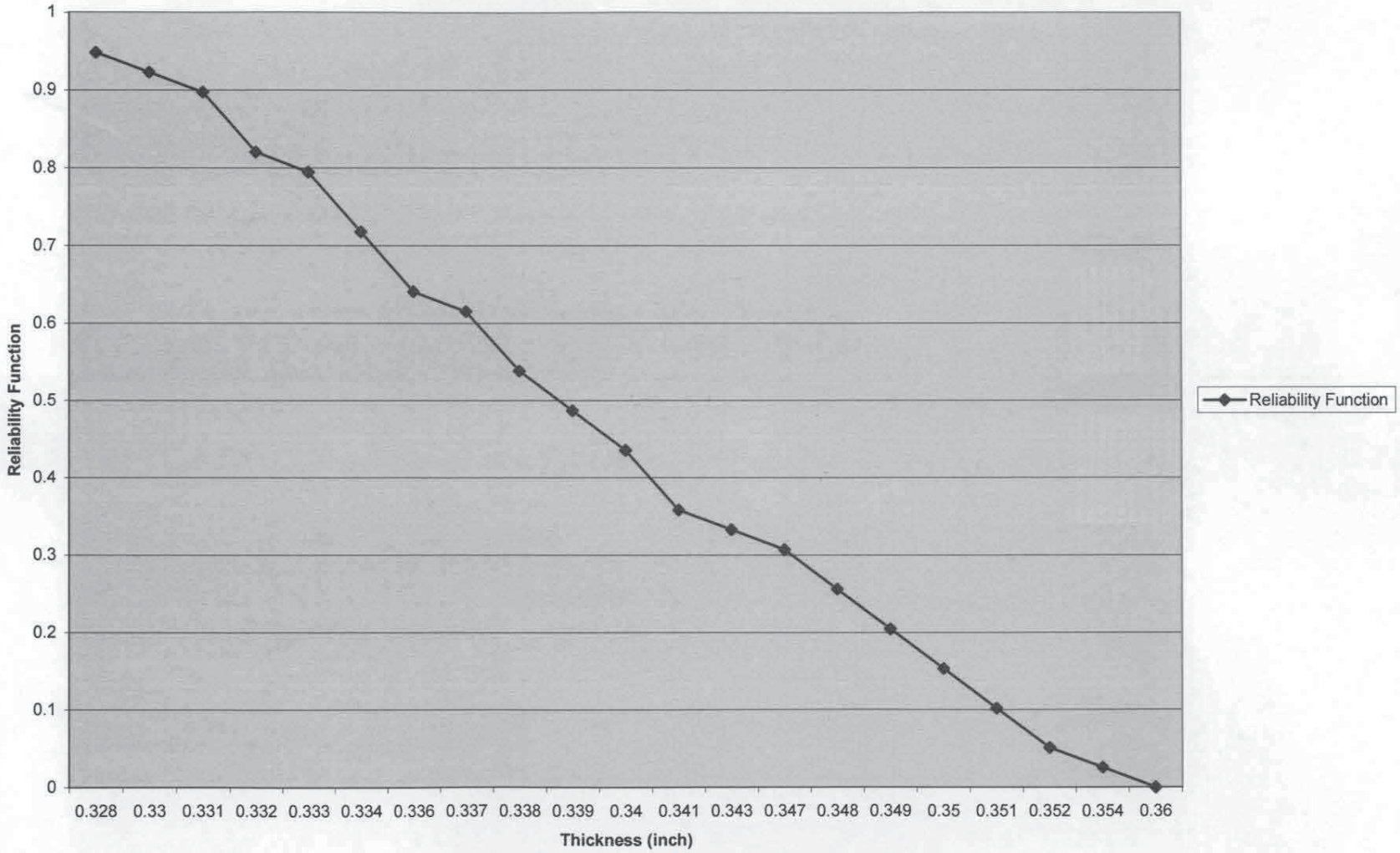


Figure 6C.LOC13.1998.4.Reliability^Area Ratio

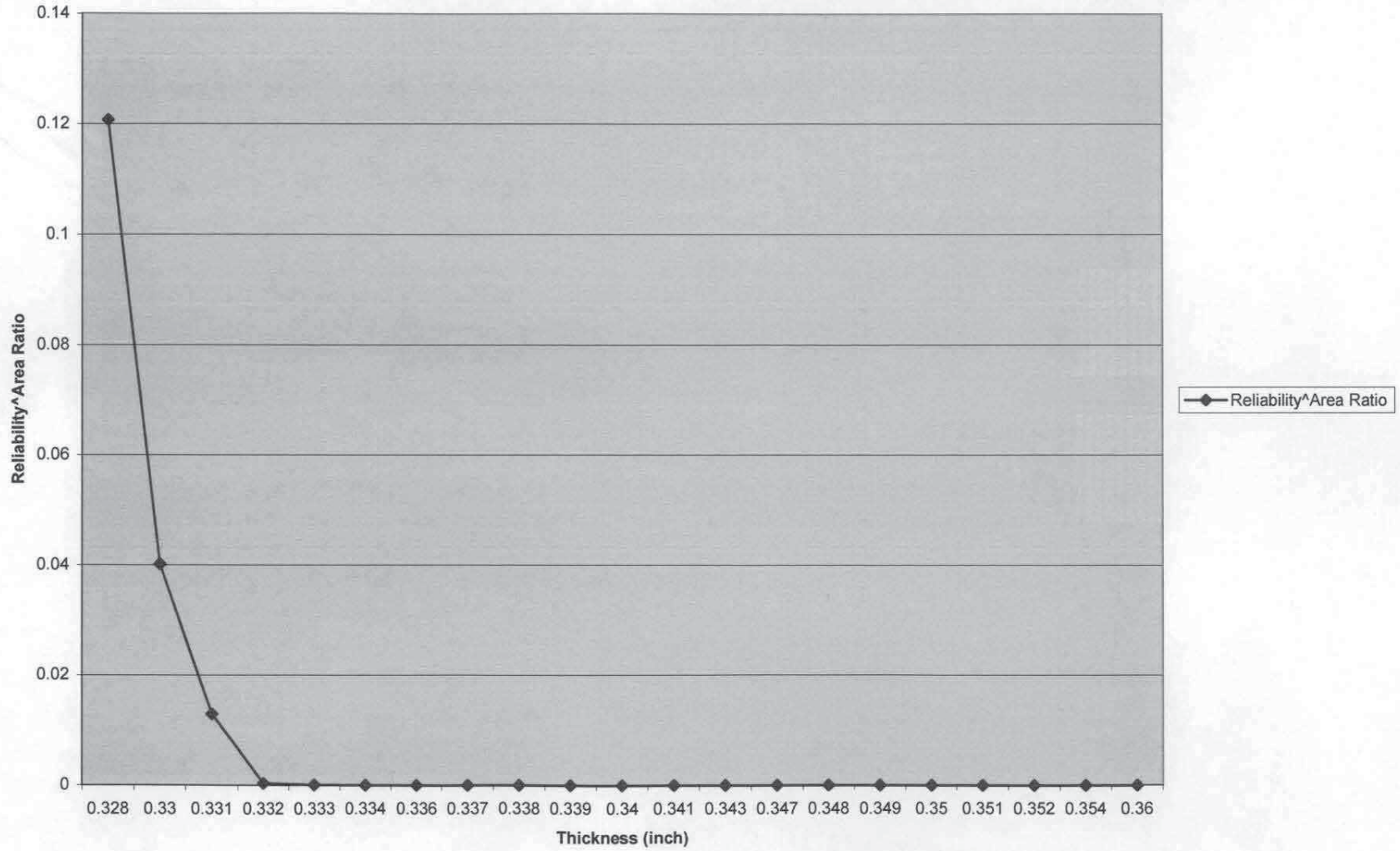


Table 6C.LOC13.2007.1	
Location 13	
Descriptive Statistics	
Mean	0.322307692
Standard Error	0.001208469
Median	0.322
Mode	0.321
Standard Deviation	0.007546884
Sample Variance	5.69555E-05
Kurtosis	0.07481747
Skewness	0.334860032
Range	0.03
Minimum	0.308
Maximum	0.338
Sum	12.57
Count	39
Largest(1)	0.338
Smallest(1)	0.308
Confidence Level(95.0%)	0.002446417

Table 6C.LOC13.2007.2	
Location 13	
Ordered Readings	
Thickness (inch)	*Count*
0.308	1
0.309	2
0.309	3
0.312	4
0.314	5
0.315	6
0.316	7
0.317	8
0.317	9
0.317	10
0.318	11
0.318	12
0.319	13
0.321	14
0.321	15
0.321	16
0.321	17
0.321	18
0.321	19
0.322	20
0.322	21
0.323	22
0.323	23
0.323	24
0.324	25
0.324	26
0.325	27
0.325	28
0.325	29
0.326	30
0.326	31
0.326	32
0.327	33
0.331	34
0.335	35
0.336	36
0.337	37
0.337	38
0.338	39

Table 6C.LOC13.2007.3						
Location 13						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.308	1	0.025641026	0.02564103	0.974359	40.15	0.352439809
0.309	2	0.051282051	0.07692308	0.9230769	40.15	0.040211978
0.312	1	0.025641026	0.1025641	0.8974359	40.15	0.012976603
0.314	1	0.025641026	0.12820513	0.8717949	40.15	0.004052538
0.315	1	0.025641026	0.15384615	0.8461538	40.15	0.001222372
0.316	1	0.025641026	0.17948718	0.8205128	40.15	0.000355354
0.317	3	0.076923077	0.25641026	0.7435897	40.15	6.82709E-06
0.318	2	0.051282051	0.30769231	0.6923077	40.15	3.87489E-07
0.319	1	0.025641026	0.33333333	0.6666667	40.15	8.51549E-08
0.321	6	0.153846154	0.48717949	0.5128205	40.15	2.26757E-12
0.322	2	0.051282051	0.53846154	0.4615385	40.15	3.29966E-14
0.323	3	0.076923077	0.61538462	0.3846154	40.15	2.18507E-17
0.324	2	0.051282051	0.66666667	0.3333333	40.15	6.98752E-20
0.325	3	0.076923077	0.74358974	0.2564103	40.15	1.86069E-24
0.326	3	0.076923077	0.82051282	0.1794872	40.15	1.12357E-30
0.327	1	0.025641026	0.84615385	0.1538462	40.15	2.30564E-33
0.331	1	0.025641026	0.87179487	0.1282051	40.15	1.52682E-36
0.335	1	0.025641026	0.8974359	0.1025641	40.15	1.96337E-40
0.336	1	0.025641026	0.92307692	0.0769231	40.15	1.89193E-45
0.337	2	0.051282051	0.97435897	0.025641	40.15	1.32199E-64
0.338	1	0.025641026	1	0	40.15	0
Total	39					

Figure 6C.LOC13.2007.1.Ordered Thickness Readings

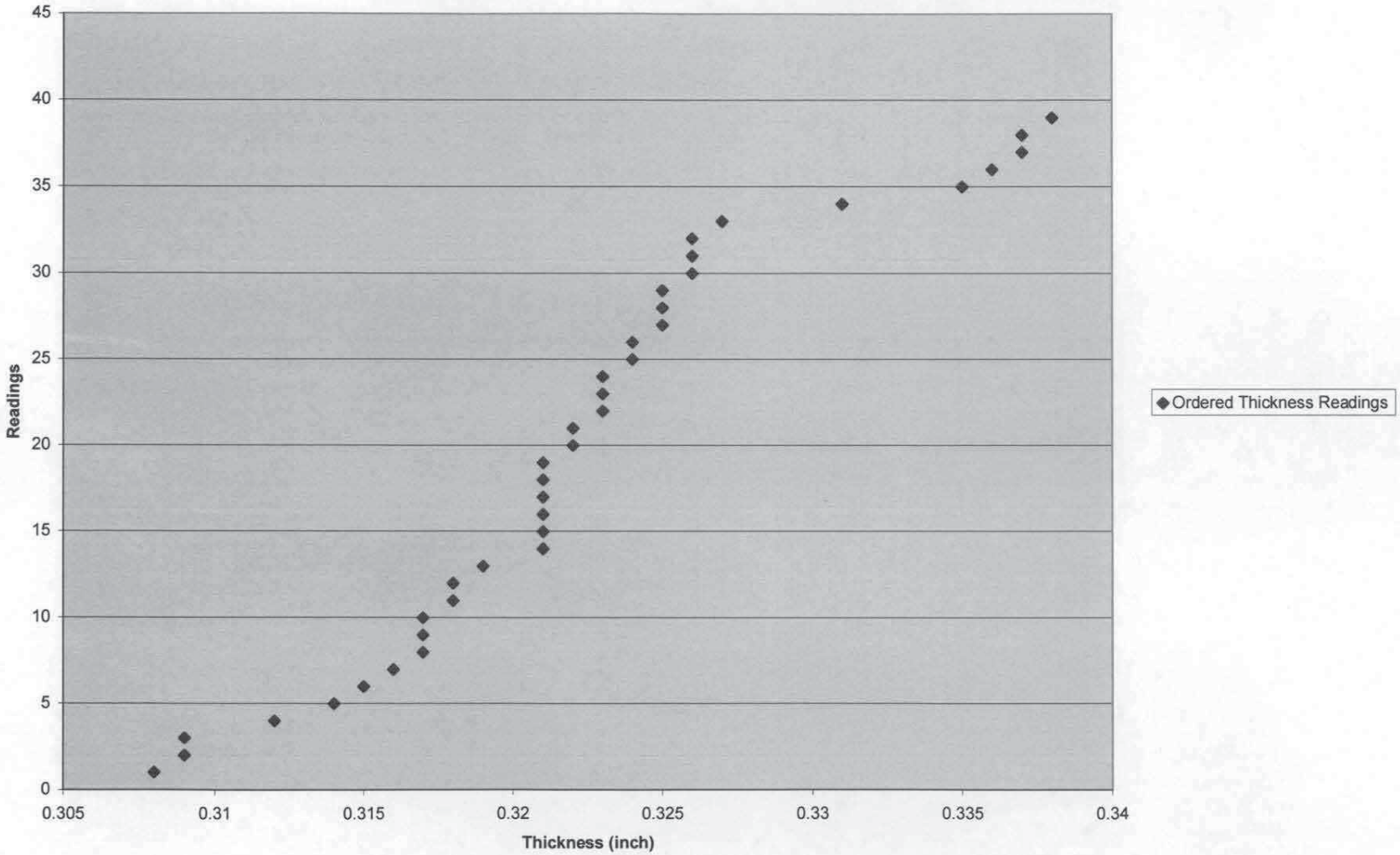


Figure 6C.LOC13.2007.2.Normalized Frequency Distribution

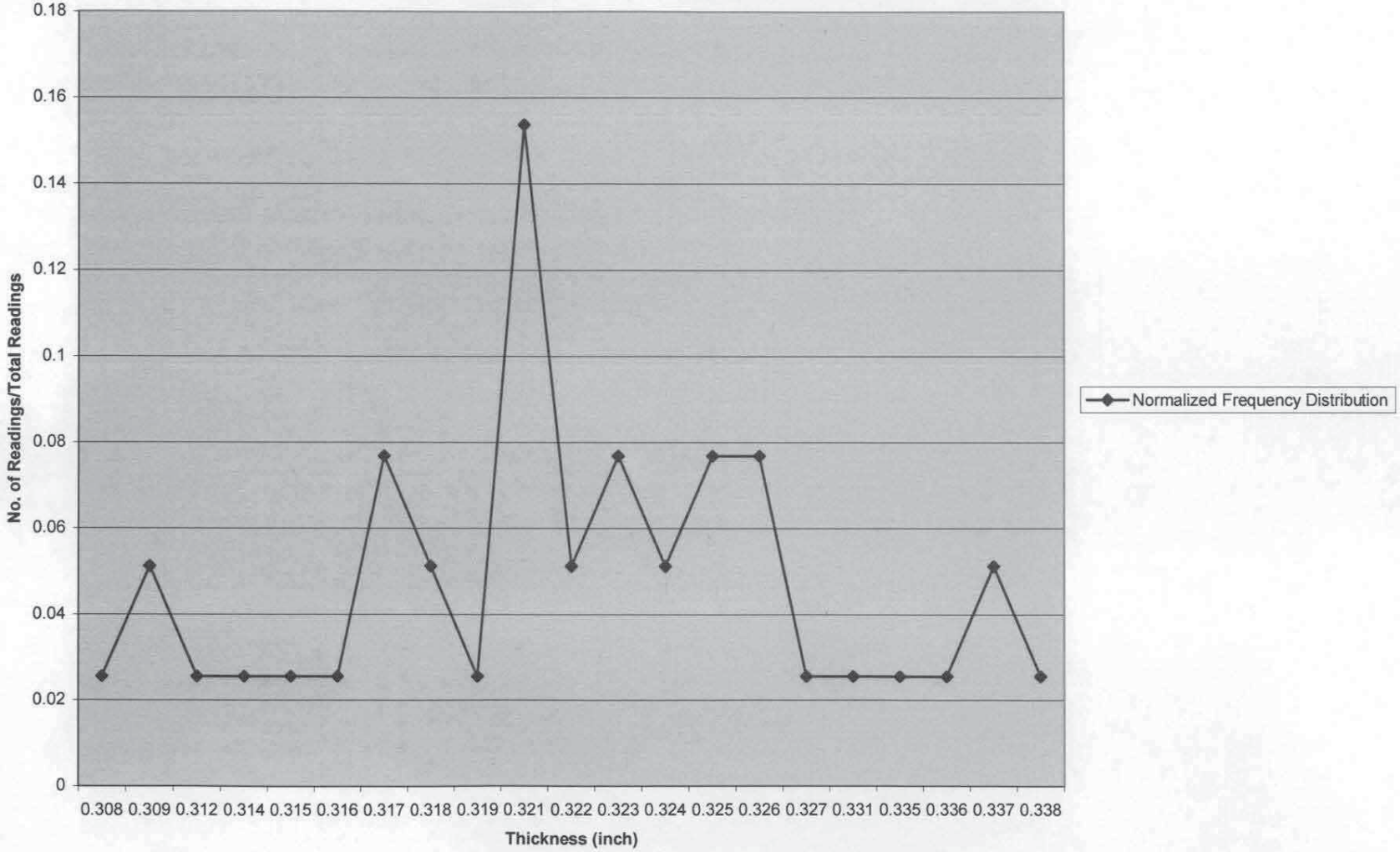


Figure 6C.LOC13.2007.3.Reliability Function

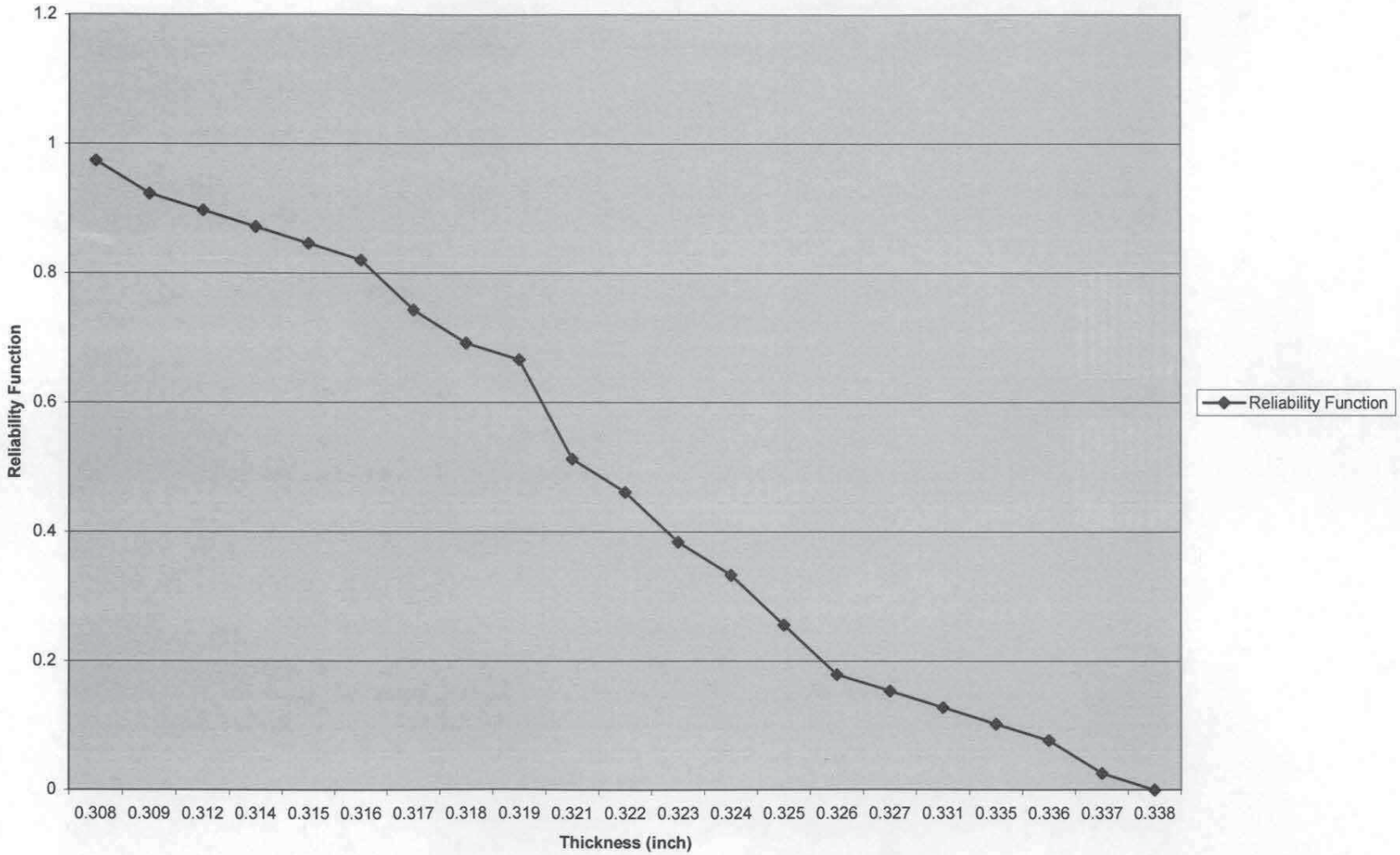


Figure 6C.LOC13.2007.4.Reliability^Area Ratio

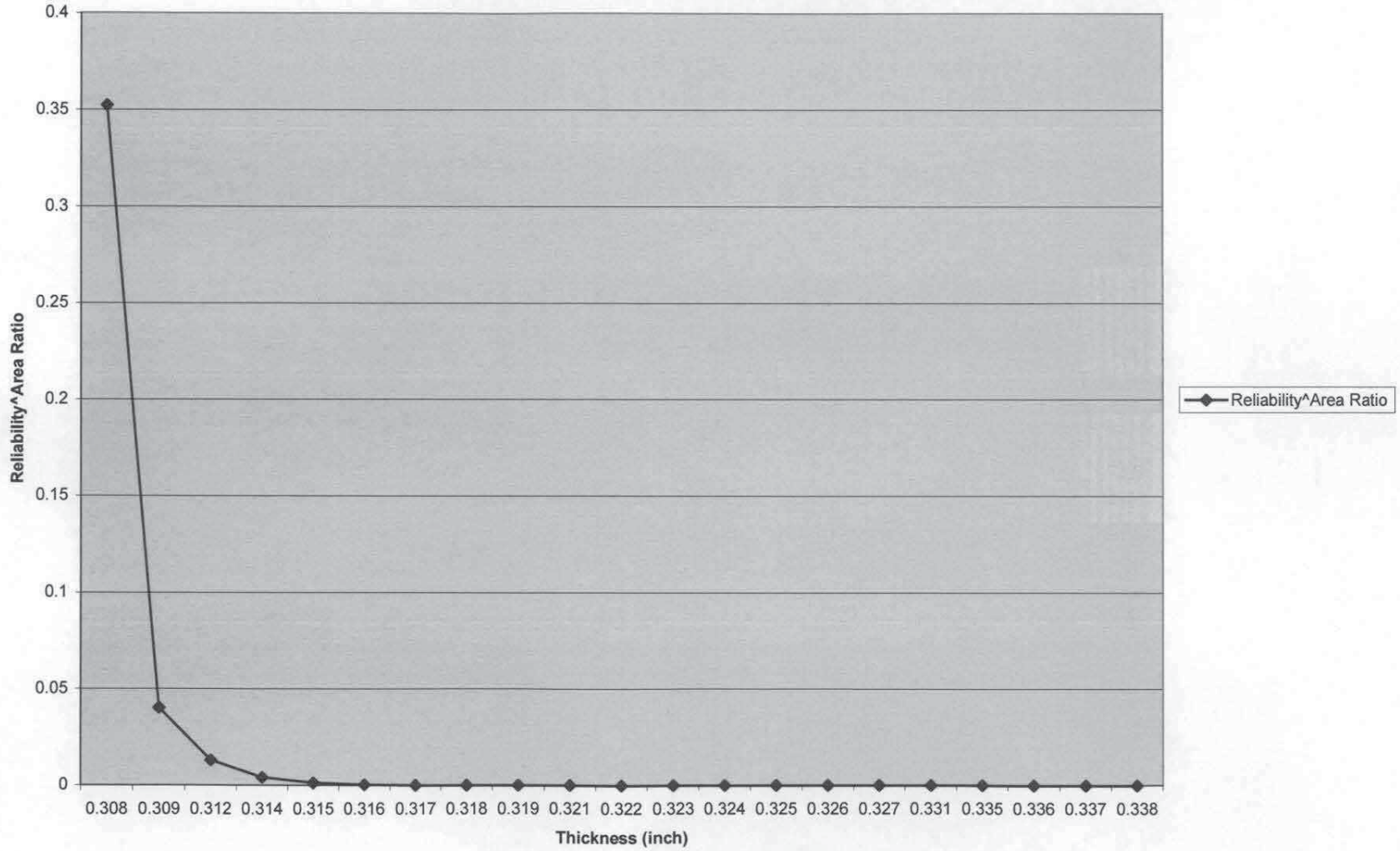


Table 6C.LOC15.1993.1	
Location 15	
Descriptive Statistics	
Mean	0.136692308
Standard Error	0.000237093
Median	0.137
Mode	0.137
Standard Deviation	0.00085485
Sample Variance	7.30769E-07
Kurtosis	-0.048451272
Skewness	-0.240675589
Range	0.003
Minimum	0.135
Maximum	0.138
Sum	1.777
Count	13
Largest(1)	0.138
Smallest(1)	0.135
Confidence Level(95.0%)	0.000516581

Table 6C.LOC15.1993.2	
Location 15	
Ordered Readings	
Thickness (inch)	*Count*
0.135	1
0.136	2
0.136	3
0.136	4
0.136	5
0.137	6
0.137	7
0.137	8
0.137	9
0.137	10
0.137	11
0.138	12
0.138	13

Table 6C.LOC15.1993.3						
Location 15						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.135	1	0.076923077	0.07692308	0.9230769	10.87	0.418764749
0.136	4	0.307692308	0.38461538	0.6153846	10.87	0.005093523
0.137	6	0.461538462	0.84615385	0.1538462	10.87	1.44462E-09
0.138	2	0.153846154	1	0	10.87	0
Total	13					

Figure 6C.LOC15.1993.1.Ordered Thickness Readings

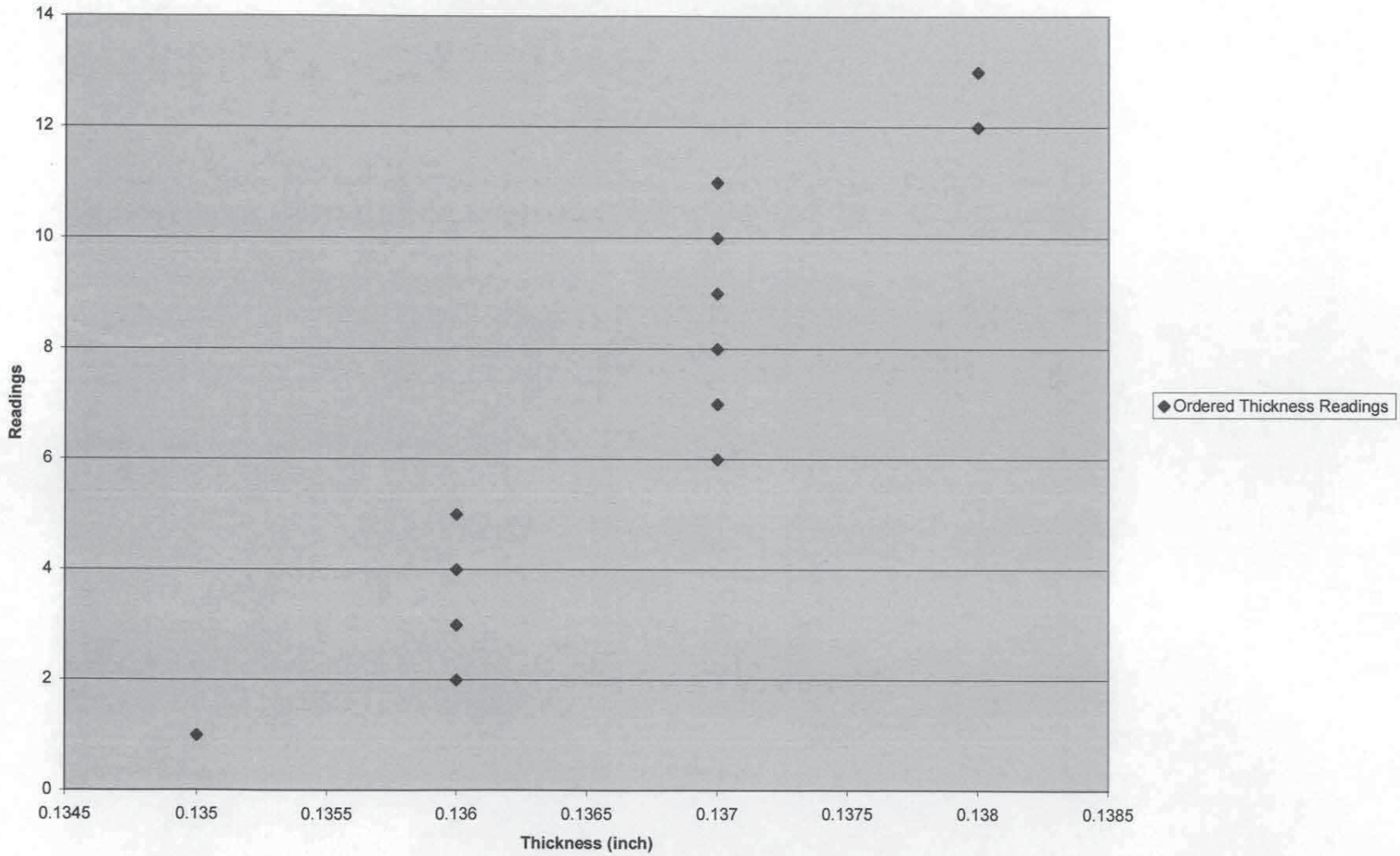


Figure 6C.LOC15.1993.2.Normalized Frequency Distribution

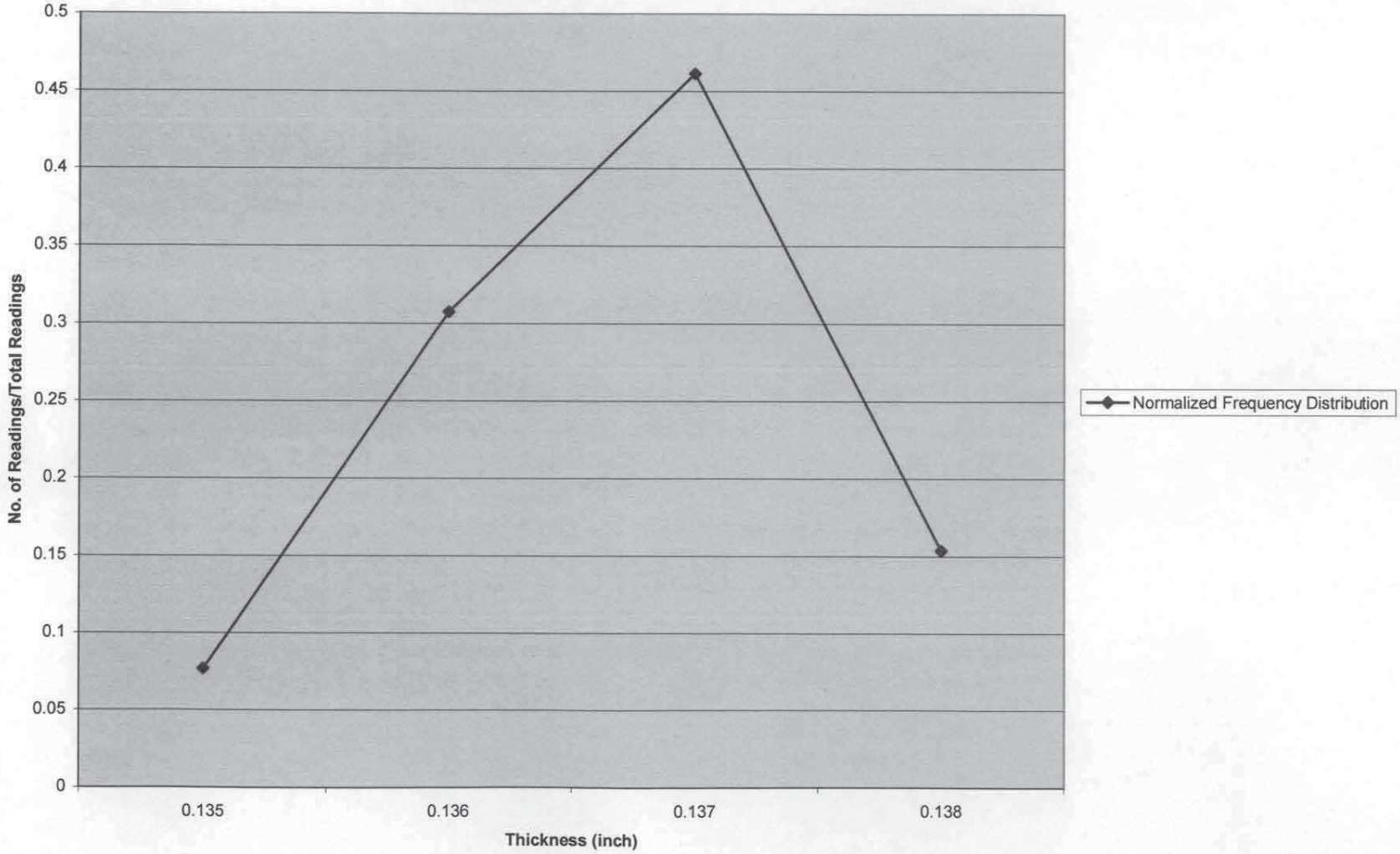


Figure 6C.LOC15.1993.3.Reliability Function

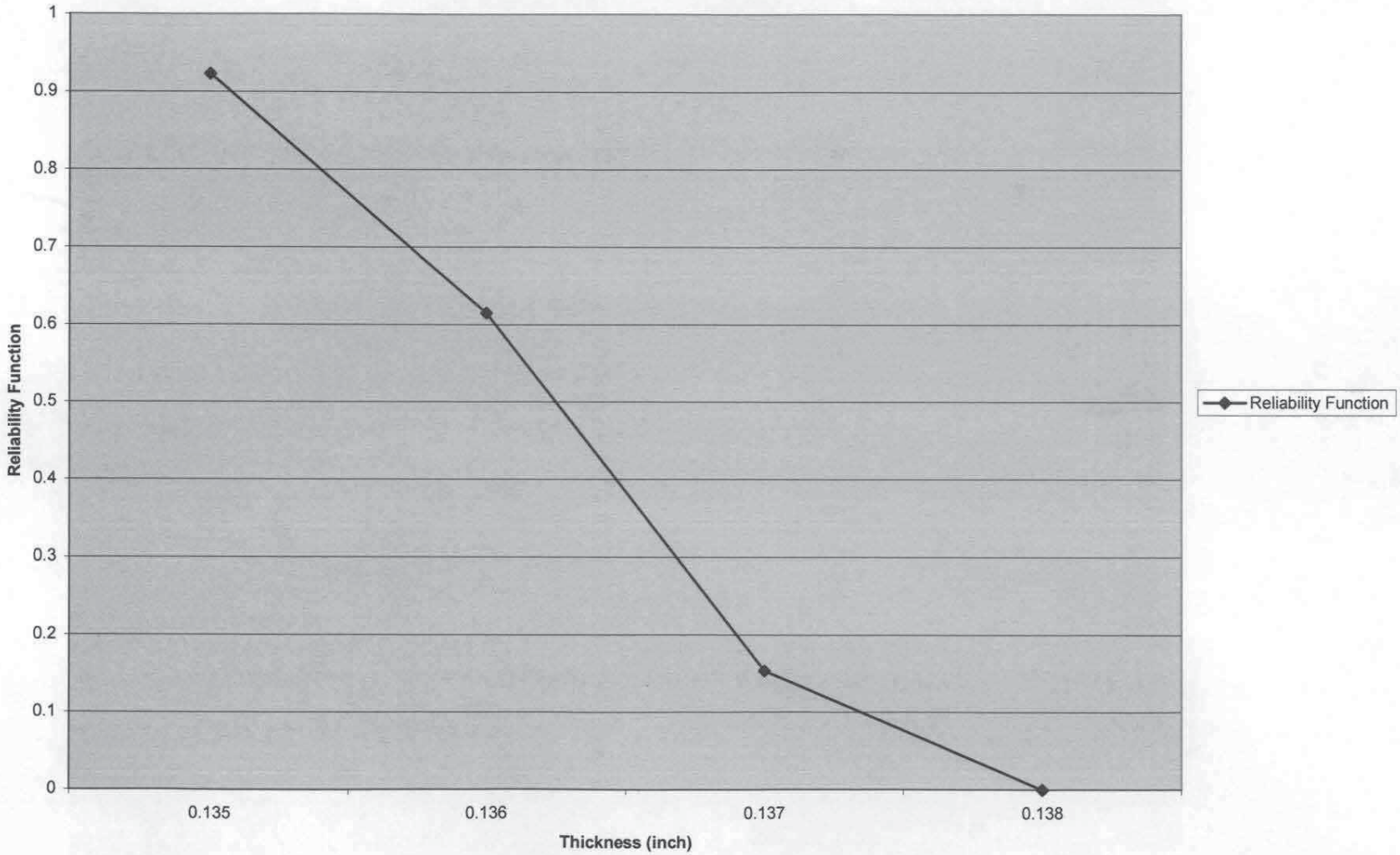


Figure 6C.LOC15.1993.4.Reliability^Area Ratio

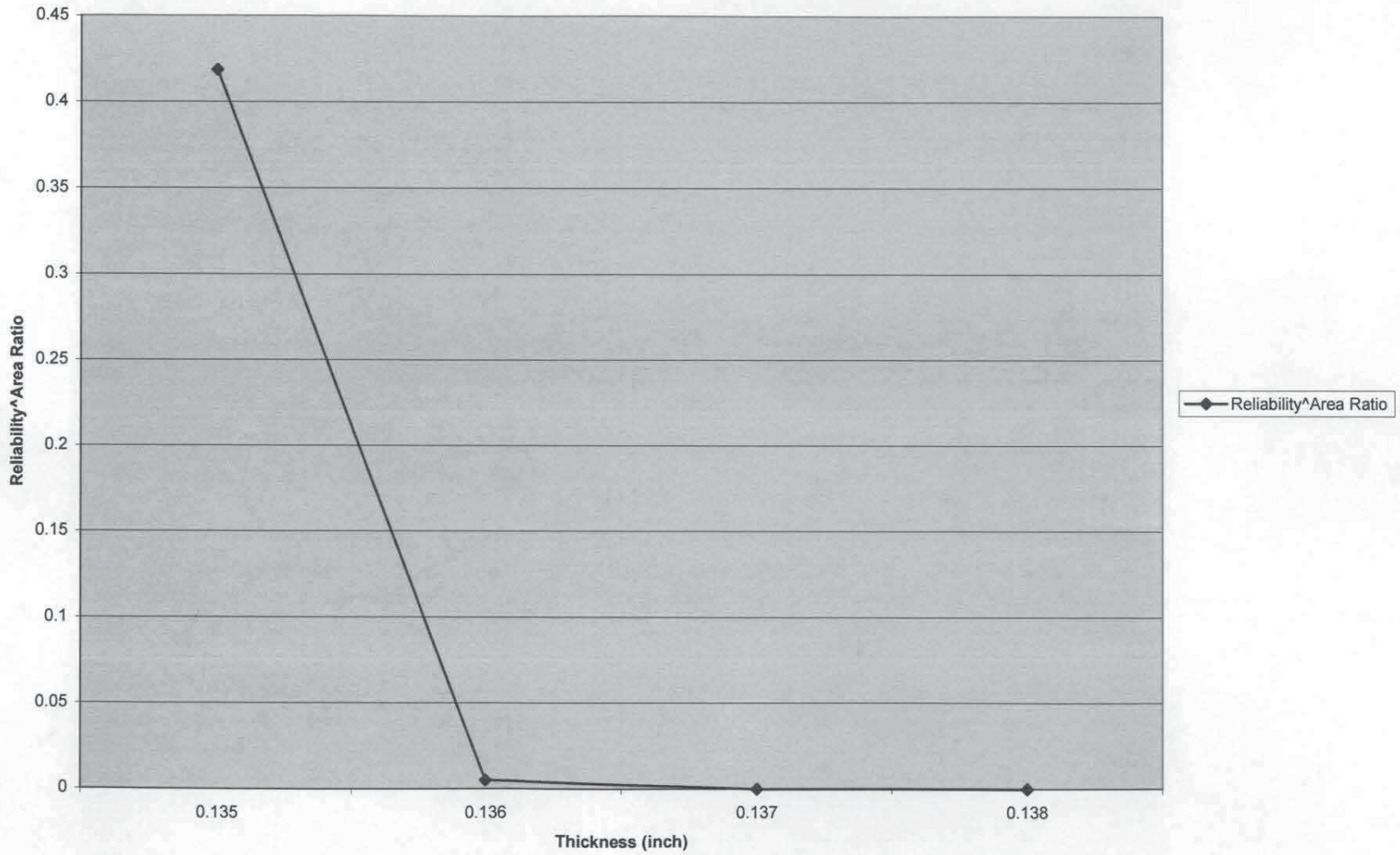


Table 6C.LOC15.1998.1	
Location 15	
Descriptive Statistics	
Mean	0.136615385
Standard Error	0.000289528
Median	0.137
Mode	0.136
Standard Deviation	0.001043908
Sample Variance	1.08974E-06
Kurtosis	-0.989095942
Skewness	-0.101428831
Range	0.003
Minimum	0.135
Maximum	0.138
Sum	1.776
Count	13
Largest(1)	0.138
Smallest(1)	0.135
Confidence Level(95.0%)	0.000630827

Table 6C.LOC15.1998.2	
Location 15	
Ordered Readings	
Thickness (inch)	*Count*
0.135	1
0.135	2
0.136	3
0.136	4
0.136	5
0.136	6
0.137	7
0.137	8
0.137	9
0.137	10
0.138	11
0.138	12
0.138	13

Table 6C.LOC15.1998.3						
Location 15						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.135	2	0.153846154	0.15384615	0.8461538	10.87	0.162565445
0.136	4	0.307692308	0.46153846	0.5384615	10.87	0.001192255
0.137	4	0.307692308	0.76923077	0.2307692	10.87	1.1877E-07
0.138	3	0.230769231	1	0	10.87	0
Total	13					

Figure 6C.LOC15.1998.1.Ordered Thickness Readings

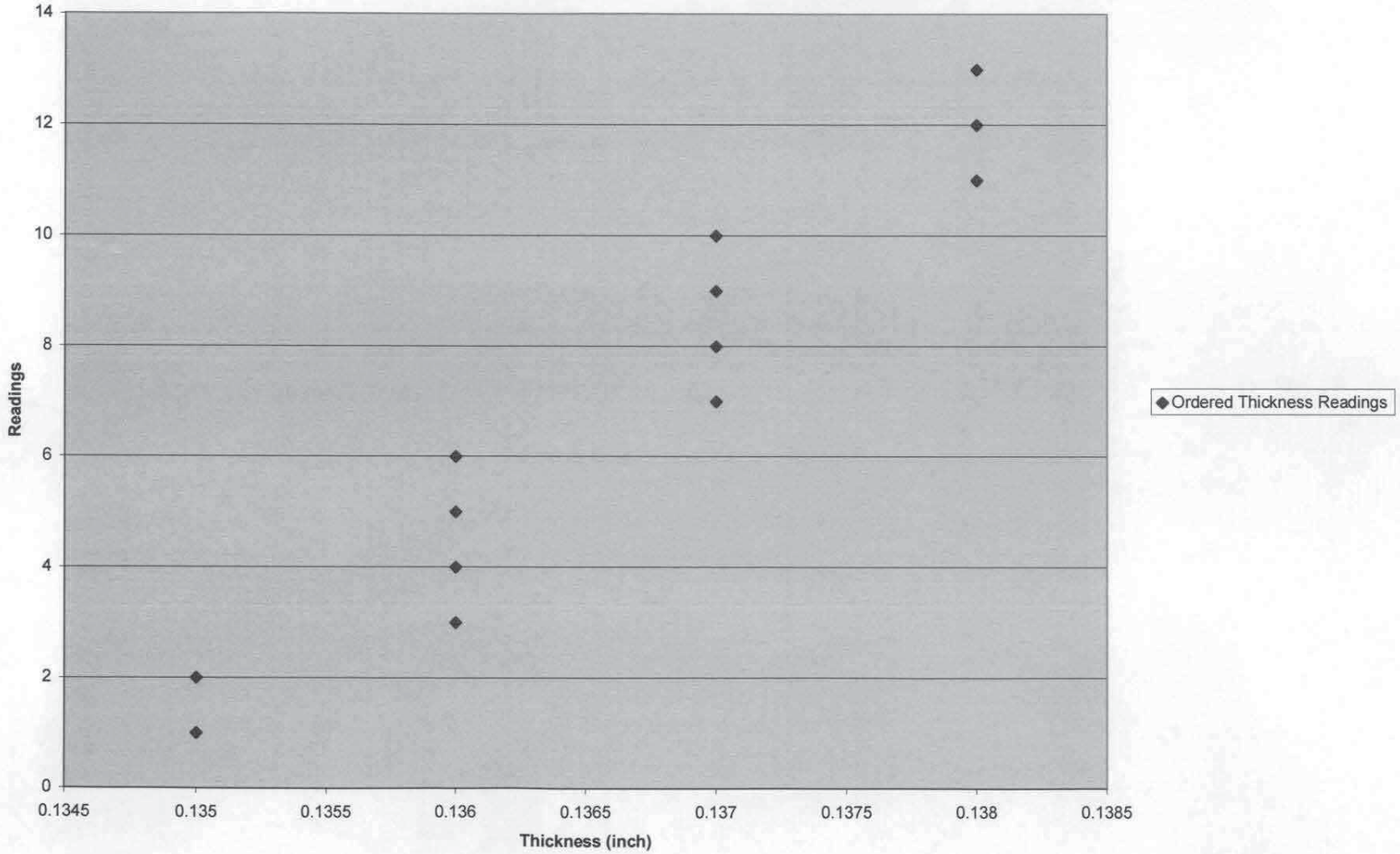


Figure 6C.LOC15.1998.2.Normalized Frequency Distribution

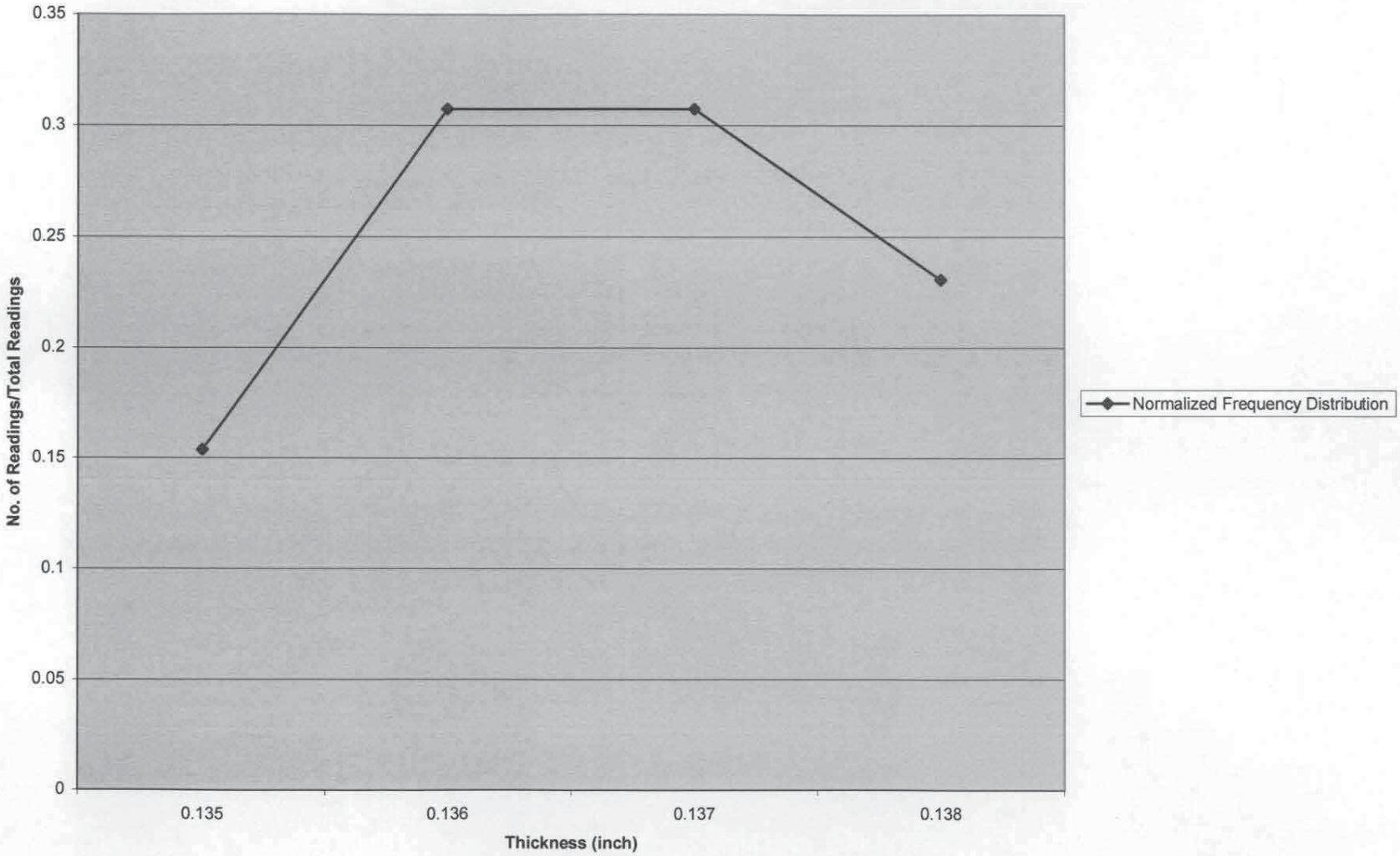


Figure 6C.LOC15.1998.3.Reliability Function

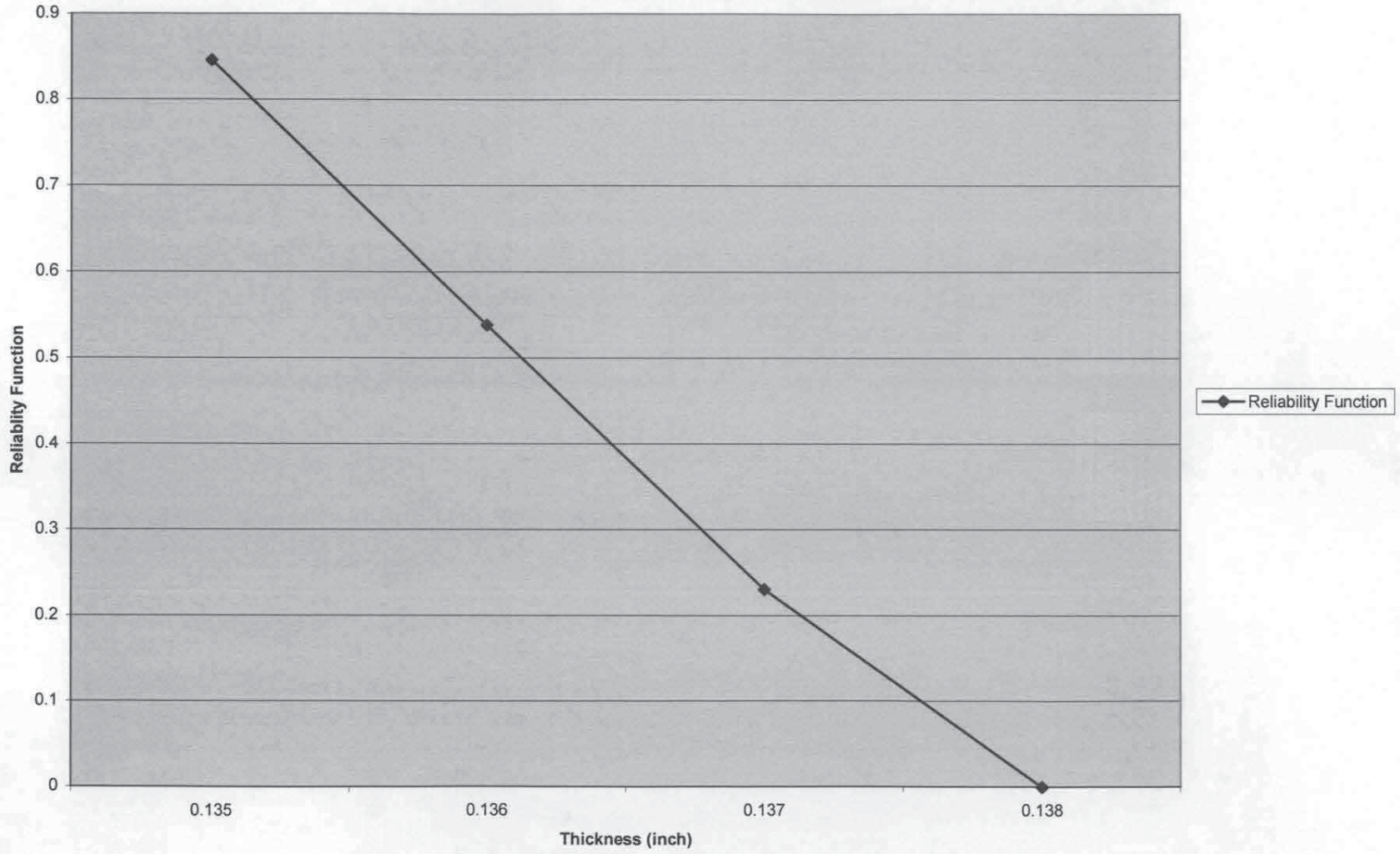


Figure 6C.LOC15.1998.4.Reliability^Area Ratio

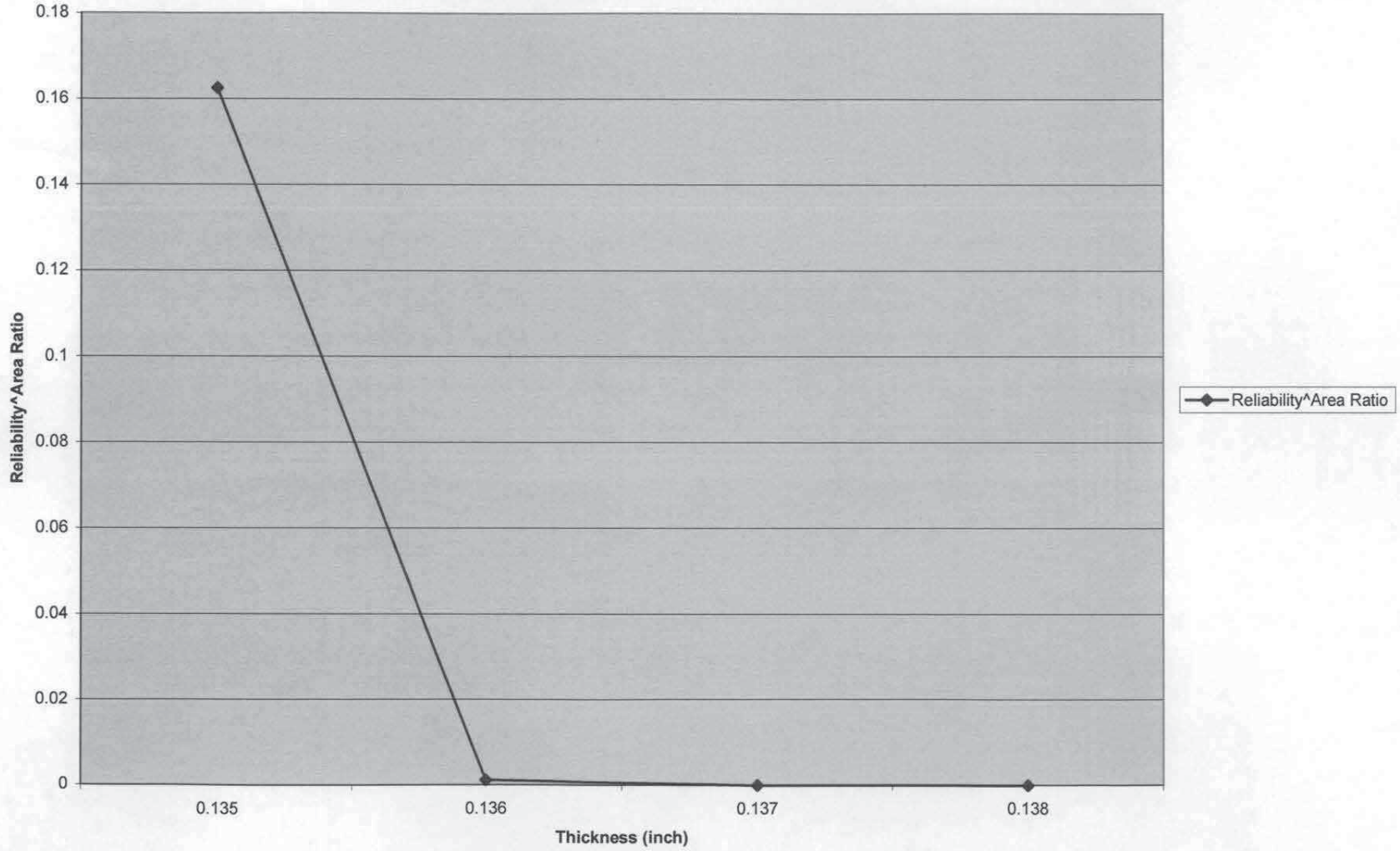


Table 6C.LOC15.2007.1	
Location 15	
Descriptive Statistics	
Mean	0.137333333
Standard Error	0.000284268
Median	0.1375
Mode	0.138
Standard Deviation	0.000984732
Sample Variance	9.69697E-07
Kurtosis	-0.9796875
Skewness	-0.1269381
Range	0.003
Minimum	0.136
Maximum	0.139
Sum	1.648
Count	12
Largest(1)	0.139
Smallest(1)	0.136
Confidence Level(95.0%)	0.000625669

Table 6C.LOC15.2007.2	
Location 15	
Ordered Readings	
Thickness (inch)	*Count*
0.136	1
0.136	2
0.136	3
0.137	4
0.137	5
0.137	6
0.138	7
0.138	8
0.138	9
0.138	10
0.138	11
0.139	12

Table 6C.LOC15.2007.3						
Location 15						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.136	3	0.25	0.25	0.75	11.78	0.033736245
0.137	3	0.25	0.5	0.5	11.78	0.000284162
0.138	5	0.416666667	0.91666667	0.0833333	11.78	1.93271E-13
0.139	1	0.083333333	1	0	11.78	0
Total	12					

Figure 6C.LOC15.2007.1.Ordered Thickness Readings

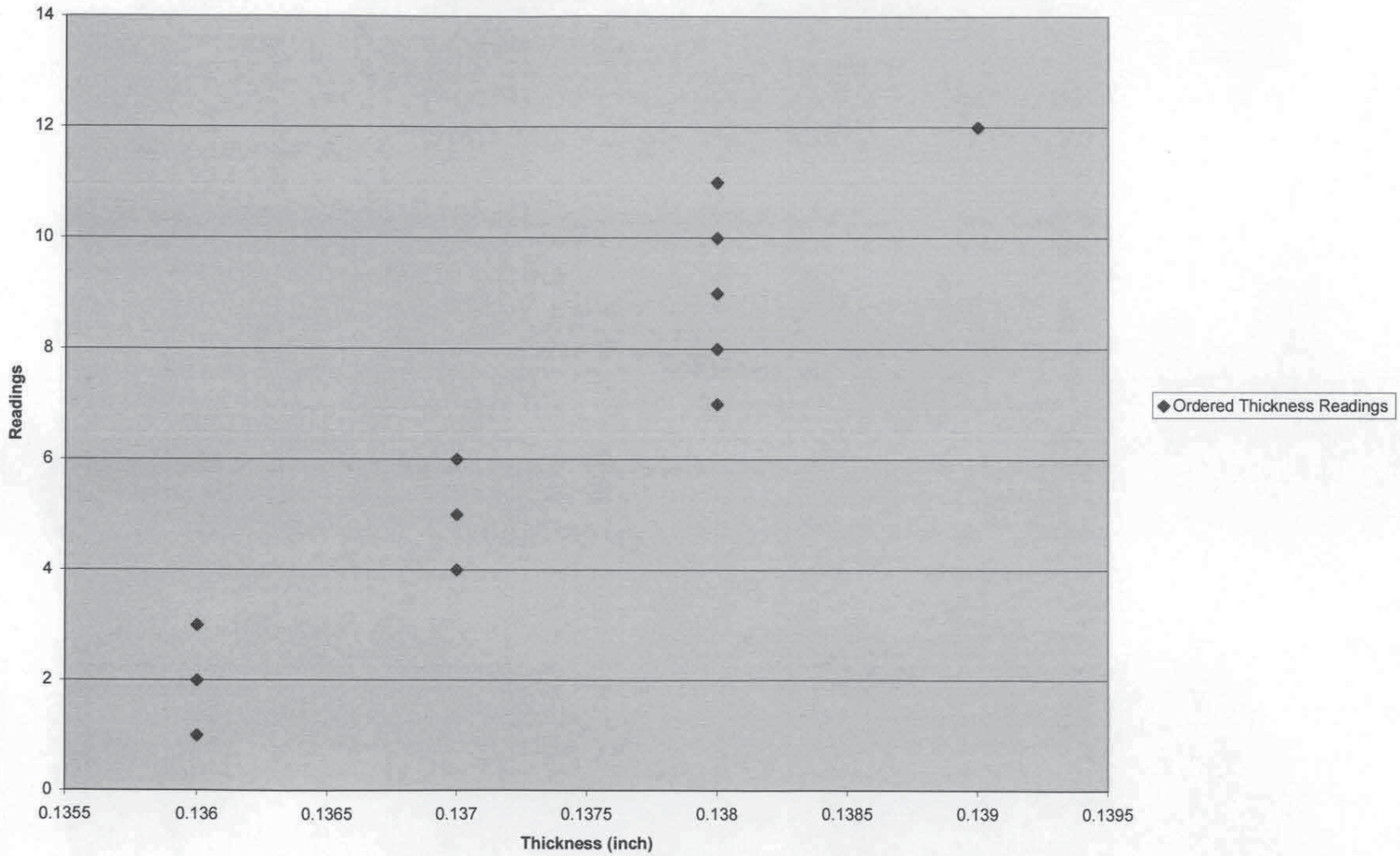


Figure 6C.LOC15.2007.2.Normalized Frequency Distribution

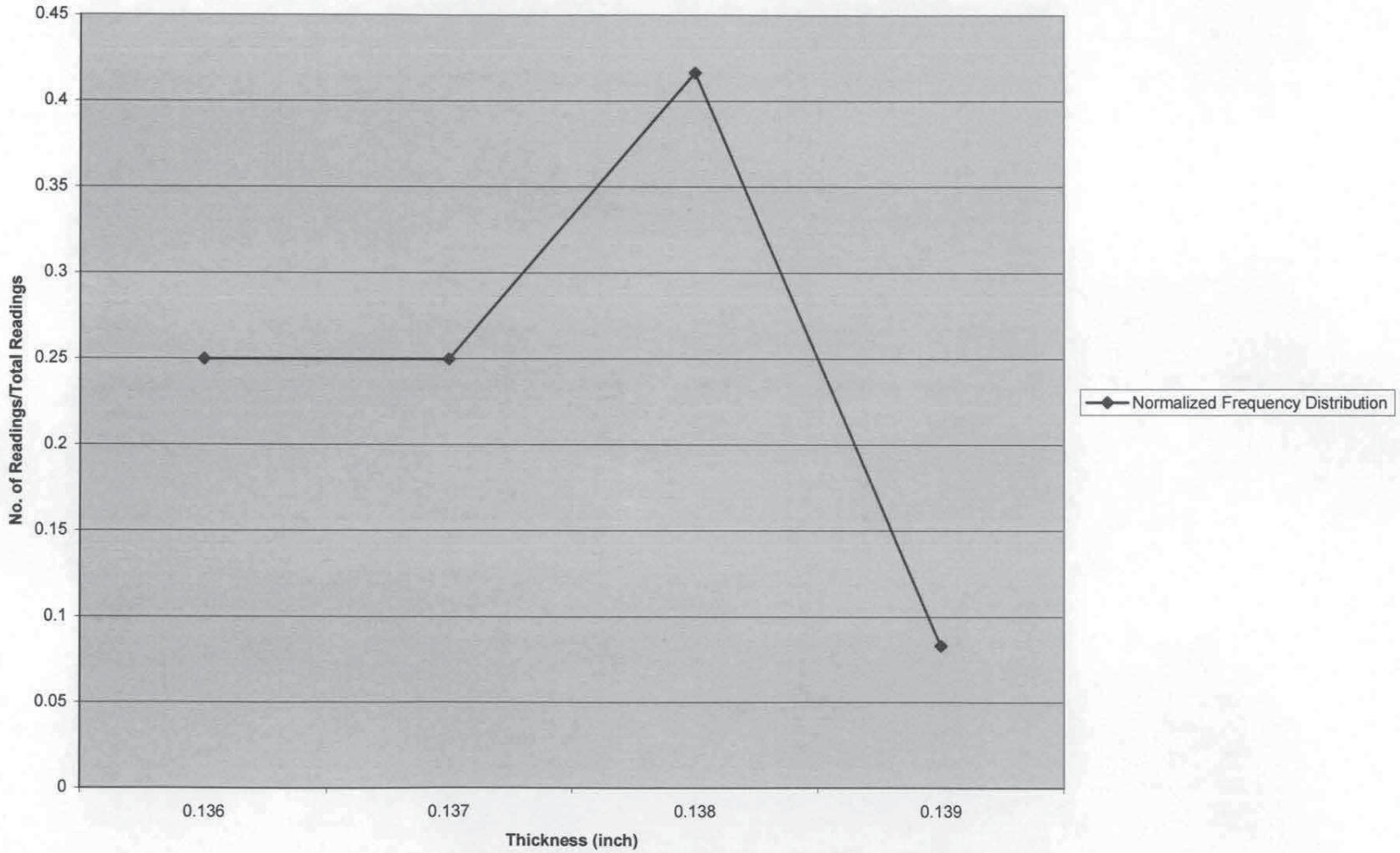


Figure 6C.LOC15.2007.3.Reliability Function

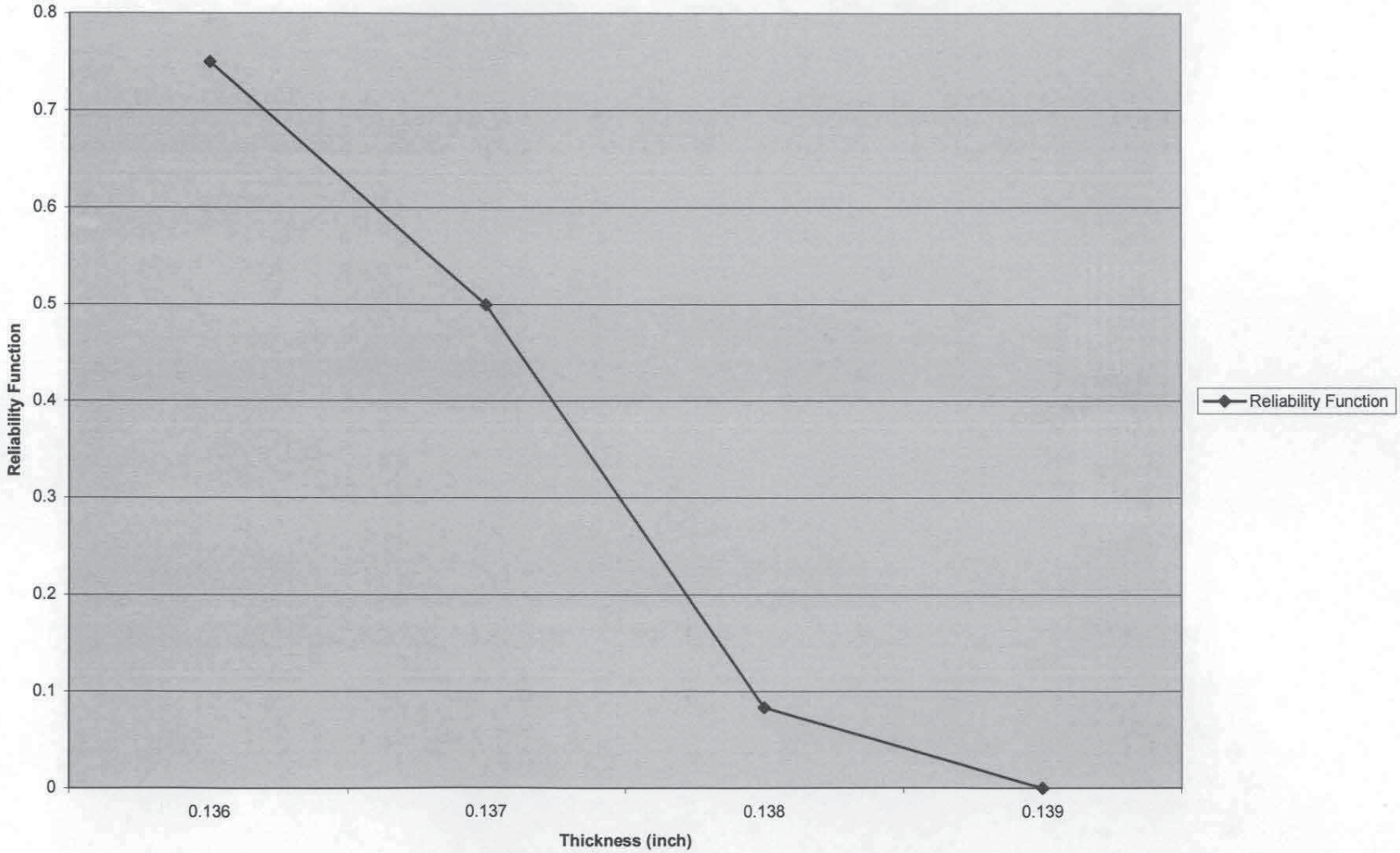


Figure 6C.LOC15.2007.4.Reliability^Area Ratio

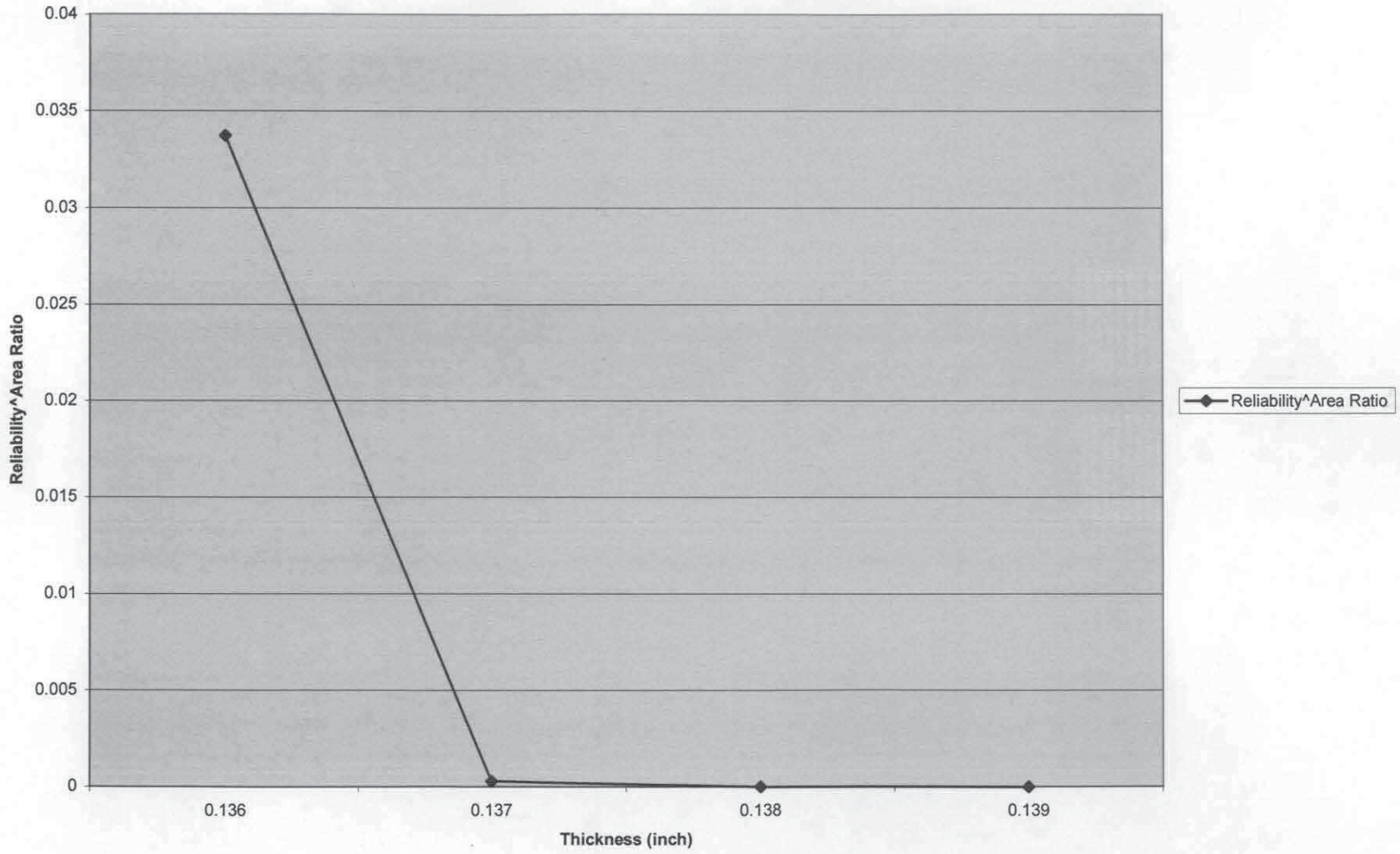


Table 6C.LOC16.1993.1	
Location 16	
Descriptive Statistics	
Mean	0.212166667
Standard Error	0.001217507
Median	0.211
Mode	0.208
Standard Deviation	0.004217568
Sample Variance	1.77879E-05
Kurtosis	-1.537635713
Skewness	0.418950127
Range	0.011
Minimum	0.208
Maximum	0.219
Sum	2.546
Count	12
Largest(1)	0.219
Smallest(1)	0.208
Confidence Level(95.0%)	0.002679715

Table 6C.LOC16.1993.2	
Location 16	
Ordered Readings	
Thickness (inch)	*Count*
0.208	1
0.208	2
0.208	3
0.208	4
0.209	5
0.21	6
0.212	7
0.215	8
0.215	9
0.216	10
0.218	11
0.219	12

Table 6C.LOC16.1993.3						
Location 16						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.208	4	0.333333333	0.33333333	0.6666667	23.56	7.09476E-05
0.209	1	0.083333333	0.41666667	0.5833333	23.56	3.05163E-06
0.21	1	0.083333333	0.5	0.5	23.56	8.07479E-08
0.212	1	0.083333333	0.58333333	0.4166667	23.56	1.10018E-09
0.215	2	0.166666667	0.75	0.25	23.56	6.52022E-15
0.216	1	0.083333333	0.83333333	0.1666667	23.56	4.62594E-19
0.218	1	0.083333333	0.91666667	0.0833333	23.56	3.73535E-26
0.219	1	0.083333333	1	0	23.56	0
Total	12					

Figure 6C.LOC16.1993.1.Ordered Thickness Readings

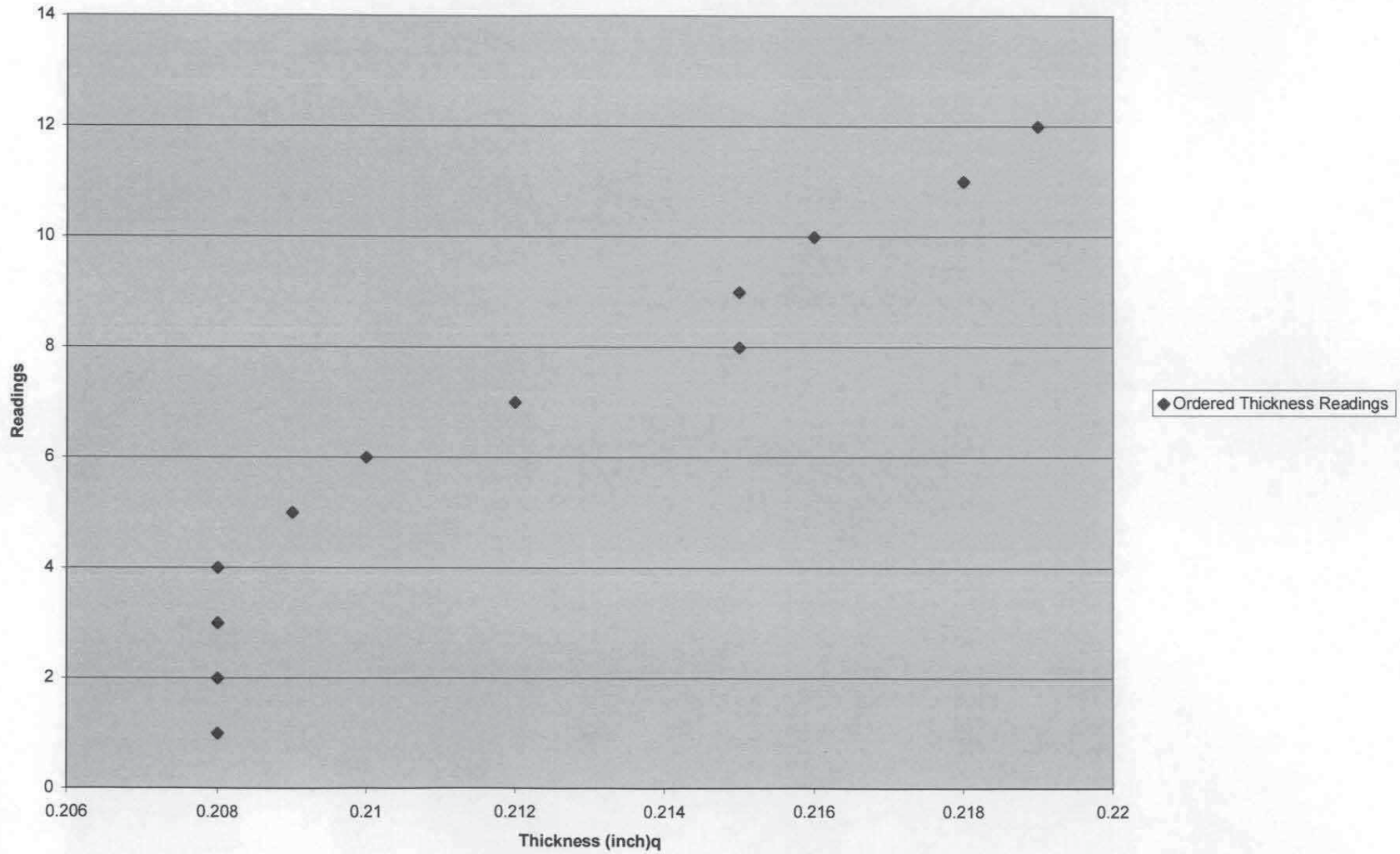


Figure 6C.LOC16.1993.2.Normalized Frequency Distribution

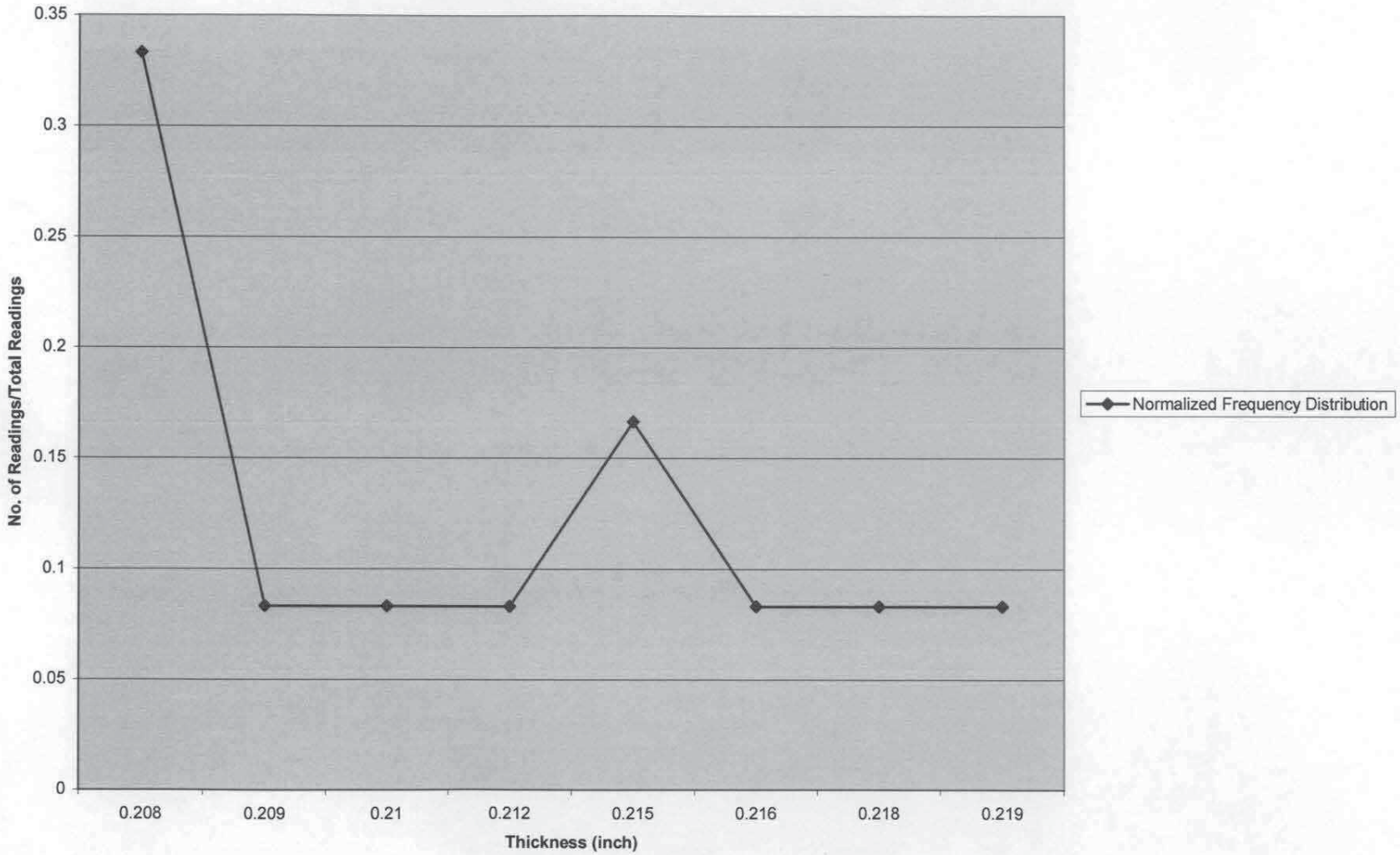


Figure 6C.LOC16.1993.3.Reliability Function

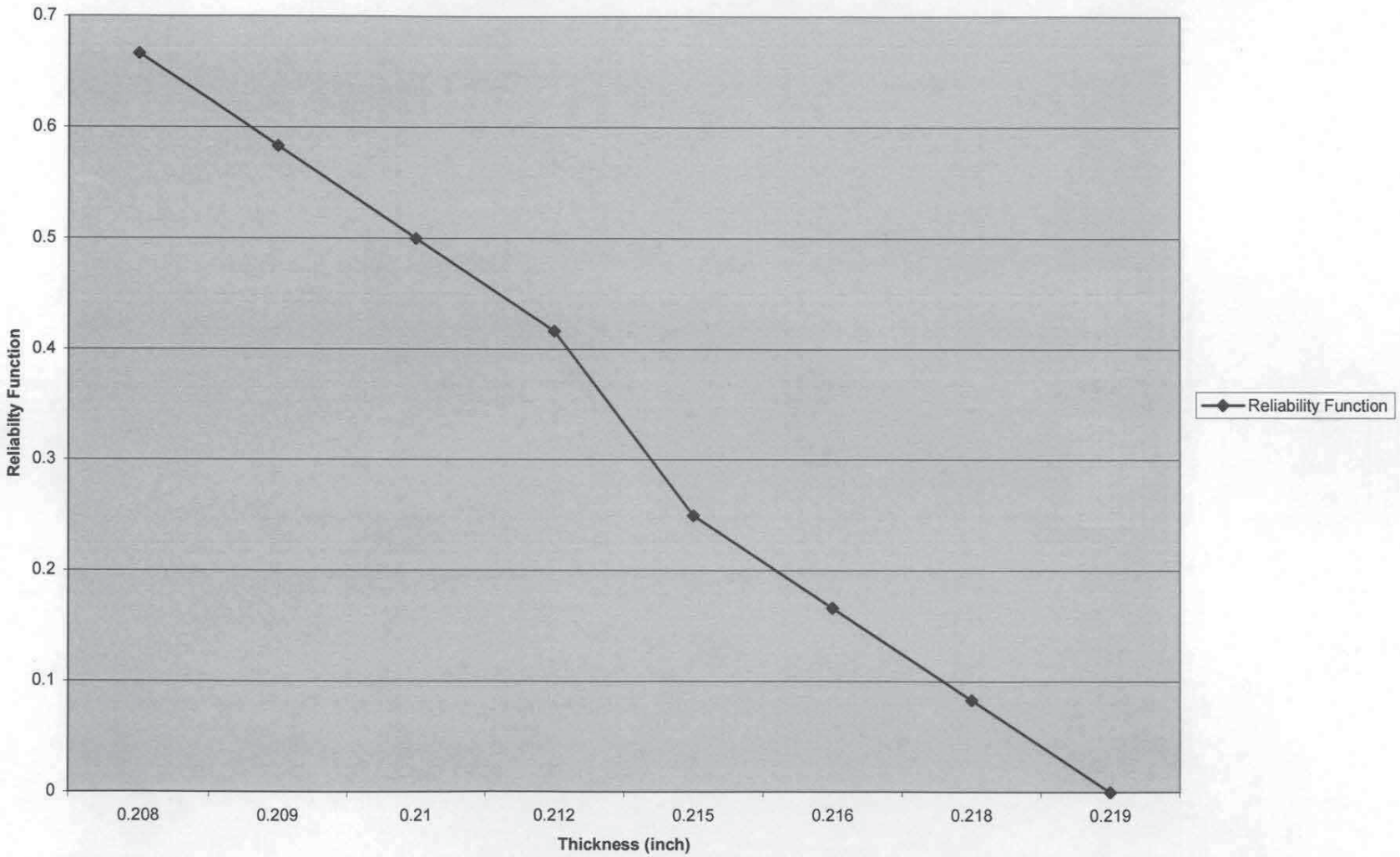


Figure 6C.LOC16.1993.4.Reliability^Area Ratio

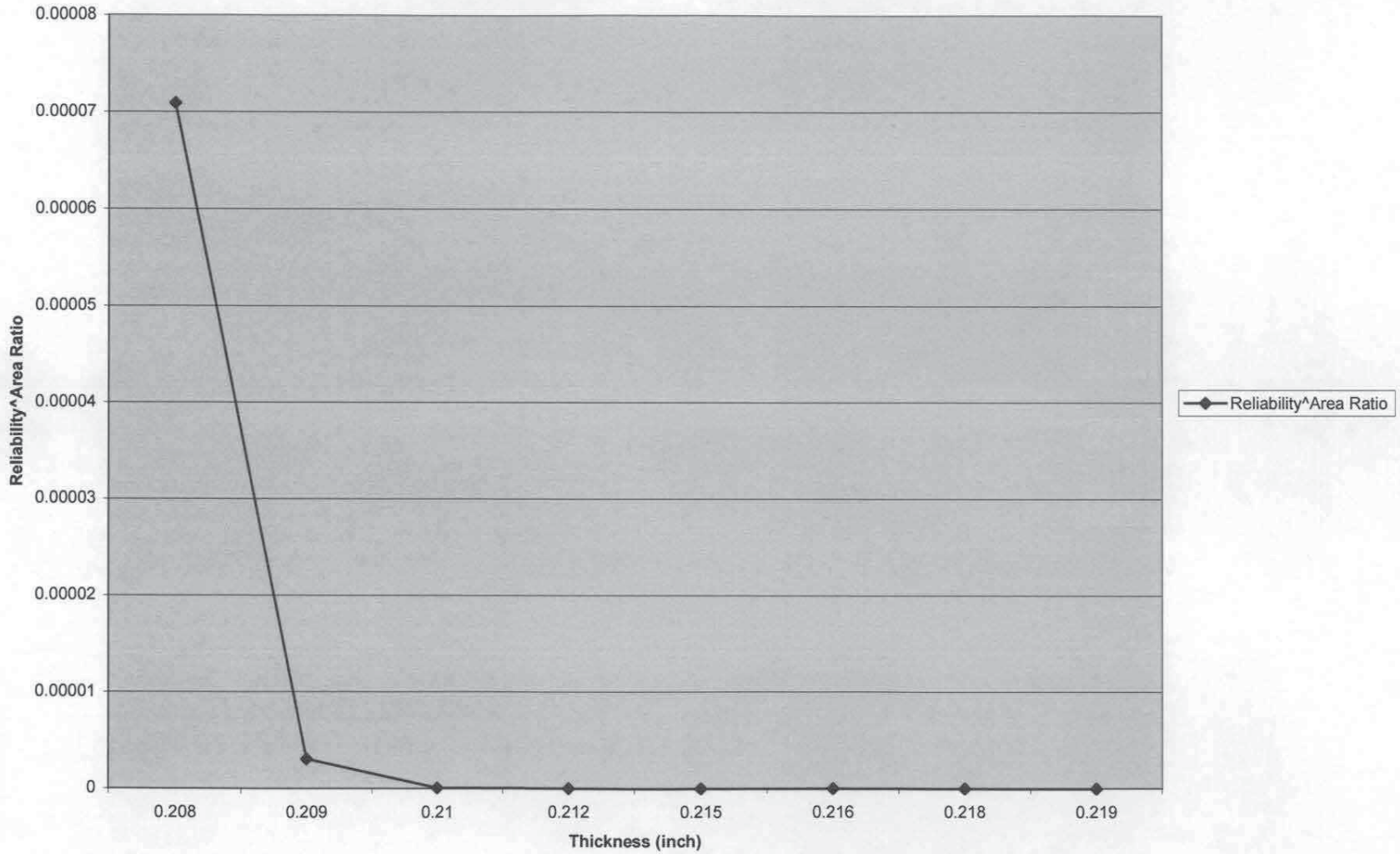


Table 6C.LOC16.1998.1	
Location 16	
Descriptive Statistics	
Mean	0.22525
Standard Error	0.008358
Median	0.218
Mode	0.218
Standard Deviation	0.028952
Sample Variance	0.000838
Kurtosis	11.2085
Skewness	3.309259
Range	0.105
Minimum	0.211
Maximum	0.316
Sum	2.703
Count	12
Largest(1)	0.316
Smallest(1)	0.211
Confidence Level(95.0%)	0.018395

Table 6C.LOC16.1998.2	
Location 16	
Ordered Readings	
Thickness (inch)	*Count*
0.211	1
0.213	2
0.213	3
0.213	4
0.214	5
0.218	6
0.218	7
0.218	8
0.219	9
0.223	10
0.227	11
0.316	12

Table 6C.LOC16.1998.3						
Location 16						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.211	1	0.083333333	0.08333333	0.9166667	23.56	0.128714042
0.213	3	0.25	0.33333333	0.6666667	23.56	7.09476E-05
0.214	1	0.083333333	0.41666667	0.5833333	23.56	3.05163E-06
0.218	3	0.25	0.66666667	0.3333333	23.56	5.72887E-12
0.219	1	0.083333333	0.75	0.25	23.56	6.52022E-15
0.223	1	0.083333333	0.83333333	0.1666667	23.56	4.62594E-19
0.227	1	0.083333333	0.91666667	0.0833333	23.56	3.73535E-26
0.316	1	0.083333333	1	0	23.56	0
Total	12					

Figure 6C.LOC16.1998.1.Ordered Thickness Readings

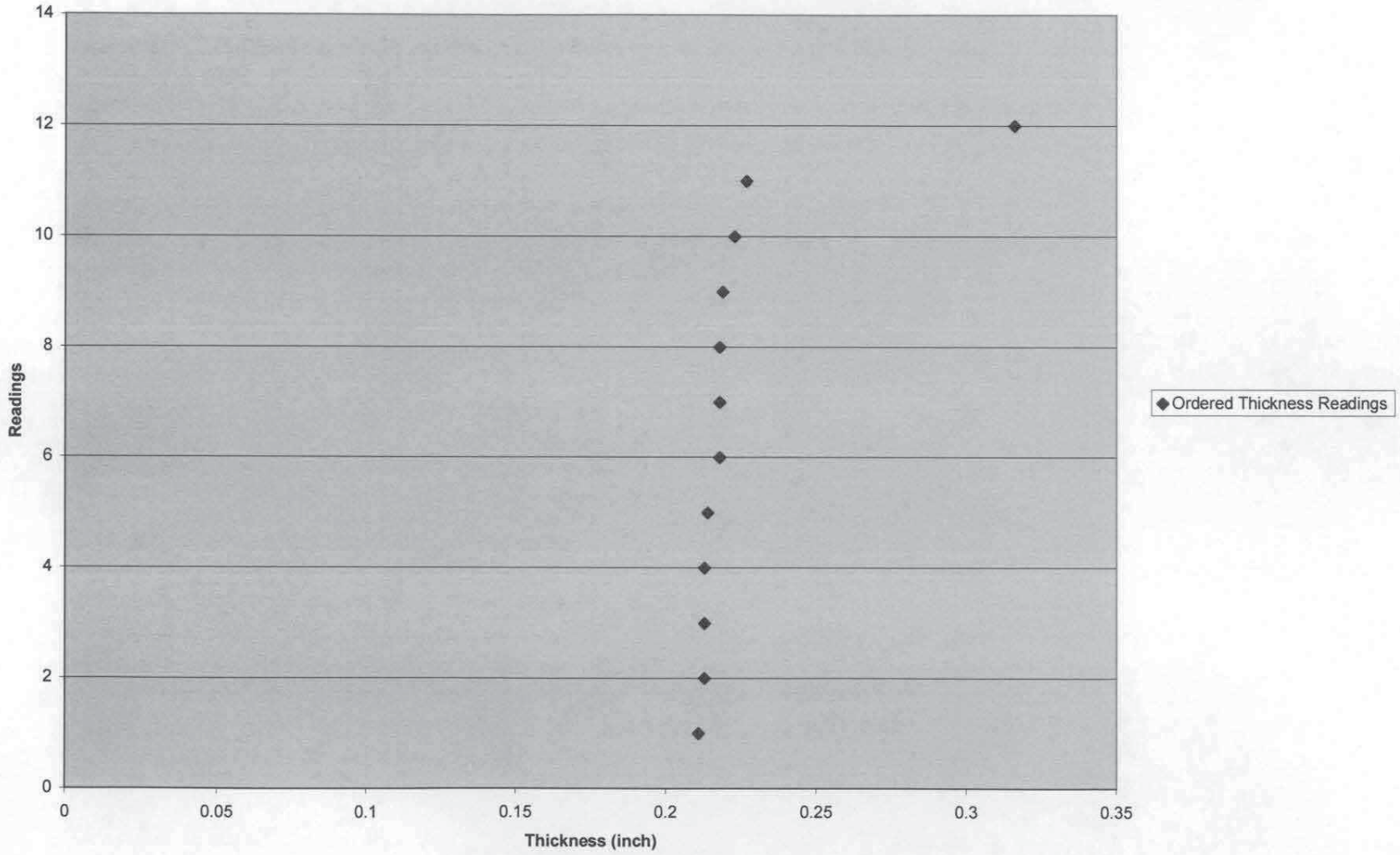


Figure 6C.LOC16.1998.2.Normalized Frequency Distribution

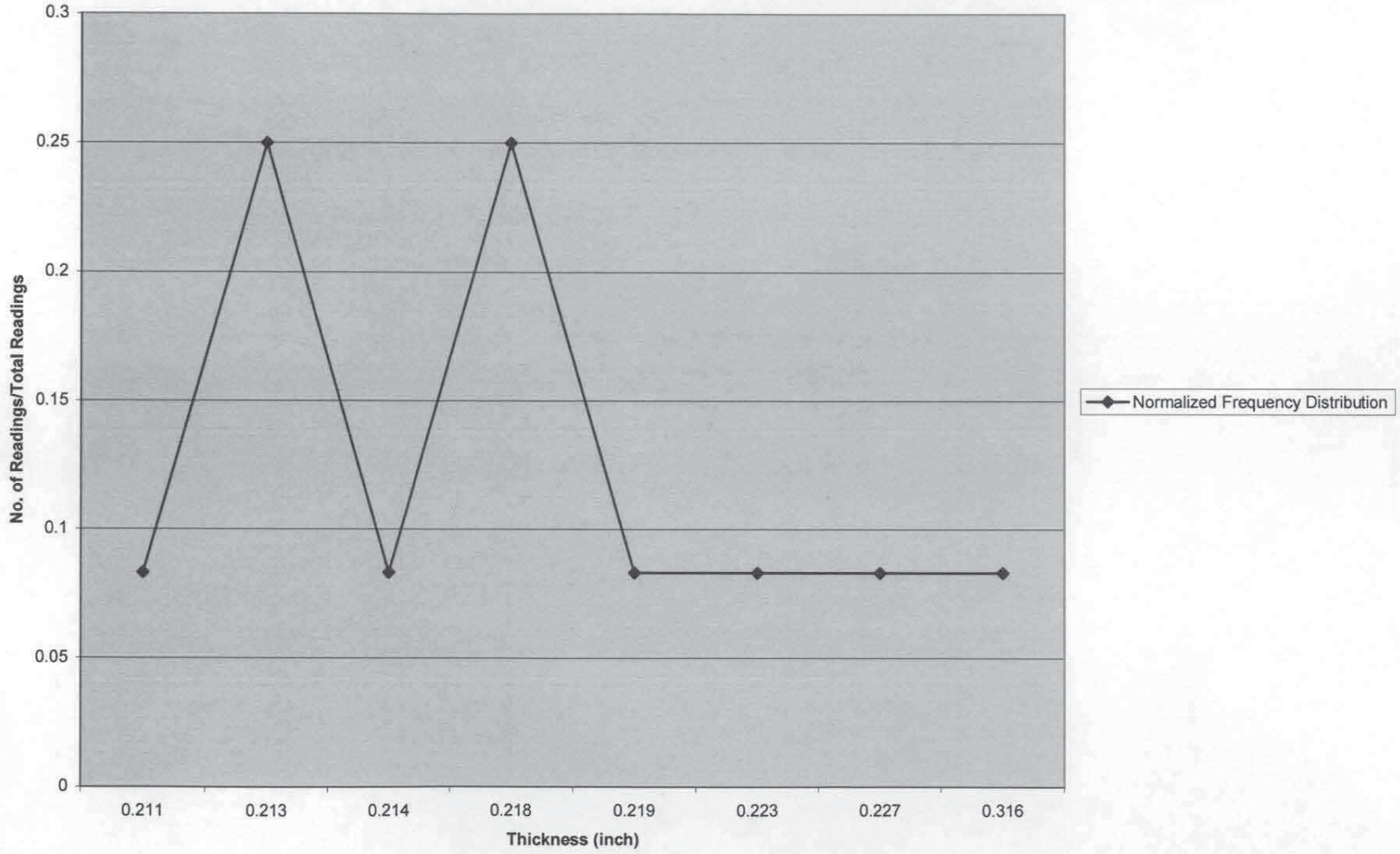


Figure 6C.LOC16.1998.3.Reliabilty Function

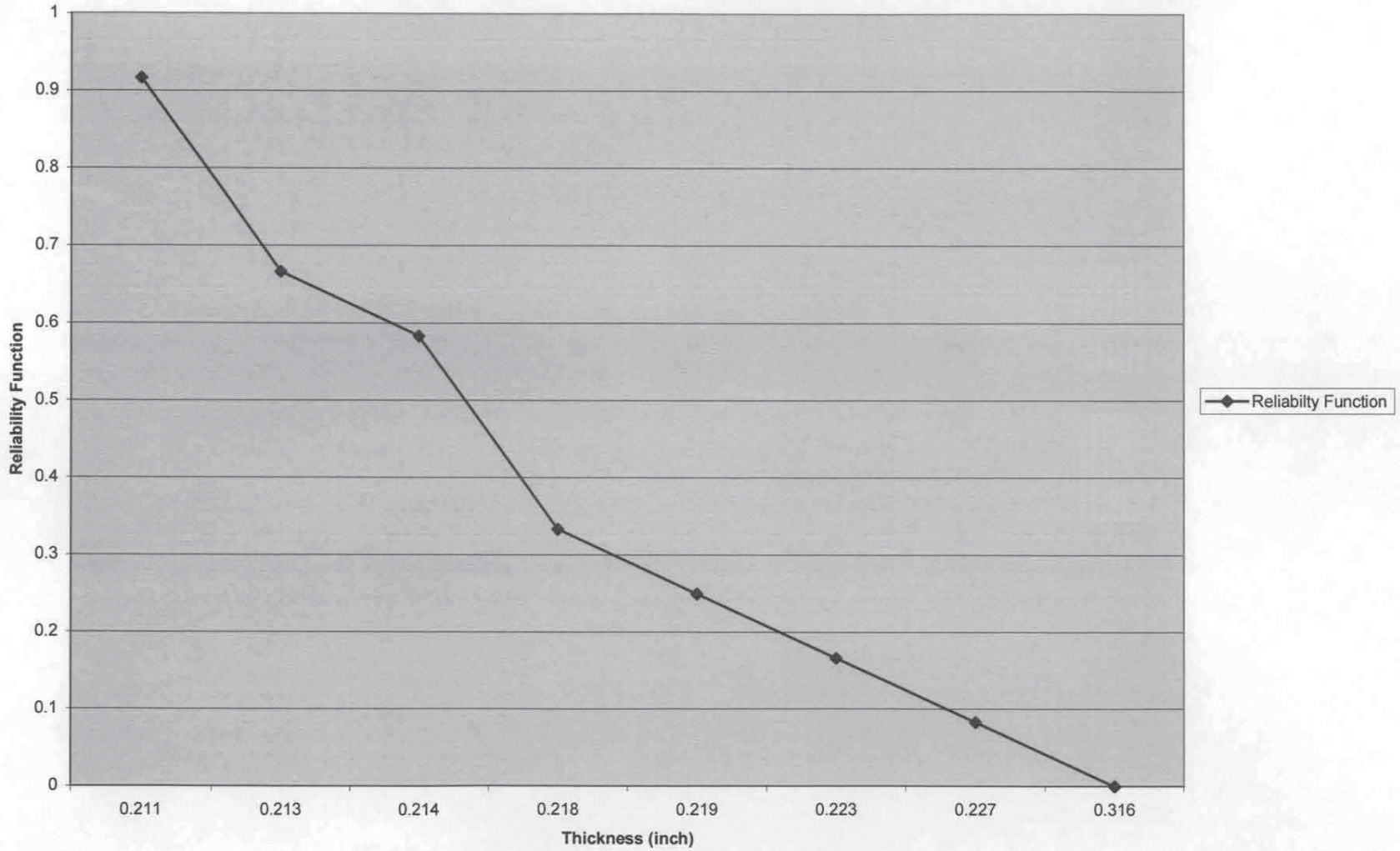


Figure 6C.LOC16.1998.4.Reliabiity^Area Ratio

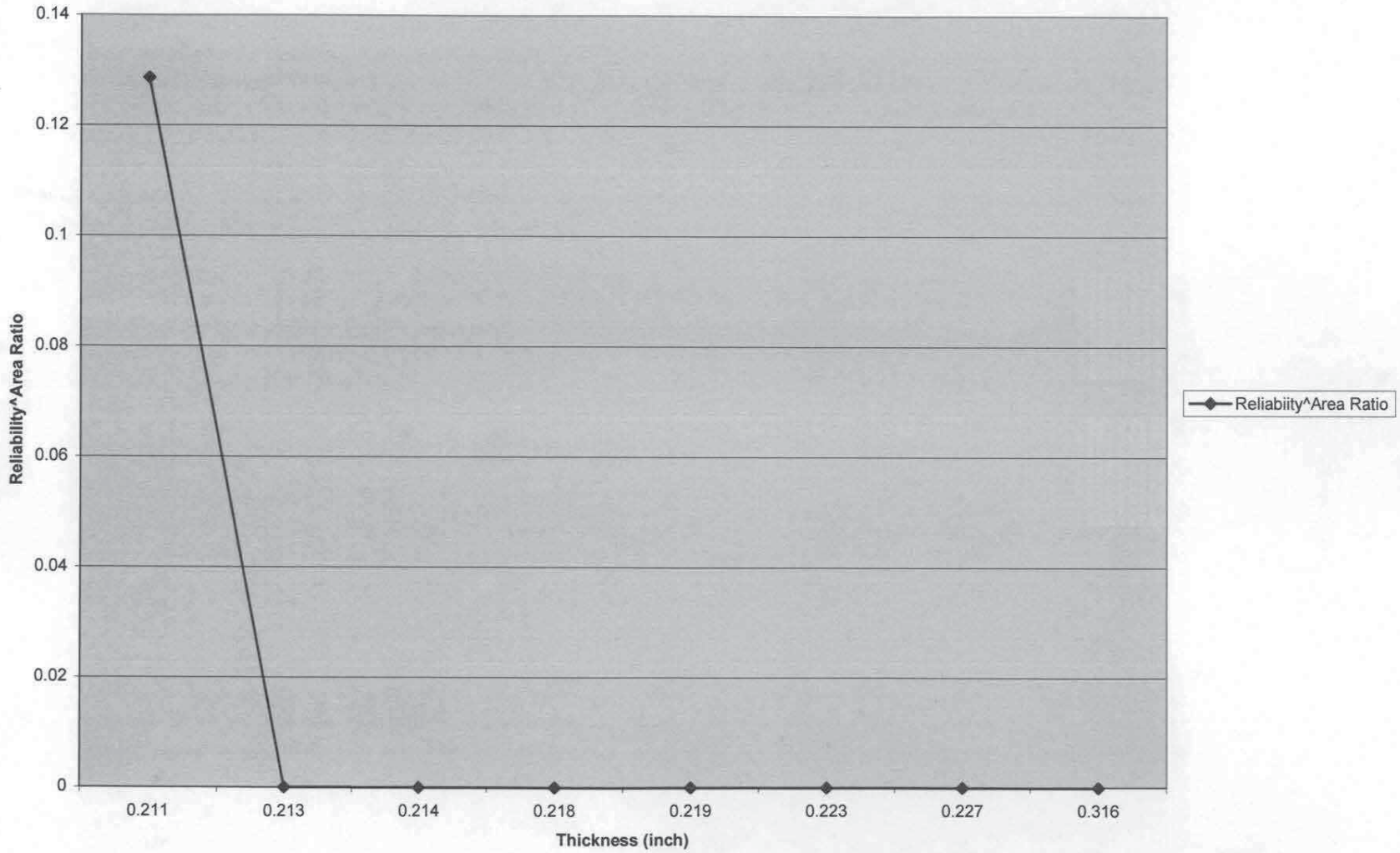


Table 6C.LOC16.2007.1	
Location 16	
Descriptive Statistics	
Mean	0.218
Standard Error	0.001037187
Median	0.216
Mode	0.215
Standard Deviation	0.003592922
Sample Variance	1.29091E-05
Kurtosis	-0.563056272
Skewness	0.959633135
Range	0.01
Minimum	0.215
Maximum	0.225
Sum	2.616
Count	12
Largest(1)	0.225
Smallest(1)	0.215
Confidence Level(95.0%)	0.002282834

Table 6C.LOC16.2007.2	
Location 16	
Ordered Readings	
Thickness (inch)	*Count*
0.215	1
0.215	2
0.215	3
0.215	4
0.216	5
0.216	6
0.216	7
0.218	8
0.22	9
0.222	10
0.223	11
0.225	12

Table 6C.LOC16.2007.3						
Location 16						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.215	4	0.333333333	0.33333333	0.6666667	23.56	7.09476E-05
0.216	3	0.25	0.58333333	0.4166667	23.56	1.10018E-09
0.218	1	0.083333333	0.66666667	0.3333333	23.56	5.72887E-12
0.22	1	0.083333333	0.75	0.25	23.56	6.52022E-15
0.222	1	0.083333333	0.83333333	0.1666667	23.56	4.62594E-19
0.223	1	0.083333333	0.91666667	0.0833333	23.56	3.73535E-26
0.225	1	0.083333333	1	0	23.56	0
Total	12					

Figure 6C.LOC16.2007.1.Ordered Thickness Readings

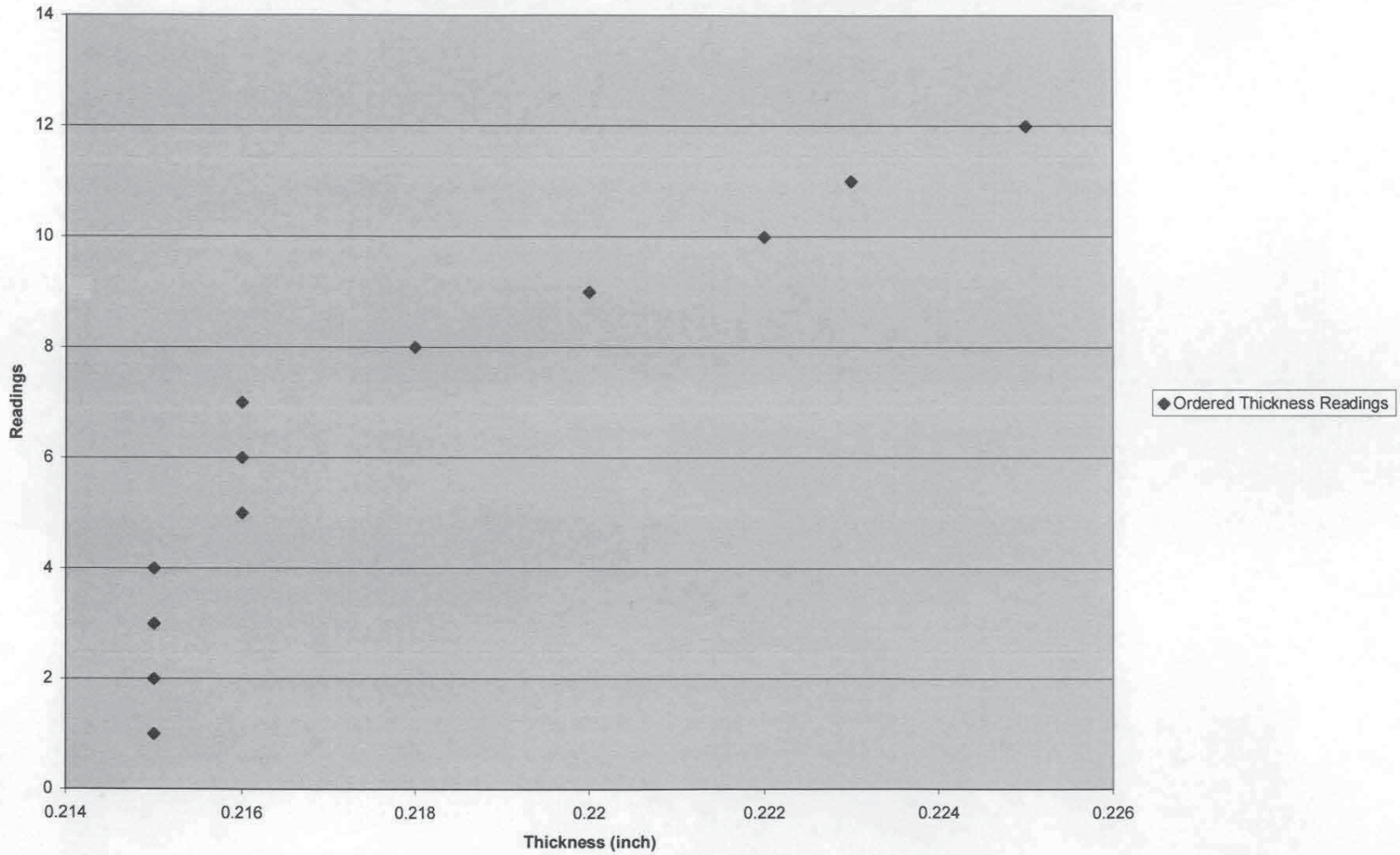


Figure 6C.LOC16.2007.2.Normalized Frequency Distribution

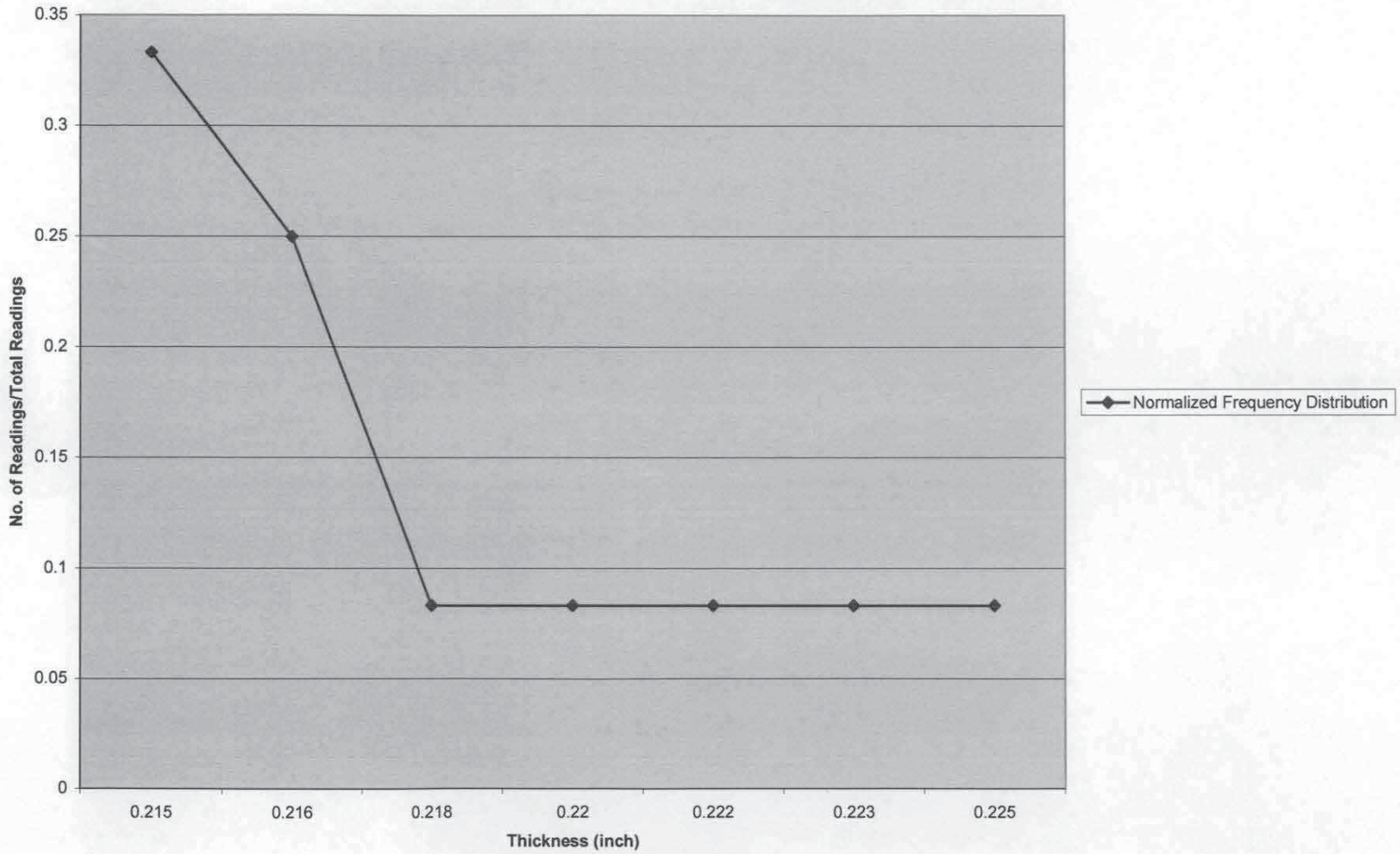


Figure 6C.LOC16.2007.3.Reliability Function

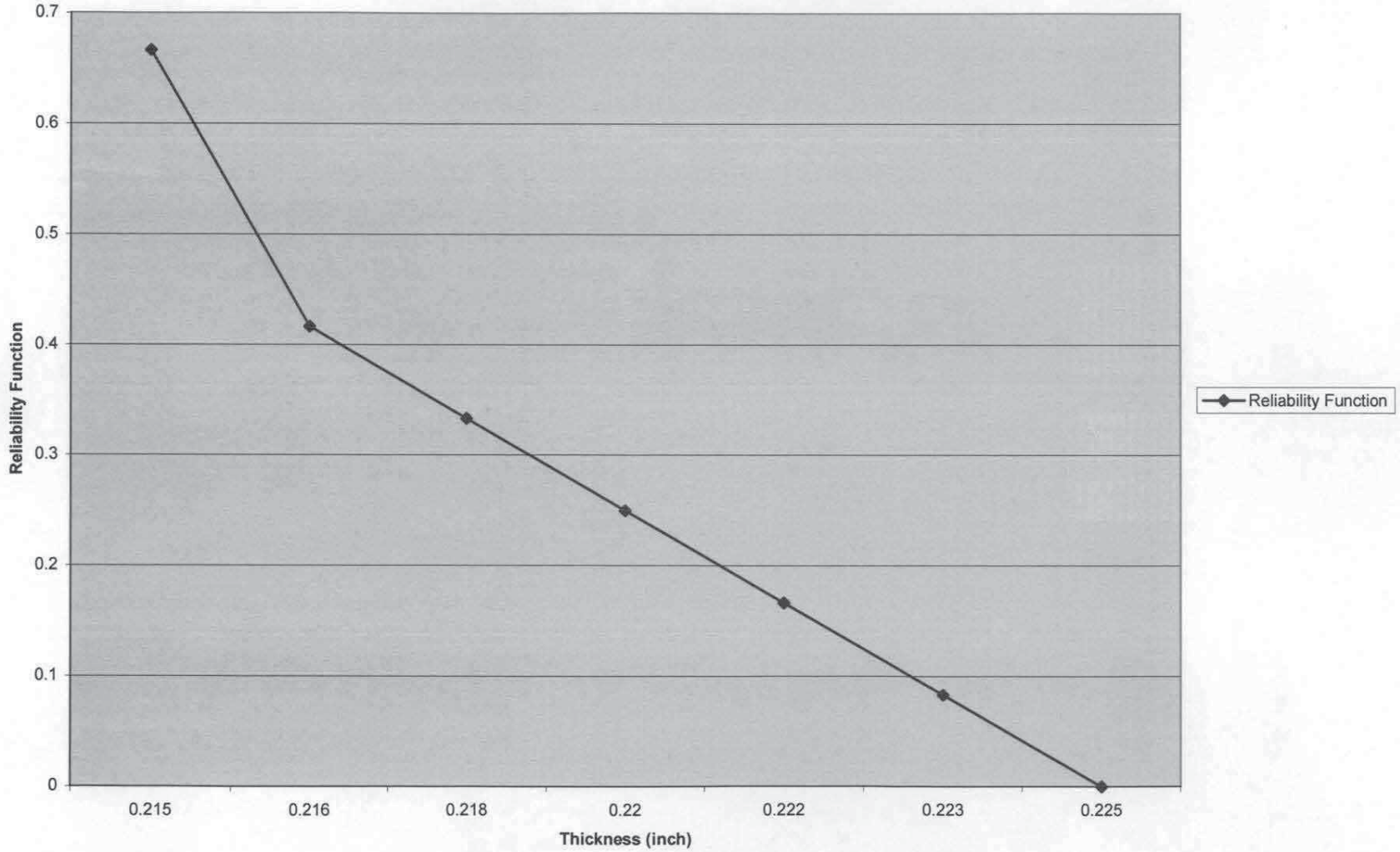


Figure 6C.LOC16.2007.4.Reliability^Area Ratio

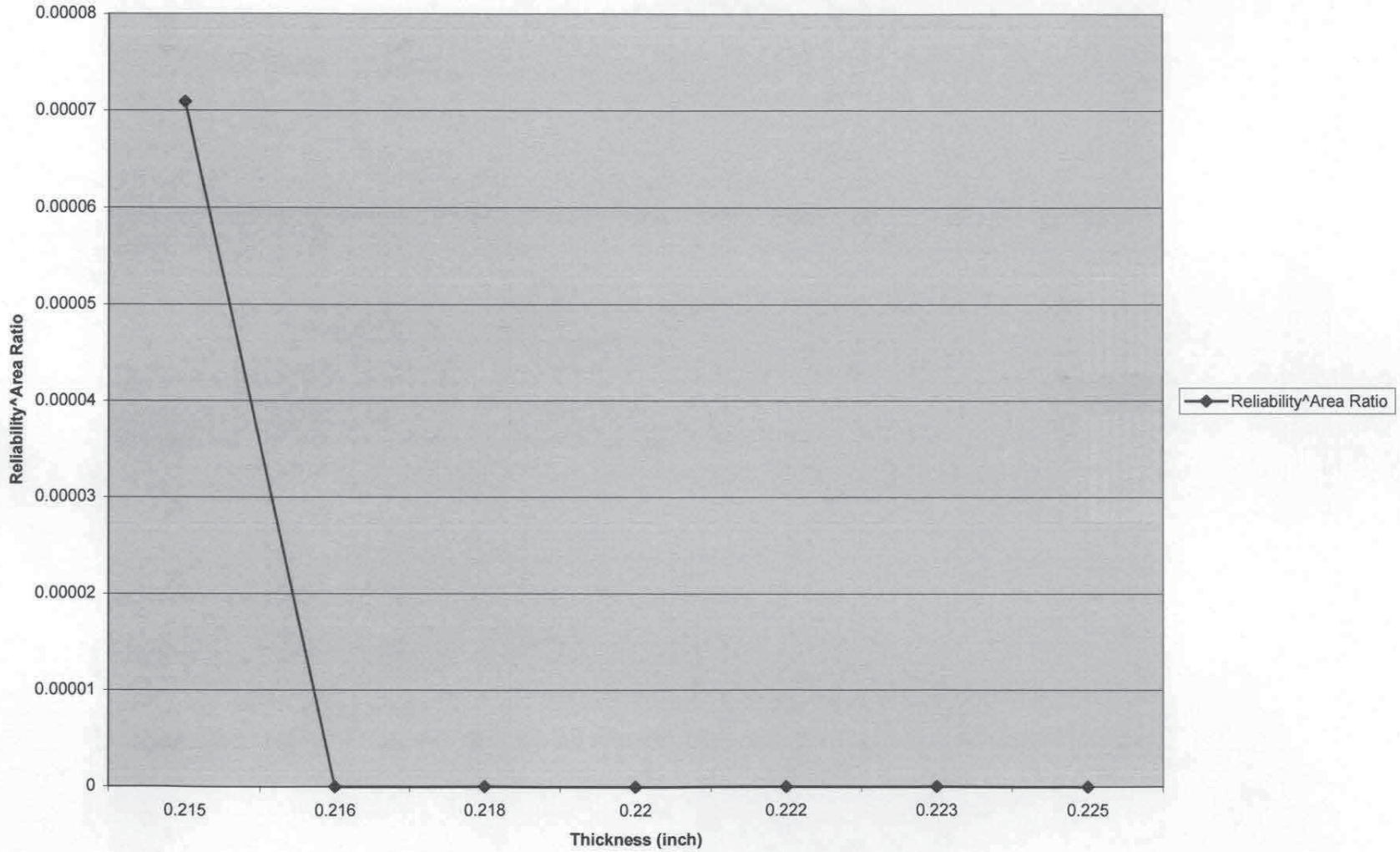


Table 6C.LOC17.1993.1	
Location 17	
Descriptive Statistics	
Mean	0.305833333
Standard Error	0.001380784
Median	0.306
Mode	0.309
Standard Deviation	0.004783178
Sample Variance	2.28788E-05
Kurtosis	-0.137690803
Skewness	0.123501264
Range	0.017
Minimum	0.298
Maximum	0.315
Sum	3.67
Count	12
Largest(1)	0.315
Smallest(1)	0.298
Confidence Level(95.0%)	0.003039086

Table 6C.LOC17.1993.2	
Location 17	
Ordered Readings	
Thickness (inch)	*Count*
0.298	1
0.3	2
0.302	3
0.302	4
0.305	5
0.306	6
0.306	7
0.308	8
0.309	9
0.309	10
0.31	11
0.315	12

Table 6C.LOC17.1993.3						
Location 17						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.298	1	0.083333333	0.08333333	0.9166667	101.5	0.000145559
0.3	1	0.083333333	0.16666667	0.8333333	101.5	9.12274E-09
0.302	2	0.166666667	0.33333333	0.6666667	101.5	1.3186E-18
0.305	1	0.083333333	0.41666667	0.5833333	101.5	1.7051E-24
0.306	2	0.166666667	0.58333333	0.4166667	101.5	2.4789E-39
0.308	1	0.083333333	0.66666667	0.3333333	101.5	3.583E-49
0.309	2	0.166666667	0.83333333	0.1666667	101.5	9.736E-80
0.31	1	0.083333333	0.91666667	0.0833333	101.5	2.6455E-110
0.315	1	0.083333333	1	0	101.5	0
Total	12					

Figure 6C.LOC17.1993.1.Ordered Thickness Readings

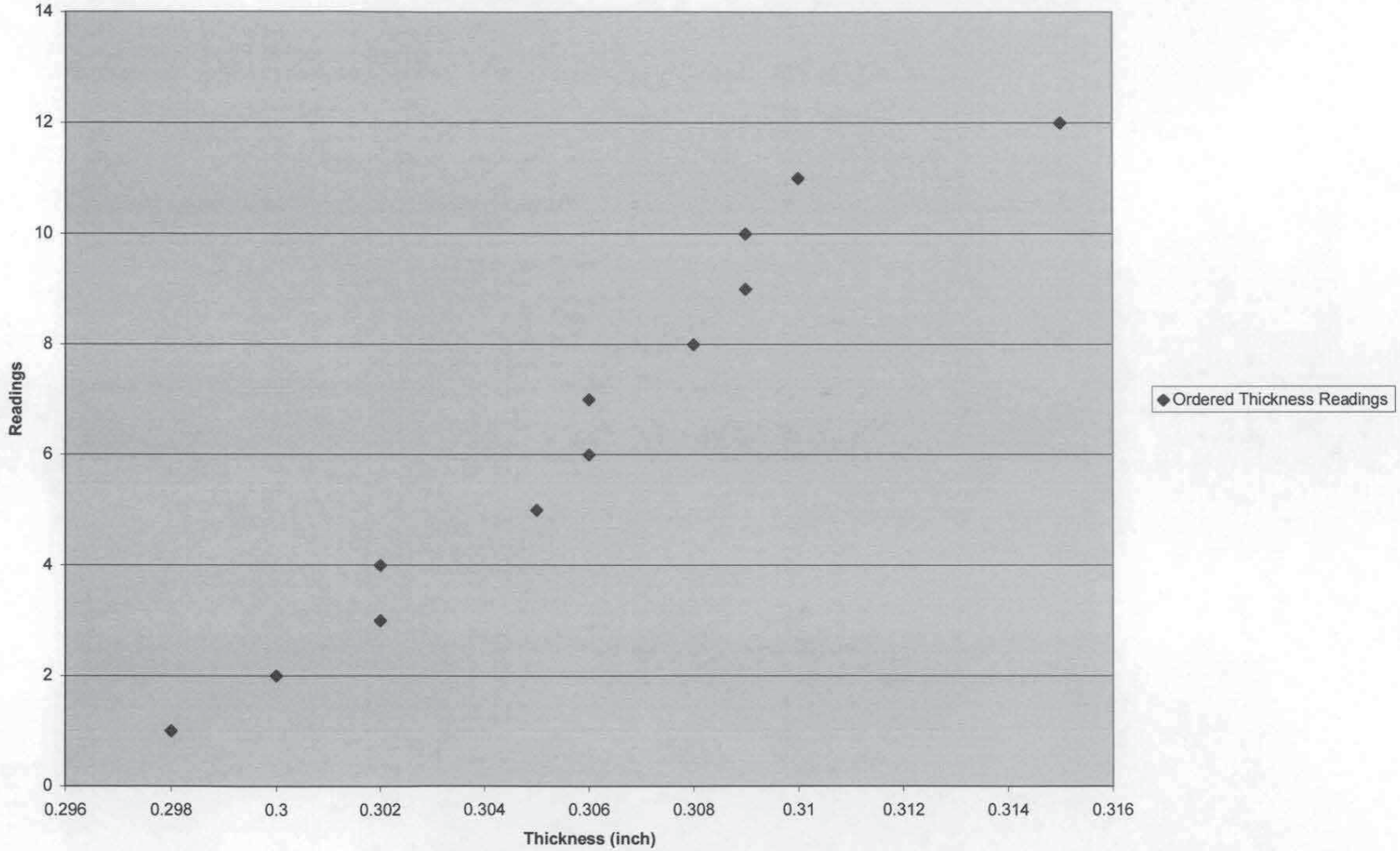


Figure 6C.LOC17.1993.2.Normalized Frequency Distribution

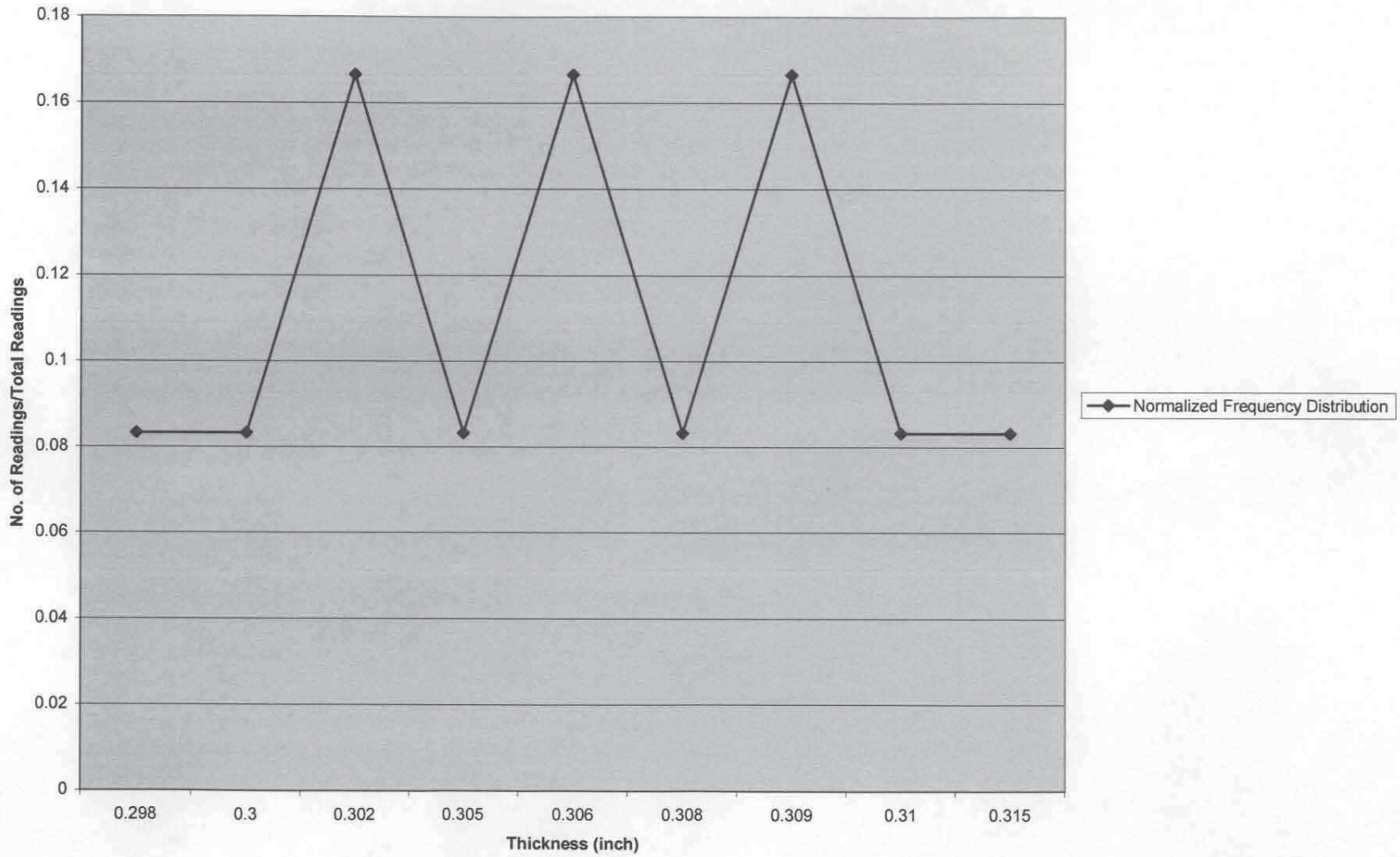


Figure 6C.LOC17.1993.3.Reliability Function

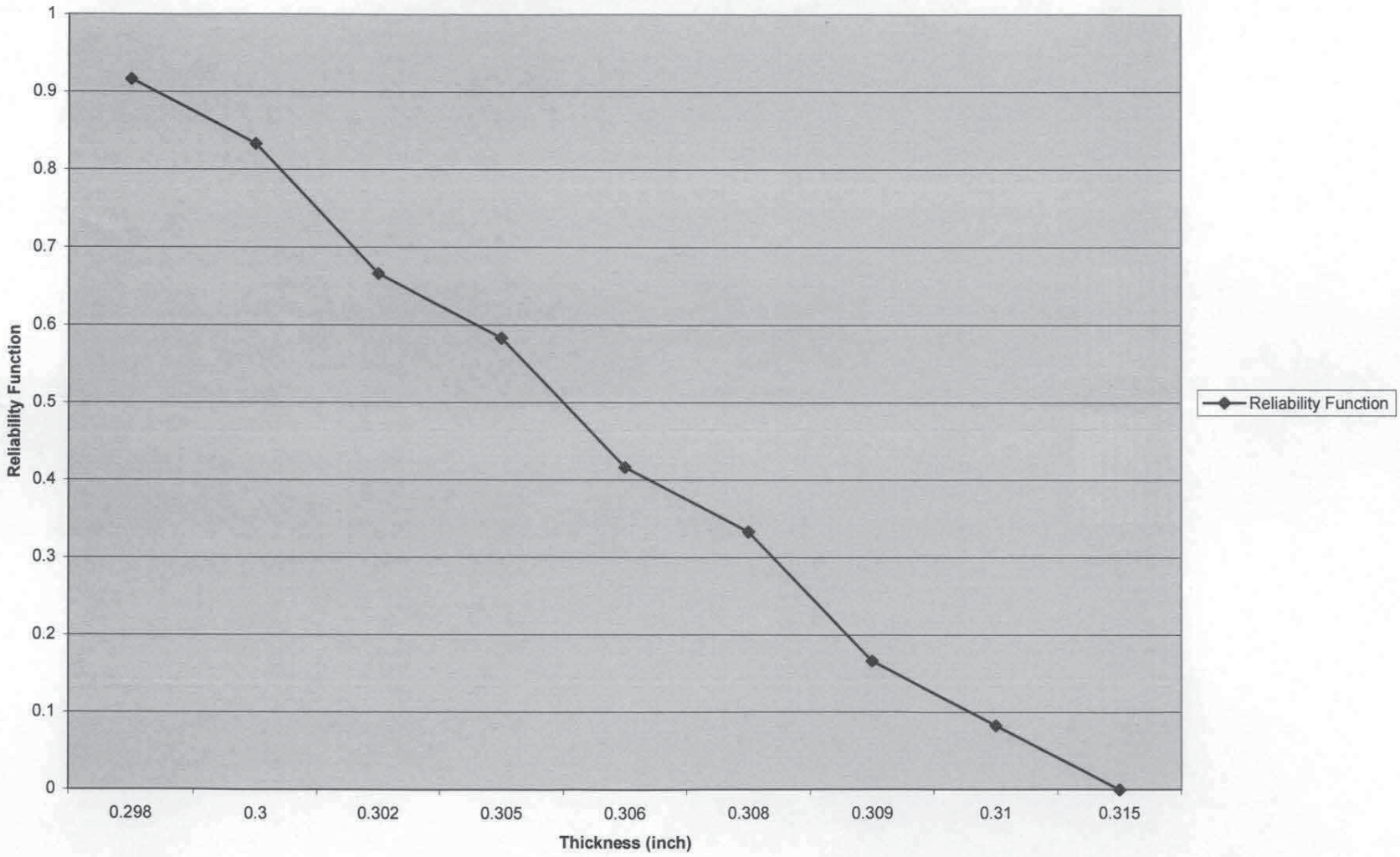


Figure 6C.LOC17.1993.4.Reliablity^Area Ratio

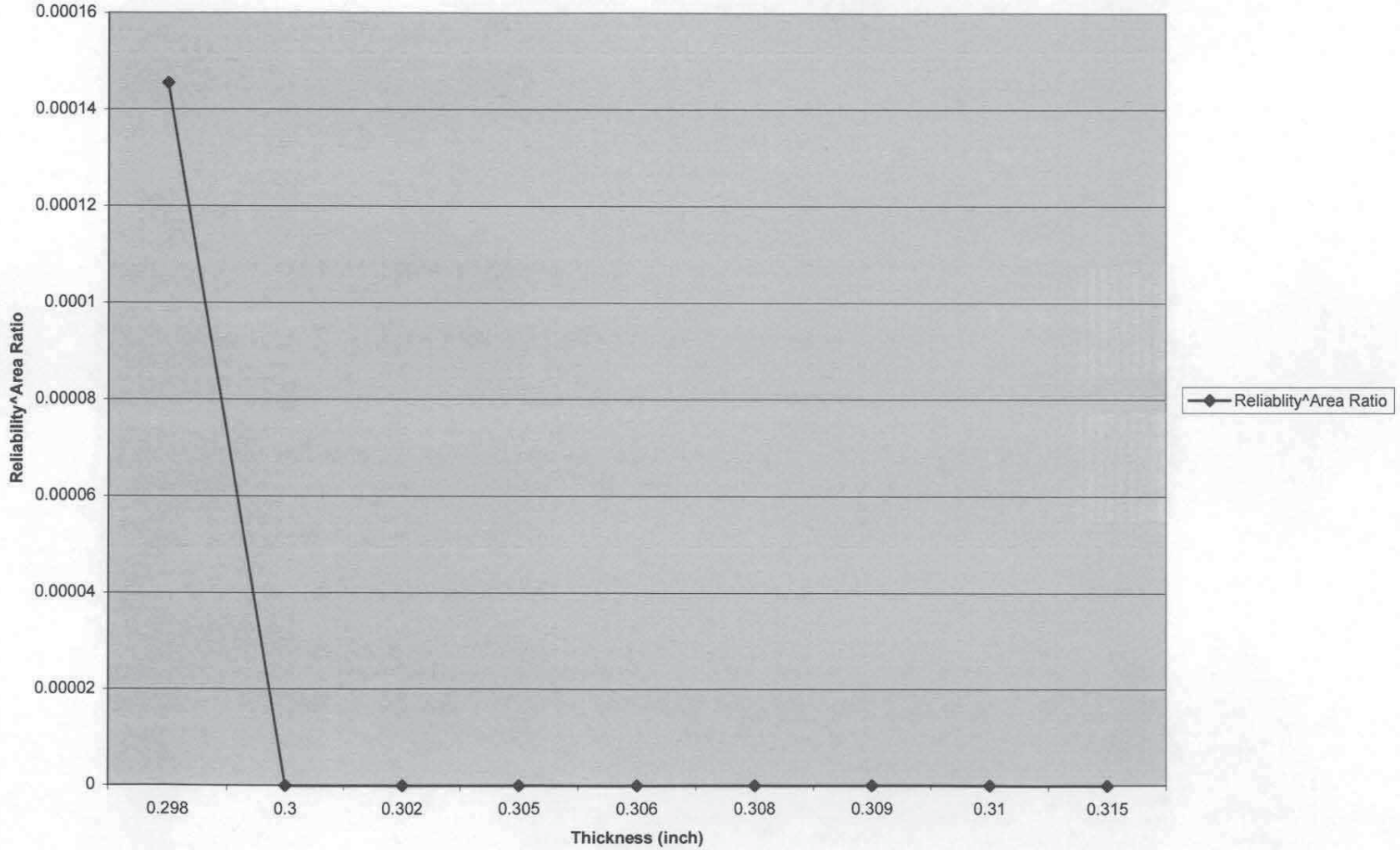


Table 6C.LOC17.1998.1	
Location 17	
Descriptive Statistics	
Mean	0.312833333
Standard Error	0.001646085
Median	0.3135
Mode	0.31
Standard Deviation	0.005702206
Sample Variance	3.25152E-05
Kurtosis	2.211107685
Skewness	-1.159767659
Range	0.021
Minimum	0.299
Maximum	0.32
Sum	3.754
Count	12
Largest(1)	0.32
Smallest(1)	0.299
Confidence Level(95.0%)	0.003623009

Table 6C.LOC17.1998.2	
Location 17	
Ordered Readings	
Thickness (inch)	*Count*
0.299	1
0.309	2
0.31	3
0.31	4
0.311	5
0.313	6
0.314	7
0.315	8
0.316	9
0.318	10
0.319	11
0.32	12

Table 6C.LOC17.1998.3						
Location 17						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.299	1	0.083333333	0.08333333	0.9166667	101.5	0.000145559
0.309	1	0.083333333	0.16666667	0.8333333	101.5	9.12274E-09
0.31	2	0.166666667	0.33333333	0.6666667	101.5	1.3186E-18
0.311	1	0.083333333	0.41666667	0.5833333	101.5	1.7051E-24
0.313	1	0.083333333	0.5	0.5	101.5	2.71727E-31
0.314	1	0.083333333	0.58333333	0.4166667	101.5	2.4789E-39
0.315	1	0.083333333	0.66666667	0.3333333	101.5	3.583E-49
0.316	1	0.083333333	0.75	0.25	101.5	7.38357E-62
0.318	1	0.083333333	0.83333333	0.1666667	101.5	9.736E-80
0.319	1	0.083333333	0.91666667	0.0833333	101.5	2.6455E-110
0.32	1	0.083333333	1	0	101.5	0
Total	12					

Figure 6C.LOC17.1998.1.Ordered Thickness Readings

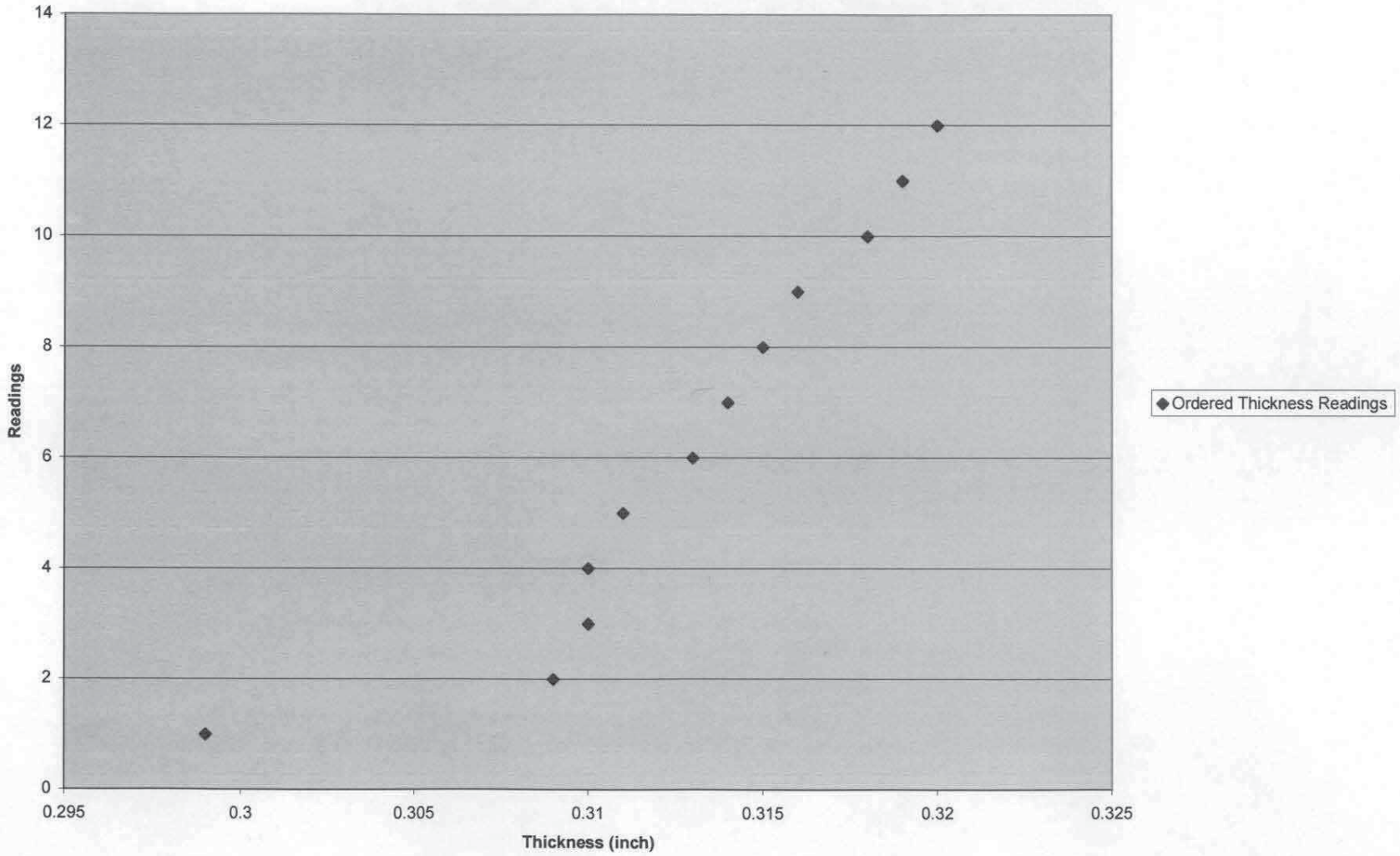


Figure 6C.LOC17.1998.2.Normalized Frequency Distribution

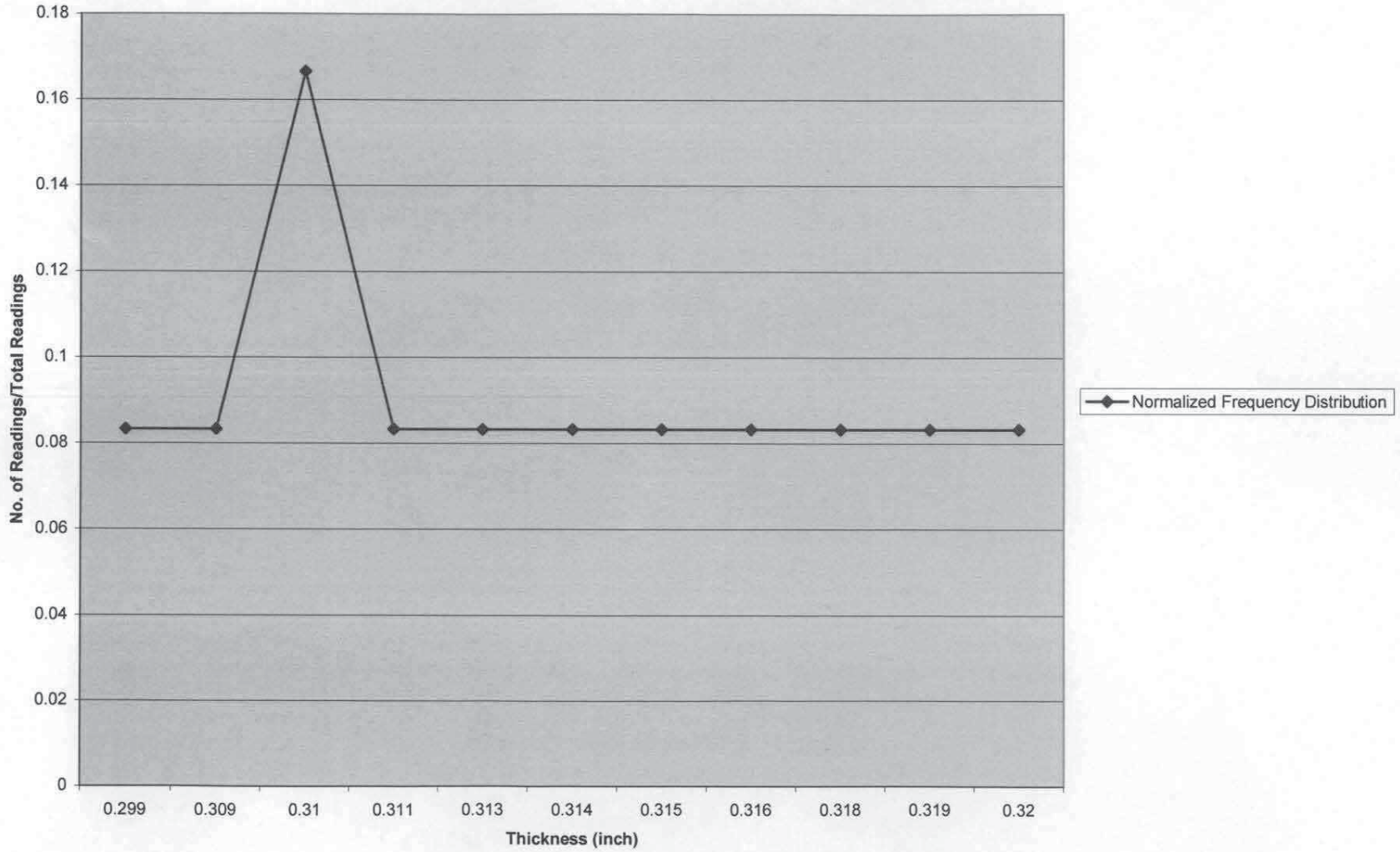


Figure 6C.LOC17.1998.3.Reliability Function

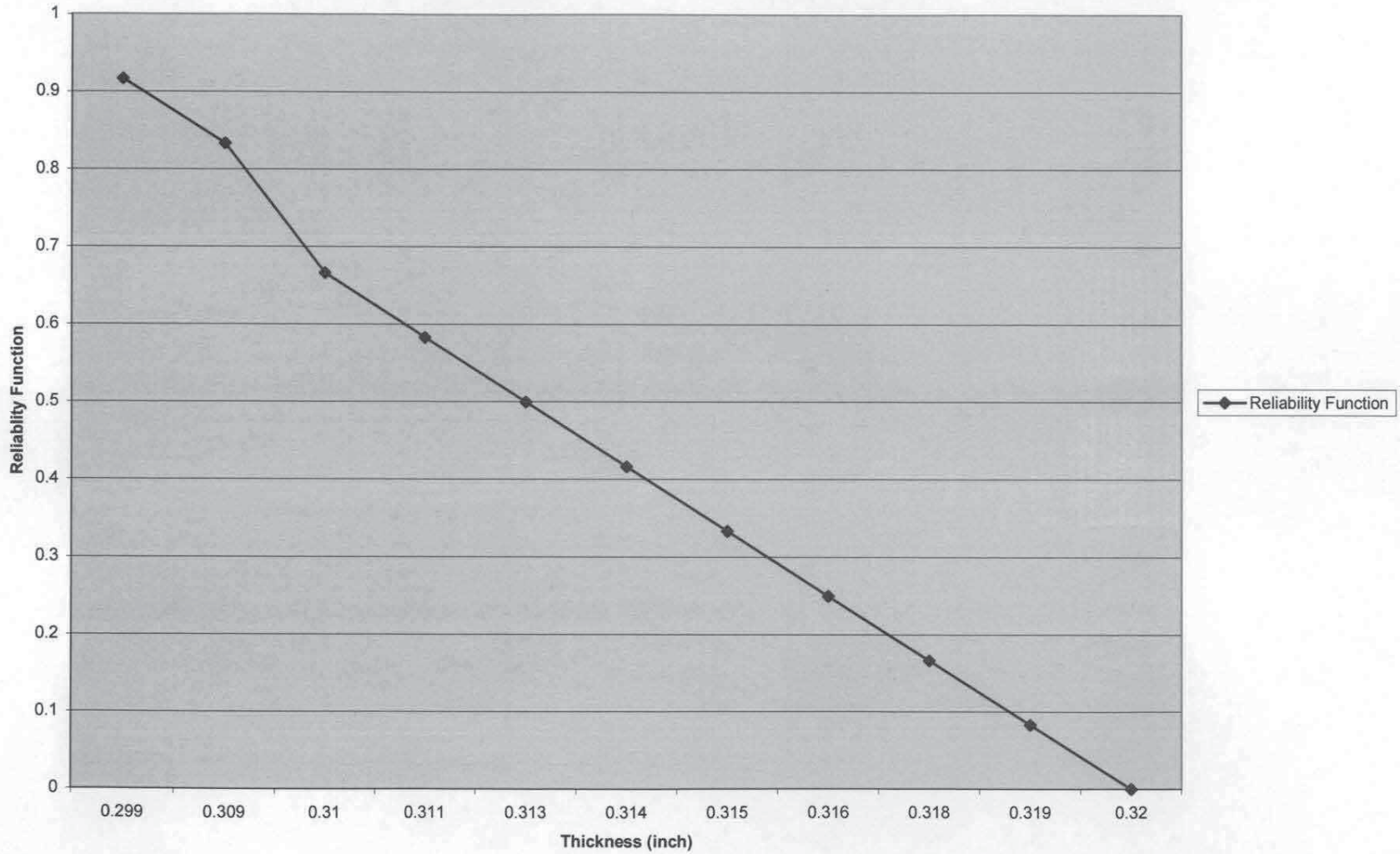


Figure 6C.LOC17.1998.4.Reliability^Area Ratio

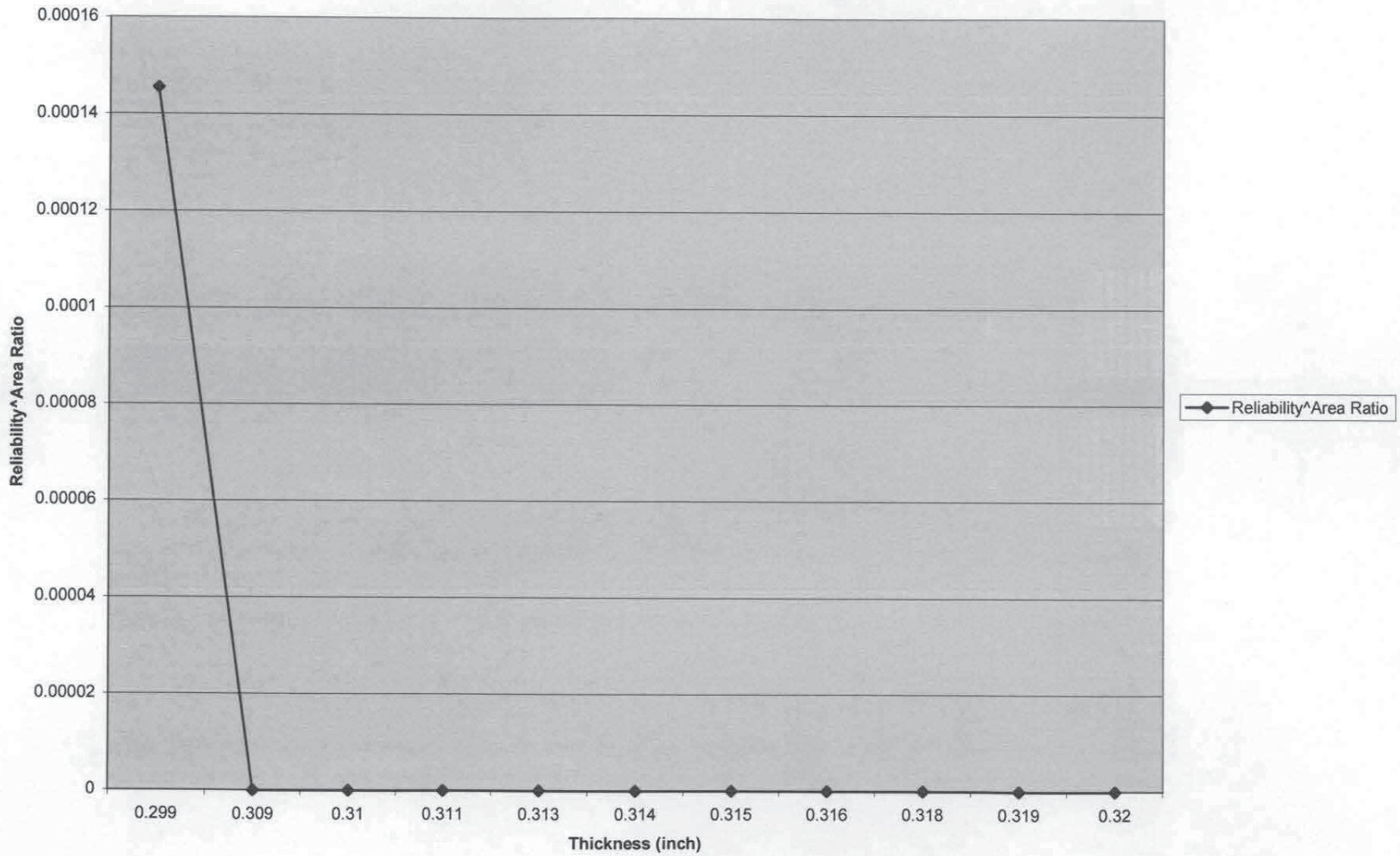


Table 6C.LOC17.2007.1	
Location 17	
Descriptive Statistics	
Mean	0.3035
Standard Error	0.001484771
Median	0.3045
Mode	0.31
Standard Deviation	0.005143398
Sample Variance	2.64545E-05
Kurtosis	-1.639276815
Skewness	-0.149125204
Range	0.014
Minimum	0.296
Maximum	0.31
Sum	3.642
Count	12
Largest(1)	0.31
Smallest(1)	0.296
Confidence Level(95.0%)	0.003267959

Table 6C.LOC17.2007.2	
Location 17	
Ordered Readings	
Thickness (inch)	*Count*
0.296	1
0.297	2
0.298	3
0.3	4
0.3	5
0.303	6
0.306	7
0.306	8
0.308	9
0.308	10
0.31	11
0.31	12

Table 6C.LOC17.2007.3						
Location 17						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.296	1	0.083333333	0.08333333	0.9166667	101.5	0.000145559
0.297	1	0.083333333	0.16666667	0.8333333	101.5	9.12274E-09
0.298	1	0.083333333	0.25	0.75	101.5	2.06072E-13
0.3	2	0.166666667	0.41666667	0.5833333	101.5	1.7051E-24
0.303	1	0.083333333	0.5	0.5	101.5	2.71727E-31
0.306	2	0.166666667	0.66666667	0.3333333	101.5	3.583E-49
0.308	2	0.166666667	0.83333333	0.1666667	101.5	9.736E-80
0.31	2	0.166666667	1	0	101.5	0
More	12					

Figure 6C.LOC17.2007.1.Ordered Thickness Readings

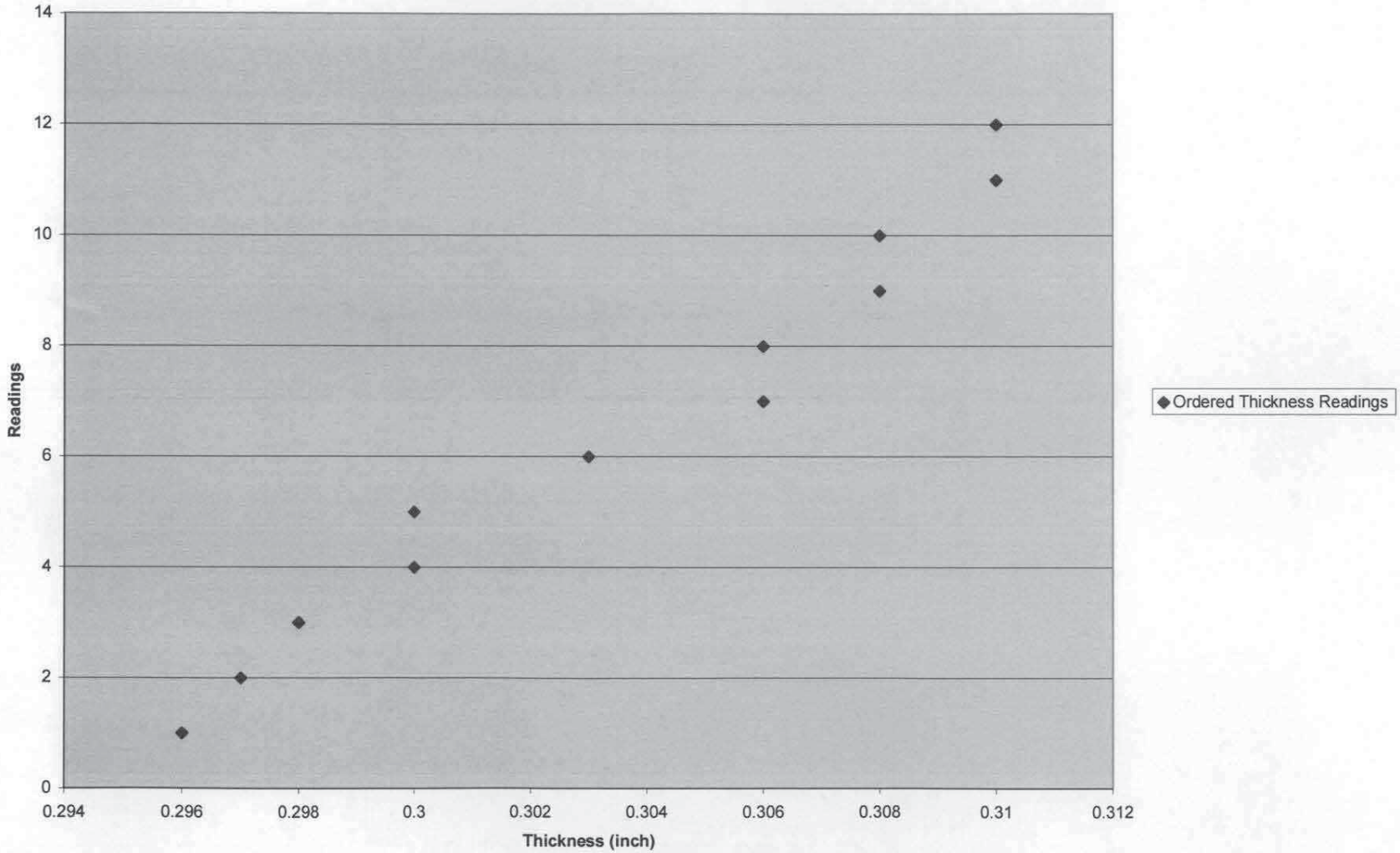


Figure 6C.LOC17.2007.2.Normalized Frequency Distribution

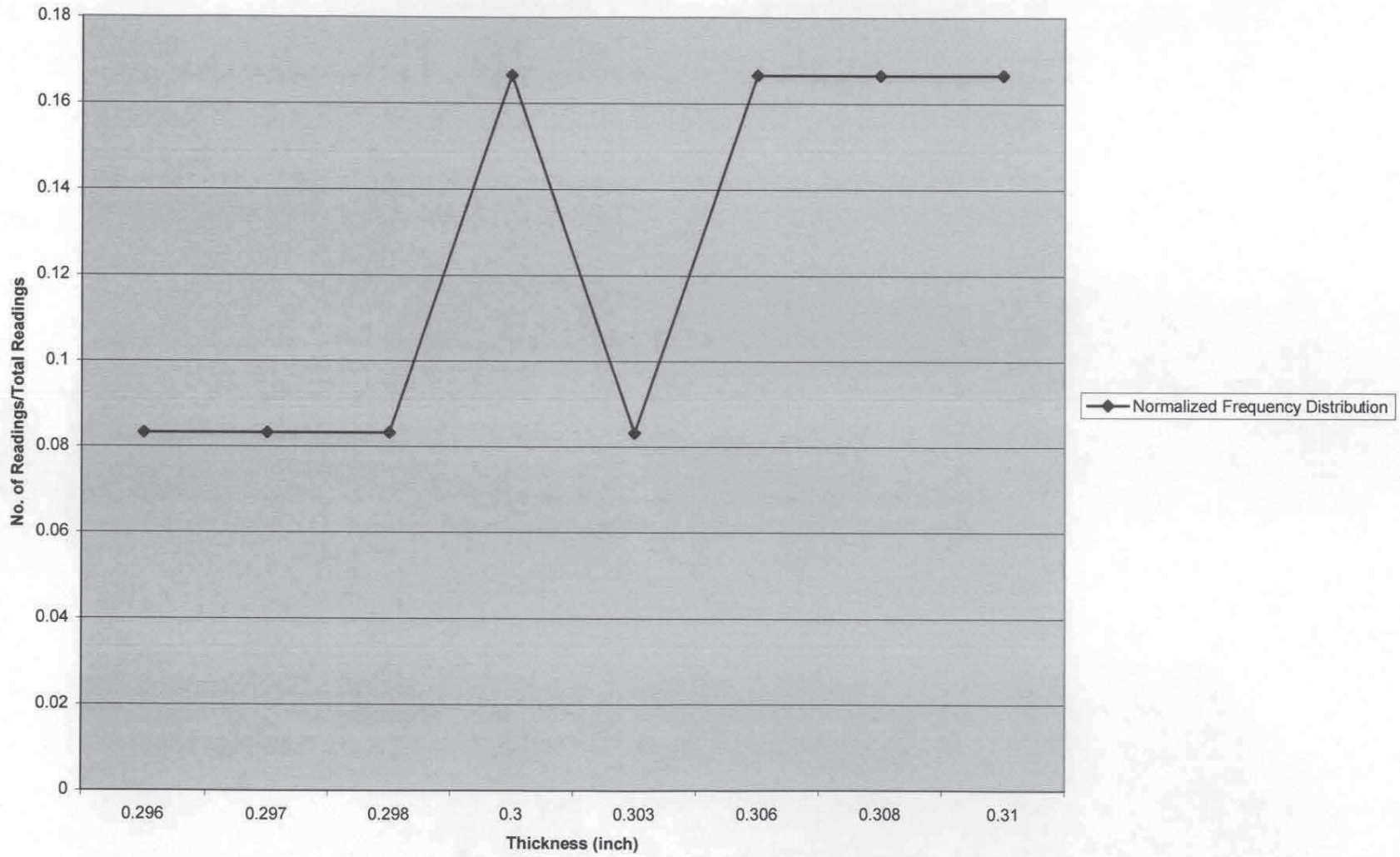


Figure 6C.LOC17.2007.3.Reliability Function

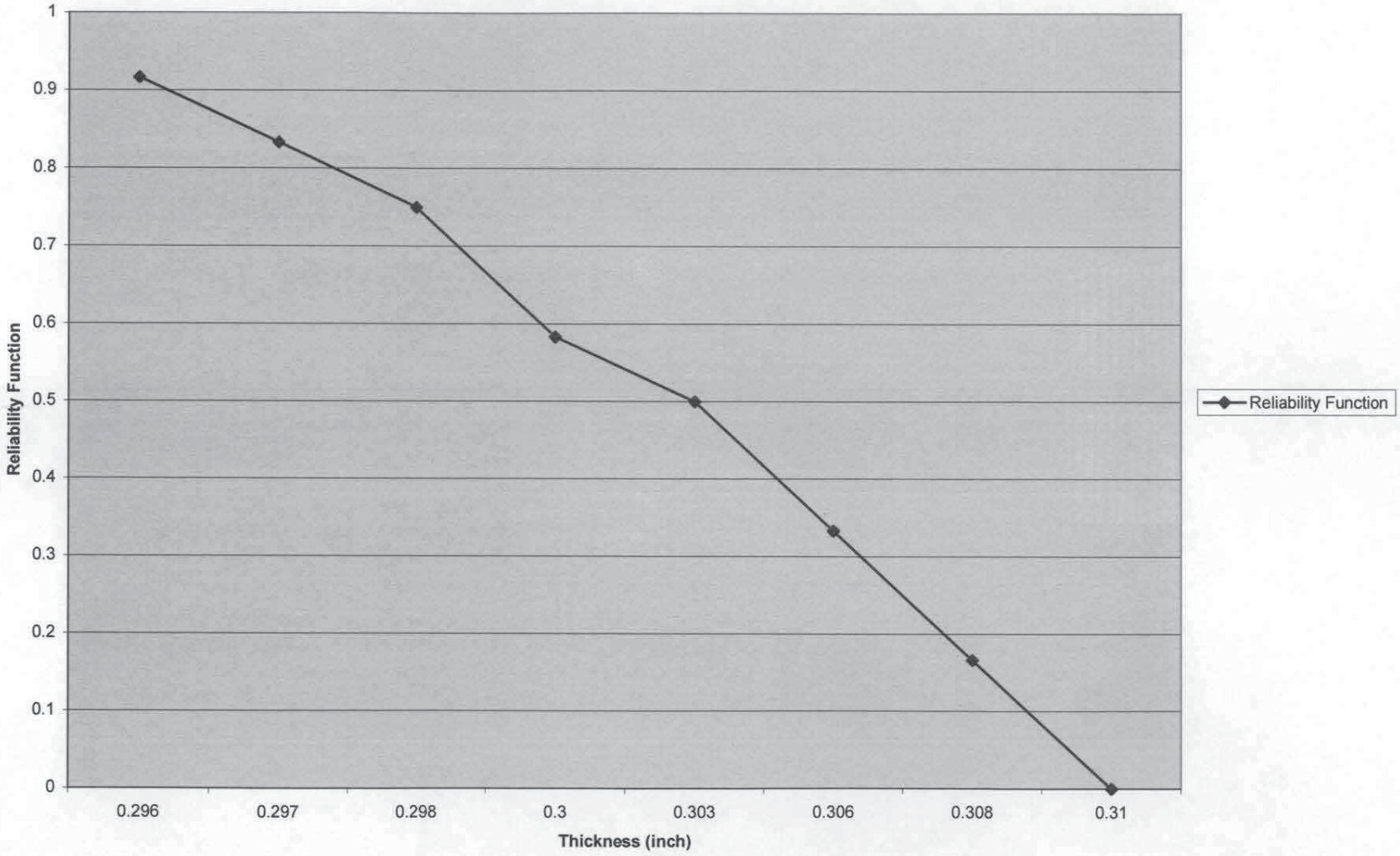


Figure 6C.LOC17.2007.4.Reliability^Area Ratio

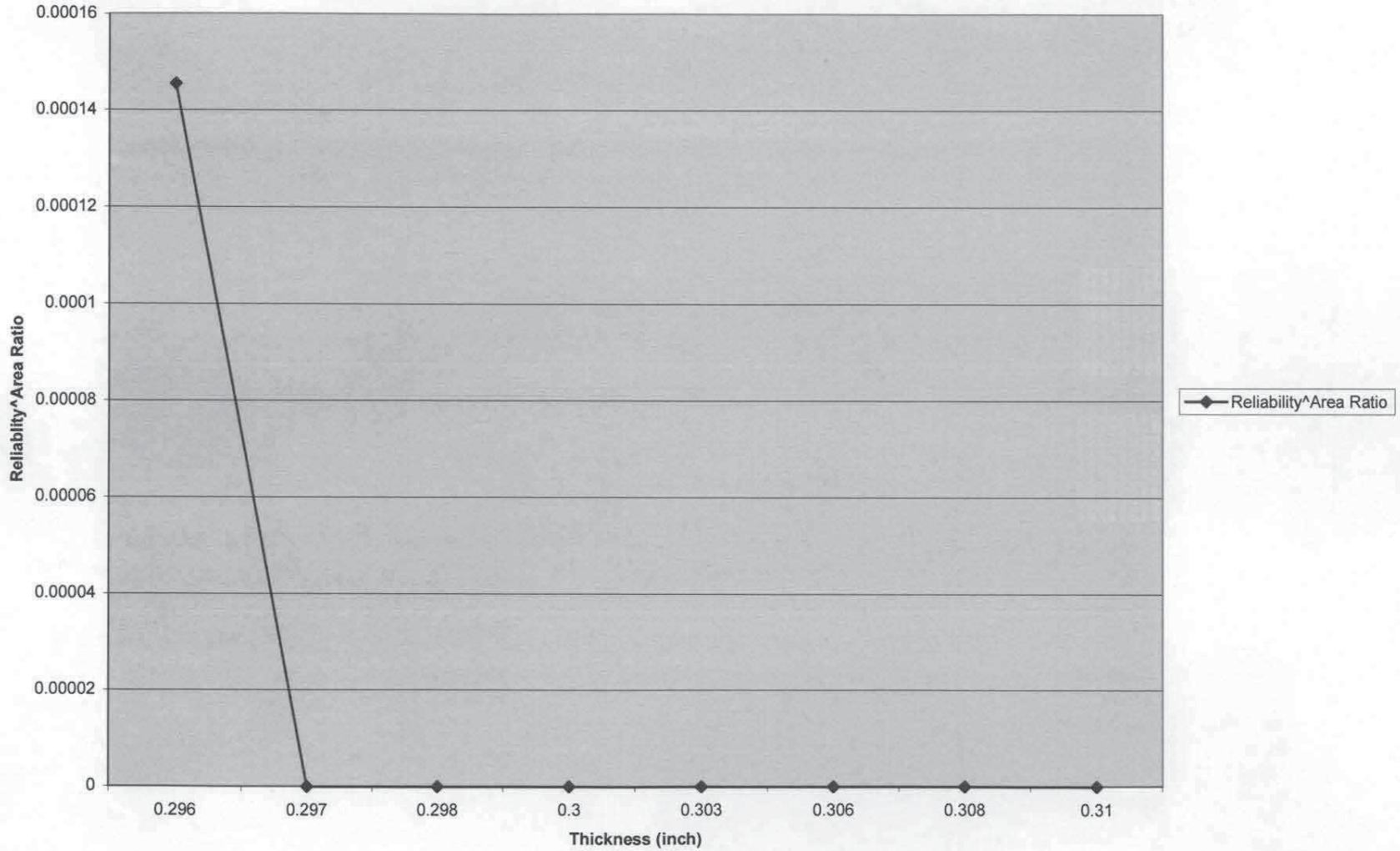


Table 6C.LOC18.2007.1	
Location 18	
Descriptive Statistics	
Mean	0.280038
Standard Error	0.005564
Median	0.2935
Mode	0.3
Standard Deviation	0.028372
Sample Variance	0.000805
Kurtosis	2.355491
Skewness	-1.742593
Range	0.1
Minimum	0.202
Maximum	0.302
Sum	7.281
Count	26
Largest(1)	0.302
Smallest(1)	0.202
Confidence Level(95.0%)	0.01146

Table 6C.LOC18.2007.2	
Location 18	
Ordered Readings	
Thickness (inch)	Count
0.202	1
0.206	2
0.237	3
0.252	4
0.257	5
0.261	6
0.265	7
0.282	8
0.283	9
0.287	10
0.288	11
0.291	12
0.293	13
0.294	14
0.294	15
0.295	16
0.297	17
0.298	18
0.298	19
0.299	20
0.299	21
0.3	22
0.3	23
0.3	24
0.301	25
0.302	26

Table 6C.LOC18.2007.3						
Location 18						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.202	1	0.038461538	0.03846154	0.9615385	879.7	1.03902E-15
0.206	1	0.038461538	0.07692308	0.9230769	879.7	2.63945E-31
0.237	1	0.038461538	0.11538462	0.8846154	879.7	1.45407E-47
0.252	1	0.038461538	0.15384615	0.8461538	879.7	1.51637E-64
0.257	1	0.038461538	0.19230769	0.8076923	879.7	2.56388E-82
0.261	1	0.038461538	0.23076923	0.7692308	879.7	5.8848E-101
0.265	1	0.038461538	0.26923077	0.7307692	879.7	1.4938E-120
0.282	1	0.038461538	0.30769231	0.6923077	879.7	3.3049E-141
0.283	1	0.038461538	0.34615385	0.6538462	879.7	4.8205E-163
0.287	1	0.038461538	0.38461538	0.6153846	879.7	3.333E-186
0.288	1	0.038461538	0.42307692	0.5769231	879.7	7.3684E-211
0.291	1	0.038461538	0.46153846	0.5384615	879.7	3.2376E-237
0.293	1	0.038461538	0.5	0.5	879.7	1.5811E-265
0.294	2	0.076923077	0.57692308	0.4230769	879.7	0
0.295	1	0.038461538	0.61538462	0.3846154	879.7	0
0.297	1	0.038461538	0.65384615	0.3461538	879.7	0
0.298	2	0.076923077	0.73076923	0.2692308	879.7	0
0.299	2	0.076923077	0.80769231	0.1923077	879.7	0
0.3	3	0.115384615	0.92307692	0.0769231	879.7	0
0.301	1	0.038461538	0.96153846	0.0384615	879.7	0
0.302	1	0.038461538	1	0	879.7	0
	26					

Figure 6C.LOC18.2007.1.Ordered Thickness Readings

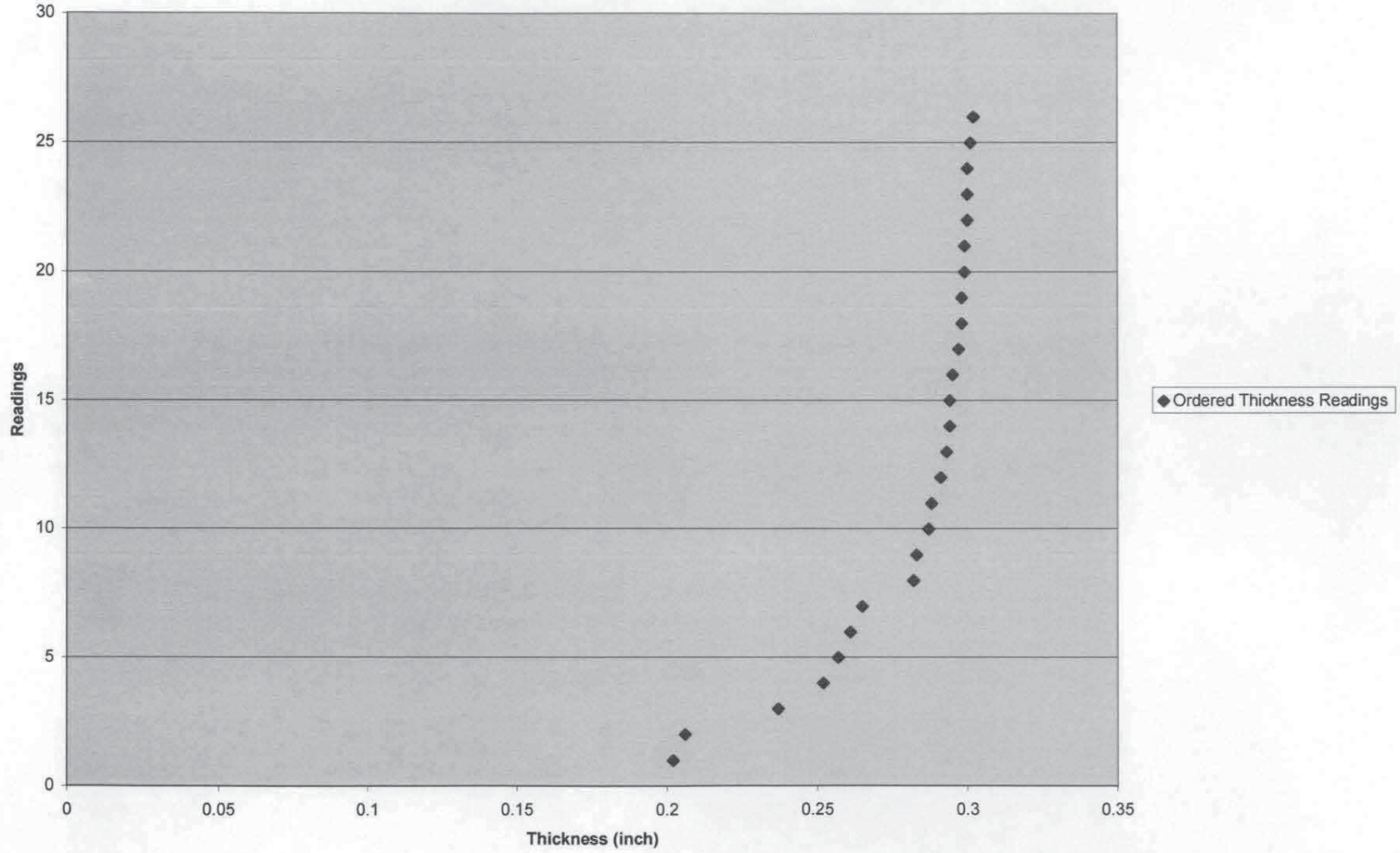


Figure 6C.LOC18.2007.2.Normalized Frequency Distribution

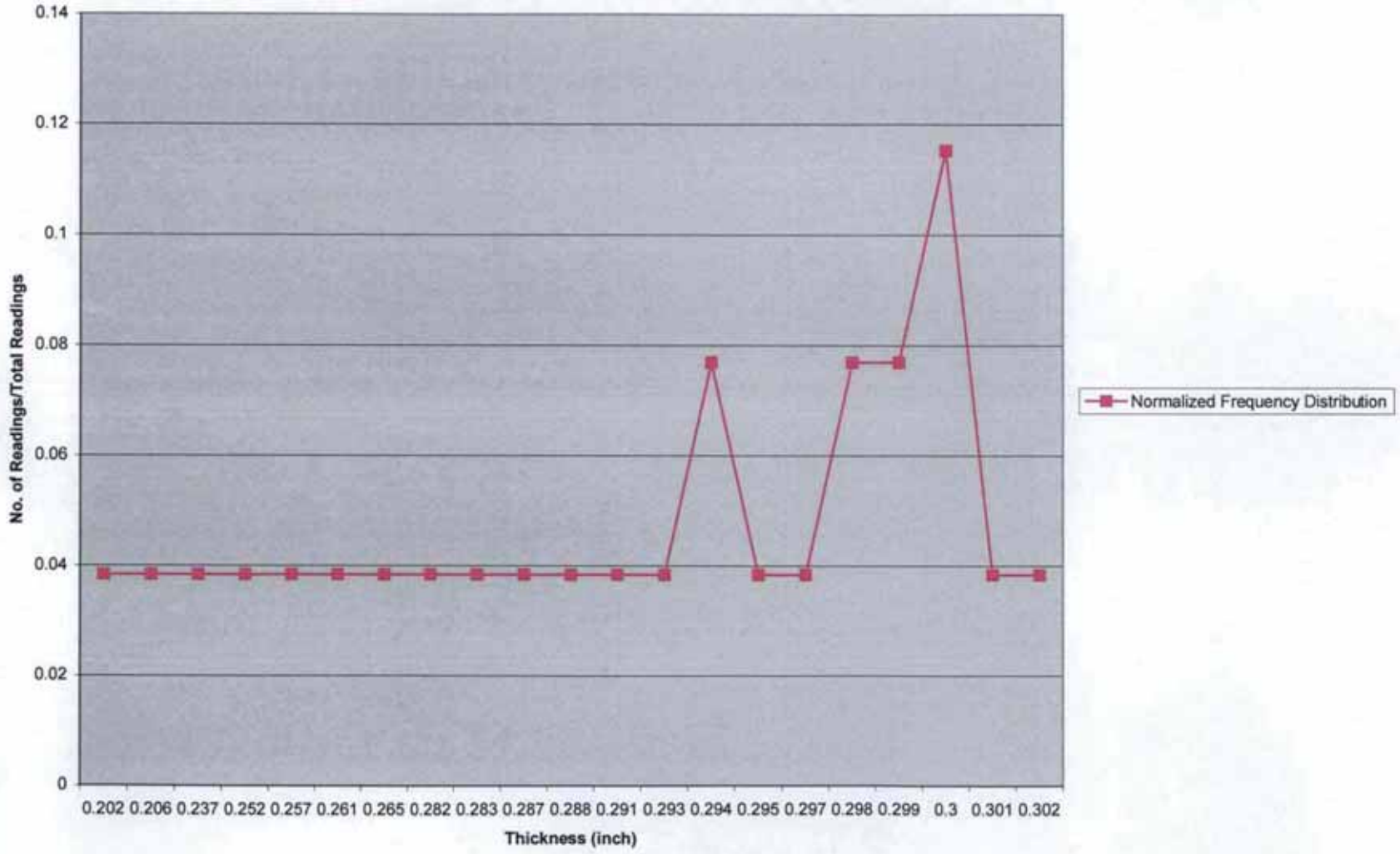


Figure 6C.LOC18.2007.3.Reliability Function

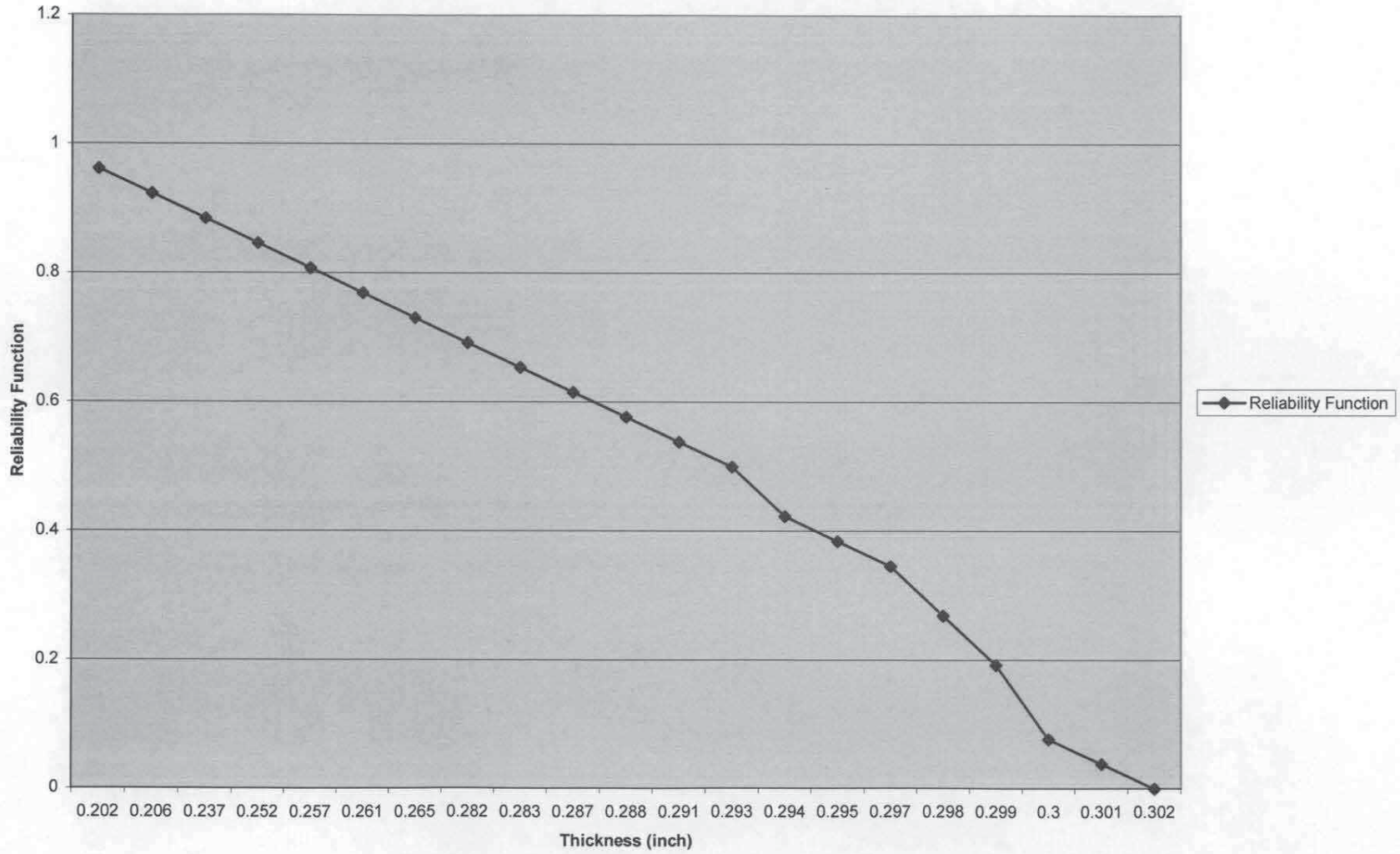


Figure 6C.LOC18.2007.4.Reliability^Area Ratio

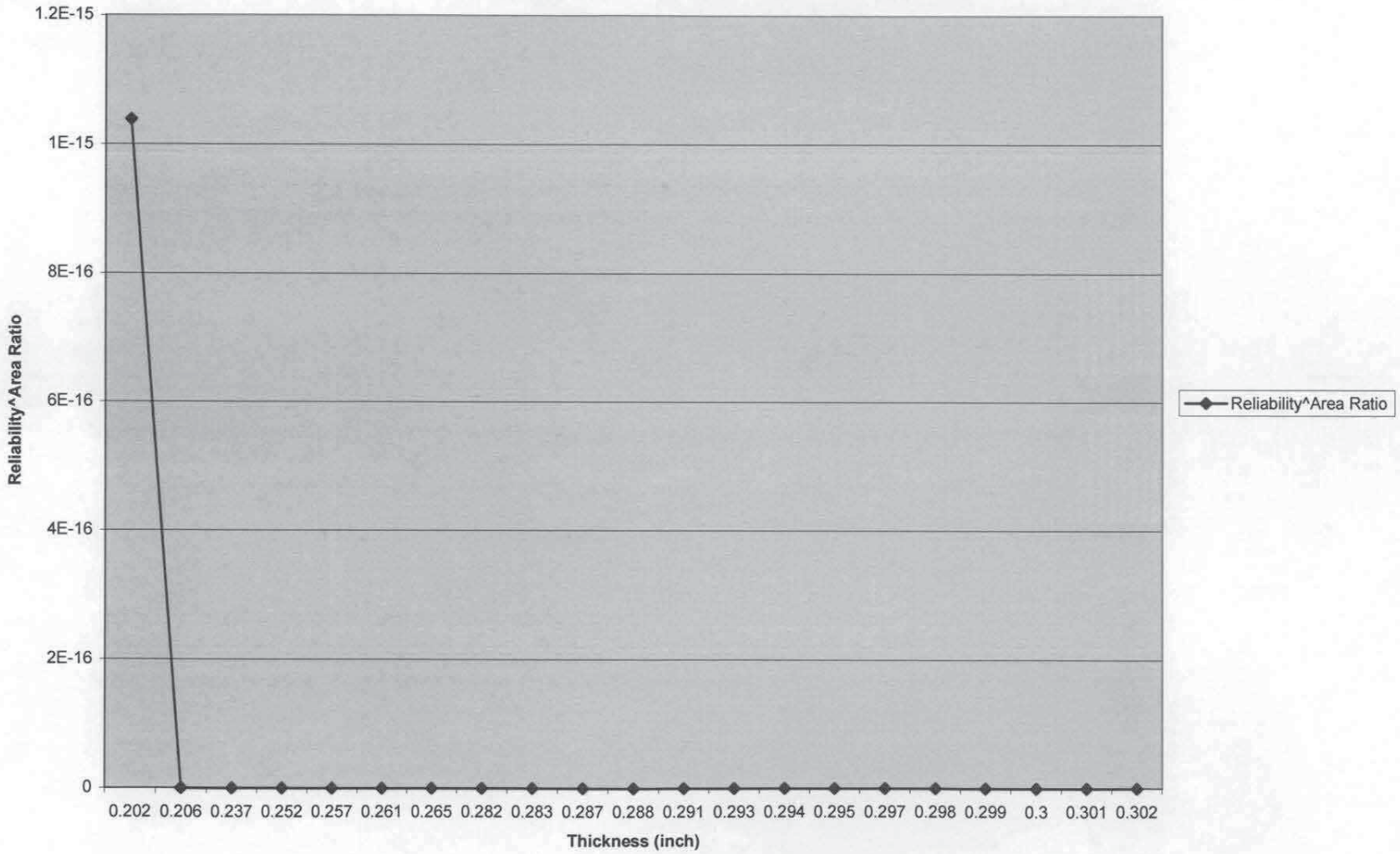


Table 6C.LOC19.2007.1	
Location 19	
Descriptive Statistics	
Mean	0.13528
Standard Error	0.000196
Median	0.135
Mode	0.135
Standard Deviation	0.0009798
Sample Variance	9.6E-07
Kurtosis	0.551627
Skewness	0.2454482
Range	0.004
Minimum	0.133
Maximum	0.137
Sum	3.382
Count	25
Largest(1)	0.137
Smallest(1)	0.133
Confidence Level(95.0%)	0.0004044

Table 6C.LOC19.2007.2	
Location 19	
Ordered Readings	
Thickness (inch)	*Count*
0.133	1
0.134	2
0.134	3
0.135	4
0.135	5
0.135	6
0.135	7
0.135	8
0.135	9
0.135	10
0.135	11
0.135	12
0.135	13
0.135	14
0.135	15
0.135	16
0.135	17
0.135	18
0.136	19
0.136	20
0.136	21
0.137	22
0.137	23
0.137	24
0.137	25

Table 6C.LOC19.2007.3						
Location 19						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.133	1	0.04	0.04	0.96	74.22	0.048324645
0.134	2	0.08	0.12	0.88	74.22	7.57699E-05
0.135	15	0.6	0.72	0.28	74.22	9.28965E-42
0.136	3	0.12	0.84	0.16	74.22	8.5052E-60
0.137	4	0.16	1	0	74.22	0
Total	25					

Figure 6C.LOC19.2007.1.Ordered Thickness Readings

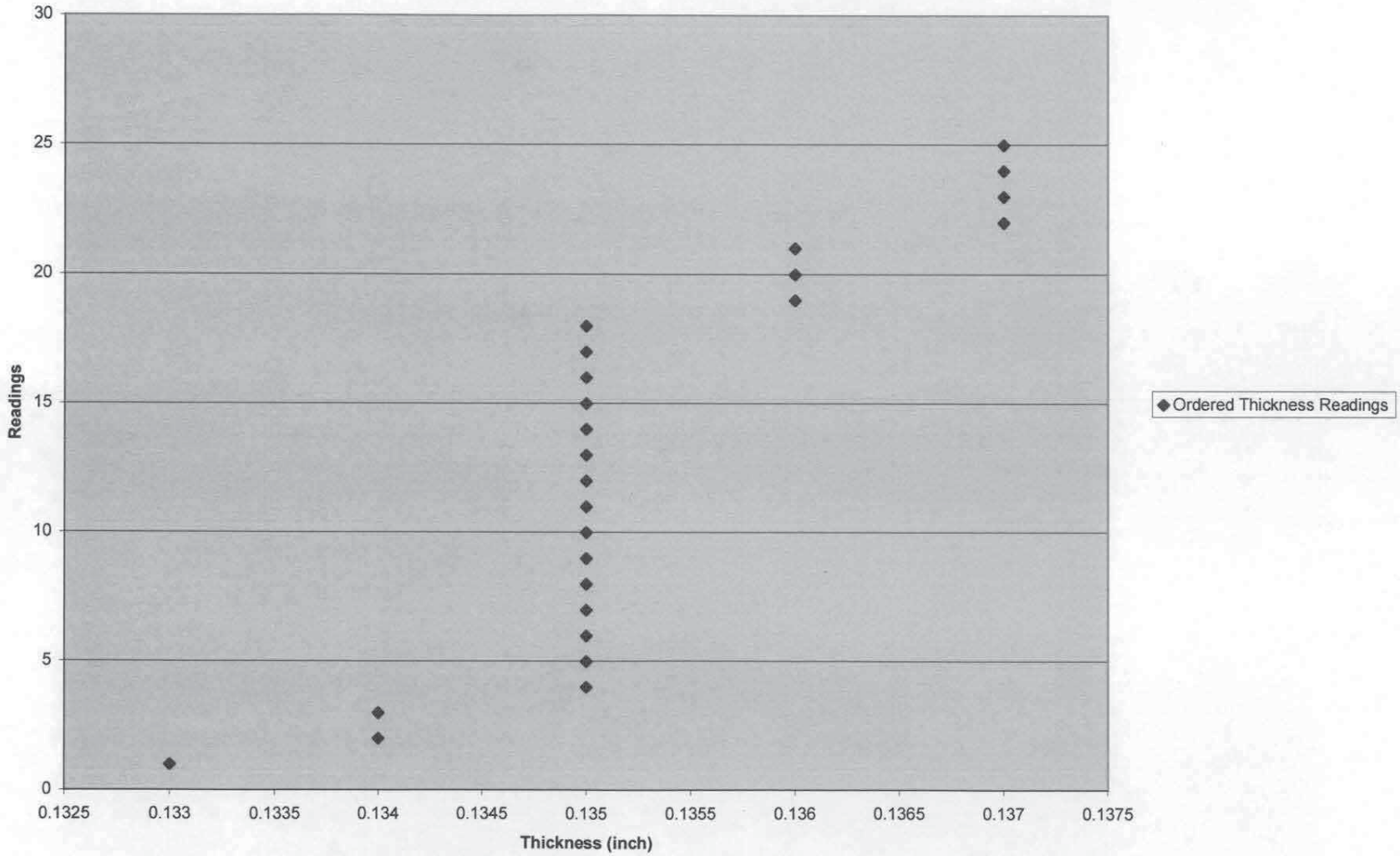


Figure 6C.LOC19.2007.2.Normalized Frequency Distribution

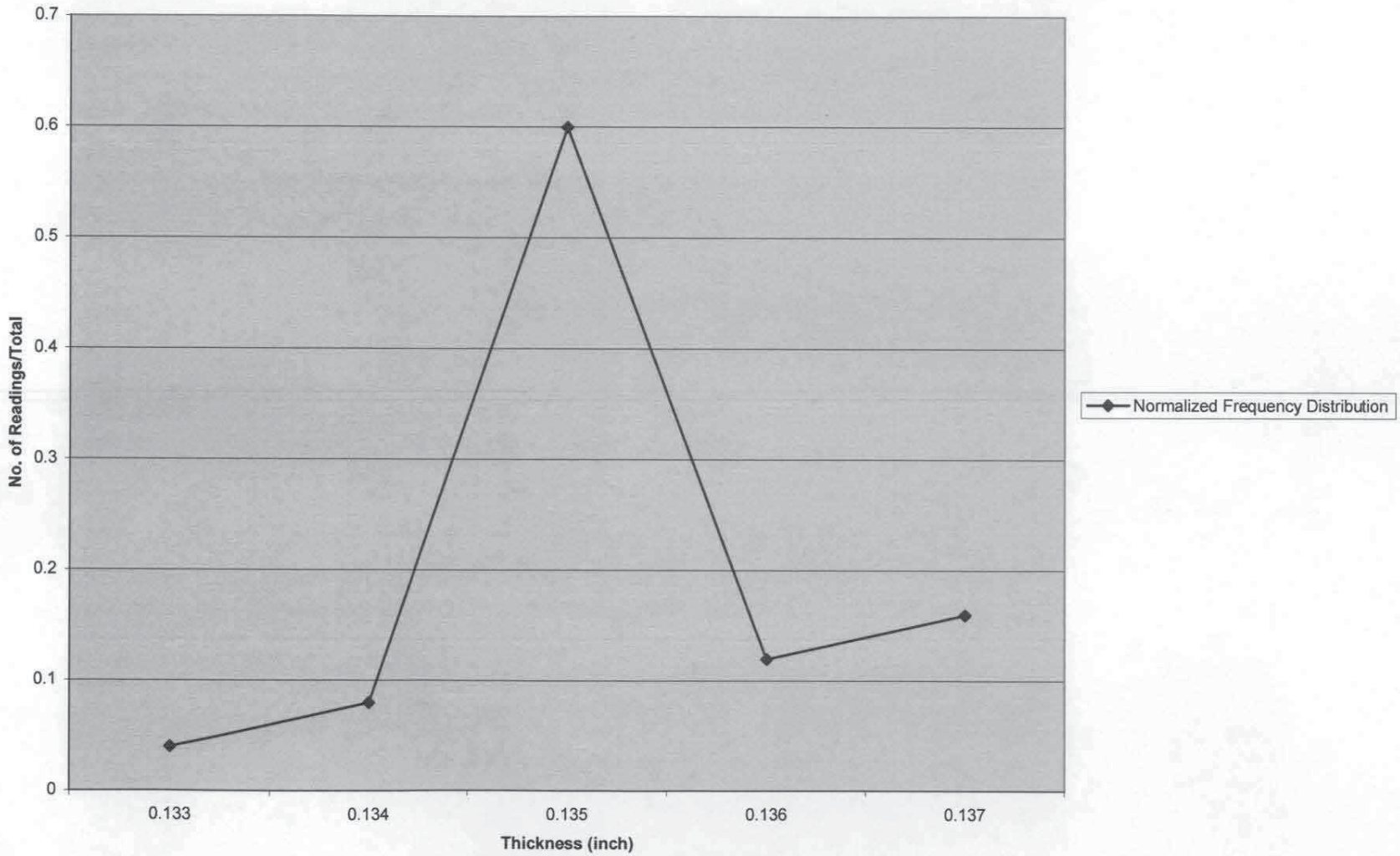


Figure 6C.LOC19.2007.3.Reliability Function

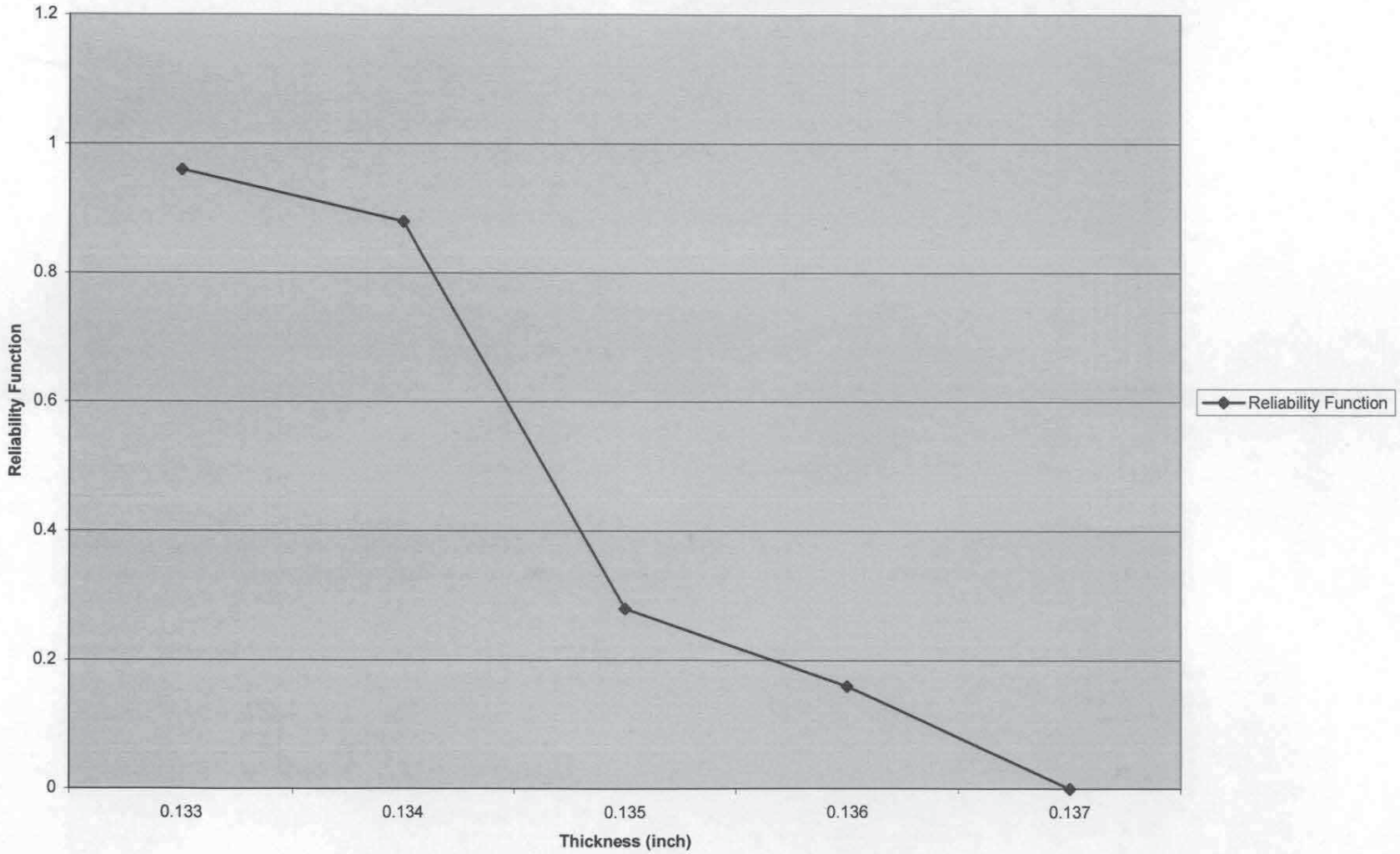


Figure 6C.LOC19.2007.4.Reliability^Area Ratio

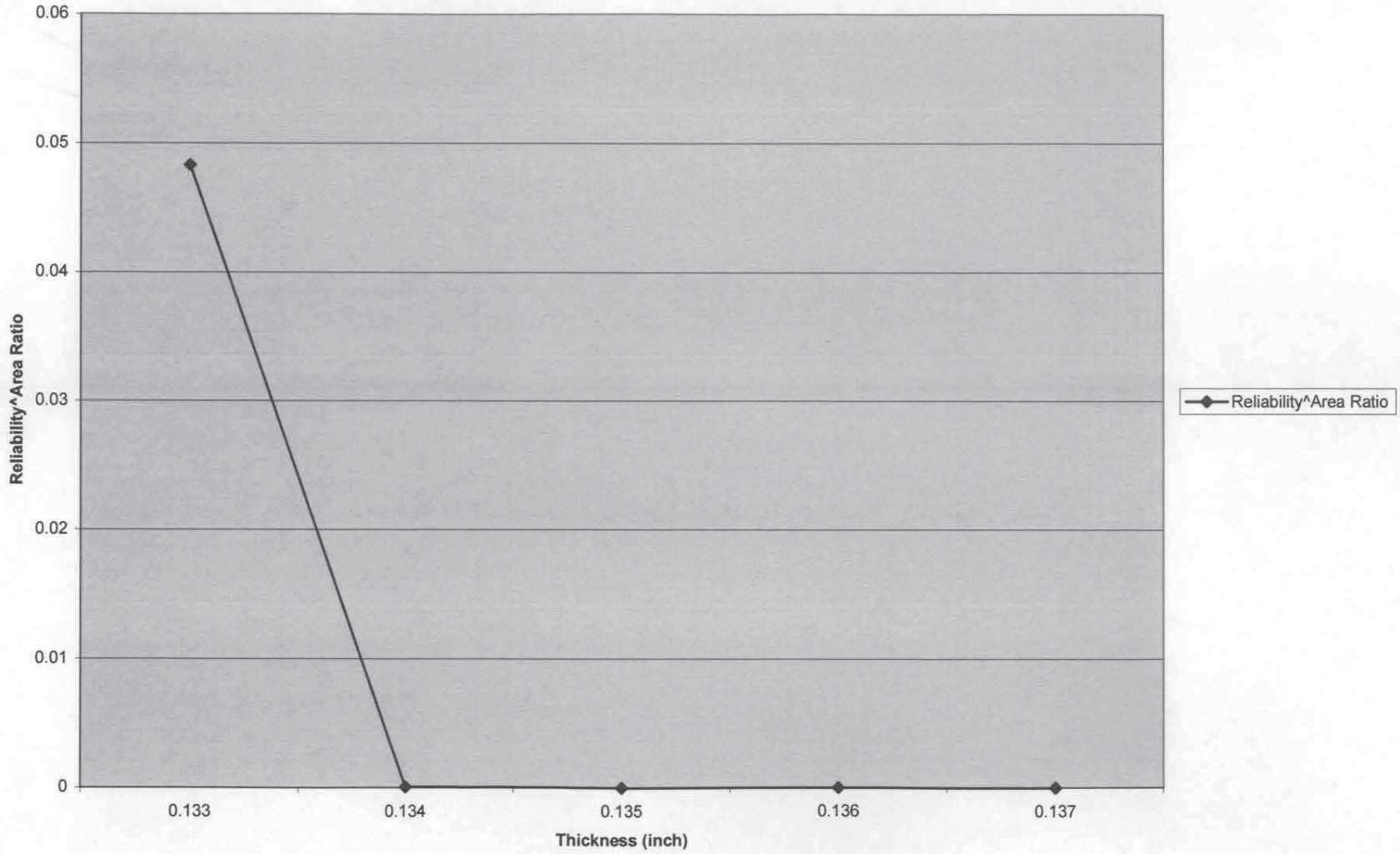


Table 6C.LOC21.2007.1	
Location 21	
Descriptive Statistics	
Mean	0.60475
Standard Error	0.017829
Median	0.598
Mode	0.564
Standard Deviation	0.071318
Sample Variance	0.005086
Kurtosis	-1.375868
Skewness	-0.220636
Range	0.209
Minimum	0.49
Maximum	0.699
Sum	9.676
Count	16
Largest(1)	0.699
Smallest(1)	0.49
Confidence Level(95.0%)	0.038002

Table 6C.LOC21.2007.2	
Location 21	
Ordered Readings	
Thickness (inch)	*Count*
0.49	1
0.494	2
0.522	3
0.547	4
0.564	5
0.564	6
0.575	7
0.584	8
0.612	9
0.653	10
0.661	11
0.666	12
0.674	13
0.682	14
0.689	15
0.699	16

Table 6C.LOC21.2007.3						
Location 21						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.49	1	0.0625	0.0625	0.9375	58.9	0.022334277
0.494	1	0.0625	0.125	0.875	58.9	0.0003837
0.522	1	0.0625	0.1875	0.8125	58.9	4.87706E-06
0.547	1	0.0625	0.25	0.75	58.9	4.3702E-08
0.564	2	0.125	0.375	0.625	58.9	9.46979E-13
0.575	1	0.0625	0.4375	0.5625	58.9	1.90986E-15
0.584	1	0.0625	0.5	0.5	58.9	1.85298E-18
0.612	1	0.0625	0.5625	0.4375	58.9	7.10987E-22
0.653	1	0.0625	0.625	0.375	58.9	8.09786E-26
0.661	1	0.0625	0.6875	0.3125	58.9	1.75473E-30
0.666	1	0.0625	0.75	0.25	58.9	3.43352E-36
0.674	1	0.0625	0.8125	0.1875	58.9	1.50051E-43
0.682	1	0.0625	0.875	0.125	58.9	6.36222E-54
0.689	1	0.0625	0.9375	0.0625	58.9	1.1789E-71
0.699	1	0.0625	1	0	58.9	0
Total	16					

Figure 6C.LO21.2007..1.Ordered Thickness Readings

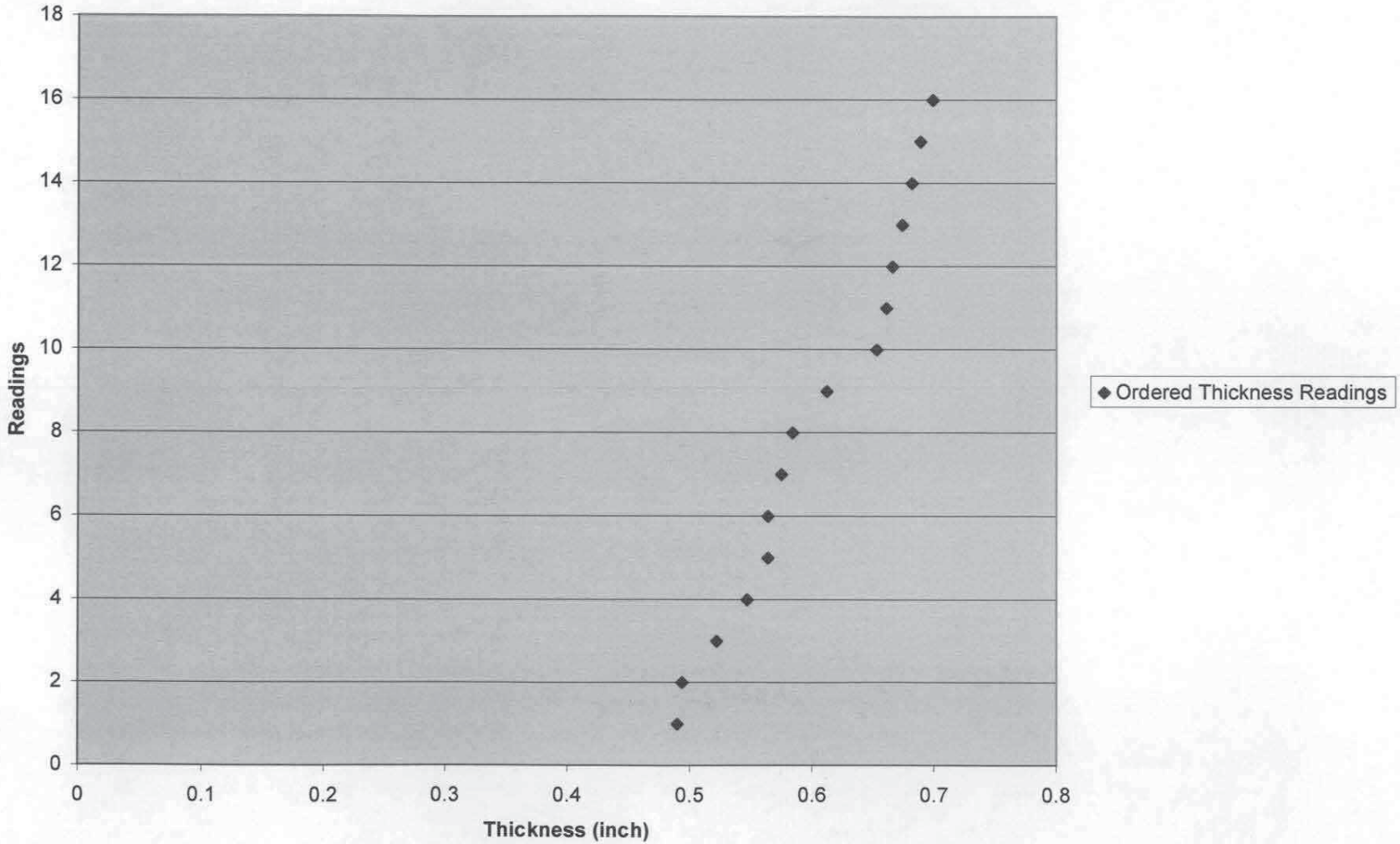


Figure 6C.LOC21.2007.2.Normalized Frequency Distribution

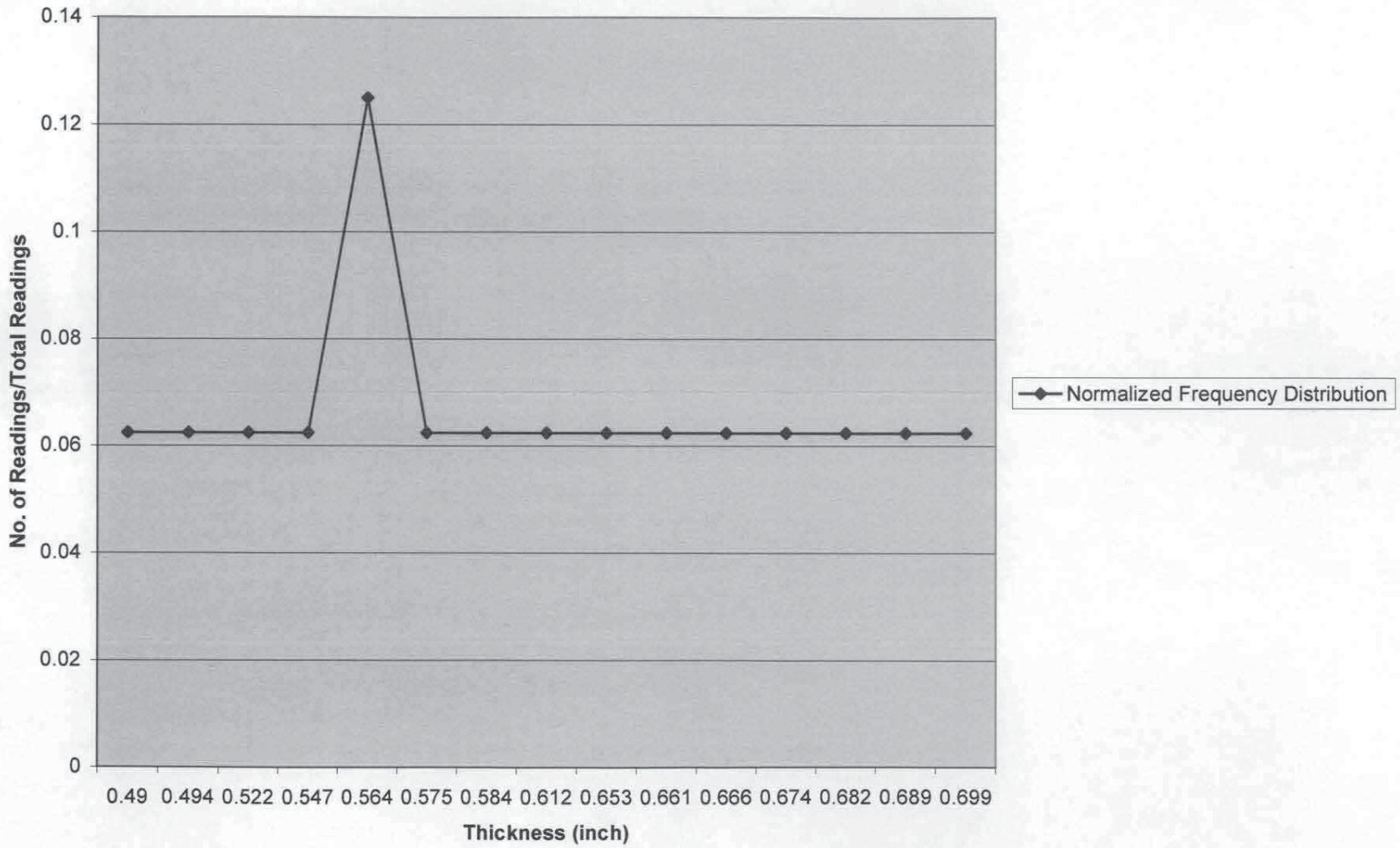


Figure 6C.LOC21.2007.3.Reliability Function

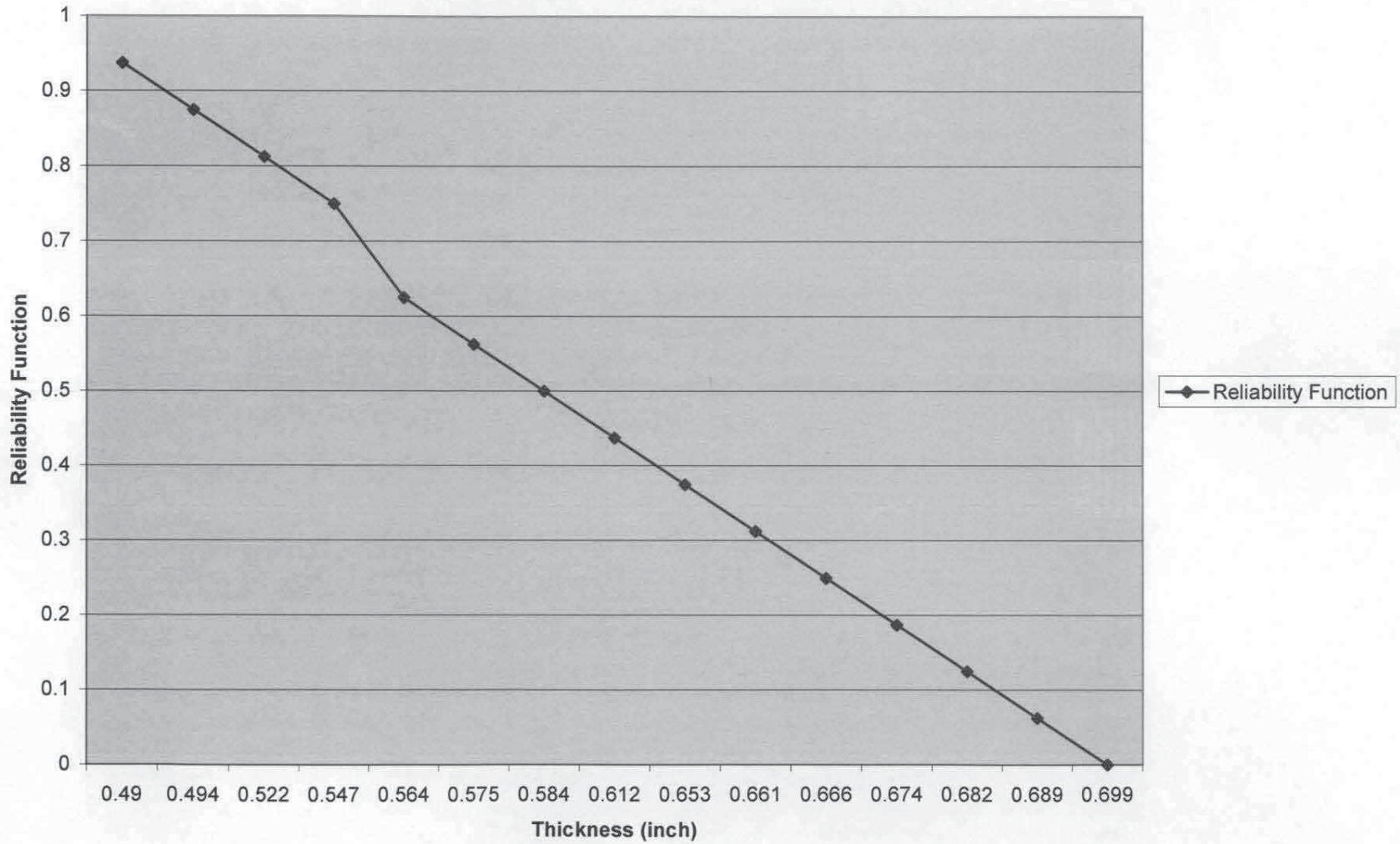


Figure 6C.LOC21.2007.4.Reliability^Area Ratio

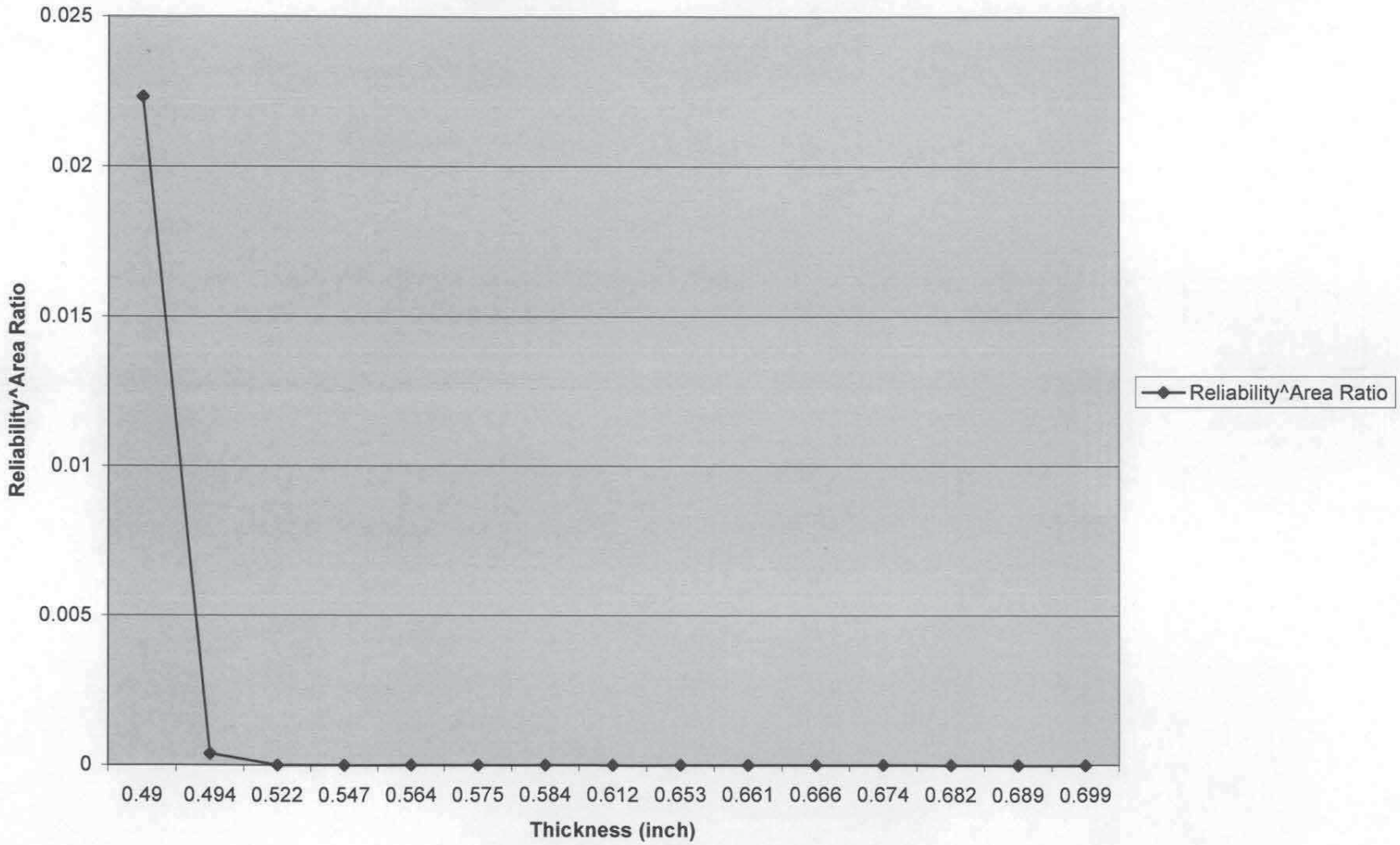


Table 6C.LOC22.2007.1	
Location 22	
Descriptive Statistics	
Mean	0.1815
Standard Error	0.000941469
Median	0.183
Mode	0.184
Standard Deviation	0.003261344
Sample Variance	1.06364E-05
Kurtosis	0.075213675
Skewness	-1.179315655
Range	0.009
Minimum	0.175
Maximum	0.184
Sum	2.178
Count	12
Largest(1)	0.184
Smallest(1)	0.175
Confidence Level(95.0%)	0.002072159

Table 6C.LOC22.2007.2	
Location 22	
Ordered Readings	
Thickness (inch)	*Count*
0.175	1
0.176	2
0.179	3
0.18	4
0.182	5
0.183	6
0.183	7
0.184	8
0.184	9
0.184	10
0.184	11
0.184	12

Table 6C.LOC22.2007.3						
Location 22						
Frequency and Reliability Statistical Analysis						
Thickness (inch)	*Frequency Distribution*	*Normalized Frequency Distribution*	*Cumulative Distribution*	*Reliability Function*	*Area Ratio*	*Reliability Function^Area Ratio*
0.175	1	0.083333333	0.08333333	0.9166667	141.4	4.54732E-06
0.176	1	0.083333333	0.16666667	0.8333333	141.4	6.39718E-12
0.179	1	0.083333333	0.25	0.75	141.4	2.17351E-18
0.18	1	0.083333333	0.33333333	0.6666667	141.4	1.27534E-25
0.182	1	0.083333333	0.41666667	0.5833333	141.4	8.07586E-34
0.183	2	0.166666667	0.58333333	0.4166667	141.4	1.77328E-54
0.184	5	0.416666667	1	0	141.4	0
Total	12					

Figure 6C.LOC22.2007.1.Ordered Thickness Readings

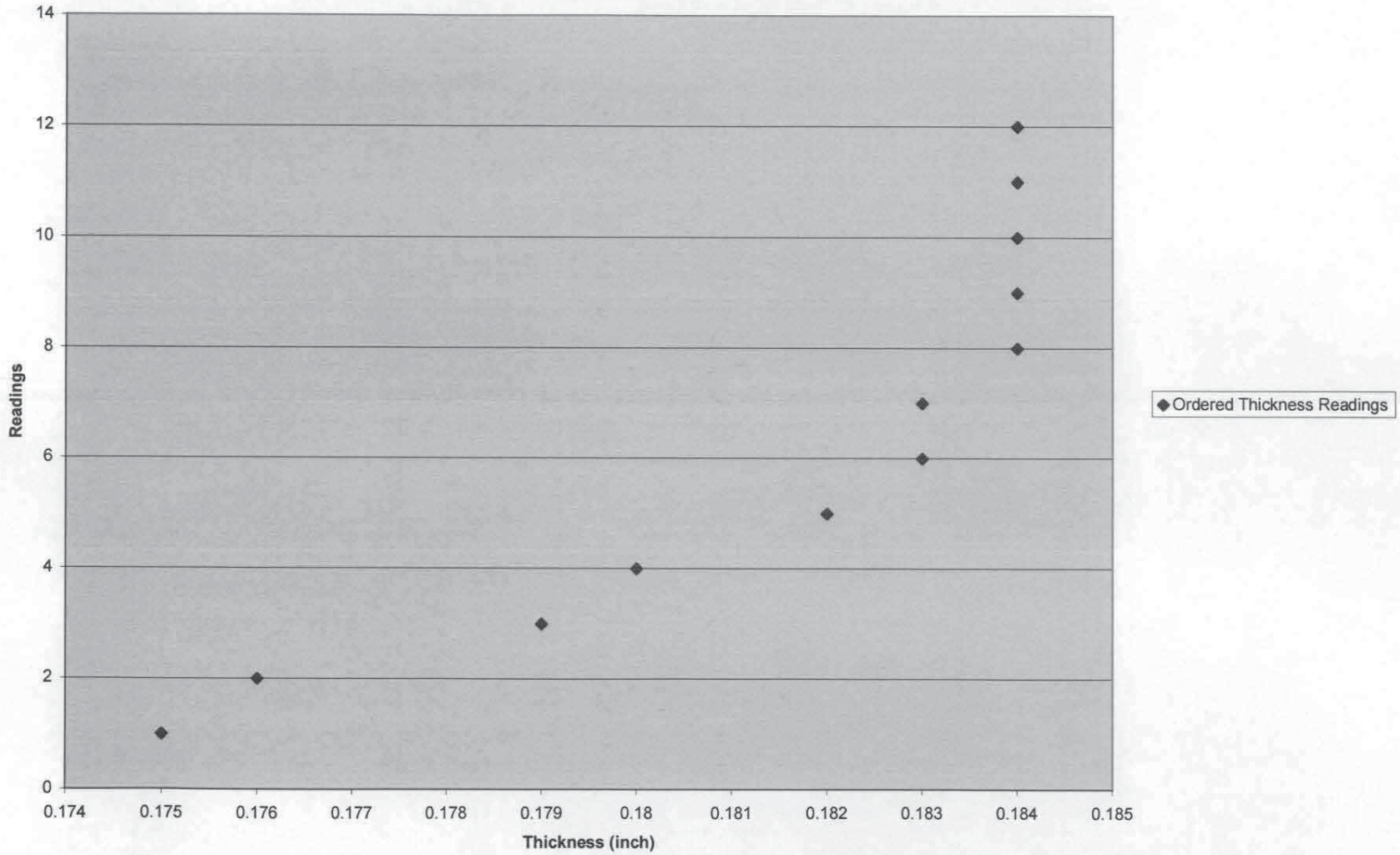


Figure 6C.LOC22.2007.2.Normalized Frequency Distribution

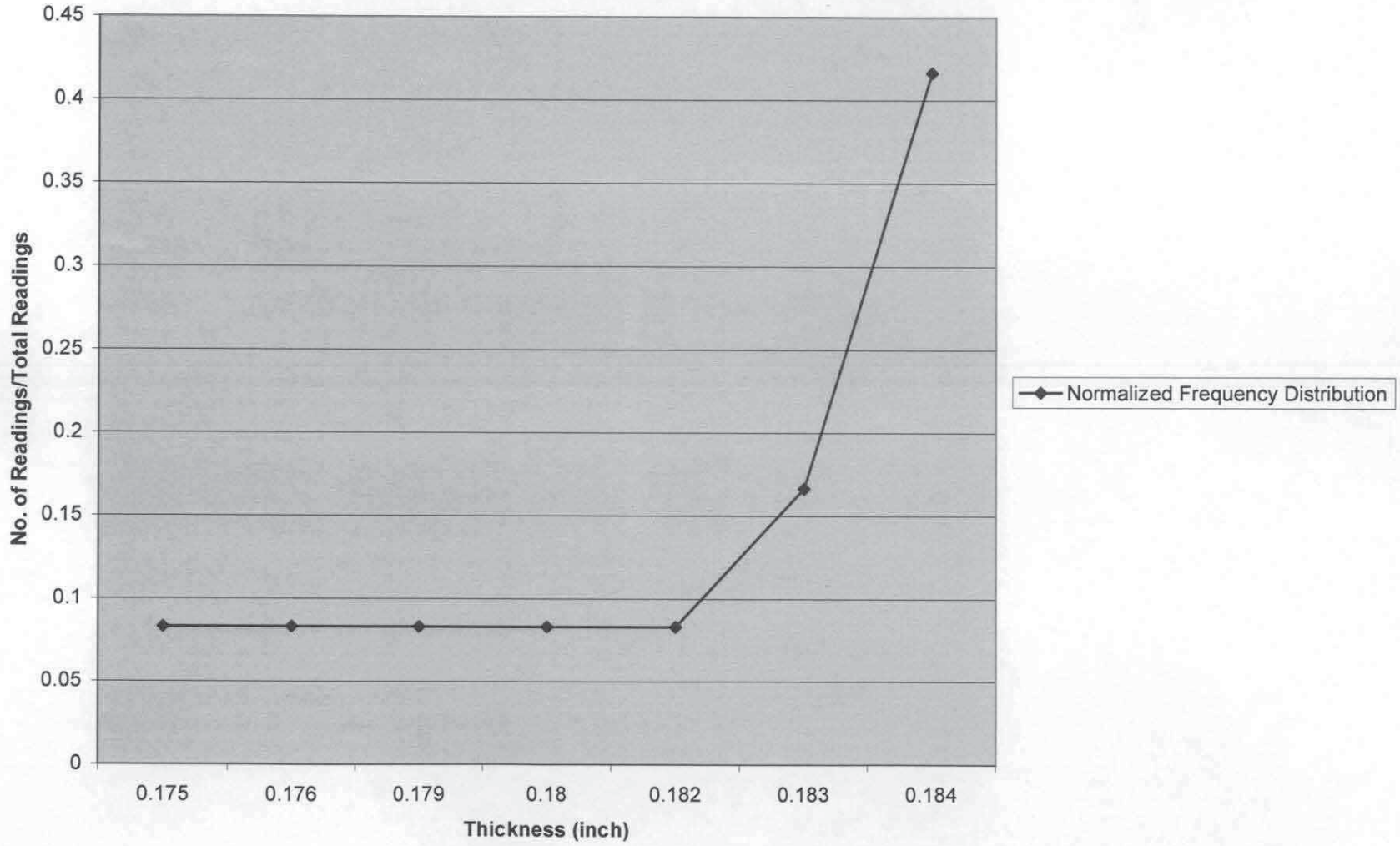


Figure 6C.LOC22.2007.3.Reliability Function

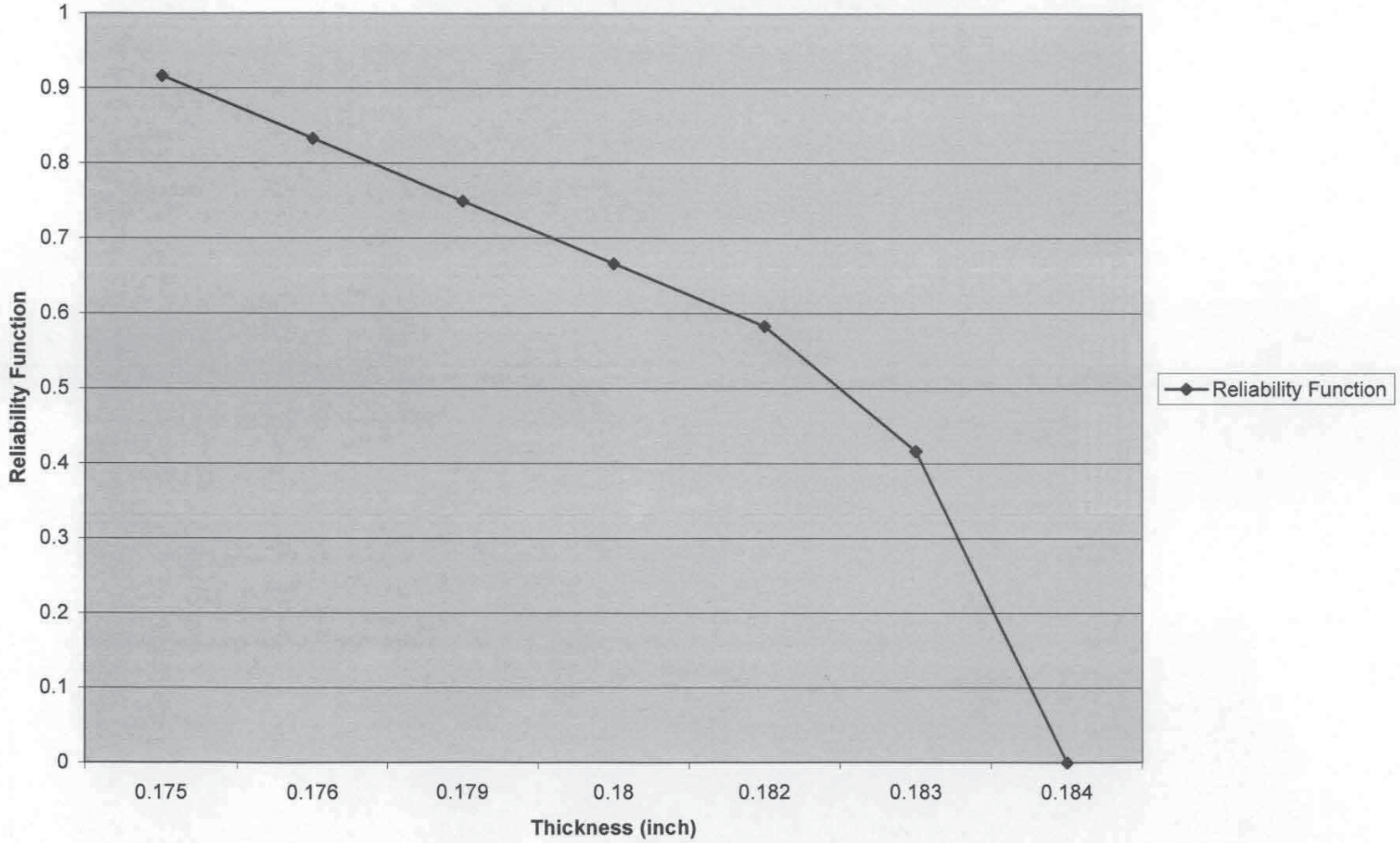
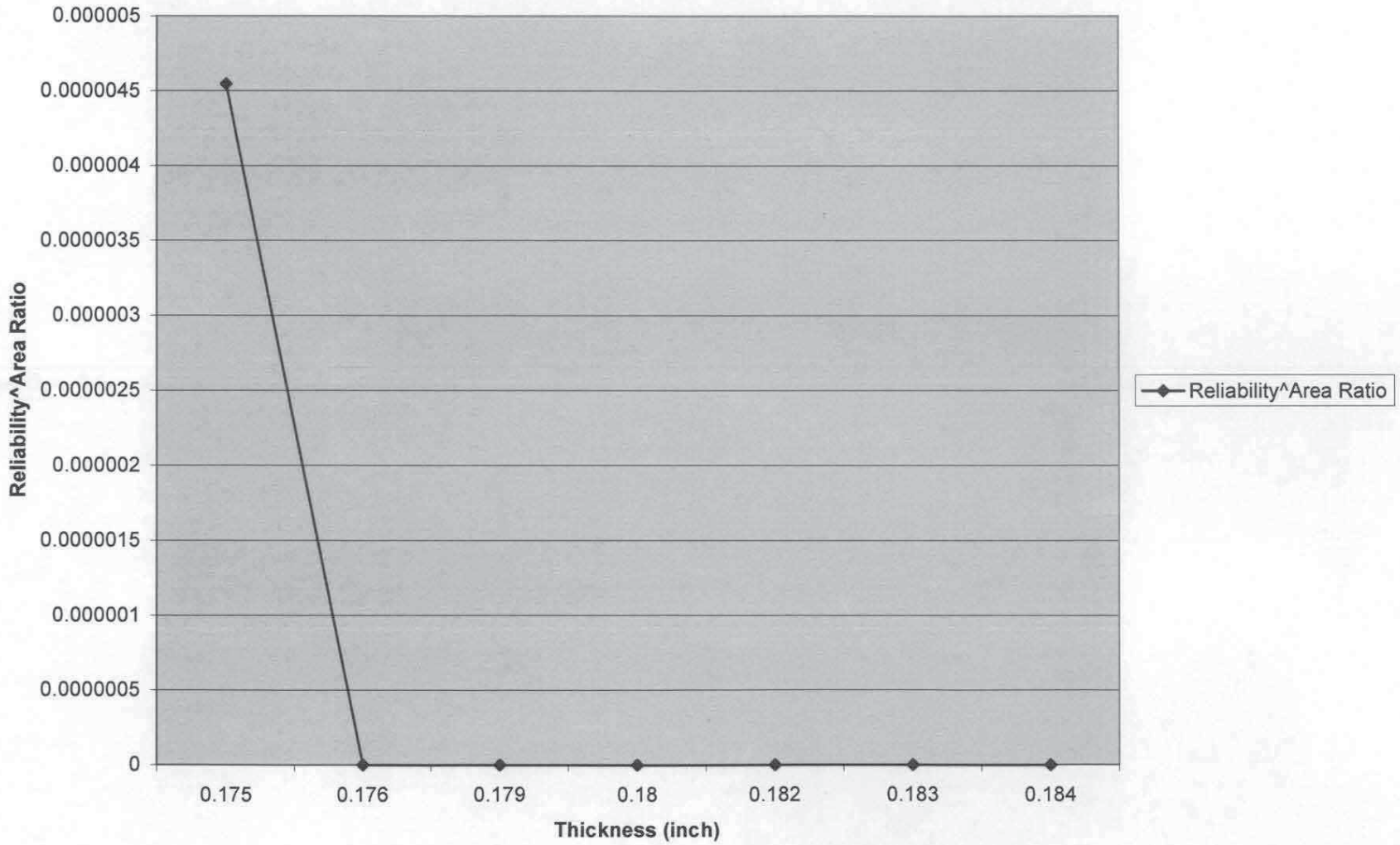


Figure 6C.LOC22.2007.4.Reliability^Area Ratio



ATTACHMENT 7

DVD AND PHOTO REVIEWS OF EVAPORATOR AND CONDENSER ROOM

(32 Pages)

ATTACHMENT 7A

DVD REVIEW OF EVAPORATOR PRIOR TO LEAK TEST

(9 Pages)

DVD Title	Type	Subtype				Location	Comment	Recommendation
Camcorder	Photo	NA	1	of	14	HVAC Room	No comment	No recommendation
HDR-L1X1	Photo	NA	2	of	14	HVAC Room	No comment	No recommendation
3/30/2007	Photo	NA	3	of	14	HVAC Room	No comment	No recommendation
	Photo	NA	4	of	14	HVAC Room	No comment	No recommendation
	Photo	NA	5	of	14	HVAC Room	No comment	No recommendation
	Photo	NA	6	of	14	HVAC Room	No comment	No recommendation
	Photo	NA	7	of	14	HVAC Room	No comment	No recommendation
	Photo	NA	8	of	14	HVAC Room	Chipped concrete.	No recommendation (not DW area)
	Photo	NA	9	of	14	HVAC Room	Chipped concrete.	No recommendation (not DW area)
	Photo	NA	10	of	14	HVAC Room	Chipped concrete.	No recommendation (not DW area)
	Photo	NA	11	of	14	HVAC Room	Chipped concrete.	No recommendation (not DW area)
	Photo	NA	12	of	14	HVAC Room	No comment	No recommendation
	Photo	NA	13	of	14	HVAC Room	No comment	No recommendation
	Photo	NA	14	of	14	HVAC Room	No comment	No recommendation
Camcorder Test #1	Video	Chapter	1	of	17	HVAC Room	No comment	No recommendation
Paul Disc #1	Video	Chapter	2	of	17	HVAC Room	No comment	No recommendation
3/12/2007	Video	Chapter	3	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	4	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	5	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	6	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	7	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	8	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	9	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	10	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	11	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	12	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	13	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	14	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	15	of	17	HVAC Room	No comment	No recommendation
	Video	Chapter	16	of	17	HVAC Room	20:30 - 2048 Chemical addition tank coating shows cracking	No recommendation (not DW area)
	Video	Chapter	17	of	17	HVAC Room	No comment	No recommendation
Camcorder Test #1	Video	Chapter	1	of	21	HVAC Room	No comment	No recommendation
Evap AMU/HVAC	Video	Chapter	2	of	21	HVAC Room	No comment	No recommendation
ROM#1	Video	Chapter	3	of	21	HVAC Room	No comment	No recommendation
3/12/2007	Video	Chapter	4	of	21	HVAC Room	No comment	No recommendation

	Video	Chapter	5	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	6	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	7	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	8	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	9	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	10	of	21	HVAC Room	17:50 CS Flange bolts on foreground valve (drain line) are corroded.	No recommendation (not DW area)
	Video	Chapter	11	of	21	HVAC Room	19:17 CS flange bolts corroded, surface corrosion on flange (drain line)	No recommendation (not DW area)
	Video	Chapter	12	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	13	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	14	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	15	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	16	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	17	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	18	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	19	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	20	of	21	HVAC Room	No comment	No recommendation
	Video	Chapter	21	of	21	HVAC Room	31:47 Scratched, corroded surface	No recommendation (not DW area)
242A	Photo	NA	1	of	12	Condenser Room	No comment	No recommendation
Condenser Room	Photo	NA	2	of	12	Condenser Room	Minor surface corrosion/staining on TKC100 tank skirt	Clean surface. Periodically monitor and reassess.
UT Photo Locations & Test Report	Photo	NA	3	of	12	Condenser Room	Surface corrosion on CS flange bolts, rust on vent and drain lines, housing of F-C-1 is chipped	Periodically monitor and reasses, replace CS flange bolts with SS when servicing. Clean and recoat chipped and corroded surfaces.
	Photo	NA	4	of	12	Condenser Room	No comment	No recommendation
	Photo	NA	5	of	12	Condenser Room	Surface corrosion on CS flange bolts on foreground flange cover	Identify flange shown. Replace CS bolts with SS when flange serviced/monitor flange connections for bolt breakage or flange leakage.
	Photo	NA	6	of	12	Condenser Room	Tool marks on foreground bolts (adjacent to Location 9)	Repaint bolts

	Photo	NA	7	of	12	Condenser Room	Flange bolts on on top flange are corroded (6" vapor line).	Replace bolts when flanges or lines are serviced/monitor flange connections for bolt breakage or flange leakage.
	Photo	NA	8	of	12	Condenser Room	No comment	No recommendation
	Photo	NA	9	of	12	Condenser Room	No comment	No recommendation
	Photo	NA	10	of	12	Condenser Room	Appearance of missing and chipped paint on and near upper elbow, 6" vapor line	Clean surface and repair coating.
	Photo	NA	11	of	12	Condenser Room	See above	See above
	Photo	NA	12	of	12	Condenser Room	Condensate tank skirt shows surface staining/corrosion, possible scaling	Clean surface. Periodically monitor and reassess.
Evap Pump Room	Video	Chapter	1	of	26	Evap Pump Room	No comment	No recommendation
4/19/2007	Video	Chapter	2	of	26	Evap Pump Room	1:37 Dark fluid in sump; scaling, white stain on floor; minor surface corrosion on floor; hairline crack on western wall	Clean floor surface to remove surface staining and corrosion; repair coating over crack
Copy #3	Video	Chapter	3	of	26	Evap Pump Room	4:37 - 4: 51 Dark fluid in sump; scaling, white stain on floor; minor surface corrosion on floor	Clean floor surface to remove surface staining and corrosion. Periodically monitor and reassess condition.
	Video	Chapter	4	of	26	Evap Pump Room	7:43 Appears to be chipped wall coating above jumper 38	Clean surface and repair coating.
	Video	Chapter	4	of	26	Evap Pump Room	9:21 - 10:42 Hairline cracks in wall above door (north wall)	Repair coating over crack
	Video	Chapter	5	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	6	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	7	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	8	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	9	of	26	Evap Pump Room	17:10 - 17:57 Minor surface corrosion PB1 pump CS flange bolts	Monitor and periodically reasses; replace with SS when servicing
	Video	Chapter	10	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	11	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	12	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	13	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	14	of	26	Evap Pump Room	No comment	No recommendation

	Video	Chapter	15	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	16	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	17	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	18	of	26	Evap Pump Room	28:26 - 29:11 Appears to be chipped wall coating above jumper 38 (see also 7:43 above)	Clean surface and repair coating.
	Video	Chapter	19	of	26	Evap Pump Room	30:06, 30:12 - 30:20 Minor dark staining on PB2 pump mounts and under pump	Determine cause of staining (rule out leaks) and remove stains
	Video	Chapter	20	of	26	Evap Pump Room	33:06 - 33:07, 34:21, 34:23 Minor dark staining on PB2 pump mounts and under pump (see also previous entry)	Determine cause of staining (rule out leaks) and remove stains
	Video	Chapter	21	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	22	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	23	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	24	of	26	Evap Pump Room	No comment	No recommendation
	Video	Chapter	25	of	26	Evap Pump Room	37:57 - 38:59 Paint chipped on PB1 support	Recoat supports.
	Video	Chapter	26	of	26	Evap Pump Room	38:00 - 38: 39 Paint chipped on PB1 support, crack in wall/wall coating	Recoat supports.
Evap Room	Video	Chapter	1	of	28	Evap Room Basement	No comment	No recommendation
Basement	Video	Chapter	2	of	28	Evap Room Basement	2:12 Minor surface rust on valve actuator linkage	Identify valve actuator shown. Remove rust, recoat valve actuator linkage.
4/18/2007	Video	Chapter	3	of	28	Evap Room Basement	No comment	No recommendation
Day Shift	Video	Chapter	4	of	28	Evap Room Basement	4:20 Pipe hanger and bolts show surface corrosion, bolt pulled free from wall	Identify line. Reanchor conduit hanger to wall, remove corrosion from hanger and replace bolts
Copy #3	Video	Chapter	4	of	28	Evap Room Basement	5:14 Pipe hanger nut loose, U-bracket corroded.	Replace U-bracket, ensure anchor nuts are tight.
	Video	Chapter	5	of	28	Evap Room Basement	No comment	No recommendation
	Video	Chapter	6	of	28	Evap Room Basement	No comment	No recommendation
	Video	Chapter	7	of	28	Evap Room Basement	No comment	No recommendation
	Video	Chapter	8	of	28	Evap Room Basement	No comment	No recommendation
	Video	Chapter	9	of	28	Evap Room Basement	No comment	No recommendation
	Video	Chapter	10	of	28	Evap Room Basement	No comment	No recommendation

Video	Chapter	11	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	12	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	13	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	14	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	15	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	16	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	17	of	28	Evap Room Basement	18:15 - 20:11 Surface corrosion on valve actuator to CA1-7 and supports	Remove corrosion and recoat
Video	Chapter	17	of	28	Evap Room Basement	19:38 - 19:46 Actuator linkage to CA1-7 is supported by pipe stand and restrained by U-hanger and loose pad underneat, creating groove in actuator linkage.	Support appears adequate (no stresses evident at base), however, another restraint or means to prevent grooving the actuator linkage should be considered.
Video	Chapter	17	of	28	Evap Room Basement	20:38 White staining on flange (upstream of Loc 15, Line 6"DR-335-M9)	Identify source of staining (rule out leaks)
Video	Chapter	17	of	28	Evap Room Basement	21:31- Surface corrosion on actuator linkage and linkage support (valve ZS-CAI-9-2)	Remove corrosion and recoat
Video	Chapter	18	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	19	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	20	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	21	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	22	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	23	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	24	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	25	of	28	Evap Room Basement	29:26 Chip in floor coating (approx 1" X 2")	Repair coating over chip
Video	Chapter	26	of	28	Evap Room Basement	31:45 - 32:26; 32:49-33:32 Multiple chips in floor coating (approx 1"X1")	Repair coating over chips
Video	Chapter	27	of	28	Evap Room Basement	No comment	No recommendation
Video	Chapter	28	of	28	Evap Room Basement	34:15; 34:29 SS pressure line sensor not attached to uni-strut hanger; line is open ended	Attach line to hanger or if abanded, remove line.

Evap Room Ground Floor 4/17/2007 Swing Shift Copy #3	Video	Chapter	1	of	7	Evap Room Ground Flr	01:36 Anchor bolt pulled out of wall (see 4:20 Evap Room Basement DVD)	Identify line. Reanchor conduit hanger to wall, remove corrosion from hanger and replace bolts
	Video	Chapter	2	of	7	Evap Room Ground Flr	No comment	No recommendation
	Video	Chapter	3	of	7	Evap Room Ground Flr	4:05 Loose U-anchor (see 5:14 Evap Room Basement DVD)	Replace U-bracket, ensure anchor nuts are tight.
	Video	Chapter	4	of	7	Evap Room Ground Flr	No comment	No recommendation
	Video	Chapter	5	of	7	Evap Room Ground Flr	5:35 Two bolts in four bolt flange, 3/4 SS line connection	Install any and all missing bolts
	Video	Chapter	6	of	7	Evap Room Ground Flr	6:28 Uni-strut hanger for 3/4 SS line pulling away from wall	Secure hanger to wall
	Video	Chapter	7	of	7	Evap Room Ground Flr	No comment	No recommendation
Evap Room 1st Floor 4/17/2007 Swing Shift Copy #3	Video	Chapter	1	of	8	Evap Room 1st Floor	No comment	No recommendation
	Video	Chapter	2	of	8	Evap Room 1st Floor	1:13 Support nuts and bolts show surface corrosion	Monitor and periodically reasses; Replace when support is serviced.
	Video	Chapter	3	of	8	Evap Room 1st Floor	No comment	No recommendation
	Video	Chapter	4	of	8	Evap Room 1st Floor	3:15 2"SS Water line anchor bolt pulled out of wall (see 1:36, Evap Ground Floor and 4:20 Evap Basement)	Identify line. Re-anchor conduit hanger to wall, remove corrosion from hanger and replace bolts
	Video	Chapter	5	of	8	Evap Room 1st Floor	No comment	No recommendation
	Video	Chapter	6	of	8	Evap Room 1st Floor	No comment	No recommendation
	Video	Chapter	7	of	8	Evap Room 1st Floor	5:06 concrete spalling and anchor possibly pulled away from wall, 2"SS Water line	Identify line. Inspect concrete and anchor to determine if anchor is firmly attached. Repair if needed.
	Video	Chapter	8	of	8	Evap Room 1st Floor	5:46 3/4" Line uni-strut anchor pulled away from north wall	Identify line. Reattach unistrut anchor.
Evap Room 2nd Floor 4/17/2007 Swing Shift Copy #3	Video	Chapter	1	of	7	Evap Room 2nd Floor	No comment	No recommendation
	Video	Chapter	2	of	7	Evap Room 2nd Floor	No comment	No recommendation
	Video	Chapter	3	of	7	Evap Room 2nd Floor	No comment	No recommendation
	Video	Chapter	4	of	7	Evap Room 2nd Floor	No comment	No recommendation
	Video	Chapter	5	of	7	Evap Room 2nd Floor	No comment	No recommendation
	Video	Chapter	6	of	7	Evap Room 2nd Floor	No comment	No recommendation
	Video	Chapter	7	of	7	Evap Room 2nd Floor	No comment	No recommendation
Evap Room 3rd Floor 4/17/2007	Video	Chapter	1	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	2	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	3	of	26	Evap Room 3rd Floor	No comment	No recommendation

Day Shift	Video	Chapter	4	of	26	Evap Room 3rd Floor	No comment	No recommendation
Copy #3	Video	Chapter	5	of	26	Evap Room 3rd Floor	3:55 Bent hanger / anchor bolt pulled away from wall, 2"SS line (east wall)	Identify line. Replace / re-anchor SS line.
	Video	Chapter	6	of	26	Evap Room 3rd Floor	5:06 Nut on U-bolt appears to have pulled through 2"SS line anchor d/t missing washers, U-bolt corroded. Anchor has pulled away from wall. (east wall)	Place washers behind nuts, replace U-bolt. Secure anchor to wall.
	Video	Chapter	7	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	8	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	9	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	10	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	11	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	12	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	13	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	14	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	15	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	16	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	17	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	18	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	19	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	20	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	21	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	22	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	23	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	24	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	25	of	26	Evap Room 3rd Floor	No comment	No recommendation
	Video	Chapter	26	of	26	Evap Room 3rd Floor	No comment	No recommendation
Evap Room 4th Floor 4/17/2007 Day Shift Copy #3	Video	Chapter	1	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	2	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	3	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	4	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	5	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	6	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	7	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	8	of	12	Evap Room 4th Floor	No comment	No recommendation

	Video	Chapter	9	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	10	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	11	of	12	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	12	of	12	Evap Room 4th Floor	No comment	No recommendation
Evap Room 4th Floor, #1 4/16/2007 Copy #3	Video	Chapter	1	of	10	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	2	of	10	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	3	of	10	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	4	of	10	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	5	of	10	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	6	of	10	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	7	of	10	Evap Room 4th Floor	27:05 From view, line appears to goes two or more floors w/no anchoring (NW corner)	Support (anchor) vertical piping at every floor. Verify adequate anchoring.
	Video	Chapter	8	of	10	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	9	of	10	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	10	of	10	Evap Room 4th Floor	No comment	No recommendation
Evap Room 4th Floor, #2	Video	Chapter	1	of	7	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	2	of	7	Evap Room 4th Floor	No comment	No recommendation
4/16/2007	Video	Chapter	3	of	7	Evap Room 4th Floor	6:10 Inner line sitting on anchor strut w/out bracket	Secure line to anchor strut. Identify line shown, appears to be a 1/2" FRW
Copy #3	Video	Chapter	3	of	7	Evap Room 4th Floor	6:47 Inner line sitting on anchor strut w/out bracket	Secure line to anchor strut. Identify line shown, appears to be a 1/2" FRW
	Video	Chapter	3	of	7	Evap Room 4th Floor	7:39 - 7:42 Inner line possibly sitting on anchor strut w/out bracket (camera angle poor)	Reinspect, secure if not anchored. Identify line shown, appears to be a 1/2" FRW.
	Video	Chapter	4	of	7	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	5	of	7	Evap Room 4th Floor	9:26 Vertical structural support missing bolt	Replace bolt
	Video	Chapter	6	of	7	Evap Room 4th Floor	No comment	No recommendation
	Video	Chapter	7	of	7	Evap Room 4th Floor	No comment	No recommendation

ATTACHMENT 7B

242-A EVAPORATOR/PUMP ROOM PHOTO REVIEW
LEVEL DRADOWN TEST OF C-A-1

(6 Pages)

242-A Evaporator/Pump Room Photo Review: Level Dradown Test of C-A-1

S.No.	Photo ID	Observations of Leak/staining	Recommendations
1	DSC00276	No wet spot; Generally clean	
2	DSC00277	No wet spot; Generally clean	
3	DSC00279	Picture not clear to see wet spot	
4	DSC00285	No wet spot; Generally clean	
5	DSC00286	No wet spot; Generally clean	
6	DSC00287	No wet spot; Generally clean	
7	DSC00288	No wet spot; Generally clean	
8	DSC00289	No wet spot; Generally clean	
9	DSC00290	No wet spot; Generally clean	
10	DSC00291	No wet spot; Generally clean	
11	DSC00292	No wet spot; Generally clean	
12	DSC00293	No wet spot; Generally clean	
13	DSC00294	No wet spot; Generally clean	
14	DSC00295	No wet spot; Generally clean	
15	DSC00296	No wet spot; Generally clean	
16	DSC00297	No wet spot; Generally clean	
17	DSC00298	No wet spot; Generally clean	
18	DSC00299	No wet spot; Generally clean	
19	DSC00304	No wet spot; Generally clean	
20	DSC00305	No wet spot; Generally clean	
21	DSC00306	No wet spot; Generally clean	
22	DSC00307	No wet spot; Generally clean	
23	DSC00308	No wet spot; Generally clean	
24	DSC00309	Picture not clear to see wet spot	
25	DSC00310	No wet spot; Generally clean	
26	DSC00311	No wet spot; Generally clean	
27	DSC00312	No wet spot; Generally clean	
28	DSC00315	No wet spot; Generally clean	
29	DSC00316	No wet spot; staining	
30	DSC00318	No wet spot; staining	
31	DSC00320	No wet spot; Generally clean	
32	DSC00322	No wet spot; Generally clean	
33	DSC00323	No wet spot; Generally clean	
34	DSC00324	No wet spot; Generally clean	

242-A Evaporator/Pump Room Photo Review: Level Dradown Test of C-A-1

S.No.	Photo ID	Observations of Leak	Recommendations
35	DSC00325	No wet spot; Generally clean.	
35	DSC00326	No wet spot; Generally clean.	
37	DSC00327	No wet spot; Generally clean; dark image.	
38	DSC00328	No wet spot; Generally clean.	
39	DSC00329	No wet spot; Generally clean.	
40	DSC00330	No wet spot; Generally clean.	
41	DSC00331	No wet spot; Generally clean.	
42	DSC00332	No wet spot; Generally clean.	
43	DSC00333	No wet spot; Generally clean; .	Check insulation gap.
44	DSC00334	No wet spot; Generally clean; .	Check insulation gap.
45	DSC00335	No wet spot; Generally clean; .	Check insulation gap.
46	DSC00336	No wet spot; Generally clean; .	
47	DSC00337	No wet spot; Generally clean; .	
48	DSC00338	No wet spot; Generally clean; .	Check insulation gap.
49	DSC00339	No wet spot; Generally clean; .	Check insulation gap.
50	DSC00340	No wet spot; Generally clean; .	Check insulation gap.
51	DSC00341	No wet spot; Generally clean; .	Check insulation gap.
52	DSC00342	No wet spot; Generally clean; .	
53	DSC00343	No wet spot; Generally clean; .	
54	DSC00344	No wet spot; Generally clean; .	
55	DSC00345	No wet spot; Generally clean; .	
56	DSC00346	No wet spot; Generally clean; .	
57	DSC00347	No wet spot; Generally clean; .	
58	DSC00348	No wet spot; Generally clean; .	
59	DSC00349	No wet spot; Generally clean; .	
60	DSC00350	No wet spot; Generally clean; .	
61	DSC00351	No wet spot; Generally clean; .	
62	DSC00352	No wet spot; Generally clean; .	
63	DSC00353	No wet spot; Generally clean; .	
64	DSC00354	No wet spot; Generally clean; .	
65	DSC00355	No wet spot; Generally clean; .	
66	DSC00356	No wet spot; Generally clean; .	
67	DSC00357	No wet spot; Generally clean; .	
68	DSC00358	No wet spot; Generally clean; .	

242-A Evaporator/Pump Room Photo Review: Level Dradown Test of C-A-1

S.No.	Photo ID	Observations of Leak	Recommendations
69	DSC00359	No wet spot; Generally clean; .	
70	DSC00360	No wet spot; Generally clean; .floor ok.	
71	DSC00361	No wet spot; Generally clean; .floor ok.	
72	DSC00362	No wet spot; Generally clean; .	
73	DSC00363	No wet spot; Generally clean; .floor ok.	
74	DSC00364	No wet spot; Generally clean; .	
75	DSC00365	No wet spot; Generally clean; .	Floor needs painting.
76	DSC00366	No wet spot; Generally clean; .	
77	DSC00367	No wet spot; Generally clean; .	
78	DSC00368	No wet spot; Generally clean; .	Floor needs painting.
79	DSC00369	No wet spot; Generally clean; .	
80	DSC00370	No wet spot; Generally clean; .	
81	DSC00371	No wet spot; Generally clean; .	Floor needs painting.
82	DSC00372	No wet spot; Generally clean; .	
83	DSC00373	No wet spot; Generally clean; .	
84	DSC00374	No wet spot; Generally clean; .	
85	DSC00375	No wet spot; Generally clean; .	
86	DSC00376	No wet spot; Generally clean; .	
87	DSC00377	No wet spot; Generally clean; .	
88	DSC00378	No wet spot; Generally clean; .	
89	DSC00379	No wet spot; Generally clean; .	
90	DSC00380	No wet spot; Generally clean; .	
91	DSC00381	No wet spot; Generally clean; .	
92	DSC00382	No wet spot; Generally clean; .	
93	DSC00383	No wet spot; Generally clean; .	
94	DSC00384	No wet spot; Generally clean; .	
95	DSC00385	No wet spot; Generally clean; .	
96	DSC00386	No wet spot; Generally clean; .	
97	DSC00387	No wet spot; Generally clean; .	
98	DSC00388	No wet spot; Generally clean; .	
99	DSC00389	No wet spot; Generally clean; .	
100	DSC00390	No wet spot; Generally clean; .	
101	DSC00391	No wet spot; Generally clean; .	Floor needs painting.
102	DSC00392	No wet spot; Generally clean; .	

242-A Evaporator/Pump Room Photo Review: Level Dradown Test of C-A-1

S.No.	Photo ID	Observations of Leak	Recommendations
103	DSC00393	No wet spot; Generally clean; .	
104	DSC00394	No wet spot; Generally clean; .	
105	DSC00395	No wet spot; Generally clean; .	
106	DSC00396	No wet spot; Generally clean; .	
107	DSC00397	No wet spot; Generally clean; .	Check insulation gap
108	DSC00398	No wet spot; Generally clean; .	
109	DSC00399	No wet spot; Generally clean; .	
110	DSC00400	No wet spot; Generally clean; .	
111	DSC00401	No wet spot; Generally clean; .	
112	DSC00402	No wet spot; Generally clean; .	
113	DSC00403	No wet spot; Generally clean; .	
114	DSC00404	No wet spot; Generally clean; .	
115	DSC00405	No wet spot; Generally clean; .	
116	DSC00406	No wet spot; Generally clean; .	
117	DSC00407	No wet spot; Generally clean; .	
118	DSC00408	No wet spot; Generally clean; .	
119	DSC00409	No wet spot; Generally clean; .	
120	DSC00410	No wet spot; Generally clean; .	
121	DSC00411	No wet spot; Generally clean; .	
122	DSC00412	No wet spot; Generally clean; .	
123	DSC00418	Image not cleat to see wet spot.	Is it possible to retake picture?
124	DSC00419	Image not cleat to see wet spot.	Is it possible to retake picture?
125	DSC00420	Image not cleat to see wet spot.	Is it possible to retake picture?
126	DSC00421	Image not cleat to see wet spot.	Is it possible to retake picture?
127	DSC00422	No wet spot; Generally clean; .	
128	DSC00423	Image not cleat to see wet spot.	Is it possible to retake picture?
129	DSC00424	Image not cleat to see wet spot.	Is it possible to retake picture?
130	DSC00425	No wet spot; Generally clean; .	
131	DSC00426	No wet spot; Generally clean; .	
132	DSC00427	No wet spot; Generally clean; .	
133	DSC00428	No wet spot; Generally clean; .	
134	DSC00429	No wet spot; Generally clean; .	
135	DSC00430	Image not cleat to see wet spot.	Is it possible to retake picture?
136	DSC00431	Image not cleat to see wet spot.	Is it possible to retake picture?

242-A Evaporator/Pump Room Photo Review: Level Dradown Test of C-A-1

S.No.	Photo ID	Observations of Leak	Recommendations
137	DSC00432	No wet spot; Generally clean; .	
138	DSC00433	No wet spot; Generally clean; .	
139	DSC00434	No wet spot; Generally clean; .	
140	DSC00435	No wet spot; Generally clean; .	
141	DSC00436	No wet spot; Generally clean; .	
142	DSC00437	No wet spot; Generally clean; .	
143	DSC00438	No wet spot; Generally clean; .	
144	DSC00439	No wet spot; Generally clean; .	
145	DSC00440	No wet spot; Generally clean; .	
146	East Third Pin	Too much rust/staining	Needs maintenance
147	East Fourth Pin	Too much rust/staining	Needs maintenance
148	West Third Pin	Rust/staining; locking key appears missing	Needs repair.
149	West Third Pin2	Rust/staining; locking key appears missing	Needs repair.
150	West Fourth Pin	Too much movement at this pin	Need attention
151	South Third Pin	Rust/staining; too much movement	Needs attention
152	South Fourth Pin	Locking key appears to be missing	Needs attention
153	North Third Pin	Rust/staining	Needs maintenance
154	North Fourth Pin	OK	
155	Leak from Nozzle E to Pump Room Floor	Not known how much leak and why	Needs information
156	Nozzle E Leak - Floor Pump Room (9/1/07)	Not known how much leak and why	Needs information
157	Nozzle E Leak - 9/1/07	Not known how much leak and why	Needs information

ATTACHMENT 7C

242-A CONDENSER ROOM 1ST PHOTO SHOOT
02/13/07

(7 Pages)

242-A Condenser Room 1st Photo Shoot (02-13-07)

S.No.	Photo ID	Observations of Rust spots, pitting, loss of metal, corrosion, blisters, discoloration of coatings, damageto insulation, bolts & welds, joint cracks, loss of weld integrity, evidence of leak	General Cleanliness	Recommendations
1	1stFlrEastWallCoat-1	None	Clean	Satisfactory
2	1stFlrEastWallCoat-2	None	Clean	Satisfactory
3	1stFlrEastWallCoat-3	None	Clean	Satisfactory
4	1stFlrEastWallCoat-4	None	Clean	Satisfactory
5	1stFlrEastWallCoat-5	None	Clean	Satisfactory
6	1stFlrEastWallCoat-6	None	Clean	Satisfactory
7	1stFlrEastWallDrain1E	None	Clean	Satisfactory
8	1stFlrNorthWallCoat-1	None	Clean	Satisfactory
9	1stFlrNorthWallCoat-2	Damage to coatings	Clean	Needs recoating
10	1stFlrNorthWallCoat-3	Damage to coatings	Clean	Needs recoating
11	1stFlrNorthWallCoat-4	None	Clean	Satisfactory
12	1stFlrNorthWallCoat-5	None	Clean	Satisfactory
13	1stFlrNorthWallCoat-6	None	Clean	Satisfactory
14	1stFlrNorthWallCoat-7	None	Clean	Satisfactory
15	1stFlrSouthWallCoat-1	None	Clean	Satisfactory
16	1stFlrSouthWallCoat-2	None	Clean	Satisfactory
17	1stFlrSouthWallCoat-3	None	Clean	Satisfactory
18	1stFlrSouthWallCoat-4	None	Clean	Satisfactory
19	1stFlrSouthWallCoat-5	None	Clean	Satisfactory
20	1stFlrSouthWallCoat-6	None	Clean	Satisfactory
21	1stFlrWestWallCoat-1	None	Clean	Satisfactory
22	1stFlrWestWallCoat-2	Staining on bottom 6" support wall	Clean	Need clarification for staining.
23	1stFlrWestWallCoat-3	None	Clean	Satisfactory
24	1stFlrWestWallCoat-4	None	Clean	Satisfactory
25	1stFlrWestWallCoat-5	None	Clean	Satisfactory
26	1stFlrWestWallCoat-6	None	Clean	Satisfactory
27	1stFlrWestWallDrain1-D	Surface staining near drain	Clean	Need clarification for staining.
28	1stFlrWideview682ft-1	Surface staining on tank walls	Clean	Need clarification for staining.
29	1stFlrWideview682ft-2	Surface staining on tank walls	Clean	Need clarification for staining.
30	2ndFlrEntryWideView692ft	Surface staining on tank walls	Clean	Need clarification for staining.
31	3rdFlrWideView702ft-1	Surface staining on tank walls	Clean	Need clarification for staining.
32	3rdFlrWideView702ft-2	Lub oil leakage below pump & motor	Clean	Need monitoring & maintenance
33	5thFlrWideView732ft-1	None	Clean	Satisfactory
34	5thFlrWideView732ft-2	None	Clean	Satisfactory

242-A Condenser Room 1st Photo Shoot (02-13-07)

S.No.	Photo ID	Observations of Rust spots, pitting, loss of metal, corrosion, blisters, discoloration of coatings, damageto insulation, bolts & welds, joint cracks, loss of weld integrity, evidence of leak	General Cleanliness	Recommendations
35	Drain#1-C	None	Clean	Satisfactory
36	Drain#1-H	Surface staining on support wall	Clean	Need clarification for staining
37	EC1@BackFlangeVacuum	None	Clean	Satisfactory
38	EC1@BotWaterFlange	None	Clean	Satisfactory
39	EC1@BotWaterFlange~view1	None	Clean	Satisfactory
40	EC1@BotWaterFlange~view2	None	Clean	Satisfactory
41	EC1@MidFlangeVacuum~view1	None	Clean	Satisfactory
42	EC1@RawWaterFlange~view1	None	Clean	Satisfactory
43	EC1@RawWaterFlange~view2	None	Clean	Satisfactory
44	EC1@TopView	None	Clean	Satisfactory
45	EC1BackFlange-3	None	Clean	Satisfactory
46	EC1BackFlange-2	None	Clean	Satisfactory
47	EC1-SupportStructure	None (half of picture not clear)	Clean	Satisfactory
48	EC2&EC3	Staining below EC2	Clean	Need clarification for staining
49	EC3&EC2	None	Clean	Satisfactory
50	FC1~view1	None	Clean	Satisfactory
51	FC1~view2	None	Clean	Satisfactory
52	FC1~view3	None	Clean	Satisfactory
53	F-C-3~view1	None	Clean	Satisfactory
54	F-C-3~view2	None	Clean	Satisfactory
55	F-C-3~view3	None (Staining and rust inside the tray)	Clean	Replace the tray
56	F-C-4&F-C-5~view1	None	Clean	Satisfactory
57	F-C-4&F-C-5~view2	None	Clean	Satisfactory
58	FIT-C100-5~view1	None	Clean	Satisfactory
59	FIT-C100-5~view2	None	Clean	Satisfactory
60	FIT-EC1-2	None	Clean	Satisfactory
61	LG-C100-1	None (Surface staining on support wall)	Clean	Need clarification for staining
62	Location11	None	Clean	Satisfactory
63	Location12	None	Clean	Satisfactory
64	Location13	None	Clean	Satisfactory
65	Location16	None (Surface staining on tank walls))	Clean	Need clarification for staining
66	Location17	None	Clean	Satisfactory
67	Location19	None	Clean	Satisfactory
68	Location21	None (Clean Tray)	Clean	Satisfactory

242-A Condenser Room 1st Photo Shoot (02-13-07)

S.No.	Photo ID	Observations of Rust spots, pitting, loss of metal, corrosion, blisters, discoloration of coatings, damageto insulation, bolts & welds, joint cracks, loss of weld integrity, evidence of leak	General Cleanliness	Recommendations
69	Location22	None (Scott review tank walls)	Clean	Satisfactory
70	Pipeline-FlangeUto-1st StructuralSupport	None	Clean	Satisfactory
71	Pipeline-FlangeUto-InlineFlange~view2	None	Clean	Satisfactory
72	Pipeline-FlangeUto-InlineFlange~view3	None (lub oil leak below motor)	Clean	Needs monitoring & maintenance
73	Pipeline-V#2-28to-LERF1stSupport~view1	None	Clean	Satisfactory
74	Pipeline-V#2-28to-LERF1stSupport~view2	None	Clean	Satisfactory
75	Pipeline-V#2-28to-LERF2ndSupport~view1	None	Clean	Satisfactory
76	Pipeline-V#2-28to-LERF2ndSupport~view2	None	Clean	Satisfactory
77	Pipeline-V#2-32to-Flex	None	Clean	Satisfactory
78	Pump-P-C-100~view1	None (surface staining on support walls)	Clean	Needs clarification for staining
79	Pump-P-C-100~view2	None (surface staining on support walls)	Clean	Needs clarification for staining
80	Pump-P-C-106	None (surface staining on support walls)	Clean	Needs clarification for staining
81	SealPot~view1	None	Clean	Satisfactory
82	SealPot~view2	None	Clean	Satisfactory
83	SealPot~view3	None	Clean	Satisfactory
84	SealPot~view4	None (bottom flange bolts rusty look)	Clean	Satisfactory
85	SealPOtView-5&Valve#2-C4	None	Clean	Satisfactory
86	TK-C-100@AgitatorFlange	None (lub oil leak below motor)	Clean	Needs monitoring & maintenance
87	TK-C-100@FlangeA	None (surface staining on support walls)	Clean	Needs clarification for staining
88	TK-C-100@FlangeC~view1	None (bolts rusty look)	Clean	Needs clarification
89	TK-C-100@FlangeC~view2	None (bolts rusty look)	Clean	Needs clarification
90	TK-C-100@FlangeE&F&H-view1	None (surface staining on tank top)	Clean	Needs clarification for staining
91	TK-C-100@FlangeE&F&H-view2	None (dark image)	Clean	Needs clear image
92	TK-C-100@FlangeE&F&H-view3	None (dark image)	Clean	Needs clear image
93	TK-C-100@FlangeG~view1	None	Clean	Satisfactory
94	TK-C-100@FlangeG~view2	None	Clean	Satisfactory
95	TK-C-100@FlangeH-2	None (dark image)	Clean	Needs clear image
96	TK-C-100@FlangeH~view1	None (dark image)	Clean	Needs clear image
97	TK-C-100@FlangeJ&L&NView1	None (dark image)	Clean	Needs clear image
98	TK-C-100@FlangeJ~view1	None	Clean	Satisfactory
99	TK-C-100@FlangeJ~view2	None	Clean	Satisfactory
100	TK-C-100@FlangeK	None (surface staining on support walls)	Clean	Needs clarification for staining
101	TK-C-100@FlangeL	None	Clean	Satisfactory
102	TK-C-100@FlangeL&N	None	Clean	Satisfactory
103	TK-C-100@FlangeM	None	Clean	Satisfactory

242-A Condenser Room 1st Photo Shoot (02-13-07)

S.No.	Photo ID	Observations of Rust spots, pitting, loss of metal, corrosion, blisters, discoloration of coatings, damageto insulation, bolts & welds, joint cracks, loss of weld integrity, evidence of leak	General Cleanliness	Recommendations
104	TK-C-100@FlangeN	None	Clean	Satisfactory
105	TK-C-100@FlangeP~view1	None (white patch at side wall)	Clean	Needs clarification for white patch
106	TK-C-100@FlangeP~view2	None	Clean	Satisfactory
107	TK-C-100@FlangeR&S&Uto-	None	Clean	Satisfactory
	inlineFlange~view1			
108	TK-C-100@FlangeS	None	Clean	Satisfactory
109	TK-C-100@FlangeS&R~view1	None (Clean tank top)	Clean	Satisfactory
110	TK-C-100@FlangeU~view1	None	Clean	Satisfactory
111	TK-C-100@FlangeU~view2	None	Clean	Satisfactory
112	TK-C-100@FlangeU~View3	None	Clean	Satisfactory
113	TK-C-100@FlangeV	None (Flange not seen)	Clean	Repeat to show Flange V
114	TK-C-100@FlangeW	None	Clean	Satisfactory
115	TK-C-100@FlangeY	None (surface staining on support wall)	Clean	Needs clarification for staining
116	TK-C-100@FlangeZ~view1	None	Clean	Satisfactory
117	TK-C-100@FlangeZ~view2	None	Clean	Satisfactory
118	TK-C-100@FlangeZ~View3	None	Clean	Satisfactory
119	TK-C-100sidewall@FlangeA	None (surface staining on tank wall)	Clean	Needs clarification for staining
120	TK-C-100sidewall@Indicator	None (surface staining on support wall)	Clean	Needs clarification for staining
121	TK-C-100-StructuralSupport	None (surface staining on support wall)	Clean	Needs clarification for staining
122	TK-C-100wall&Utpoints	None (same as Location 11 picture)	Clean	Satisfactory
123	Valve#1-3&1-3A	None (surface staining on support wall)	Clean	Needs clarification for staining
124	Valve#1-8	None (surface staining on support wall)	Clean	Needs clarification for staining
125	Valve#1-8toFlextoP-C-100	None (surface staining on support wall)	Clean	Needs clarification for staining
126	Valve#1-9	None (surface staining on support wall)	Clean	Needs clarification for staining
127	Valve#1-9&1-9A	None (surface staining on support wall)	Clean	Needs clarification for staining
128	Valve#1-15	None	Clean	Satisfactory
129	Valve#1-16	None	Clean	Satisfactory
130	Valve#1-17	None	Clean	Satisfactory
131	Valve#1-91&1-92	None	Clean	Satisfactory
132	Valve#2-9	None	Clean	Satisfactory
133	Valve#2-24-1	None	Clean	Satisfactory
134	Valve#2-24-2	None	Clean	Satisfactory
135	Valve#2-24-3	None	Clean	Satisfactory
136	Valve#2-25maybe	None	Clean	Satisfactory
137	Valve#2-26	None	Clean	Satisfactory

242-A Condenser Room 1st Photo Shoot (02-13-07)

S.No.	Photo ID	Observations of Rust spots, pitting, loss of metal, corrosion, blisters, discoloration of coatings, damageto insulation, bolts & welds, joint cracks, loss of weld integrity, evidence of leak	General Cleanliness	Recommendations
138	Valve#2-28	None	Clean	Satisfactory
139	Valve#2-29	None	Clean	Satisfactory
140	Valve#2-30	None	Clean	Satisfactory
141	Valve#2-32~view1	None	Clean	Satisfactory
142	Valve#2-32~view2	None	Clean	Satisfactory
143	Valve#2-32Support	None	Clean	Satisfactory
144	Valve#2-33	None	Clean	Satisfactory
145	Valve#2-33-1	None	Clean	Satisfactory
146	Valve#2-33-2	None (white powder spots)	Clean	Needs clarification for white powder
147	Valve#2-33-3	None	Clean	Satisfactory
148	Valve#2-33-4	None	Clean	Satisfactory
149	Valve#2-43	None	Clean	Satisfactory
150	Valve#2C-4andSealPotBottom	None	Clean	Satisfactory
151	Valve#3-23~view1	None (some rusty look at top flange)	Clean	Satisfactory
152	Valve#3-23~view2	None	Clean	Satisfactory
153	Valve#3-24	None	Clean	Satisfactory
154	Valve#3-25~view1	None	Clean	Satisfactory
155	Valve#3-25~view2	None	Clean	Satisfactory
156	Valve#3-26	None (some rusty look)	Clean	Satisfactory
157	Valve#4-18	None (rusty look)	Clean	Satisfactory
158	Valve#4-23	None (dark image)	Clean	Needs clear image
159	Valve#4-23View~1	None	Clean	Satisfactory
160	Valve#4-23~View2	None	Clean	Satisfactory
161	Valve#4-24	None (Picture not clear)	Clean	Needs clear image
162	Valve#4-24~View1	None (Picture not clear)	Clean	Needs clear image
163	Valve#4-24~View2	None (Picture not clear)	Clean	Needs clear image
164	Valve#HC-RC3-3	None	Clean	Satisfactory
165	Valve#HV-RC3-1	None	Clean	Satisfactory
166	Valve#SRV-1	None	Clean	Satisfactory

242-A Condenser Room 1st Photo Shoot (02-13-07)

S.No.	Photo ID	Observations of Rust spots, pitting, loss of metal, corrosion, blisters, discoloration of coatings, damageto insulation, bolts & welds, joint cracks, loss of weld integrity, evidence of leak	General Cleanliness	Recommendations
167	U-582-M9pic1	None	Clean	Satisfactory
168	2inU-582-M9pic1	None (Clamp looks rusty)	Clean	Needs maintenance on clamps
169	2inU-582-M9pic2	None (Clamp looks rusty)	Clean	Needs maintenance on clamps
170	242AirLinepic1	None	Clean	Satisfactory
171	242AirLinepic2	None	Clean	Satisfactory
172	242AirLinepic3	None	Clean	Satisfactory
173	242AirLinepic4	None	Clean	Satisfactory
174	242AirLinepic5	None (Clamp dispositioned); other half of	Clean	Satisfactory
		pipe is not clear; need picture for other half		
175	242AirLinepic6	None	Clean	Satisfactory
176	242AirLinepic7	None	Clean	Satisfactory
		None	Clean	Satisfactory
VIDEOS IN EVAPORATOR ROOM				
177	DVD-XXX3558	None	Clean	Satisfactory
178	DVD-XXX4906	Appears to be aged; we need to review	Clean	Satisfactory
		specifications and construction drawing		
		for structural strength..		
		Appears to be dislocated.		
179	DVD-XXX5001	Appears to be aged; we need to review	Clean	Satisfactory
		specifications and construction drawing		
		for structural strength..		
		Appears to be dislocated.		
180	DVD-XXX4640	Pipes not properly secured to the grating	Clean	Needs to be properly secured
181	DVD-XXX5106	Damaged floor coating	Clean	Needs recoating

ATTACHMENT 7D

242-A INTEGRITY ASSESSMENT PHOTO DESCRIPTION UT EXAMINATION EVAPORATOR ROOM 11/07

(4 Pages)

242-A INTEGRITY ASSESSMENT PHOTO DESCRIPTION
UT Examination Evaporator Room 11/07

PHOTO FILE ID	DESCRIPTION	EVALUATION / RECOMMENDATION
DSC05395	View from grating above upper recirculation line connection to C-A-1 evaporator vessel. UT location 7 grid on recirculation piping; location 3 on side of vessel over person's left shoulder.	None / none
DSC05396	View from scaffolding up through grating used in previous photo.	None / none
DSC05397	View from scaffolding up through grating used in previous photo.	None / none
DSC05398	UT location 6, grid S (transition above reboiler, E-A-1)	None / none
DSC05399	Transition above reboiler to the right of DSC05398	None / none
DSC05400	Transition above reboiler to the right of DSC05398	None / none
DSC05401	Looking down on reboiler and upper transition piece from downstream elbow	None / none
DSC05402	Looking down on reboiler and upper transition piece (note process steam line below that intersects about the vertical centerline of the reboiler).	None / none
DSC05403	Looking down on reboiler and upper transition piece (note process steam line below that intersects about the vertical centerline of the reboiler).	None / none
DSC05404	Looking down on reboiler and upper transition piece (note process steam line below that intersects about the vertical centerline of the reboiler).	None / none
DSC05405	Elbow in recirculation line below reboiler and lower transition section	None / none
DSC05406	Looking down on reboiler and upper transition piece (note process steam line below that intersects about the vertical centerline of the reboiler).	None / none
DSC05407	Looking down on reboiler and upper transition piece (note process steam line below that intersects about the vertical centerline of the reboiler).	None / none
DSC05408	Looking down on reboiler and upper transition piece (note process steam line below that intersects about the vertical centerline of the reboiler).	None / none
DSC05409	Looking down on reboiler and upper transition piece.	None / none
DSC05410	Level III technician obtaining some of the Location #3 UT readings	None / none
DSC05411	Level III technician obtaining some of the Location #3 UT readings	None / none
DSC05412	Level III technician obtaining some of the Location #3 UT readings	None / none
DSC05413	Level III technician obtaining some of the Location #3 UT readings	None / none

242-A INTEGRITY ASSESSMENT PHOTO DESCRIPTION
UT Examination Evaporator Room 11/07

PHOTO FILE ID	DESCRIPTION	EVALUATION / RECOMMENDATION
DSC05414	Existing grid for Location #3 on side of C-A-1.	None / none
DSC05415	Existing grid for Location #3 on side of C-A-1.	None / none
DSC05416	Existing grid for Location #3 on side of C-A-1.	None / none
DSC05417	Location #6-S	None / none
DSC05418	Location #6-S	None / none
DSC05419	Location #6-S	None / none
DSC05420	Location #6-S, bottom of Location #7 in upper part of photo	None / none
DSC05421	Upper mitered elbow in recirculation line between E-A-1 and C-A-1	None / none
DSC05422	Upper mitered elbow in recirculation line between E-A-1 and C-A-1	None / none
DSC05423	Penetration of 28" recirculation line into C-A-1	None / none
DSC05424	Penetration of 28" recirculation line into C-A-1	None / none
DSC05425	Recirculation piping transition above reboiler	None / none
DSC05426	Recirculation piping transition above reboiler	None / none
P1010001	Location #18, recirculation piping below C-A-1	None / none
P1010002	Location #18, recirculation piping below C-A-1 (Level III obtaining thickness data)	None / none
P1010003	Location #18, recirculation piping below C-A-1 (Level III obtaining thickness data)	None / none
P1010004	Location #18, recirculation piping below C-A-1 (Level III obtaining thickness data)	None / none
P1010005	Location #18, recirculation piping below C-A-1 (Level III obtaining thickness data)	None / none
P1010006	Location #18, recirculation piping below C-A-1 (Level III obtaining thickness data)	None / none
P1010007	Location #18, recirculation piping below C-A-1 (Level III obtaining thickness data)	None / none
P1010008	Location #18, recirculation piping below C-A-1 (Level III obtaining thickness data)	None / none
P1010010	Laying out grid for Location #6-T	None / none
P1010011	Laying out grid for Location #6-T	None / none
P1010012	Taking UT measurements at Location #6-T	None / none
P1010013	Taking UT measurements at Location #6-T	None / none
P1010014	Taking UT measurements at Location #6-T	None / none
P1010015	Taking UT measurements at Location #6-T	None / none
P1013565	Completion of scaffolding for recirculation piping UT measurements	None / none
P1013566	Completion of scaffolding for recirculation piping UT measurements	None / none
P1013567	Location #5, 28" recirculation line	None / none
P1013568	Location #5, 28" recirculation line	None / none
P1013569	Location #5, 28" recirculation line	None / none

242-A INTEGRITY ASSESSMENT PHOTO DESCRIPTION
UT Examination Evaporator Room 11/07

PHOTO FILE ID	DESCRIPTION	EVALUATION / RECOMMENDATION
P1013570	Location #5, 28" recirculation line	None / none
P1013571	Location #5, 28" recirculation line	None / none
P1013572	Location #5, 28" recirculation line	None / none
P1013573	Pressure transducer connection at reboiler, E-A-1	None / none
P1013574	Thermowell on 28" recirculation line where leak was discovered earlier this year. No evidence of leakage found after the replacement and repair done at that time. A waste reduction campaign was conducted after the repair (June-July, 2007).	Thermo-well leak was discovered and corrected prior to current campaign (2007) / Does not affect current assessment – no recommendations
P1013575	Thermowell on 28" recirculation line where leak was discovered earlier this year. No evidence of leakage found after the replacement and repair done at that time.	Thermo-well leak was discovered and corrected prior to current campaign (2007) / Does not affect current assessment – no recommendations
P1013576	Thermowell on 28" recirculation line where leak was discovered earlier this year. No evidence of leakage found after the replacement and repair done at that time.	Thermo-well leak was discovered and corrected prior to current campaign (2007) / Does not affect current assessment – no recommendations
P1013577	Pressure transducer connection at reboiler, E-A-1	None / none
P1013579	Thermowell on 28" recirculation line where leak was discovered earlier this year. No evidence of leakage found after the replacement and repair done at that time.	Thermo-well leak was discovered and corrected prior to current campaign (2007) / Does not affect current assessment – no recommendations
P1013580	Insulation removal to gain access to Location #7	None / none
P1013581	Insulation removal to gain access to Location #7	None / none
P1013582	Grid for Location #7	None / none
P1013583	Grid for Location #7	None / none
P1013584	Grid for Location #7	None / none
P1013585	View of recirculation line at junction with C-A-1; Location #3 to right	None / none
P1013586	Grid for Location #3	None / none
P1013587	Connection of recirculation line to C-A-1	None / none
P1013588	Insulation being removed from upper recirculation piping elbow	None / none
P1013589	Location #7-T	None / none
P1013590	Location #7-U	None / none
P1013591	Locations #7-U and 7-V	None / none
P1013592	Location #7-U	None / none

ATTACHMENT 7D

242A INTEGRITY ASSESSMENT PHOTO DESCRIPTION
ION EXCHANGE ROOM
(3 Pages)

242A INTEGRITY ASSESSMENT PHOTO DESCRIPTION
Ion Exchange Room

PHOTO FILE ID	DESCRIPTION	RECOMMENDATION
P1010001.jpg	Beginning of Process Condensate line at valve 1-17 in Condenser Room. Line is designated 3" DR-338-M42 (ref. H-2-98990, Sh. 1, Zone C-3). Valve 1-17 is normally closed. Facility personnel state is opened rarely, if ever.	No recommendation.
P1010002.jpg	Continuation of 3" DR-338-M42 toward penetration into IX room	No recommendation.
P1010003.jpg	Continuation of 3" DR-338-M42 toward penetration into IX room	No recommendation.
P1010004.jpg	Continuation of 3" DR-338-M42 toward penetration into IX room	No recommendation.
P1010005.jpg	Penetration into IX room	No recommendation.
P1010021.jpg	Inside IX Room with 3" DR-338-M42 floor penetration and flange. Flange is shown on H-2-98990, Sh. 1, Zone C-2). IX Room is rarely entered; floor is about 3' below access opening from Condenser Rm. where the rest of the photos were taken.	No recommendation.
P1010022.jpg	Inside IX Room with 3" DR-338-M42 floor penetration and flange. Flange is shown on H-2-98990, Sh. 1, Zone C-2).	No recommendation.
P1010023.jpg	Riser section of 3" DR-338-M42 inside IX Room.	No recommnendation.
P1010024.jpg	Riser section of 3" DR-338-M42 inside IX Room and horizontal section heading toward the penetration in the common wall with the Condenser Rm.	No recommendation.
P1010025.jpg	Looking up from opening, showing horizontal run to penetration (continuation of P1010025.	No recommendation.
P1010026.jpg	Looking up at ceiling which is a removable concrete cover block. Bright steel part is for handling; penetration is core drill that is not used since IX equipment has been removed.	No recommendation.
P1010027.jpg	Wall to right of entry door opening.	No recommendation.
P1010028.jpg	Same as P1010027 and also showing part of cover block ceiling.	No recommendation.
P1010029.jpg	Floor directly below the access opening showing loose dirt (about 3' below access door sill).	No recommendation.
P1010030.jpg	Upper left part of access door opening showing switch indicating door position.	No recommendation.
P1010031.jpg	Same view as P1010025	No recommendation.
P1010032.jpg	Floor at wall opposite access door.	No recommendation.
P1010033.jpg	Floor drain in IX Room.	No recommendation.
P1010034.jpg	Wall to right of access door showing thermostat (no longer used).	No recommendation.
P1010035.jpg	View looking up the wall to the right (forms right-hand boundary to the IX Rm).	No recommendation.
P1010036.jpg	View directly over access door (above lintel).	No recommendation.

242A INTEGRITY ASSESSMENT PHOTO DESCRIPTION
Ion Exchange Room

P1010037.jpg	View looking up at wall forming the left-hand boundary of the IX Rm).	No recommendation.
P1010038.jpg	Detail of P1010038, showing far corner	No recommendation.
P1010039.jpg	View directly over access door (above lintel).	No recommendation.
P1010040.jpg	Detail of flange connection for 3" DR-338-M42 at floor of IX Rm.	No recommendation.

ATTACHMENT 7F

242-A CONDENSER ROOM 1ST PHOTO SHOOT
02/13/07

(2 Pages)

242-A Condenser Room 1st Photo Shoot (02-13-07)

Photo ID	Observations of Rust spots, pitting, loss of metal, corrosion, blisters, discolration of coatings, damage to insulation, bolts & welds, joint cracks, loss of weld integrity, evidence of leak	General Cleanliness	Recommendations
P2030003	None	Clean	Satisfactory
P2030004	None	Clean	Satisfactory
P2030005	None	Clean	Satisfactory
P2030007	None	Clean	Satisfactory
P2030011	None	Clean	Satisfactory
P2030012	None	Clean	Satisfactory
P2030013	None	Clean	Satisfactory
P2030014	None	Clean	Satisfactory
P2160019	None	Clean	Satisfactory
roll up door L	None	Clean	Satisfactory
roll up door R	None	Clean	Satisfactory
SAMPLER3	None	Clean	Satisfactory
viewing window from LOR	None	Clean	Satisfactory

ATTACHMENT 8

NDE CERTFICATION

(6 Pages)

ATTACHMENT 8A

CERTIFICATION LETTER

(2 Pages)

AREVA

To: Certification File

cc: W. H. Nelson

CERTIFICATION

LETTER

This letter certifies **W. H. Nelson** has qualified by training, experience, and examination as a **Level III Penetrant Examiner**, in accordance with the requirements of COGEMA Inc.'s Procedure COGEMA-SVCP-PRC-014, Qualification and Certification of Nondestructive Examination Personnel.

Date assigned to Nondestructive Examination: June 1987

Certification Expires: October 2010

M. D. Rickenbach
Director of Services

10/31/05
Date

COGEMA, INC.
2425 Stevens Center Place, Second Floor, Richland, Washington 99354 - P.O. Box 840, Richland, Washington 99352
Tel.: 509 372 8256 - Fax: 509 372 3169 - www.areva.com

ATTACHMENT 8B

CERTIFICATION FOR VT-2

2007 INTEGRITY ASSESSMENT

(3 Pages)

OFFICIAL USE ONLY
May be exempt from public release under the Freedom of Information Act (5 U.S.C. 552), exemption number and category: 6
Department of Energy review required before public release
Name/Org: D.R. Gregory QAP Date: 02/05/07
Guidance (if applicable): N/A

12/28/07

To: Certification File

cc:

INSPECTION AND TEST PERSONNEL CERTIFICATION LETTER

This letter certifies that RON A. COWGILL, identification number [redacted], has successfully met the qualification requirements as specified in HNF-PRO-263, *Qualification and Certification of Inspection and Test Personnel*. Refer to attached *Inspection Personnel Qualification Checklist* for basis of certification.

Mr. Cowgill is hereby certified to perform ISI VT-2 inspections as a Level II inspector for CH2M HILL.
(Company Name)

THIS CERTIFICATION IS VALID FOR 3 (No.) **YEARS THRU** 01/10 (Mo./Yr.)

Joel Connor
(Signature of Certifier)

1/30/07
(Date)

Quality Assurance lead
(Title of Certifier)

A-6000-796 (12/97)

OFFICIAL USE ONLY
May be exempt from public release under the Freedom of Information Act (5 U.S.C. 552), exemption number and category: 6
Department of Energy review required before public release
Name/Org: D.R. Gregory Date: 02/05/07
Guidance (if applicable): QAP N/A

Jda 12/28/07

To: Certification File

cc:

INSPECTION AND TEST PERSONNEL CERTIFICATION LETTER

This letter certifies that PAUL A. WERNER, identification number [redacted], has successfully met the qualification requirements as specified in HNF-PRO-263, *Qualification and Certification of Inspection and Test Personnel*. Refer to attached *Inspection Personnel Qualification Checklist* for basis of certification.

M r. Werner is hereby certified to perform ISI VT-2 inspections as a Level II inspector for CH2M HILL.
(Company Name)

THIS CERTIFICATION IS VALID FOR 3 (No.) **YEARS THRU** 01/10 (Mo./Yr.)

(Signature of Certifier) 1/30/07 (Date)

Quality Assurance lead
(Title of Certifier)

A-6000-796 (12/97)

ATTACHMENT 9

DESIGN EVALUATION CORRESPONDENCE

(6 Pages)

Table 9.1
Design Evaluation

Component	Date	Company Name	Design Evaluation	Reference
242-A Evaporator Vessel	1/5/1982	Rockwell International	Lower liquid level (LLL) calculated as 721.12 feet. Total loop volume at this height is 21,500 gallons. Designed for the LLL to be at the centerline of the inlet to the separator (Struthers). Struthers has not yet been able to supply an upper liquid level limit.	SD-WM-TI-003
242-A Evaporator Vessel	2/22/1980	Rockwell International	Investigated the effects of pump lubricant oil on the properties of uncomplexed Hanford waste liquor in boildown under 242 evaporator operations. The presence of 0.1 weight percent turbine oil in uncomplexed feed had no observable effect on boildown behavior and did not cause observable fouling of coupons of reboiler material. Recommended replacement of worn graphite lubricated waste liquor pumps with oil lubricated pumps.	
242-A Evaporator Vessel Condensate Collection Tank	4/28/1980	Rockwell International	Provided basis for not allowing a separable organic phase in any material that enters the AW/AN tanks. Stated that the following hazards may occur if an organic layer presents: 1. Distillate fire or vapor explosion in the condensate collection tank; 2. An organic vapor fire or explosion hazard Permitted lubricating oil into the waste material when the lubricating oil is at a maximum soluble concentration of 0.0001 gmmole/L.	
PB-1 Motor	10/6/1980	Rockwell International	When the ambient temp. is 80° C or less, the PB-1 motors could operate continuously at 172 amps. They should not be operated over 165 amps when the temp goes over 80° C	
PB1 and PB2 Pumps	8/27/1980	Rockwell International	Process and Operating Limitations suggested: 2.0 SpG ----- 100Cp viscosity---110 amp 250 Cp viscosity ---- 1.67 Sp.G 1.98 Sp.G ---- 160 amp	SD-WM-TI-003
	9/10/1980	Rockwell International	Recommended the ambient temp. should not exceed 175° F for steady continuous long term operation.	

Table 9.1
Design Evaluation

Component	Date	Company Name	Design Evaluation	Reference
242-A Evaporator Vessel (Max. allowable temp.)	10/12/1981	Rockwell International	Reported that no separate stress analysis was performed for the 242-A Vessel. Vitro provided copies of stress and seismic analyses for the 242-S vessel. The ultimate stress for 304-L SS was performed at 176° F but not able to confirm this temp. by Rockwell. Rockwell wrote a specification based on Struthers drawing and ASME Form U-2 for 242-S to mimit the temperature to to 200° F Recommended a new analysis for the expected max. temp. be performed if the vessel is to be used above this temp. limit. The analysis should include the stress effects of the hottest and coldest points in the recirculation loop (reboiler outlet and feed addition point).	SD-WM-TI-003
Recirculation Pump Piping Stress Analysis	1/7/1972	Struthers Nuclear & Process Company	Analysis done for recirculation piping from the crystallizer to the pump and from the pump to the heat exchanger. Recommendations: Discard support from pump housing Change pipe support detail as recommended Analysis gives the lowest forces and moments transmitted through the pipe support plate into the wall.	SD-WM-TI-003
Lateral Restraint for the 242-S Evaporator	5/1/1972	Atlantic Richfield Hanford Company (AEC-RL)	Reviewed the drawing by Struthers for the lateral restraint on the evaporator. Not checked fit with building structural or the design loading assumptions or calculations.	SD-WM-TI-003
	5/1/1972	Atlantic Richfield Hanford Company (AEC-RL)	Several dimensions are lacking. The location of the 1-1/2" thick plate containing the pin will be critical Needed installation instructions and tolerances.	SD-WM-TI-003
242-A Evaporator Facilities (Design Calculations for Evaporator Crystallizer)	4/14/1972	Struthers Wells Corporation	Contains (1) Design load for upper support on Evaporator; (2) Detail stress analysis and sizing calculations for Guide pin, stiffening rings, guide bracket bolts, guide bracket, and I-beam; and appendices.	SD-WM-TI-003

Table 9.1
Design Evaluation

Component	Date	Company Name	Design Evaluation	Reference
Evaporator Seismic Analysis (Evaporator, support structures, major support rings, critical sections within the support ring and shell)	10/1/1971	Struthers Nuclear & Process Company	Performed seismic analysis of the critical evaporator-crystallizer structural components and inter-connecting piping for earthquake acceleration factors described in Section V, page 7 of Appendix A to Contract No. AT(45-1)-2178. All of the equipment is designed to withstand a Design Basis Earthquake (DBE) of 0.25g for horizontal acceleration and 2/3 x 0.25g for vertical acceleration and remain safe without undue risk to public health and safety. Also, all of the equipment is designed to withstand the operating basis earthquake (OBE) to produce horizontal and vertical maximum ground accelerations at least equal to 1/2 of the corresponding DBE accelerations for continued operation of the facilities with no undue risk to public health and safety and remain functional. The stress analysis demonstrated that the equipment does meet all design criteria for both the DBE and OBE acceleration conditions.	SD-WM-TI-003
Evaporator-Crystallizer System	1/18/1974	Atlantic Richfield Hanford Company and Vitro	Approved B-100-F1, Specification for fabrication of evaporator-crystallizer system for 242-A Evaporator facility	SD-WM-TI-003
242-A Building Pipe Support Analysis	9/3/1991	Kaiser Engineers Hanford	Verified the structural adequacy of anchor and seismic restraint for pipe routing for existing line as given by drawings H-2-69336 & H-2-69343.	W-105-24

Table 9.1
Design Evaluation

Component	Date	Company Name	Design Evaluation	Reference
Vacuum Condenser System	12/15/1994	Westinghouse Hanford Company	Contains Vacuum Condenser System Design Description (SDD) for the following major components: Primary condenser, E-C-1 Inter-Condenser, E-C-2 After Condenser, E-C-3 Steam jet ejector, J-EC1 and J-EC2-1 and valve control system, air intake supply system, MCS faceplates, and associated interlock parameters. This SDD is a supporting document for the 242-A evaporator and reflects the latest Project B-534 upgrades to the evaporator facility and provides design requirements, construction details, and operating and monitoring requirements.	WHC-SD-WM-SDD-024, Rev.0
Guidelines for Assessing the Seismic Adequacy of Existing Performance Category Equipment at the Hanford Site	4/5/1996	Westinghouse Hanford Company	Provides sitewide standard procedures and guidelines assuring adequate anchorage and proper documentation during seismic evaluation of Performance Categoty 0, 1, and 2 (PC012) systems components and equipment (SCE's). The guidelines apply to existing SCE's, modifications to existing SCE's and new installations. No documentation is available whether these guides were used for the existing SCE's.	WHC-SD-GN-DGS-30006, Rev. 1-A
242-A Evaporator Ventilation System Mechanical Upgrades	12/13/2002		Contains functional requirements, design criteria, acceptance criteria, and design verification record (drawings, calculations, specifications, and other design procedures)	HNF-FMP-02-11765-R0
242-A Evaporator Ventilation System Electrical/ Instrumentation Upgrades	12/13/2002		Contains functional requirements, design criteria, acceptance criteria, and design verification record (drawings, calculations, specifications, and other design procedures)	HNF-FMP-02-11766-R0

Table 9.1
Design Evaluation

Component	Date	Company Name	Design Evaluation	Reference
Engineering Design and Evaluation (Natural Phenomena Hazard)	9/7/2006		This document supersedes Hanford Plant Standards Standards Design Criteria SDC-4.1, Design Loads for Facilities, and GC-LOAD-01, Design Loads for Facilities. The minimum criteria for structural design and evaluation of structures, systems, and components (SSCs). The structural design loads and structural acceptance criteria are established to design new SSCs, to evaluate existing SSCs, to evaluate anchorage effects of new and modified systems on existing SSCs, and to design additions and modifications to existing SSCs. No documentation is available to verify that the above criteria are met with the existing 242-A evaporator facility SSCs.	HNF-PRO-097, Rev.4
Hanford Plant Standards, Architectural/Civil Manual	12/21/1994	ICF Kaiser Hanford	Contains general and specific design criteria for all desciplines, drawings, specifications and guide for architectural/civil, electrical, mechanical, and instrumentation. This manual is inactive for new design work effective Jan 1, 1995. It is historically maintained as supporting document for reference and characterization of existing designs only.	KH-SD-GN-DGS-30012
Design of Expansion Anchors	10/26/2005	Fluor Federal Services	Addresses the design and specification of new expansion anchors used in Project Hanford concrete facilities and components. This 2005 update allows the use of any ICC-ES-approved expansion anchors for PC-2 applications to comply with requirements in Department of Energy standard DOE-STD-1020-94.	Practice 134-215-1206 dated 12/01/2005
242-A Evaporator Ventilation Upgrade Project	9/21/2006	CH2MHILL, Hanford Group, Inc	Provides the functions and requirements that must be satisfied for the successful upgrade of the ventilation systems in the 242-A Evaporator facility. These functions and requirements apply to design, procurement, construction, fabrication, and acceptance testing.	RPP-24717, Rev. 1

ATTACHMENT 10

STEAM PRESSURE OSCILLATION EVALUATION

(13 PAGES)

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

10 lb Steam Heating Issues - Summary:

Performance monitoring conducted during the 2006 Cold Run campaign at the 242-A Evaporator facility noted problems with the 10 lb steam. These problems were reported in RPP-RPT-25891, Rev. 1, *System Health Report for the 242-A Evaporator Facility for Cold Run – CY 2006*. During the cold run, while attempting to increase the 10 lb steam flow rate to its upper operational limit of 27,000 lb/hr, the steam flow rate and the steam pressure started to oscillate, once every two to three minutes. Again, during the 2006 hot run campaign, the same oscillations were observed when the steam flow rate was increased to 21,000 lb/hr. Because of these oscillations, 242-A personnel have not been able operate above 21,000 lb/hr. The lowered steam flow rate in turn limits the waste volume reduction that can be achieved during campaigns.

The following evaluation will provide an explanation of the observed pressure oscillations, and make recommendations for further operation of the 10 lb heating steam. The following is a brief summary of the findings of this evaluation:

- The oscillations are a form of water/steam hammer in the reboiler, known as thermal shock. Thermal shock may be causing damage to the reboiler and adjacent piping.
- The cause of the thermal shock is too much condensate in the reboiler.
- The condensate return line is poorly designed. Modifications may be required to improve condensate flow rate and therefore increase steam heating.
- Without changes in the design of the system and/or changes in the way the system is operated, the steam flow rate needs to be limited to 20,000 lb/hr.

Explanation of Flow and Pressure Oscillations:

To help describe the steam configuration and the pressure oscillations, figure 1 is provided of the steam flow path through the facility and of the steam condensate flow path from the reboiler.

The observed oscillations in flow and pressure in the 10 lb steam is known as thermal shock, and occurs in the reboiler. Thermal shock is a type of water hammer that occurs in steam heating equipment, where heating steam comes in contact with condensate cooled below the temperature of the steam. Steam, which occupies a much greater volume than condensate, collapses suddenly from the cooler condensate. This collapse sends shock waves through the system, which can eventually damage reboiler tubes and connected piping.

Thermal shock is depicted in figure 2, which is a plot of steam pressure and flow at different locations during the 2006 cold run. As can be seen on figure 1, pressure indicators PI-STM-1 and PI-EA1-14 are located upstream of the steam flow control valve FV-EA1-1, and PI-EA1-1 and PI-EA1-11 are downstream. PI-EA1-1 is located upstream of the reboiler (at the de-superheater) and PI-EA1-11 is downstream of the reboiler.

Attachment 10
Page 2

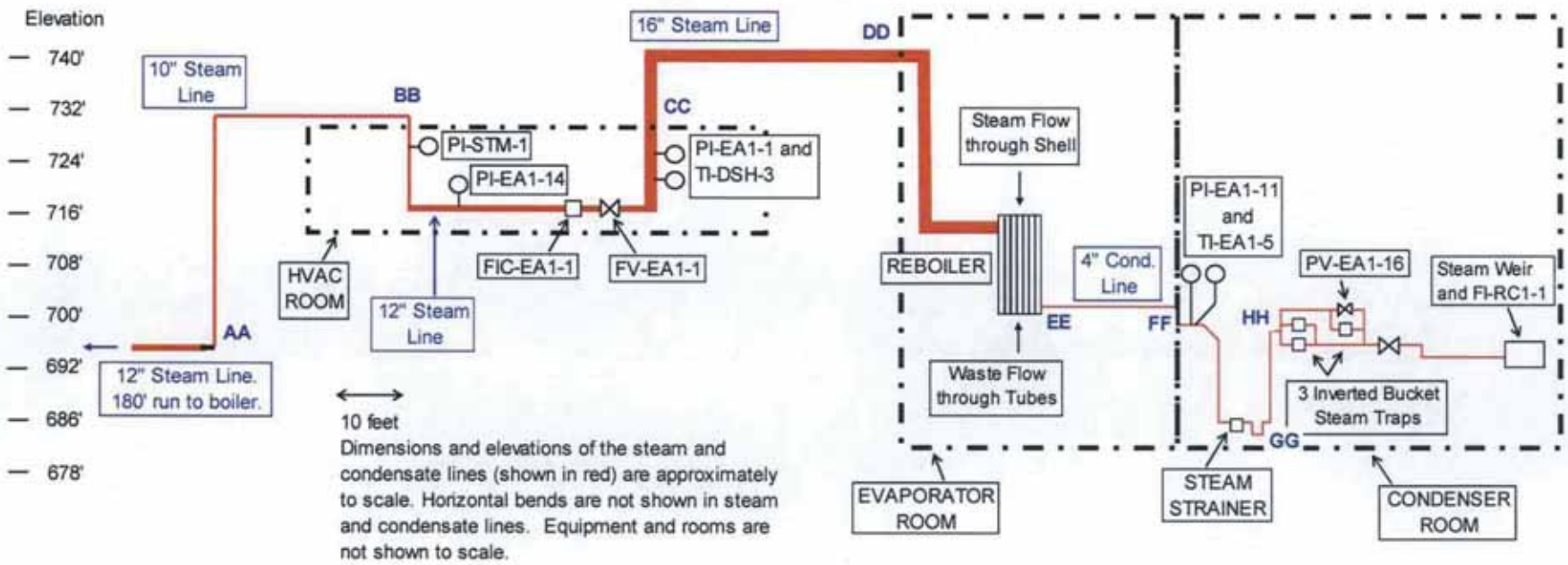
IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

Flow indication of the steam supply to the reboiler is provided by FI-EA1-1, and flow indication of the condensate exiting the reboiler is provided by FI-RC1-1.

Attachment 10
Page 3

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

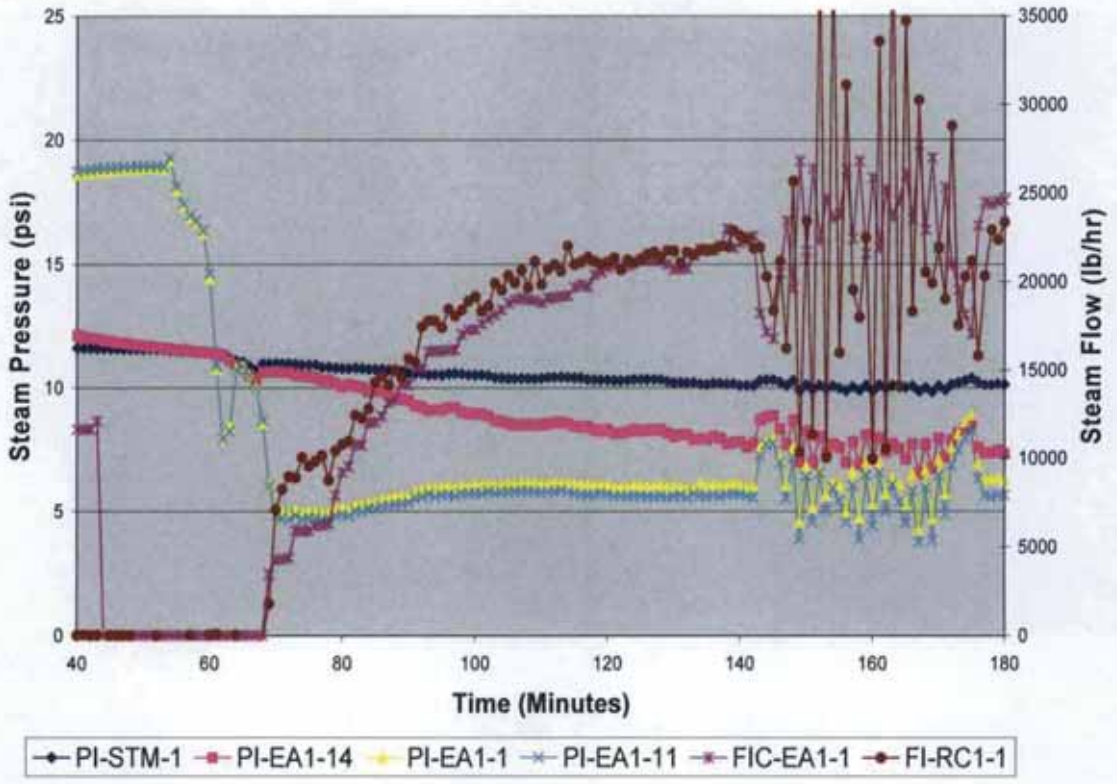
Figure 1. 242-A Steam and Condensate Lines



Attachment 10
Page 4

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

Figure 2: Steam Pressure and Flow During Thermal Shock Cycles

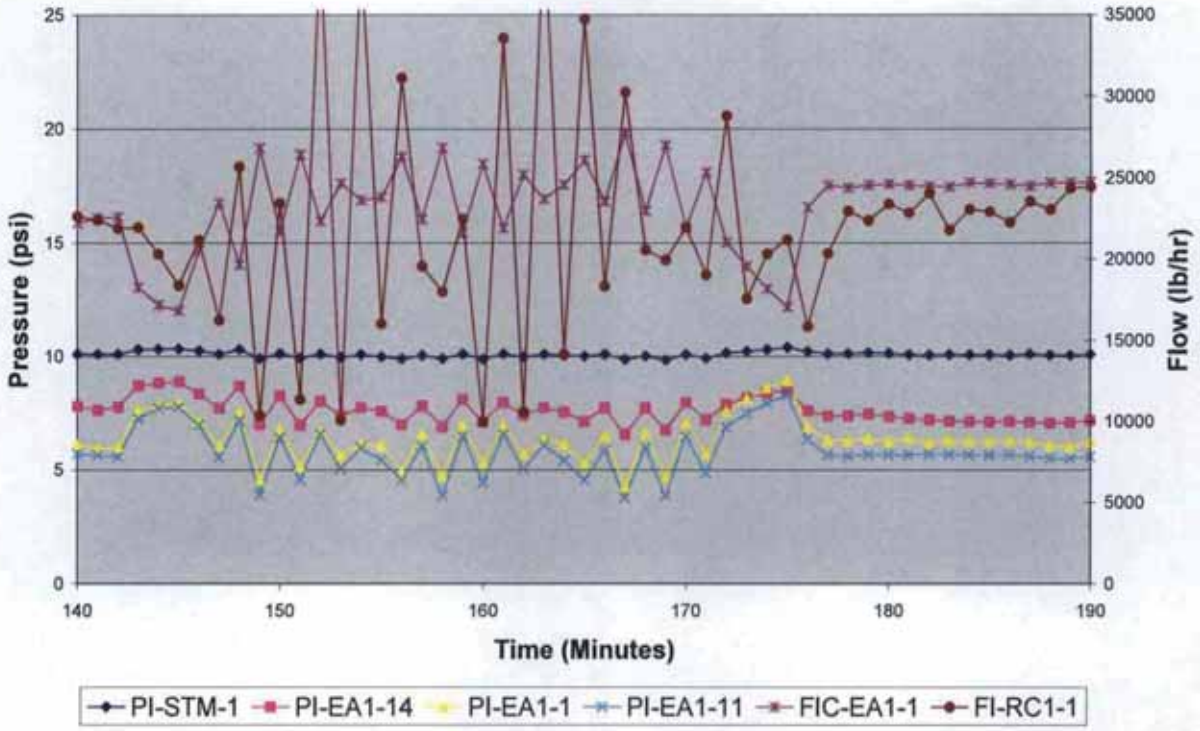


Before steam is opened to the reboiler, PI-STM-1 and PI-EA1-14 read approximately 11-12 psig (the JCI steam supplied pressure at no-flow conditions). PI-EA1-1 and PI-EA1-11 read approximately 19 psig, which is the air compressor-supplied air pressure held in the reboiler when steam is not flowing. Before steam supply is started (by opening FV-EA1-1) the air is first purged from the reboiler chest by opening the steam condensate back-pressure valve PV-EA1-16. When the air pressure is low enough, steam is opened to the reboiler, and the steam flow is slowly increased as air clears the system and as waste (or water) is slowly heated to boiling temperature. Steam heating proceeds normally until the steam flow rate (as read on FIC-EA1-1) reaches 21,000 – 22,000 lb/hr. At this point thermal shock occurs in the system, as depicted by the sharp pressure and flow oscillations observed on the right side of figure 2. Figure 3 shows the thermal shock oscillations blown up over a smaller time period. Further evidence that these pressure spikes are occurring at the reboiler can be seen in figures 2 and 3. The oscillations are most pronounced in instruments PI-EA1-1 and PI-EA1-11, which are on each side of the reboiler. The oscillations are less noticeable on PI-STM-1 and PI-EA1-14, which are closer to the JCI steam supply.

Attachment 10
Page 5

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

Figure 3: Steam Pressure and Flow during Thermal Shock Cycles - Expanded



Thermal shock in steam heating equipment is a signal that condensate is not being properly drained from the heater (reboiler). This inability to adequately remove condensate from the system is explained in better detail later (see Condensate Return Considerations below). Proof that condensate is being backed up into the reboiler can be seen in the temperature of the condensate pipes after the reboiler during operation. During the cold run, the temperature of the condensate piping was recorded to be 110-115 °F, which is 123-128 °F below the saturation temperature of 10 lb steam. During the hot run, the temperature of the condensate piping was recorded to be 132-134 °F. In both cases, the temperature of the condensate coming out of the reboiler is only 2-5 °F above the temperature of the water (or waste) that is being heated in the tubes of the reboiler. These temperature measurements were recorded on temperature element TI-EA1-5 (steam condensate temp) and were confirmed using a handheld temperature indicator directly off of the pipes in the condenser room. In addition to causing thermal shock in the reboiler, condensate retention in the reboiler also lowers the efficiency of steam heating. Steam in direct contact with the reboiler tubes transfers heat at a much higher rate than condensed water in direct contact with

Attachment 10
Page 6

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

the tubes. Although the steam heating is efficient (most of the energy is still transferred), the rate of heating is reduced.

Two different mechanisms were observed to induce thermal shock in the reboiler. The first is an increase in 10 lb heating steam flow rate to the reboiler. When the steam is increased to a certain flow rate, more condensate is formed in the reboiler and is unable to exit the reboiler quick enough. At a certain flow rate, large pockets of steam contact sub-cooled condensate, and collapses to create a sudden vacuum in the shell of the reboiler. These vacuum spikes can be seen in figure 3 as low pressure points during the oscillations. This sudden vacuum in the shell of the reboiler causes a portion of the warmer condensate in the reboiler to flash back to steam, which is seen as high pressure points in figure 3. During the high pressure events, heating steam is pushed out of the reboiler. Heating steam re-enters the reboiler, and the cycle (oscillation) starts again. Thermal shock was observed during the 2006 hot run campaign with steam flow rates as low as 21,000 lb/hr.

The second mechanism that was observed to initiate thermal shock oscillations is when operations attempted to increase the condensate flow by opening the condensate back-pressure valve PV-EA1-16. It is counter-intuitive that this should cause thermal shock, and the cause for this is speculative. What is likely happening when the condensate flow is increased is that a sudden void is made in the shell of the reboiler due to the removed condensate. This removal causes an increase in the vacuum, which causes some of the condensate to flash. This initiates the same cycle described in the preceding paragraph. It may also be that the sudden release of some of the condensate from the reboiler causes mixing in the reboiler, which mixes the cooler condensate with the heating steam. Either way, it is proposed that if more condensate is to be removed from the reboiler, it needs to happen from the start, before it accumulates in the shell.

<u>Steam Supply Considerations:</u>

1. Steam Supply: One of the concerns voiced by operations is that JCI may not be supplying enough steam (flow and/or pressure) to meet heating needs. As can be seen in figure 2, the supply steam pressure before operation was 11-12 psig. After the steam was opened to the reboiler, and throughout the heating cycle, the supply steam (as recorded by PI-STM-1) never dropped below 9.8 psig. However, the pressure prior to the desuperheater (PI-EA1-14) dropped down to 7.5 psig, and at the reboiler the pressure dropped all the way to 5.5 psig (PI-EA1-1 and PI-EA1-11). This pressure drop is more likely due to the increasing pipe size as the steam approaches the reboiler (10" pipe at PI-STM-1, 12" pipe at PI-EA1-14, and 16" at PI-EA1-1). To achieve 10 psig heating steam at the reboiler, more steam pressure would have to be supplied by JCI than is currently specified or the 90 lb steam tie in would have to be employed to raise steam pressure. Steam supply pressure is of less concern when discussing steam heating than are the condensate problems (discussed later).
2. Steam Pipe Insulation: Steam pipe insulation in the HVAC room and outside at ground level was inspected for obvious deficiencies as part of system walk-downs

Attachment 10
Page 7

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

performed during the 2006 cold run. The portion of the piping that runs along the outside wall and roof of the facility were not inspected (Figure 1, Sections AA-BB and CC-DD). Additionally, the insulation under the weather-proof barrier covering the insulation was not inspected (to determine if the insulation was saturated with water). A more thorough inspection and repair (if necessary) of steam insulation may increase the steam supply to the system.

3. Desuperheater Cooling: During the hot run campaign, operations noted that they could dampen the oscillations by adding filtered raw water to the steam flow, at the desuperheater. The original purpose of the desuperheater was to bring superheated steam (provided by the old steam plant) down to near saturation temperatures, by adding a spray of cold water into the steam flow. However, if the supply steam is already saturated, the only effect that the cold water spray can have is to condense the already saturated steam. The reason that this spray of cold water dampened the oscillations was that it was condensing a portion of the heating steam and thus reducing the overall steam flow. Therefore, although 20,000 – 21,000 lb/hr of steam was being measured at FIC-CA1-1, a lesser amount (say 17,000 – 18,000 lb/hr) was actually reaching the reboiler. The difference was being captured by steam traps in the HVAC room. This operation, although it has the appearance of helping, accomplishes nothing.
4. Steam/Condensate Flow Meters: Either FIC-CA1-1 or FI-RC1-1, or both meters are not accurate. On figure 2 it can be seen that FI-RC1-1 almost always reads more flow than FIC-CA1-1. The two instruments should show the same flow, or FIC-CA1-1 should show more flow. This is because a portion of the steam flow read by FIC-CA1-1 will condense before it enters the reboiler, and will exit the line via steam traps in the HVAC room. Engineering has already requested that the signal lines for FIC-CA1-1 be repositioned per vendor recommendations. Another flow transmitter next to the strainer, FT-EA1-3 does not work and is not shown on figure 1.

<u>Condensate Return Considerations:</u>

1. Length of Condensate Return Line: Ideally, the condensate steam traps are located immediately after the steam heating equipment (in this case, the reboiler). This ensures that condensate generated in the reboiler drains out as it is generated and that steam in the reboiler stays in the reboiler until it has given up its latent heat of vaporization. At the 242-A facility, there is approximately 60' of pipe between the reboiler and the 3 inverted bucket steam traps. The operating temperature of this condensate line would indicate that the steam traps have never seen steam. The length of the condensate return line is a major reason why the condensate does not drain quickly enough from the reboiler. It takes over ½ minute for condensate to make its way from the reboiler to the traps at a steam flow of 18,000 lb/hr. In addition to the length of the return line, there appears to be some source of pressure loss upstream of the traps, or some source of back-pressure downstream of the traps. The pressure loss effects through this line need further investigation.
2. Steam Strainer Loop to Basement of Condenser Room: In the original design of the condensate return line, the condensate pipe came out of the wall from the evaporator

Attachment 10
Page 8

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

room into the condenser room and dropped a short distance to the steam traps. From the steam traps, the line continued on to the steam weir. In 1995, an addition was made to the steam condensate return line to pipe the flow down to a strainer in the basement level of the condenser room. Because of the strainer leg, steam flow now drops approximately 15' from the wall to the strainer (Section FF to GG), and rises approximately 13' to get back up to the traps (Section GG to HH). This creates a 13' water trap in the condensate return line. It takes 5.6 psi (13' Water) just to push a slug of condensate back up to the steam traps once it has passed through the strainer. Since the steam/condensate pressure in the reboiler is only 5.5 psi (as mentioned in Steam Supply Considerations above), there is not enough steam pressure to push the condensate back up to the traps. In order just to push a slug of condensate back up to the traps, more condensate has to be generated to create enough head pressure to overcome the 13' rise and to overcome system pressure losses (i.e. pipe bends, the strainer, and the steam traps themselves). Therefore, the addition of the steam strainer and its associated piping caused an increase in condensate retention in the reboiler and condensate line.

3. Horizontal Pipe Section in Evaporator Room: There is 19' of horizontal condensate pipe between the reboiler in the evaporator room and the wall penetration to the condenser room (Figure 1, Section EE to FF). This section needs to be considered if a re-design of the steam condensate system is made. If steam condensate flow is increased, and condensate is being removed from the reboiler, then the steam/condensate interface may be moved from the reboiler to this section of pipe. This may create a possible water hammer in the 19' horizontal pipe section. This is another reason that steam traps are typically located immediately after the heating unit.
4. Inverted Bucket Steam Traps: The steam traps are Armstrong inverted bucket type steam traps, model number 816. The orifice in each trap is 1-1/16", and is designed for a flow capacity of 8,000 lb/hr for a system pressure differential of 1 psig. At 2 psig, the traps are designed to handle 10,000 lb/hr condensate load. Therefore, 3 traps should easily be able to handle a condensate load of 30,000 lb/hr, as long as there is at least 2 psig of system pressure coming into the traps. As mentioned previously, this is only possible under the current configuration when there is a condensate load. The purpose of the traps is to stop steam flow and keep the steam in the reboiler where it can heat. Therefore, the existing steam traps are always open since the system is full of condensate and the traps are not needed.
5. Back-Pressure Valve PV-EA1-16: Valve PV-EA1-16 was added to the system in parallel with the steam traps. Its purpose is to keep 4.4 to 7.4 psig pressure on the steam in the reboiler. It was designed to accomplish this by closing for more pressure, and opening for less pressure. The valve was also installed to increase condensate flow when the condensate is backed up in the reboiler. Under a properly designed system, there is no need to compensate for poor condensate flow through steam traps. The traps were designed to remove 30,000 lb/hr condensate load, provided there is at least 2 psig pressure upstream of the traps. However, the valve still performs an important function. Upon steam start-up, the valve is used to purge air from the system.

Attachment 10
Page 9

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

6. Steam Strainer: The steam strainer is used to keep rust and other particulates out of the 1-1/16" inch orifices in the steam traps. Because of the air that is introduced into the system when steam is down, rusting is a problem in the steam and condensate lines.
7. Pressure discrepancies: The pressures read at PI-EA1-11 do not agree with pressures read at the strainer gauges PI-SST-1 and PI-SST-2. When PI-EA1-11 reads 5-6 psig, strainer gauges read anywhere from 1-5 psig. The strainer gauges should read greater than PI-EA1-11, as they are 13 feet below and are subject to more head pressure.

Heating Limitations:

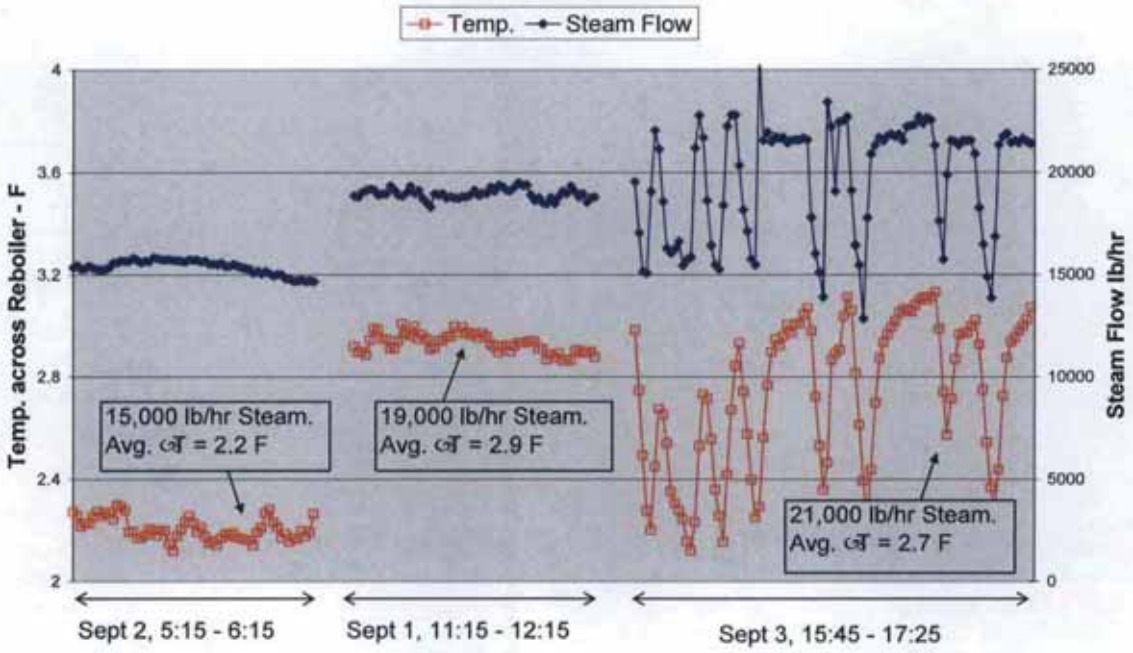
Because of the inability of the condensate system to adequately drain condensate from the reboiler, the heat that can be supplied by the reboiler for evaporation during evaporator campaigns is reduced. During the 2006 hot run campaign, the heat added by the reboiler at different steam flow rates was observed. Figure 4 shows steam heating at three different steam flow rates, 15,000 lb/hr, 19,000 lb/hr, and 21,000 lb/hr. The amount of heating performed by each steam flow rate is approximately proportional to the temperature increase of the waste across the reboiler. As can be surmised, the heating increased as the steam flow rate increases from 15,000 lb/hr to 19,000 lb/hr (as seen by the temperature change across the reboiler from 2.2 °F to 2.9 °F). However, at 21,000 lb/hr of steam flow, the overall (average) heating dropped, with an average temperature change across the reboiler of 2.7 °F. The reason for this decrease is because of the thermal shock oscillations that were occurring while operating at this steam flow rate. Not only can thermal shock harm equipment, but it can cause a decrease in the heating performance of the system. The reason for this is that steam that could be used to heat the tubes in the reboiler (and therefore the waste in the tubes) is instead being forced back out of the reboiler during the pressure surges caused by flashing condensate.

The most important factor in heating is the steam flow rate. The need to decrease the retention time of condensate in the reboiler is not to improve efficiency of steam heating in the reboiler. Even with the condensate backed up into the reboiler, the steam is still losing its heat in the reboiler and not in the pipes (provided that the insulation is in good condition). In fact, the condensate in the reboiler is also helping to heat the waste in the tubes as the condensate cools to sub-saturation temperatures. The problem is that condensate retention limits the steam flow rate to about 20,000 lb/hr. If the system is modified to decrease condensate retention time in the reboiler, then steam flow rates of 27,000 lb/hr should be achievable.

Attachment 10
Page 10

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

Figure 4: Heating at different Steam Flow Rates



Simple calculations (summarized below) show the difference in steam heating possible at various steam flow rates:

- Case 1 – Steam flow rate of 20,000 lb/hr, 5.5 psig (20.1 psia), with condensate retention – condensate cooled in reboiler from 228 °F (saturated) to 130 °F:
  Latent Heat of evaporation = 19.2 $*10^6$ BTU/hr.
  Heat from cooling water to 130 °F = 2.0 * 10^6 BTU/hr.
  Total heat transfer in reboiler = <u>21.2 * 10^6 BTU/hr</u>.
- Case 2 – Steam flow rate of 27,000 lb/hr, 5.5 psig (20.1 psia), with no condensate retention:
  Latent Heat of evaporation (Total heat transfer) = <u>25.9 * 10^6 BTU/hr</u>.
- Case 3 – Steam flow rate of 27,000 lb/hr, 10 psig (25.6 psia), with no condensate retention:
  Latent Heat of evaporation (Total heat transfer) = <u>25.7 * 10^6 BTU/hr</u>.

The heating performed by condensate cooling in the reboiler shell is minimal compared with the heating performed by the condensing of the heating steam (latent heat of evaporation). Therefore, to accomplish better heating, it is better to get the condensate out of the system and heat at higher steam flow rates (as seen in case 1 and case 2).

Also note that there is no value gained in heating by increasing the pressure of the heating steam from 5.5 to 10 psig at the reboiler, as long as a higher flow rate can be maintained

Attachment 10
Page 11

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

(as seen in case 2 and case 3 above). The only argument for increasing steam supply pressure is to help clear the condensate on the downstream side of the reboiler.

Short Term Recommendations:

1. **Do not operate heating steam above 20,000 lb/hr.** Thermal shock in the reboiler needs to be avoided, as it could be damaging to the reboiler and adjacent piping. All procedures that reference an upper limit to the heating steam need to be changed. The campaign process memo will reflect this new upper limit.
2. Do not inject cold water spray into the heating steam via the desuperheater. All procedures that make this option available should be changed.
3. In the next available cold run (or between hot runs when water is in pot), the following exercises should be performed, to obtain more information about condensate clearing. This information will provide engineering information about condensate removal and in providing better heating, and might even resolve some of the heating issues without modifications:
    a. Recommend trying to operate with condensate flow control valve PV-EA1-16 more open. Monitor steam temperatures on TI-EA1-5 to determine if temperature of steam condensate exiting reboiler increases.
    b. Add more steam pressure to the reboiler, by adding 90 lb steam to the 10 lb steam flow at the desuperheater. Monitor steam temperatures on TI-EA1-5 to determine if temperature of steam condensate exiting reboiler increases.
    c. Monitor pressures in better detail at different locations along the condensate return line. This might require calibrations of existing gauges, or placement of temporary gauges at different locations.

Long Term Recommendations:

1. Engineering needs to evaluate the integrity of the reboiler, and determine if the thermal shock events may have caused any damage.
2. Process engineering needs to evaluate the need for more heating in future campaigns (i.e. for increased waste volume reduction). Waste volume reduction is primarily limited by steam heating and by slurry flow rate (solids settling).
3. If the testing performed in the short term recommendations does not improve heating, then redesign the steam condensate system to provide shorter condensate retention time in the reboiler. Provided are three recommendations, given in the order that is most likely to maximize steam heating. Also provided is a list of pros and cons:
    a. Move steam strainer and bucket traps into the evaporator room. Strainer and traps will run directly horizontal from the condensate outlet of the reboiler. The 13' leg to the existing strainer will be removed so that only down-hill sections remain in the condensate return line. Automated valves would have to be added for strainer clearing.

Attachment 10
Page 12

IQRPE Report IAR-001 Integrity Assessment Report RPP-RPT-33306, Rev.0

i. PROS: Best heating. Shortest condensate retention time in reboiler. No chance of water hammer in horizontal line in the evaporator room.
ii. CONS: High risk work. Extensive piping changes. A platform would probably have to be build in the evaporator room for support of the equipment and for maintenance.

b. Add a Pump Trap in the basement level, after the strainer (example: Armstrong PT-516). A pump trap is a steam trap that pumps condensate up to a condensate return main. It otherwise functions as a steam trap (only allows condensate to pass – stops steam). It uses higher pressure steam or compressed air as a motive force, therefore this modification would require that 90 lb steam or compressed air be piped to the basement of the condenser room to the location of the trap. The three existing steam traps would be removed. An automated valve (just like PV-EA1-16) may have to be piped in parallel with the pump trap, to help in startup air purge.
   i. PROS: Forced condensate removal would provide better heating. Low maintenance system.
   ii. CONS: Extensive piping changes. There may be a chance of water hammer in the 19' section of horizontal pipe in the evaporator room.

c. Delete the 13' strainer loop to the basement (return to the original design). This could be performed by adding pipe "T"s so that operations have the option of still using the strainer. Since there is no strainer, a dirt pocket would be piped in front of the traps to catch larger rust particles. More frequent cleaning of the dirt pocket and of the steam traps would be required.
   i. PROS: Easiest modification.
   ii. CONS: There is still a large run of unforced condensate drainage. It is uncertain what the benefit to the heating is, large or small – you will get what you get. The traps are no longer protected by a strainer. There may be a chance of water hammer in the 19' section of horizontal pipe in the evaporator room.

d. Last Option – No change – operate with reduced steam flow.

4. Add new flow transmitter to the condensate return system. Add between the traps and the weir, so that the transmitter is always reading liquid flow rate. Remove the existing flow transmitter FT-EA1-3.
5. Perform detailed inspection of steam insulation. Inspect in the areas that are not readily accessible. Inspect under the protect layer for water in the insulation.
6. Open up steam traps and inspect for corrosion. Need to determine maintenance schedule for traps.

Attachment 10
Page 13

ATTACHMENT 11

PROBLEMS FROM PAST CAMPAIGNS AND RECOMMENDATIONS

(25 Pages)

PROBLEMS THAT OCCURRED DURING CAMPAIGNS AND RECOMMENDATIONS FOR THE UP-GRADE OF THE FACILITY CAMPAIGN 1994 POST RUN PROBLEMS

1.0 Low Hydroxide Waste

Review of Campaign 94-2 feed and slurry samples (T1364, T1408, and T1409) indica ted hydroxide concentrations of less than the minimum operational specification requirement of 0.01 molar for double-shell tanks (Harris 1992). A subsequent review of pre-campaign characterization data for 107-AP and 108-AP revealed "less-than" hydroxide values that were above the minimum required hydroxide limit. In accordance with applicable QA documentation, the hydroxide concentrations in 107-AP and 108-AP were accepted to be within specification. Because lab detection limits for feed and slurry samples were slightly better than the pre-campaign characterization effort, the determination was made that the waste contained 107-AP and 108-AP was out-of-specification.

Tanks 107-AP and 108-AP were subsequently added to the list of other "low-hydroxide" tanks and documented in Occurrence Report RL-WHC-TANKFARM-1994-0046. The bulk of the waste contained in tanks 107-AP and 108-AP was concentrated into specification by the 242-A Evaporator campaign. The 107-AP and 108-AP low hydroxide heels were mitigated by mixing 103-AW with 107-AP and 105-AW with 108-AP. Internal Memo's 7CF10-042-094 and 7CF10-055-094 outline the mixing strategy and waste compatibility assessment.

2.0 Vessel Vent Ammonia

When initiating evaporator boiloff on 9/22/94 with waste feed from 101-AP, the vessel vent ammonia monitor readings spiked above the range of the instrument. Drager tube samples were taken as a verification in the vessel vent stack and ammonia levels were found to be in excess of 700 ppm. To lower the ammonia discharge concentration, steam flow to the reboiler was reduced, followed by feed blending with waste from 107-AP.

A preliminary estimate of the vessel vent ammonia concentration was calculated in the PCP using the Evaporator Flowsheet Model. The actual ammonia concentrations measured by AI-NH3-1 were substantially higher than the model estimates. Despite the unexpectedly high ammonia releases, no discharge limits were exceeded. A work package was generated to modify the ammonia monitor range from 0-1000 ppm to a new range of 0-5000 ppm prior to the next campaign.

3.0 Loss of I0I-AP Pump Prime

On 10/3/94, a transfer from 101-AP to the feed tank (102-AW) was attempted several times without success. The transfer pump was flushed but the pump continued to trip on low amperage without any waste being transferred. Later, it became apparent that the previously assumed stick pump in 101-AP was actually a flex and float pump. At the time of transfer, the liquid level in 101-AP was 115 inches. Because the flex and float pump impeller remains fixed approximately 33 feet below the tank riser, at least 200 inches of waste in the tank are required for the pump to prime. Several attempts were made to prime the pump with flushwater, but were unsuccessful.

On 10/7/94, approximately 100 inches of waste from 108-AP was transferred to 101-AP to raise the liquid level above the transfer pump impeller. On 10/8 the 101-AP to 102-AW transfer was successfully started, but the transfer was shutdown prematurely on 10/11 due to spurious radiation alarms in A, AX, AY, and AZ farms. With 54 inches of waste remaining in 101-AP, further attempts to empty the tank were determined to be unproductive. Subsequently, the total available feed for Campaign 94-2 was slightly less than anticipated.

RECOMMENDATIONS

1.0 Ammonia Predictions for Vessel Vent

The Evaporator Flowsheet Model was used prior to Campaign 94-2 to estimate ammonia concentrations in the vessel vent system using characterization data from the candidate feed tanks. Actual vessel vent concentrations measured during the run by an in-line ammonia monitor were substantially higher (2 to 3 orders of magnitude) than was predicted in the model. Consequently, an improved method of estimating vessel vent ammonia concentrations was needed.

Data obtained from Campaign 94-2 feed, process condensate, slurry and vent streams were analyzed in order to determine what fraction of ammonia in the feed goes into the process condensate and vessel vent streams. The statistical analysis performed strongly suggested that approximately 5% of ammonia in the feed is discharged through the vessel vent stack and 95% is left in the process condensate stream, regardless of the feed concentration. Future campaign ammonia levels will be approximated as per the analysis.

2.0 Flex and Float Pump Usage for Evaporator Waste Staging

Because waste tank flex and float pumps cannot be used intermittently below the elevation of the impeller (typically 200 inches above the tank bottom), these pumps cannot provide reliable service for necessary evaporator process control. Additionally, the tanks containing these pumps cannot be completely emptied if a transfer is interrupted and the waste level is below the pump impeller (as with 101-AP on 10/11/94). Such process interruptions may have significant effects on evaporator schedules and campaign objectives.

Future waste scheduled for evaporator processing should not be staged in 101-AP, 106-AP, 103-AW or other tanks having flex and float pumps, unless methods can be developed to eliminate the problems with pump priming. Consideration should be taken to use 101-AP or 106-AP as the designated "spare" DST, so 104-AP (current designated "spare") may be used for evaporator waste staging.

3.0 Other Recommendations

On December 1, a meeting was held to review the strengths, weaknesses, and lessons learned of Campaign 94-2. All personnel associated with evaporator activities were invited, and action items for weaknesses/lessons learned items were assigned. The internal memo summarizing Campaign 94-2 strengths and weaknesses (IM# 7CB00-94-063) is found in Appendix K.

CAMPAIGN 1995 POST RUN

PROBLEMS

High Process Condensate Temperature/Poor Vacuum condenser Performance

The condensate transfer line from 242-A to LERF has an operating limit of 120 Deg F for structural integrity. Maintaining a process condensate temperature below the alarm point of 110 Deg F and an overall condensate tank temperature below 120 Deg F was difficult during the final pass of the evaporator campaign. Contributing factors included warm summertime (70°) cooling water temperatures, higher waste SpG's with associated higher vapor temperatures, and evaporator operating pressures of > 60 TORR. Typical ways to reduce process condensate temperatures are by controlling cooling water flow and controlling vacuum in the evaporator vessel. During campaign 95-1, the cooling water flow was increased in an attempt to decrease condensate temperature, but the changes made had only small effects. One method to reduce condensate temperature would have been by decreasing the operating pressure/temperature of the evaporator, but the operating efficiency (with zero air bleed-in) of the vacuum-condenser system was poor, attaining only 60 TORR operating pressure during the final pass. A 40 or 50 TORR operating pressure would have easily kept the process condensate temperature below 110 Deg F during Campaign 95-1. Historical vacuum-condenser system operating pressures were typically in the 40 TORR range. One postulated reason for the observed performance reduction of the vacuum condenser system is hard water fouling in EC2 and EC3. Fouling of' the main EC1 condenser has been well documented, but little information exists on EC2 and EC3. Because high condensate temperatures may significantly impact transfers to LERF, a work package has been generated to assess fouling of the EC2 and EC3 condensers prior to the next campaign. Furthermore, the poor performance of EC2 and EC3 may be contributing to the condensation problems with the vessel vent system during the last three campaigns.

Inadvertent Draining of Steam Condensate to 102-AW

On July 10, several adjustments were made to the reboiler steam trap bypass valve to smooth steam flow and pressure instability but were unsuccessful. Later, troubleshooting began which included checking drains and traps on the inlet and outlet side of the reboiler. Upon completion of the investigation, one of the steam traps was left open unintentially causing a portion of the steam condensate to purge to 102-AW. The daily material balance was performed on the morning of July 11 and did not come within specifications. After an investigation of the material balance discrepancy, the 102-AW liquid intrusion was determined to be coming from the steam condensate. Upon walkdown of the plant, the open trap valve was identified. Approximately 30,000 gallons of steam condensate was transferred to 102-AW, resulting in reduced overall evaporator operating efficiency.

Slurry Sampler Recirculation Line Plugging

On July 21 and 22, slurry samples were taken from the F2 sampler for the evaporator final pass waste evaluation. The slurry samples were found to contain an unusually high percentage of solids (50 Vol%), which did not represent process predictions. Review of the recirculation bypass jumper flowmeter FI-CA1-3 indication over the duration of the campaign suggested that solids were accumulating in the jumper and occasionally

restricting flow. To ensure representative data of the Campaign 95-1 slurry product was obtained, post-campaign samples were taken from the slurry tank 106-AW and sludge measurements were taken to estimate the true solids volume of the slurry product.

The evaporator hot water flush at the end of the campaign appeared to clear the solids in the F-2 slurry sample loop. The current F-2 slurry sampler arrangement positions the sample head approximately eleven inches below the sampler inlet and outlet connections. Because of this, the area around the sampler head tends to become a solids trap if flow velocities become too low. The main limiting factor to increasing flow velocity is the lack of a motive force. Flow through the sampler is driven by the differential pressure across the P-B-1 recirculation pump. Historical data from the 95-1 campaign indicated that this pressure was less than 4 psid. Hydraulic modeling, using process parameters obtained from the 95-1 campaign, showed that the flow velocity is marginal at keeping solids suspended throughout the entire sample loop.

Engineering is currently evaluating options for improving the ability of the sampler to obtain representative samples. In addition, the reliability of the sample loop flowmeter, FI-CA1-3 will be improved prior to the next campaign. This flowmeter is instrumental in determining if plugging is occurring in the slurry sample loop.

Seal Water/PC Recycle System Problems

A new process condensate recycle system was installed just prior to Campaign 95—1. The system was designed for waste minimization by utilizing process condensate for the CAI deentrainment sprays and the P81 and P82 pump seals, thereby reducing raw water addition to the evaporator process.

The performance of the PC recycle pump (P-C106) began to degrade in the early stages of the campaign, progressively failing to provide adequate pressure for the PB2 pump seals and deentrainment sprays. On 6/17, the deentrainment sprays were shut down in order to gain seal water pressure. Later the PC recycle system was shutdown for troubleshooting and P-C106 was disassembled for inspection. Visual analysis of the P-C106 showed that the majority of breakdown was due to corrosion caused by the incompatibility between the bronze impeller and high ammonia content in the process condensate. Because the existing P-C105 and P-CI05A seal water pumps also had bronze impellers, similar degradation was also seen in those pumps. On 7/19, the impeller on P-C106 was replaced and the PC recycle system was operated during the final pass.

A PC recycle design change has been proposed which includes replacement of P-C106 with a higher capacity stainless steel pump. The new pump will provide sufficient pressure to eliminate the need for the seal water booster pumps when operating with process condensate, and will resist corrosion if the process condensate contains high ammonia. The seal water booster pumps will be operated only when filtered raw water is used for PB1 and PB2 pump seals. The changes are expected to occur prior to the next evaporator campaign.

RC2 Sampler Leakby

During campaign 95-1 the RC-2 sample carboy was observed filling at an accelerated rate compared to normal. Upon further investigation, it was determined that the RC-2

isolock sampler head was allowing raw water to leak by the O-ring seals. At first, this was not deemed a significant problem because the leakby was not severe. The sample frequency for the composite sampler was decreased to compensate for the sample head leak rate. No work could be performed on the isolock sampler head during evaporator operation. As the campaign continued, the leakby increased to a point where it was determined to be a significant problem. The RC-2 carboy was filling so rapidly that a representative composite sample of the used raw water stream was impossible to obtain. Environmental engineering was consulted and agreed to the use of grab samples of the used raw water stream until the sample head could be replaced during the outage planned before the final pass. In addition, the excess used raw water sample being drained was becoming a significant waste addition to tank 102-AW. To address the problem, the overflow drain from the RC-2 carboy was temporarily rerouted to the TK-C-103 (steam condensate). During the planned outage before the campaigns final pass, the RC-2 isolock sampler head was replaced with a new sample head from spare parts. The RC-2 carboy drain line and the RC-2 composite sample frequency was returned to its original configuration/frequency.

Raw Water Flow Indicator Failure

On July 7, 1995, the raw water flow indicator FI-Cal-IA (a metal float and glass housing) - ruptured, allowing a water leak to the 242-A condenser room. The flow indicator was immediately isolated to prevent further leakage. The water spray caused several of the facility instruments to read erratically, resulting in a 43 hour facility shutdown. The root cause of flow indicator failure was determined to be excessive operation the raw water valve HV-CA1-6 over the years. This operation caused the piping to vibrate enough that the flow indicator finally failed at some point on the glass housing. During the campaign, the raw water valve was frequently cycled to let slurry valves (HV-CAI-2 and HV-CA1-2A) seat and prevent water leakage into the slurry line. The raw water flow indicator was used as an operational process aid only and will be isolated permanently to prevent recurrent failure.

Erratic LERF Basin 43 Automatic Level Readings

LERF basin 42 routinely received process condensate from the Evaporator Campaign 95-1. Due to concerns that ETF startup could be significantly delayed, the process condensate generated during the final pass was routed to LERF basin 43 in order to use all available LERF capacity, thereby providing adequate space for future campaigns. The automatic liquid level measurement systems for LERF basin 43 provided erroneous readings during warming and cooling periods of the campaign. The liquid level was manually measured to verify compliance with LERF operating specifications.

After extensive troubleshooting, the problem was found to be a bad Probe/Transmitter connection mechanism as supplied by the vendor. The end of the probe had a thermo well type cavity that housed a spring loaded post that pushed against a solder pad on the transmitter. During significant temperature changes, this connection became unstable and caused erratic level outputs from the transmitter. To resolve this problem, the spring loaded pin was removed. The opening of the well was threaded and the wire lead was bolted to the end of the probe. This provided a very solid probe/transmitter connection and resulted in a stable output from the transmitters. A copy of the internal letter addressing the LERF Basins Level Transmitters Troubleshooting can be found in 14755 Rev.1.

Loss of Feed due to AW Instrument Air Loss

Instrument air compressors in AW farm shut down several times during the campaign. Since instrument air from AW farm is used to operate the feed valve DOV-02E-1 for the evaporator, loss of AW instrument air will cause the feed valve to fail open, diverting feed flow from Evaporator to the 102-AW feed tank. Loss of feed will result in Evaporator shutdown due to lowering liquid level in the vessel. In addition, significant efforts were required to regain feed flow control after losing instrument air to the feed valve. The Evaporator was shutdown due to AW instrument air loss on one of three occasions during the campaign. To prevent recurrence, a work package has been generated to use instrument air from evaporator compressors for the feed valve operation.

Process Condensate Diversion to Tank 102-AW

On June 20, 1995, a spurious alarm from leak detector LDI-A1 on the process condensate (PC) line between the 242-A Evaporator and the Liquid Effluent Retention Facility (LERF) annunciated in the 242-A Evaporator control room and cleared immediately. As a design of the computer control system, the alarm activated the automatic shutdown mechanism of PC pump (P-C100) and diversion of valve HV-RC3-3 to permit process condensate flow back to the 102-AW Evaporator feed tank. The P-C100 was manually restarted in a few minutes after the alarm annunciated. However, the HV-RC3-3 valve was not repositioned to send the process condensate- to LERF. The Evaporator system was unintentionally operating in a nonproductive recycle loop for approximately eight hours. This caused 27,000 gallons of PC to be diverted to the feed tank and 2,000 gallons of seal and flush water being added to the system.

A modification to the valve lineup was performed which will divert the PC flow back to TK-C100 if a similar alarm occurs.

Condensate Buildup In Radiation Monitoring Systems

High differential pressure (dP) across the vessel vent de-entrainer pads occurred several times during the campaign. Typical response in an attempt to lower the high dP is to reduce the vessel vent stack flow rate and manually adjust air bleed-in valve 3-1. On 6/19/95, while investigating a spurious alarm from vessel vent high alpha radiation monitor, the vessel vent CAMs and record sampler were found to contain water. Water condensation in the vessel vent was due to insufficient air flow and high humidity during a rain storm. The problem was temporary resolved by draining water out of the CAMs and replacing the record sampler filters. A temporary heater was installed on the vessel vent air inlet to reduce water condensation from high humidity. In the future, a rain cap or permanent inlet heater may be installed to reduce condensation problem in the vessel vent system.

RECOMMENDATIONS

Specific Gravity Modeling

A precise prediction of specific gravity (SpG) of the slurry waste at the end of an evaporator campaign is vital for evaporator process control strategy and operation. The evaporator slurry is limited to SpG of < 1.41. The SpG limit was chosen because of a

statistical correlation between SpG and flammable gas watch list tanks. The pre—campaign boildown SpG Is always much higher than the actual slurry SpG mainly due to the suspended and precipitated solids in the boildown flask.

For several years now, the 242-A Evaporator SAR (WHC-SD-WM-SAR- 023) has provided the correlation for estimating the final product slurry SpG. However, this SAR SpG correlation was found to be substantially different from the actual sample SpGs taken during evaporator campaigns in 1994 and 1995. The SAR SpG correlation was derived from an equation based on four—component synthetic waste with SpGs ranging from 1.490 to 1.728. This correlation was not derived for, the range of current evaporator operation and does not include some important waste components that contribute to SpG such as NaF, Na3PO4, Na2SO4, and Na2CO3 which are known to be fairly common among the evaporator wastes. Therefore, it was felt that a new SpG correlation was needed.

The new SpG correlation for the evaporator waste was determined as a function of the concentration sum (moles) of eight major salts which are found abundantly in the waste. The major salts are NaAlO2, NaOH, NaNO3, NaNO, NaF, Na3PO4, Na2S04, and Na2CO3. It is recommended to use this new SpG correlation in the next campaign to determine SpG (as a test case). Based on results of this test and using further data to refine the equation as necessary, a recommendation may be made at that time to incorporate it into the Evaporator Flow Sheet model.

PB1/PB2 Seal Water Modification

At the present time, orifices are used to maintain backpressure of water seals for PB1 and PB2. Because of the small size of these orifices, plugging is a common occurrence. Entries into the pump room (a high radiation zone) have been made frequently to unplug these orifices. To promote ALARA, waste minimization, and eliminate the down-time currently associated with cleaning the orifices, an engineering study (WHC- SD-WM-ES-359) has been completed proposing modifications to redirect the PB1 and PB2 pump seal to TK-C100 instead of 102-AW, and to Install accessible needle valves for flow control.

Insufficient Anti-Foam Concentration Results In High De- entrainment Pad dP's

Excessive foaming at the C-A-1 vessel liquid-vapor interface resulted in plant shutdown on five separate occasions during the campaign. During the initial stages of campaign 95-1, the facility was operated using an anti-foam concentration which had proved effective during campaigns 94-1 and 94-2. Anti-foam concentration was increased incrementally after each of the first three successive shutdowns to a concentration of approximately 300 ppm of anti-foam in the C-A-1 vessel at the time of the fourth shutdown. After the fourth shutdown the decision was made to double the anti-foam concentration, which resulted in smooth plant operation until the anti-foam addition was prematurely stopped prior to the end of the campaign (the fifth shutdown).

Much valuable experience was gained during campaign 95—1 concerning the behavior of foam in the evaporator process. The main points are summarized below:

1) Boildown studies are valuable tools for predicting foaming potential. During both campaign 94-1 and 95-1, foaming problems occurred at approximately the same WVR

as noted during the pre-campaign boildown studies. The boildown study for campaign 94-2 did not predict significant foaming, and in fact the entire campaign was run successfully at a very low anti-foam concentration.

2) The evaporator process is very destructive to the anti- foam. Foaming problems encountered during campaign 95-1 were resolved after anti-foam concentration in the C-A-1 vessel was raised to approximately 600 ppm, or three times the maximum concentration recommended by the anti-foam manufacturer.

3) Adjustment of process parameters will not cure foaming. During both campaign 94-1 and 95-1, steam, vacuum and level set point adjustments were made in an effort to control foaming in the vessel, to no effect. In both cases, the only successful cure for foam was anti-foam chemical addition.

4) Filling the vessel with water and restarting will not cure foaming. During both campaign 94-1 and 95-1, C-A-1i was dumped and filled with raw water in an attempt to "wash out" the foam. In both cases foaming problems resumed when the vessel contents returned to the original concentration. This technique is particularly non-beneficial given the negative impact on PC to WVR ratio, a PB1 goal.

5) Anti-foam chemical does not clog the de-entrainment pads. Review of de-entrainment pad dP data for all three campaigns reveals no upward trend that is associated with scaling or material buildup from beginning to end of campaign.

CAMPAIGN 1996

PROBLEMS/RECOMMENDATIONS

Unusual Vessel Level/Density Indication

On 5/22, the evaporator vessel was filled with the waste staged for the final pass and sampled. While the evaporator operated in recirculation without vacuum awaiting feed sample results, the density indicators began trending downward and the liquid level indicators were trending upward. The main recirculation pump (PB1) vibration also increased. After reviewing data trended on the MCS and starting/stopping/starting PB1, a recommendation was made to increase the vessel liquid level. The increase in operating level suppressed the effect of drifting SpG and liquid level indication, but did not eliminate the problem. The problem was solved later when anti-foam agent was injected.

It is possible that the vessel operating level was actually lower than the normal, where surface effects from the outlet of the recirculation line and/or from possible formation of a vortex may have caused excessive foam/air mixing into the waste. The effects would cause increased recirculation pump vibration due to cavitation, as well as a reduction in measured density. The density decrease would yield a higher apparent liquid level in the vessel, complicating the situation. Part of the problem may be due to the fact that the evaporator density indicators have been reading consistently higher than actual lab analysis of the waste has indicated. This in turn would cause the true liquid level in the vessel to be lower than anticipated during operation (i.e. nearer to the recirculation line outlet), where increased waste agitation, foaming, and possible vortex formation could result. The error in the operating liquid level would increase as the waste SpG increases.

The probable reason this phenomenon was not observed in the three previous campaigns was because waste SpG's were lower during shutdown w/recirculation modes, and antifoam chemical suppression of the effects of agitation.

Engineering is recommending implementation of density correction factors into the MCS programming. The "correction factors" or equations are based on data taken from the last four evaporator campaigns. The SpG offset has been expressed by linear equations with a coefficient correlation of 0.97 (R2 value), and can be found in Appendix E. The correction factor will be of crucial importance when processing feed with high initial SpG's (to optimize WVR), and will be implemented prior to the next campaign.

104-AP Transfer Pump Overload Relay

On 5/6/96, an attempt was made to start the 104-AP to 102-AW transfer. When the transfer pump start button was engaged, the red light (which indicates transfer pump operation) illuminated but went out as soon as the button was released. Amperage indication did not occur. Later, electricians troubleshooting revealed loose tension in the springs of the overload relay (heater overload). After adjustments were made, the transfer was started. The three hour delay in the transfer did not affect evaporator operations.

PT-CA1-11 Air In-leakage

On 5/6/96, an air leak at PT-CAI-11 caused a temporary interruption with drawing vacuum on the evaporator vessel. The air leakage created a rise in the lower de-entrainment pad dP indication when the steam jets were started. After the air leak was fixed, evaporator startup commenced.

AW Farm Process, Pit Alarm Shuts Down Evaporator Feed

On 5/7/96, moisture in an AW process pit (05A pit) activated a leak detection alarm and caused a six hour down-time due to loss of feed. A temporary electrical jumper was promptly installed on LDE-05A-1 since the leak detector was not on any current transfer routes. The evaporator was shutdown in recirculation mode, and restarted after the jumper was installed.

Loss of Feed due to AW Air Dryer Failure

On 5/12/96, malfunctioning instrument air dryers in AW farm caused loss of air to the evaporator feed valve DOV-02E-I. Upon loss of air, the feed valve will fail-open, which directs feed flow from Evaporator to the 102-AW feed tank. Prompt actions were taken to bypass the air dryers, which prevented plant shutdown. Corrected measures were taken which included air dryer replacement and the installation of' a low air pressure alarm, giving evaporator operators the much needed early warning of an AW instrument air problem.

CAMPAIGN 1997 POST RUN

PROBLEMS/RECOMMENDATIONS

Slurry Density Anomalies

A density correction factor was added to the MCS programming after Campaign 96-1 to rectify the discrepancy between density indicators DI-CA1-1 &-2, and actual SpG received from sample results. Specific gravity of the slurry samples taken during the last four evaporator campaigns was significantly lower than the evaporator density monitors indicated, so a correction factor was implemented to optimize waste volume reduction.

After Campaign 97-1 startup, the slurry flow was adjusted to maintain an evaporator SpG of 1.39 (maximum allowed = 1.41 avg.). A slurry sample was taken early in the campaign to assess adequacy of the density correction factors, but analysis of the sample indicated a SpG of 1.48 which was much higher than anticipated. Immediately, the process was adjusted to a SpG of 1.39 using "uncorrected" density indication, which was also available on the MCS. Rerun of the first slurry sample later indicated a SpG of 1.51. A second set of samples were taken (feed and slurry) after process readjustment with results of 1.31 and 1.33 respectively, which was much lower than expected. The uncertainty in SpG, was blamed on inadequate slurry sampler operation/flushing and possible suspect lab analysis. A backup plan was then implemented to use a second SpG correlation using PB1 amperage, and the process was readjusted again to optimize WVR. A final slurry sample was taken after extensive flushing of the slurry sampler jumper. The lab result of the slurry sample was 1.49 and the re- run was 1.42. The SpG of the process was reduced to an "uncorrected" SpG of 1.39 and the process remained steady for the rest of the campaign.

A more representative slurry sample was taken from 106-AW after completion of the campaign. The specific gravity result from a composite of 3 tank samples was 1.29. The slurry SpG was well below the flammable gas limit of 1.41, but not as high as desired to optimize waste volume reduction in the tank farms.

An entry into the sampler room was made to troubleshoot and flush the slurry sampler during shutdown. The troubleshooting lead to the conclusion that the recirculation bypass jumper valve HV-F2-3 may have been mislabeled and positioned incorrectly for proper sampler operation. Troubleshooting of the evaporator vessel density instrumentation was also performed, and no problems could be identified.

The software density correction factors were removed after Campaign 97-1, until further sample data provides convincing need for a correction factor. During the next evaporator campaign, more sampler troubleshooting will take place to ensure HV-F2-3 is correctly positioned to enable the taking of representative slurry samples.

Leaking Feed Pit Jumper

On February 27, shortly after startup of Campaign 97-1, the 02E leak detector activated and shut down the feed and slurry pumps. A visual inspection of the pit was made by operations and health physics and found to be dry with some moisture around the floor drain. The next day, the 02E jumper was leak tested after the pit leak detector alarm had cleared. During the leak test, the pit leak detector activated again, indicating a leaking jumper. A video of the jumper showed the leak to come from 02E-1 valve bonnet, which was especially evident during valve manipulation.

The evaporator was shutdown and dumped to 102-AW and a work order was generated to fabricate a new jumper using a valve with a more radiation resistant ultra high

molecular weight polyethylene bonnet (instead of Teflon1 as was installed in the failed jumper valve). After the jumper was fabricated, the jumper was installed and successfully leak tested to 150 psig in the shop. Installation and leak testing of the jumper in the field was completed approximately 3 weeks after discovery of the leak.

Steam Condensate Diversion Valve HV-RC1-3 Misalignment

During startup of Campaign 97-1, the liquid level in 102-AW did not decrease as usual when bringing feed into the evaporator. Troubleshooting commenced to find potential sources of water intrusion, without success. Later, shift personnel, suspected the steam condensate diversion valve HV-RC1-3 may have been the problem, so the valve was operated/cycled and determined by engineering to be 90 degrees out of alignment. Because HV-RC1-3 was a "Safety Significant" diversion valve, an occurrence report was generated (RL-PHMC-200LWP-1997-0004) since the valve would not perform its safety function.

The valve had been incorrectly installed earlier in the year after performing maintenance to replace the seals. Due to the lack of vendor information, incorrect field markings, and inadequate construction specifications, the valve was put back into service with incorrect alignment.

To prevent recurrence, history files will be created for all divert valves showing correct valve rotation and piping configuration. Retest requirements for verifying correct valve orientation were developed.

CAMPAIGN 1998 COLD RUN

PROBLEMS/RECOMMENDATIONS

Several problems were identified during the Cold Run. Investigation into process improvements will continue until the next Evaporator campaign, currently scheduled for March 1999.

Unusual Temperature Readings

The temperature of the boiling solution in the Evaporator vessel was reading about 10°F below the expected boiling temperature at typical operating pressures. The cause is believed to be anomalous temperature or pressure readings.

Poor Vacuum Control

When attempting to increase the boiloff rate to the flowsheet value, the operating pressure of 60 torr absolute could not be maintained. Possible causes include:
• Air leakage into the vacuum condenser system
• Very warm summer cooling water temperature, which decreases the capacity of the vacuum jets. Heat gun temperature readings of raw water were higher than those seen during previous campaigns.

Inadvertent Diversion Process Condensate to Tank 102-AW

The misrouting of 5500 gallons of condensate to tank 102-AW occurred when the diversion valve was in the divert position, due to a spurious leak detector alarm on the LERF transfer line, and pump P-C-100 was restarted. To reduce the likelihood of this recurring, several improvements have been proposed:

- Add a yellow warning alarm on diversion valve HV-RC 3-3 indication to better notify the operator of the valve position.
- Change the computer programming to require a separate command to select the route (to LERF or 102-AW) before restarting the P-100 pump.
- Move diversion valve indication to the C-100 pump graphic to allow the flow path to be easily recognized.
- Investigate the feasibility of changing the computer programming to maintain a blinking annunciator light on the Monitoring and Control Sy stem skid keys until the alarm is acknowledged.
- Improve the reliability of the LERF transfer line leak detection system to reduce the number of spurious alarms, such as the one which caused. HV-RC3-3 to divert pr ocess condensate flow to tank 102-AW.

Low Steam Supply Pressure

The pressure indication on the 10-pound steam supply to the reboiler was lower than expected at steam flow rates greater than 20,000 pounds per hour, this lower steam supply pressure may have been a contributing factor to the low boiloff rate observed during the Cold Run. Poss ible causes include instrumentation problems or increased line losses on the steam supply to the facility from the new Johnson Controls package boiler. Further troubleshooting is required before process improvements can be suggested.

CAMPAIGN 1999 POST RUN

PROBLEMS AND RECOMMENDATION

Cooling Water Radiation False Alarm

On July 27, immediately after slurry pump PB-2 started, cooling water high radiation alarm activated. Radiation monitor readings spiked above the range of the instrument. The readings got back to its normal range as soon as after slurry pump PB-2 was turned off. Electricians made a visual inspection of the cooling water radiation monitoring system and found that induced noise picked up by the radiation signal wire caused false alarms. The radiation monitor discriminator setting and some of the signal wire between the radiation detector and monitoring equipment in the control room were installed in the same vicinity (conduit or cable tray) as the PB-2 pump power cable. With PB-2 operating, instrument technicians adjusted the discriminator for the radiation monitoring equipment to filter out the noise caused by the pump and then tested the alarms with a source. It is recommended that the radiation monitor calibration procedures should be reviewed to make sure some reasonable setting for the discriminator is included or signal wires of radiation monitor should be relocated.

Inoperable Vessel Density Indicators

On July 31, vessel density DI-CA1-1 reading suddenly increased, indicating dip tube plugged. Air purging and water flushing were performed to unplug the dip tubes, but were not successful. Later, sight glass 5-1108 on the water dripping system was found

broken, which caused air leakage into the dip tubes. The air leakage made density monitoring instrumentation read high. Backup vessel density DICA-2 was then used as the controlling parameter. However, it also appeared to become plugged several times during the campaign and had to be air purged or water flushed. Some dip tube water flushes and air purges were taking place during evaporator operations. It is recommended that these activities should be not performed during evaporator boil-off to prevent process upsets (i.e a sudden loss of vacuum or "vessel burp"). Installation of a permanent flush manifold, for easier flush operations, should be evaluated.

Vessel liquid level and Density Reading Abnormalities

On August 5, electrical storms power outage that resulted in a sudden loss of vacuum at Evaporator. While the Evaporator operated in recirculation without vacuum, density indicator DI-CA1 -2 began trending downward and the liquid level indicators began trending upward. The main recirculation pump (PB1) vibration also increased. In six hours, the density reading went down from 1.41 to 1.32. The vessel liquid level indication was above allowable operating level. The density indicator stabilized for a couple hours, and then began to trending upward to 1.38. Air purging and water flushing did not eliminate the problem.

Similar density reading abnormalities were observed in the past campaigns. The problem was possibly caused when the vessel operating level was actually lower than the vessel liquid level reading. The actual liquid was possibly at a level where surface effects from the outlet of recirculation line and from possible formation of a vortex may have caused excessive foam or air mixing into the waste. The effects would cause increased recirculation pump vibration due to cavitation. This is confirmed to what was observed in during the period that vessel density indicator readings fluctuated between 1.41 and 1.32. Water addition to the vessel was not an option during troubleshooting effort because the erroneous density reading caused vessel liquid reading higher than operating limit level, complicating the situation. Therefore, the problem was resolved by emptying the vessel content. The water dripping systems on the dip tubes were isolated to eliminate air-leakage through the sight glass. After the vessel was refilled with fresh feed, evaporator continued to operate for more three days and finished the campaign without any density reading abnormalities.

New density Correlation

From the past campaigns, the evaporator density indicators have been reading consistently much higher than actual density of the waste from lab analysis. For several past campaigns, a density model developed in 1995 had provided a good estimation for campaign slurry products. This model worked because it accounted for air- leakage into the dip tubes from the water dripping systems. Actual vessel densities measured after the water dripping system was isolated were substantially higher than was predicted in the model. Consequently, an improved model of estimating slurry density was needed. A precise prediction of specific gravity of the slurry waste is vital for evaporator process control strategy and is required for all future salt-well liquid processing campaigns.

The following simple equations with very coefficient of correlation (R2) of greater than 0.9997, which means more than 99.97% of the total data variability is expressed by the equations.

Actual SpG = 0.9649 * (DI-CAI-I) - 0.0023

Or, Actual SpG = 0.9902 * (DI-CA1-2) - 0.0182

The data used for the new SpG correlation are provided in Appendix E. Graphical illustrations of how close the correlation compare to the sample data can be found in the Appendix E. It is recommended that these above equations will be used in the next campaign to determine SpG (as a test case). Based on results of this test and using further data to refine the equations as necessary. These equations will not be used to calculate corrected/raw vessel weight factors. These correlations will only be used as engineering or operator aid.

Lightning Alerts Shutdown Evaporator

Approximately 30% of the total downtime was due to Tank Farm Technical Safety Requirement (TSR, Noorani 1997) Section 5.3.2. 23.2 that Tank Farm transfers be discontinued when there is the threat of lightning within a 50-mile radius. This TSR shuts Evaporator down during lightning activity to ensure that activities resulting in gas releases are minimized, and therefore reduces the likelihood of ignition of flammable gas. It reduces the likelihood of an organic solvent fire or organic nitrate-salt reaction by removing potential lightning dissipation paths in the tanks. The additional downtime caused by lightning alerts will lower the evaporator operating efficiency.

Seal Water Pump Failures

Booster pumps P-C 105 and P-C105A are designed to p rovide seal water to vessel recirculation pump PB-1 and slurry pump PB-2. These pumps were used occasionally with process condensate during campaign 99-1 to assist the process condensate recycle pump P-C 106 deliver adequate pressure for the PB-I and PB2 pump seals. The performance of these pumps began to degrade in the early stages of the campaign and was progressively failing to provide sufficient pressure. Visual analysis of these pumps showed that the majority of breakdown was due to corrosion caused by incompatibility between the brass impellers and ammonia content in the process condensate. On 8/5, these pumps were replaced with the same type of pumps. It is recommended that these booster pumps be used to deliver filtered raw water only in future campaigns. Process condensate is not compatible with these booster pumps due to the presence of ammonia. It is also recommended that a search be made to find a pump that can tolerate the ammonia in process condensate. During the booster pumps operational test, the system was not isolated from the process. As the result, MCS interlocks were activated to shut down PB-I and reboiler steam supply valve FV-EA1-1. Inactivation of MCS interlocks is needed prior to any equipment/instrumentation tests during the evaporator operation.

Inadvertent pot dump

On August 7, while troubleshooting vessel density DI-CA1-2 plugging, pump PB-1 was put on interval on-and-off operations to prevent solids settling and increase in vessel temperature. During these operations, the MCS interlock #2 was not bypassed. As the results, approximately 2,500 gallons of slurry was inadvertently drained to 102-AW tank. To prevent recurrence, a MCS read alarm will be created to alert operations that PB-1 pump and its bypass are both off.

Low Steam Supply

Through the campaign, maximum obtainable steam flow rate into reboiler was approximately 25,000 lbs/hr. This is well below the rated capacity of JCI package boilers (29,000 lbs/hr). The pressure indication on the 10-pound steam supply to the reboiler was about 5 - 6 psia much lower than what package boilers delivered (11 psia). The lower steam supply pressure was a contributing factor to the low boil-off-rate observed during the campaign. The campaign maximum boil-off rate was 45 gpm, which was about 10 - 15 gprn lower than the average boil-rate from the previous campaigns. Possible causes include plugging steam strainer HV-H-10C and increased line losses on the steam supply to boilers. It is recommended that the steam strainer HV-H-10C should be cleaned prior to next campaign.

Loss of Tracetek Analog Signals

Throughout the campaign, the Tracetek analog signal was loss during the periods that evaporator slurry product was transferred to 106-AW tank. During the troubleshooting effort, it was discovered that the Tracetek analog signal LDI-A 1 went from 4 mA to 0 mA when slurry valve HV-CA1-2 was opened. Further investigations indicated that a ground loop (a ground connection between building and computer ground grids) might be one of the possible causes. A bad ground loop can have detrimental effects on other Evaporator MCS functions like communications. One possible solution has been found that eliminates the interference to the Tracetek signal, but further troubleshooting is required to find and isolate the noise.

CAMPAIGN 2000 POST RUN

PROBLEMS AND RECOMMENDATION

USQ Evaluation of HEPA Filter Efficiency

High Efficiency Particulate Air (HEPA) filters are relied upon for accident mitigation in the 242-A authorization basis (AB): a pre-filter with two stages of HEPA filtration per filter bank. The accident analysis took this configuration into account in the calculation of the dose consequences in that material released and receptor dose consequences were calculated based on multiple HEPA filtration, resulting in an assumed efficiency of 99.999%.

Prior to the campaign, Vent and Balance personnel using procedure 6-TF-156, HEPA Filter In- Place Leak Test, performed filter aerosol testing. The test was performed over the filter bank as a whole, with acceptable efficiency being at least 99.95%. Although the calculated exposures for accident mitigation with a 99.95% efficient filter system are well below the accepted risk evaluation guidelines in HNF-PRO-704. They were higher than those reported in the AB. The original safety analysis took credit for two banks of HEPA filtration. However, the basis of surveillance requirement 3.5.1.3 requires testing per ANSI Standard N510, which requires testing of individual banks of HEPA filters in series when multiple banks are credited. The physical configuration of the K1 exhaust ventilation system prohibits testing of individual banks of filters. As the results, the SAR was changed to reflect the new dose consequences of this accident that is re-calculated based on only a single bank of HEPA filtration.

High Antifoam flow

On April 21, antifoam flow rate was high and could not be controlled to a lower flow rate. The cause of the high antifoam flow was probably a sticky controller. The problem was eliminated by placing the local stroke controller override switch to "Manual" and adjusting the dial on the stroke controller manually to the lowest possible setting. Then, the local stroke controller override switch was placed back to "Auto". The antifoam flow controller FIC-EI02 was then freed up by raising and lowering flow rate set ppint. There was no indication the high antifoam flow affected the process.

Effluent Sampling Valve Upgrades

Due to the high pressure of steam condensate and cooling water sampling lines, taking small VOA bottle samples from the existing sampling valves 2-20 and RC 1-17 was very difficult. It was recommended during the campaign that these valves be replaced with needle valves to enable more control when filling the sampling bottles. In addition, process condensate brass valve 1-26 was identified having a small leak during the campaign. Visual observation of the valve indicated that the leakage was due to corrosion caused by incompatibility between brass component and ammonia in the process condensate. It was also recommended during the campaign that this valve be replaced with a stainless valve.

USQ Evaluation of Gravity Transfer of Slurry

Gravity transfer of slurry is used in certain situations where operation of slurry transfer pump PB-2 is not advised. During the campaign, slurry transfers by gravity greater than 1.3 g/ml were found to represent a change to the procedure described in 242-A Evaporator SAR, chapter 6, section 6.1.3.4.2. This procedure addresses potential plugging of the transfer line, which is not a design bases accident in Chapter 9 of the SAR. The concern over plug of the slurry line is addressed by performing critical velocity calculations, which is given in an AIChE journal article, "Critical Velocity in Pipeline flow of Slurries" (Oroskar 1980). The critical velocity is calculated in the Process Control Plan for Campaign 2000-1 based on density, particle size, viscosity, and other information and assumptions for the slurry stream. The Process Control Plan shows that the gravity slurry flow velocity (0.934 m/s) is greater than the critical velocity (0.418 m/s) for conditions in this campaign. Based on the evaluation, the slurry transfer by gravity was not a USQ. The limitation on slurry transfers by gravity for solutions with SpG greater than 1.3, in SAR Chapter 6, Section 6.1.3.4.2, will be revised during the next annual SAR review.

JCI Steam Boiler Problem

The primary factor of not achieving 100% TOE for this campaign was due to operation of JCI boiler problems. The problems occurred when the water softener regeneration failed and caused a shut down of 10 pounds steam supply to 242-A Evaporator. It is recommended that prior to a campaign, JCI should be contacted to have their water softeners checked and serviced, so that these softeners are ready and in good condition for the campaign.

Area Radiation Monitor (ARM) Alarm

On April 27, 2000, during feed and slurry sampling activities, an ARM alarm activated in the loadout room. The evacuation of personnel in the loadout room was performed immediately. Later, radiological surveys showed that there was no radioactive contamination or leaks in the loadout room. It was speculated that a radio being operated during the sampling was too close to the ARM may have set off the alarm. The sampling was then later resumed and completed without a problem.

Slurry Density & Slurry Sampler Problems

After the campaign startup, process control parameters were implemented to generate a slurry product of 1.40 SpG. A slurry sample was taken early in the campaign to evaluate product SpG. The analysis of the sample indicated a SpG of 1.37, which was lower than anticipated. Maintaining the same process control parameters, second slurry was taken a couple days later to insure compliance with operating specifications. The lab result of this slurry sample was 1.49, with the rerun was 1.44. This was much higher than expected. A rerun of the first slurry sample was then requested and later indicated a SpG of 1.42.

The uncertainty in SpG sample results was blamed on poor slurry sampler design and possible suspect lab analysis due to wide variances in SpG results. A backup plan was implemented to adjust slurry flow rate to obtain a final campaign WVR of 51%. The plan was carried for the rest of the campaign. Based on the pre-campaign boildown studies, this process adjustment effort would make overall slurry product SpG to be about 1.39. A more representative slurry sample was taken from 106-AW after completion of the campaign. The specific gravity result from a composite of two tank samples was 1.38. The actual slurry SpG was close to the predicted value from the pre-campaign boildown studies and was well below the flammable gas limit of 1.41 (Von Bargen 1998).

The problems with inaccurate evaporator density indicators (DI-CA1-I and DI-CA1-2) and with the existing sampler inability of taking representative slurry samples have been known since the early 80's. Density of slurry product was not a critical control parameter at that time since waste was allowed to be concentrated to sodium aluminate precipitation boundary. At his boundary, slurry SpG was usually around 1.5 - 1.7. An accurate on-line SpG indicator was not needed since the main purpose was to obtain a maximum waste reduction without exceeding its sodium aluminate boundary. This is no longer the situation after November 1, 1991, when slurry SpG limit of 1.41 was established to prevent potential flammable gas generation in the receiver tank. The problems with the density indicators and slurry sampler have not been fixed due to lacking of funding, prioritization, and ability to find instrumentation suitable for high radiation.

From past campaigns, the evaporator density indicators have been reading consistently higher than actual density of the waste, based on laboratory analysis. In addition, the indicators do not agree with each other. The discrepancy (DI-CA] -I minus DI-CA1-2) between the two averages was about 0.02. Since the dip tubes are located at the same elevations, this implies that differences in instrument calibrations or one of the tips of the dip tubes may have been damaged.

Similarly, based on past experience, a representative slurry sample is difficult to collect. One of main problems is inadequate flow through the entire sample loop causing solids buildup. This flow is driven by a low differential pressure (<4 psi) across the P-B-I

recirculation pump. The low differential pressure is caused by the position of sampler flow inlet nozzle in the 28-in recirculation loop. This nozzle is installed backward, which is the same direction of the flow. If the nozzle inlet were installed against the flow direction, a much higher dP across sampler would be obtained. The intent of the original design of installing the nozzle backward was to keep solids from plugging in sample loop.

In addition to the inadequate sample loop flow, the current slurry sample arrangement positions the sampler head approximately one foot below the sample inlet and outlet connections. This arrangement tends to make the area around the sampler head become a solids trap. If the sample loop is not flushed adequately prior to sampling, then the sample would have a much higher density than the actual slurry product, as shown in slurry samples with unusually high SpGs from several past campaigns. If a sample were collected too early after line flushing, then the sample would be diluted. One additional problem is that the correct position of the sample loop valve HV-F2-3 is still uncertain for taking of representative slurry samples. An entry into the sampler room just prior to the campaign 2000-1 was made to determine the position of this valve. The flow test was somewhat inclusive but lead to believe that the HV-F2-3 valve is leaking by heavily.

Slurry SpG is one of the main process control parameters for the evaporator. Accurate SpG results of slurry product is needed to maximize waste volume reduction. Efforts have been taken in the past to develop several SpG models and used to predict the slurry product prior to and during the campaign. However, it was found that the some models worked for some waste streams but not for others.
Until a new slurry sampler and/or good reliable vessel SpG monitors are installed at the evaporator, it is difficult to achieve precise WVRF using the existing evaporator SpG indicators and slurry sample SpG from F-2 slurry sampler. It is recommended that overall SpG will be primarily based on pre-campaign boildown data (i.e. WVRFs, pressure, temperature, and etc.).

Batch Operation of the Slurry Pump

During the campaign, gravity slurry transfers were made by batch operation of slurry pump. This reduced wear on the leaking slurry transfer valves HVCA1-2 and -2A. Batch operation of the slurry pump was found to be the primary process disturbance that caused the automatic feed flow to fluctuate and be unresponsive controller during the campaign. Additional process problems with batch slurry operation are: (1) wide liquid level fluctuations in the evaporator vessel, which caused occasional level alarms; (2) fluctuation in the specific gravity of the slurry, which made it more difficult to maintain the target specific gravity; (3) inability to reach process steady state, which make it more difficult to detect other process disturbances that are masked by the batch-induced disturbance. Batch operation of the slurry pump can be eliminated by using slurry transfer by continuous gravity flow or using of continuous slurry operation with recycling of the slurry to the feed tank as needed or at lower slurry flow rate (< 42 gpm).

Pump PC-105-A leakage

Booster pump PC-105-A was found to have a mechanical seal leak during the campaign. This pump provides seal water to vessel recirculation pump PB-1 and slurry pump PB-2. The pump was used occasionally during campaign to assist the process

condensate recycle pump P-C 106 deliver adequate pressure for the PB-1 and PB-2 pump seals. The cause of the seal leak was probably corrosion caused by the ammonia content in the process condensate. It is recommended that the seal is replaced and the system is flushed of all process condensate with raw water at shutdown. It is also recommended that the pump be replaced with a new pump that is compatible with ammonia-bearing solution.

High pressure in feed tank

Based on the 102-AW pressure and feed flow data obtained during the campaign, some pressurization in the feed tank during the campaign occurred, probably caused by operation of air-lift circulators (ALCs) and erratic feed flow as a result of batch slurry operation. The data showed that the tank pressure stabilized at a lower pressure when a continuous slurry flow was implemented at the end of the campaign and after the 102-AW ALCs were shut down. Since the feed tank pressure trip point was near the operating pressure, it is recommended that the pressure trip point may be set lower or feed tank vacuum be optimized by 241-AW vent system prior to the campaign.

Process Condensate Model Validation

The flow sheet model has been used to pre-determine process condensate generation during a campaign to ensure it is compliant with LERF radiological limits. Three sets of field and process condensate samples were taken during the evaporator run with an intent that the data obtained from the samples would be useful for process condensate model verification using the evaporator flow sheet. The process condensate and feed streams were sampled within several hours of each other during evaporator equilibrium.

Based on the analytical data results from these samples, most of the projected process condensate radionuclides by the flow sheet were near to actual sample data. Only C-14, Sr-90, and Tc-99 were too conservatively projected, the predictions being a couple orders of magnitude above the actual data. It is recommended that a correction factor of' 1.0E-02 will be used when projecting concentrations of C-14 and Sr-90, and a correction factor of 1.0E-05 for Tc-99. Several radionuclides in the process condensate were below the detectable quantities. The model validation of these undetected constituents can not be performed. These radionuclides may be validated if they are detected in future campaign feed.

Raw Water Leak into CA-1 Vessel

An in-leakage of raw water into the CA-1 vessel was discovered 25 days after completion of campaign 2000-1. The leak appears to start on June 1 with a rate of 0.35 gpm. The source of the leak was determined to be raw water valve RWV- 11 in the AMU room was not closed. This valve is normally closed after slurry sampling is finished per TO-630-001, step 6.3.64. An additional test was conducted on August 8 indicating that one or more of the three isolation valves (HV-F2- 1, HV-F2-2, and HV-F2-5) located downstream of RWV-11 have damaged seats. Manipulation of the valves during trouble shooting activities may have dislodged debris thus allowing the valves to close properly. Having three isolation valves rebuilt or replaced would be difficult and costly because they are in high radioactive area and poor configuration. Since closing valve RWV-11 stops the in-leakage of raw water, it is recommended that RWV- 11 be closed when the feed and slurry samplers are not in use per TO- 630-001 and continue observing system

performance if there is any observable degradation of the three isolation valves, rebuilding/replacing of these valves will be reconsidered.

Evaporator Facility Upgrade List

A. Recommended Punch List for Future Campaigns
• Change MCS logic's & operating procedures to operate PB-2 pump below 42 gpm for better WVR controls.
• Evaluate sampling needs.
• Replace seal for booster pump PC-105A (work package # EL00-512).
• Replace sample valves RC1-17 (SC), 2-20 (CW), 1-20 (PC), and leaking brass valves on PC system (work package #EL98-405).
• Replace broken ammonia monitor filter.
• Add pH and conductivity calibrations to the recall list.
• Replace leaking sock filter F-CA1-L
• Eliminate data collection redundancy in TO-600-040 and TO-600- 101.
• Resolve/Plan post transfer flushing with RPP (Tank Farms Contractor).

B. Engineering Studies:

High Priority
New on-line slurry density monitors: Investigate alternative on-line density monitors replacing the existing inaccurate density indicators.

Medium Priority
• Slurry sampler upgrade/replacement: Upgrade or replacement is needed to collect representative slurry product samples.
• EC- 1 corrosion study: A study will be performed to determine if the new stainless steel EC- 1 condenser life will last through 2019 after replacement in order to fully support vitrification project.
• 42-in vapor header bellows: A corrosion study is needed to determine the remaining life of the 42-in vapor header bellows can support the vitrification project.
• Ducts and filter housing: A corrosion study is needed to determine the remaining life of the outside/underground ducts and filter housing in support the vitrification project.

Low Priority
• Air compressor closed-loop cooling: Study is needed to evaluate the cost savings of closed-loop for the air compressors.

C. Facility Repairs and Upgrades:

High Priority
• Install electric actuators on hard to open raw water valves (on Safety Council list)

Medium Priority
• Slurry jumper: Fabricate new slurry jumper.
• EC- 1 condenser replacement: Install the new stainless steel primary condenser that was purchased in the last evaporator upgrade project B-534.
• HVAC upgrade: Replace the K 1 ventilation control system and the evaporative cooler.
• IX column: Dispose contents of IX column.
• Effluent radiation monitors: Replace the radiation monitor in the process condensate system, the raw water system, and the steam condensate system.
• Building roof replacement: Replace the conventional built-up roof.

• Electrical upgrade: Install new 200A electrical distribution panels and redistribute the existing loads to relieve the current overload problems.
• Steam traps: Replace the existing steam traps with better ones.

Low Priority
• Slurry flowmeter replacement in slurry sampler loop: Install a new slurry flowmeter.
• Computer training simulator system: Upgrade the Simulator system for cold run training.

CAMPAIGN 2001-01 POST RUN

PROBLEMS/RECOMMENDATIONS

Earthquake.

At 10:54 AM on February 28, 2001, the Nisqually Earthquake was felt in the 242-A Building. Steps in Emergency Procedure (EP) EP-685-040, for a seismic event, were performed: cooling water to the EC-1, EC-2, and EC-3 condensers was shut down and all personnel were evacuated from the building. There were no fires or loss of containment, no radiation alarms, no loss of electrical service, no loss of building ventilation. The EP was properly followed and no damage was observed at the time. However, approximately 2-3 months after the seismic event, operators found some cracks in the condenser room walls. Engineering performed a walk-through inspection of the cracks and determined that there was no loss of containment and the integrity of the concrete walls is good. Engineering is organizing an inspection and evaluation of the cracks by an experienced civil/structural engineer before the next campaign.

Tank Farm Material Balance Calculations.

An error was discovered in the method used to calculate Tank Farm material balances. Water is added to the evaporator vessel via the slurry flush line. The material balance program assumes water going into the slurry flush line goes to tank 106-AW when, in fact, it can go to either 106-AW or the evaporator vessel, depending on the position of flush valve HV-CA1-2. The material balance program (and procedure TO-600-101) have steps which allows the user to correct for flush water additions to Tank Farms, but the wording of the prompt does not make it clear what needs to be done. Filling the evaporator vessel results in a significant error in the material balance (greater than the 5000 gallons allowed by the procedure).

A second, less significant, error occurs during the cold run. The seal water pumps are interlocked to shutdown on low seal water flow to the slurry pump, P-B-2. Because the slurry pump is not operated during the cold run, a false slurry pump seal water flow of about 1.5 gallons per minutes is entered into the MCS to prevent the interlock from engaging. The material balance program includes this false flow as waste going to tank 102-AW.

K1 Ventilation Monitoring System Failures.

On March 14, 2001, when restarting the building supply fan, which had been shut down because high winds were affecting building pressures, both building exhaust fans were momentarily shutdown. Exhaust fan K1-5-2 was immediately restarted, but building

exhaust radiation monitor trouble alarm, QXS-K1, annunciated in the control room. Facility personnel entered OSR Limiting Condition for Operation (LCO) 3.5.1 (Campbell 2000), which allows for one hour of continued operation to restore the system or to shut down the feed and slurry transfers. The trouble alarm was caused by failure of the record sampler vacuum pump. The record sampler line was temporarily tied into the alpha Continuous Air Monitor (CAM) vacuum pump, clearing the alarm within one hour. Later that day, the record sampler vacuum pump was replaced.

A second alarm on the K1 ventilation system occurred during this period. An over range alarm on the building exhaust flow indicator, FI-K1 -1, was occurring intermittently. An over range alarm indicated the flow transmitter was no longer sending a signal in the normal range of 4 to 20 milliamps. The exhaust fan was still providing airflow, but the flow transmitter was not working properly. Procedure TF-OR-OSR-01 requires entering LCO 3.5.1 if no airflow is detected on FI-K1-1. Operations met the requirements of the LCO by shutting down the feed transfer from tank 102-AW (the slurry flow had not yet started). Procedure TF-OR-OSR-01 was modified to allow operation without FI-K1-1 provided the operator performing the surveillance verifies the exhaust fan is operating.

Steam Supply Problems.

During the cold run and campaign, there were several instances where steam supply problems adversely impacted 242-A Evaporator operations:
• On March 5, 2001, Johnson Controls, Inc. (JCI) shut down 10 pounds per square inch (psig) steam to the 242-A Building. At the time, the evaporator vessel was filled with water in preparation for the initial boiloff of the cold run. Upon loss of steam, the operators performed shutdown of cooling water to the condensers.
• On March 15, 2001 the steam flow to the reboiler was reduced from 26,500 lbs/hr to 24,000 lbs/hr to prevent excessive foaming while the anti-foam line was plugged. During the next shift, the control room operator noticed the steam supply flow had dropped even more and raised the flow back to 24,000 lbs/hr. The drop in steam flow was likely due to JCI performing regeneration of their boiler. When the regeneration was completed, the steam flow increased without any adjustments by the control room operator. This surge in steam flow contributed to foaming problems in the evaporator caused by loss of anti-foam flow (see below).
• On March 16, 2001, the 242-A Evaporator experienced difficulty maintaining steam flow while the steam condensate pH fluctuated between 5.8 and 8.5. JCI was contacted, but they did not believe they were the source of the problem. On March 17, the steam flow and pH returned to normal. When contacted on March 18, JCI admitted the problems were due to a faulty chemical addition valve on their system.
Although these incidents are separate events, in each case poor communication between JCI and 242-A Evaporator contributed to the problems.

Anti-Foam Transfer Line Plug.

The transfer line between the anti4oam tank and the evaporator vessel plugged on March 15, 2001. Operation continued on reduced boiloff until the line was cleared. Plugging of the transfer line is common and several fixes have been suggested, including using water in the anti- foam tank during the cold run and installing a flush system for the transfer line.

EC-2 Intercondenser Leak.

A steady rise was noticed in tank TK-C-100 level after completion of the campaign. Troubleshooting determined there was a small raw water leak (less than one gallon per minute) in the EC-2 Intercondenser tubes. Isolating the system stopped the leak, but the condenser will have to be replaced if the leak worsens. No replacement schedule has been established. The adjacent EC-3 Aftercondenser will be replaced at the same time.

Miscalculated Flush Volume to Tank 102-AW.

A Waste Stream Profile Sheet for the wastes going to Tank Farms during the campaign stated the campaign would transfer 27,500 gallons of flush water to 102-AW (Lechelt 2001). In fact the campaign transferred 36,700 gallons of flush water. Because of the difference, Tank Farms had to reevaluate their calculations of tank content. In the future, a reasonable maximum flush volume will be provided to Tank Farms in the Waste Stream Profile Sheet.

ATTACHMENT 12

OCCURRENCE SUMMARY

(5 Pages)

Attachment 12
Occurrence Summary

Occurrence Report No.	Date of Occurrence	Nature of Occurrence	Actions Taken/Results
RP--CHG-TANKFARM-2002-0014	1/28/2002	During Saltwell pumping of tank 241-A-101, catch tank A-350 local and remote level indicators were de-energized at the 242-A Evaporator during scheduled maintenance. Tank farm personnel did not anticipate this loss of level indication. Monitoring of A-350 level is required by procedure T0-210-200, "Perform 241-A-101 Saltwell Pumping." A-350 catch tank level instrument is a safety significant component required to be operable per Tank Farms Technical Safety Requirements, Administrative Control (AC) 5.12, "Transfer Controls," during physically connected waste transfers.	Secured Saltwell pumping at tank 241-A-101 at 10:30. Initiated Management investigation. The cause was verified to be electrical isolation at 242-A Evaporator due to a scheduled maintenance activity. Power was restored to catch tank A-350 level indication at 1520, and 241-A-101 Saltwell pumping was restarted.
RP--CHG-TANKFARM-2004-0020	4/6/2004	Three breakers to be tested/refurbished for reinstallation in 242-A per work package EE-04-00318 were found to have suspect/counterfeit fasteners.	Issued non-conformance report CH-04-NCR-017 Initiated Problem Evaluation Request 2004-1992 Notified facility manager and engineering
RL--WHC-TANKFARM-1996-0011	1/22/1996	Inadequate work release at 242-A Evaporator results in near miss electrical incident	At 1445, Evaporator Operations Management discovered that the events involving the lockout and tagout on HY-CA1-7 solenoid were an occurrence. Evaporator Management then verified that the HY-CA1-7 solenoid valve was in a safe condition, work had been completed and the valve was re- energized
RL--WHC-TANKFARM-1993-0020	2/5/1993	Planned circuit outage at 242-A causes evaporator slurry line control valves to fail open, allowing ~8,000 gallons of water into 241-AW-106.	As an immediate corrective action, the raw water isolation valve upstream of the slurry line flush control valve was closed to prevent further inadvertent raw water discharges.
RL--WHC-TANKFARM-1994-0020	4/11/1994	Routine radiological survey of 242-A Evaporator change room results indiscovery of 6000 DPM Beta/Gamma contamination on work jacket	On 4/8/94, at 0215, the jacket was bagged and a thorough survey of the surrounding area was conducted with no further contamination being detected. On 4/8/94, at 0245, a resurvey of the area showed no change in activity level and no alpha contamination was detected. On 4/8/94, the contaminated portion of the jacket was removed and sent tc the lab for analysis. On 4/9/94, at 0500, a survey of the operator's locker was conducted, with no contamination being detected.
RL--WHC-TANKFARM-1994-0021	4/18/1994	Low seal water flow to PB-1 pump results in 242-A Evaporator process interruption	On 4/17/94, at 2340, seal water low pressure alarms were received. Multiple alarms were received, which immediately cleared after each alarm. On 4/17/94, at 2347, backup seal water pump was placed in operation in manual mode. On 4/17/94, at 2348, seal water pump "Start-Fail" indications were received on both seal water pumps. On 4/17/94, at 2350, while attempting to reset the "Start- Fail" indications on one pump per Alarm Response Procedure (ARP), seal water flow to PB-1 pump dropped to the low alarm setpoint, resulting in activation of the PB-1 interlock shutdown. This resulted in process interruption.

Attachment 12
Occurrence Summary

Occurrence Report No.	Date of Occurrence	Nature of Occurrence	Actions Taken/Results
RL–WHC-TANKFARM-1994-0021 (Continued)			On 4/17/94, at 2355, the 242-A Evaporator was placed in recirculation mode with vacuum, feed and slurry secured. On 4/18/94, at 0010, sock filters associated with the seal water system were switched and cleaned. The seal water system was verified as operating normally. On 4/18/94, at 0130, normal startup of the 242-A facility was initiated.
RL–WHC-TANKFARM-1994-0024	5/2/1994	Exit survey through portal monitor (PCM-1B) at 242-A Evaporator results in discovery of contamination on work jacket.	On 05/01/94, at approximately 1815, the jacket was bagged and a thorough survey of the area was conducted. This survey included retracing the steps of the DOE employee. No additional contamination was found. On 05/01/94, at 2120, HPT's completed a survey of all work jackets in the 242-A Evaporator. The results of this survey also indicated no additiona contamination. On 05/01/94, the contaminated portion of the work jacket was sent to the 222-S laboratory for analysis.
RL–WHC-TANKFARM-1994-0025	5/12/1994	Steady state boil-off rate at 242-A Evaporator unattainable over past 48 hours due to high-high alarm conditions across deentrainment pad.	On 5/10/94, at 1400, plant vacuum was lowered to 50 torr. This was in order to achieve greater boiloff control. Also completed efforts to tune the air bleed controller for valve HV-CA1-7 for similar reasons. On 5/10/94, at 1833, high pressure across the lower pad was experienced shutting down the plant. On 5/11/94, at 0145, the lower pad DP transmitter was cleaned and recalibrated. On 5/11/94, at 0930, the Process Memo was changed to place plant vacuum at 70 torr based on laboratory boildown study. The study showed occurrence of foaming at 40 torr at onset of boiling, but no foaming at 60 or 80 torr at onset of boiling. On 5/11/94, after further engineering review of the process upsets, the most probable cause is concluded to be foaming in CA1. A plan of action to prevent further process interruptions was developed.
RL–WHC-TANKFARM-1993-0064	7/29/1993	Inadequate test procedure results in failure of 242-A Evaporator Condensate Pump P-C100	On 07/28/93 at 0500 hours troubleshooting confirmed that the therma overloads for P-C100 were not in place. On 07/28/93 at 0800 hours the overloads were installed. On 07/28/93 at 0835 hours P-C100 pump started successfully.

Attachment 12
Occurrence Summary

Occurrence Report No.	Date of Occurrence	Nature of Occurrence	Actions Taken/Results
RL–WHC-TANKFARM-1993-0067	8/1/1993	Loss of power at 242-A Evaporator as a result of an automatic transfer switch (ATS) failure during drill.	On 07/30/93 at 1630 hours, a loss of primary power drill was initiated tc 242-A. The Automatic Transfer Switch failed to switch from normal power tc the emergency backup diesel power, therefore, the drill was terminated On 07/30/93 at 1700 hours, 242-A was returned to normal power and al conditions verified in a safe configuration. On 07/31/93 at 2330, The Shift Operations Manager received final approva for a priority 1 work package to repair the Automatic Transfer Switch. On 08/01/93 at 0730 hours, two electricians started troubleshooting efforts on the Automatic Transfer Switch. Poor drawings and Certified Vendor Information (CVI) made troubleshooting efforts difficult. After many hours of troubleshooting and several attempts at transfer of loads, it was determined additional engineering and vendor support would be required foı the Automatic Transfer Switch. On 10/26/93 and 10/27/93, the vendor arrived to aid in the resolution of the Automatic Transfer Switch problems.
RL–WHC-TANKFARM-1993-0109	12/9/1993	Access door to a high radiation area at 242-A Evaporator found to be unlocked resulting in a nonconformance to administrative controls.	On 12/08/93 at 1015 hours, the HPT notified an Operations supervisor that the access door was unlocked. On 12/08/93 at 1025 hours, a visual search of the high radiation area was conducted and the door was subsequently locked close. A review of operations log determined the last entry into the high radiation area occurred on 12/04/93 at 1430 hours to perform a valve line-up. Corrective Actions Taken: 1. Implemented second checker verification on 242-A Evaporator high radiation area access doors to ensure proper lock and closure until the corrective actions #2 and #3 can be completed. 2. Installed self-locking door hardware to ensure high radiation area doors remain locked at all times. Note: Crash bars will allow personnel to the exit the areas if evacuation is required. 3. Revised the High Radiation Area key access control log to require a signature from the person returning the key to signify that the High Radiation Area was properly locked close.

Attachment 12
Occurrence Summary

Occurrence Report No.	Date of Occurrence	Nature of Occurrence	Actions Taken/Results
CH2M-PER-2007-0805 Evaporator Vessel, C-A-1	4/30/2007	The videos taken at the 732'-6" level of the Evaporator Room shows the upper support ring of the C-A-1 vessel and its attachment to the building structural framing. The upper rings are attached to the building framing with 4-1.75" diameter guide pins spaced equally around the vessel (90 degrees apart). Each pin has a washer and a cotter pin at each end where it protrudes from the vessel support rings. The guide pins are to restrain horizontal motion of the vessel. They are not required to restraint vertical motion. The cotter pins function to keep the guide pin from sliding out of the vessel support ring. One of the guide pins does not show both ends of the top cotter pin. It appears to have moved downward about 1/4". The head of the cotter pin is still visible, retaining the top washer and the guide pin assembly.	Pertinent drawings and calculations were reviewed. The design purpose for the guide pin is satisfied as long as the top remains above the bottom of the upper guide ring. That would mean that the present situation is acceptable as long as the pin does not drop about 1". The photo shows about 1/4" drop (assuming it was installed as shown on the drawings initially) after 30 years of service since the top of the guide pin is stil restrained. Even if the pin were to drop through, the calculations only take credit for two of the four pins when determining response to a seismic event. Based on this, there is no immediate safety or operational concern. This should have no negative impact to the next campaign. It is recommended that the pin be driven from below until a new washer and cotter pin can be installed after the next Evaporator campaign.

ATTACHMENT 13

242-A PROCEDURES MASTER INDEX AND OWNERS LIST

(10 Pages)

242-A Master Index

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:	
242-30-002	E	3	1/10/2007	COLD WEATHER PROTECTION SURVEILLANCE	242-A	RINGO	HASTY	
242-65G-001	B	1	1/10/2007	RADIOLOGICAL CATCH CONTANER USAGE AT 242-A EVAPORATOR	242-A	RINGO	HASTY	
242-65J-002	I	2	1/4/2007	SAMPLING OPERATIONS AT 242-A EVAPORATOR	242-A	RINGO	HASTY	
242-85B-005	O	13	2/2/2007	SAFETY EQUIPMENT INSPECTIONS AND OPERATIONAL CHECKS	242-A	RINGO	HASTY	
3-RM-652	H	7	11/30/2006	RC3 RADIATION MONITOR/DIVERSION SYSTEM FUNCTIONAL CHECK	242-A	MELDROM	WRIGHT	
3-RM-653	H	3	11/30/2006	K1 VENTILATION SYSTEM FUNCTIONAL CHECK	242-A	MELDROM	WRIGHT	
3-RM-654	G	5	11/30/2006	RC1 RADIATION MONITOR FUNCTIONAL CHECK	242-A	MELDROM	WRIGHT	
3-VB-656A	A	2	9/22/2004	APPENDIX A, 242-A HOT CELL EXHAUSTER 296-A-21 HEPA FILTER AEROSOL TEST DATA SHEETS		242-A	RAVENCRAFT	WRIGHT
3-VB-656B	A	2	9/22/2004	APPENDIX B, 242-A AS-1 AIR SAMPLER HEPA FILTER AEROSOL TEST DATA SHEETS	242-A	RAVENCRAFT	WRIGHT	
3-VB-656C	A	3	9/22/2004	APPENDIX C, 242-A VESSEL VENT INLET FILTER AEROSOL TEST DATA SHEETS		242-A	RAVENCRAFT	WRIGHT
3-VB-656D	A	2	9/22/2004	APPENDIX D, 242-A VESSEL VENT FILTER AEROSOL TEST DATA SHEETS		242-A	RAVENCRAFT	WRIGHT
3-VB-657A	C	0	3/6/2006	APPENDIX A, 242-A HOT CELL EXHAUST STACK 296-A-21 AIR FLOW TEST DATA SHEETS		242-A	RAVENCRAFT	WRIGHT
3-VB-657B	C	1	1/3/2007	APPENDIX B, 242-A VESSEL VENT EXHAUSTER STACK 296-A-22 AIR FLOW TEST DATA SHEETS	242-A	RAVENCRAFT	WRIGHT	
3-VBP-656	A	2	9/22/2004	242-A EVAPORATOR HEPA FILTER IN-PLACE LEAK TEST (AEROSOL TEST)		242-A	RAVENCRAFT	WRIGHT
3-VBP-657	C	1	10/31/2006	242-A EVAPORATOR STACKS AIR FLOW TEST	242-A	RAVENCRAFT	WRIGHT	
6-CVT-715	A	0	7/27/2006	AW MODEL IFI-420 FLOW TRANSMITTER VERIFICATION AND CALIBRATION		242-A	MELDROM	WRIGHT
6-FCD-716	A	0	8/4/2006	CALIBRATE ROSEMOUNT 8712D MAGFLOW TRANSMITER FT-CA1-4 AT 242-A		242-A	MELDROM	WRIGHT
ARP-T-601-010	E	4	10/17/2006	RESPOND TO GRAPHIC #10 ALARMS AT THE 242 A	242-A	RINOG	HASTY	

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:
ARP-T-601-011	F	1	1/3/2006	RESPOND TO GRAPHIC #11 ALARM AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-012	G	7	11/9/2006	RESPOND TO GRAPHIC #12 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-013	E	2	8/15/2006	RESPOND TO GRAPHIC #13 ALARMS AT THE 242-A EVAPORATOR	242-A	JARECKI	HASTY
ARP-T-601-014	C	6	1/3/2006	RESPOND TO GRAPHIC #14 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-015	F	1	9/22/2005	RESPOND TO GRAPHIC #15 ALARMS AT THE 242-A EVAPORATOR	242-A	JARECKI	HASTY
ARP-T-601-016	D	4	8/21/2006	RESPOND TO GRAPHIC #16 ALARMS AT THE 242-A EVAPORATOR	242-A	JARECKI	HASTY
ARP-T-601-017	E	3	1/6/2006	RESPOND TO GRAPHIC #17 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-018	F	0	1/15/2007	RESPOND TO GRAPHIC #18 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-019	F	0	8/30/2004	RESPOND TO GRAPHIC #19 ALARM SAT THE 242-A EVAPORATOR	242-A	JARECKI	HASTY
ARP-T-601-020	E	4	2/23/2006	RESPOND TO GRAPHIC #20 ALARMS AT THE 242-A EVAPORATOR	242-A	JARECKI	HASTY
ARP-T-601-021	E	0	2/10/2005	RESPOND TO GRAPHIC #21 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-023	H	5	2/9/2006	RESPOND TO GRAPHIC #23 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-024	E	0	6/17/2004	RESPOND TO GRAPHIC #24 ALARMS AT THE 242-A EVAPORATOR	242-A	JARECKI	HASTY
ARP-T-601-044	F	9	5/18/2006	RESPOND TO GRAPHIC #44 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-064	F	1	12/12/2003	RESPOND TO GRAPHIC #64 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-081	D	6	3/17/2006	RESPOND TO GRAPHIC #81 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-270	E	0	4/1/2005	RESPOND TO GRAPHIC #270 ALARMS AT THE 242-A	242-A	RINGO	HASTY

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:
ARP-T-601-272	D	5	3/17/2006	RESPOND TO GRAPHIC #272 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-273	D	2	4/27/2005	RESPOND TO GRAPHIC #273 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-274	E	0	3/17/2005	RESPOND TO GRAPHIC #274 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-290	F	0	3/4/2005	RESPOND TO GRAPHIC #290 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-292	D	6	9/22/2005	RESPOND TO GRAPHIC #292 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-294	E	4	8/2/2005	RESPOND TO GRAPHIC #294 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-295	E	2	9/19/2005	RESPOND TO GRAPHIC #295 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-300	E	1	8/2/2005	RESPOND TO GRAPHIC #300 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-301	E	5	9/19/2005	RESPOND TO GRAPHIC #301 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-302	E	1	9/19/2005	RESPOND TO GRAPHIC #302 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-303	D	12	9/19/2005	RESPOND TO GRAPHIC #303 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-304	D	4	9/19/2005	RESPOND TO GRAPHIC #304 ALARMS AT 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-320	G	1	8/10/2005	RESPOND TO GRAPHIC #320 ALRAMS AT THE 242-A EVAPORATOR	242-A	JARECKI	HASTY
ARP-T-601-321	D	2	4/14/2004	RESPOND TO GRAPHIC #321 ALRAMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-322	D	2	3/11/2004	RESPOND TO GRAPHIC #322 ALRAMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-323	D	3	3/11/2004	RESPOND TO GRAPHIC #323 ALRAMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-340	D	4	8/2/2005	RESPOND TO GRAPHIC #340 ALRAMS AT THE 242-A	242-A	RINGO	HASTY

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:
ARP-T-601-341	E	0	1/5/2006	RESPOND TO GRAPHIC #341 ALRAMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-343	E	4	8/1/2005	RESPOND TO GRAPHIC #343 ALRAMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-344	D	4	8/1/2005	RESPOND TO GRAPHIC #344 ALRAMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-AB1	E	9	6/1/2006	RESPOND TO PANEL# AB1 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-AB2	F	2	8/15/2005	RESPOND TO PANEL #AB2 ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
ARP-T-601-EDG	D	2	3/17/2006	RESPOND TO LOCAL DIESEL GENERATIOR ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
DC-AOP-EVAP-001E	C	0	4/20/2006	EMERGENCY SHUTODWN OF K1 VENTILATION SYTEM	242-A	RINGO	HASTY
DC-AOP-EVAP-006	B	3	10/17/2006	LOSS OF COMPRESSED AIR SYSTEM	242-A	RINGO	HASTY
DC-EVAP-001A	B	0	2/22/2002	EMERGENCY SHUTDOWN OF ELECTRICAL POWER	242-A	RINGO	HASTY
DC-EVAP-001C	B	1	7/7/2006	EMERGENCY SHUTDOWN OF RAW WATER SYSTEM	242-A	RINGO	HASTY
DC-EVAP-001D	B	0	12/6/2001	EMERGENCY SHUTDOWN OF SANITARY WATER SYSTEM		242-A	RINGO HASTY
DC-EVAP-001F	B	0	12/6/2001	EMERGENCY SHUTDOWN OF K2 VENTILATION SYSTEM	242-A	RINGO	HASTY
DC-EVAP-001G	B	0	12/6/2001	EMERGENCY SHUTDOWN OF CONTROL ROOM VENTILATION SYSTEM AND SHIFT MANAGER'S OFFICE HEAT PUMP	242-A	RINGO	HASTY
DC-EVAP-001J	B	0	12/6/2001	EMERGENCY SHUTDOWN OF FIRE PROCTECTION (SPRINKLER) SYSTEM AND TELEPHONESYSTEM	242-A	RINGO	HASTY
EL18003	B	1	11/22/2006	242-A STACK SAMPLERCABINET FUNCTIONAL CHECK	242-A	MELDROM	WRIGHT
EL18011	E	1	11/29/2006	HONEYWLL/LEEDS AND NORTHRUP MODEL 7082 pH ANALYZER/CONTROLLER	242-A	MELDROM	WRIGHT
EL18012	B	1	11/29/2006	BROOKS MAGLITE ELECTROMAGNETIC FLOWMETER	242-A	MELDROM	WRIGHT
EL18014	A	1	9/11/2003	BROOKS FLOWINDICATING TRANSMITTERS FOR 242-A	242-A	MELDROM	WRIGHT
EL18021	B	2	11/29/2006	242-A LIQUID EFFLUENT MONITORS	242-A	MELDROM	WRIGHT
EL18022	A	2	8/25/2004	FOXBORO E69 SERIES CURRECNT-TO-PNEUMATIC CONVERTERS	242-A	MELDROM	WRIGHT

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:
EL18027	B	1	11/29/2006	BRISTOL ISOLOK SERIES SAB SAMPLER WITH INPUT MODULE -E OR -G	242-A	MELDROM	WRIGHT
EL18037	C	1	10/3/2006	FISCHER GOVERNOR 543 AND FISCHER CONTROL 546 E/P TRANSDUCTER	242-A	MELDROM	WRIGHT
EL18040	B	2	8/24/2006	FOXBORO INTELLIGENT TRANSMITTERS	242-A	MELDROM	WRIGHT
EL18041	B	1	11/29/2006	BROOKS MODEL 4023 DIFFERENTIAL INDUCTANCE FLOW CONVERTER	242-A	MELDROM	WRIGHT
EL18042	D	1	11/29/2006	VALTEK ELECTRO VALVE POSITIONER AND	242-A	MELDROM	WRIGHT
EL18043	B	2	10/30/2006	DIFFERENTIAL PRESSURE TRANSMITTER FOR 242-A	242-A	MELDROM	WRIGHT
EL18044	C	1	11/1/2006	BROOKS MODEL 1110-6200 INDICATING FLOW METER FUNCTIONAL TEST	242-A	MELDROM	WRIGHT
EL18045	B	2	10/30/2006	MODEL 3560 SERIES III BROOKS MAG-FLOW CONVERTORS	242-A	MELDROM	WRIGHT
EL18046	C	1	10/5/2006	CANBERRA LIN -LOG RATEMETER MODEL 1481L	242-A	MELDROM	WRIGHT
EL18047	B	1	10/30/2006	SENSOTEC PRESSURE AMP/IIND	242-A	MELDROM	WRIGHT
EL18048	D	0	9/1/2006	ITT BARTON TURBINE METER FLOW TRANSMITTER SERIES 900	242-A	MELDROM	WRIGHT
EL18049	B	2	8/25/2004	PRINCO L-3610 TRANSMITTERS USED AT LWPF RETENTION BASINS	242-A	MELDROM	WRIGHT
EL18050	B	1	11/29/2006	ABSOLUTE PRESSURE TRANSMITTERS FOR 242-A	242-A	MELDROM	WRIGHT
EL18052	B	1	11/29/2006	ROCHESTER SERIES SC4372 TEMPERATURE TRANSMITTER FOR 242-A	242-A	MELDROM	WRIGHT
EL18054	B	1	11/30/2006	ROSEMOUNT MODEL 1151AP/GP ELECTRONIC PRESSURE TRANSMITTER	242-A	MELDROM	WRIGHT
EL18056	C	2	11/30/2006	MOORE IND. TCA/STD THERMOCOUPLE ALARM AND CONTROLLER	242-A	MELDROM	WRIGHT
EL18057	B	2	9/27/2007	BARTON MODEL 277A DIFFERENTIAL PRESSURE INDICATOR	242-A	MELDROM	WRIGHT
EL18058	C	2	11/30/2006	HONEYWELL/LEEDS AND NORTHRUP MODEL 7082 CONDUCTIVITY/RESISTIVITY ANALYZER/CONTROLLER	242-A	MELDROM	WRIGHT
EL18084	B	1	11/30/2006	PRESSURE TRANSMITTERS FOR 242-A	242-A	MELDROM	WRIGHT
EL18085	C	2	11/30/2006	FISCHER AND PORTER MAGNETIC FLOWMETER AND CONVERTER (MIN-MAG DESIGN), MODEL 10D1475	242-A	MELDROM	WRIGHT
EL18090	B	0	6/8/2006	ROCHESTER SERIES SC8300 TRANSMITTERS FOR 242-A	242-A	MELDROM	WRIGHT

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:
EL18094	A	1	10/1/2003	MOORE (PRV TYPE) PRESSURE TRANSMITTER	242-A	MELDROM	WRIGHT
EL18097	B	0	11/10/2006	IRD MECHANANALYSIS MODEL 5806 CHANNEL A CALIBRATION	242-A	MELDROM	WRIGHT
EL18100	A	1	10/1/2003	FOXBORO MODEL 69TA-2R CURRENT-TO-AIR TRANSDUCER		242-A	MELDROM WRIGHT
EL22035	B	2	9/12/2006	480 V SWITCHGEAR BUS INSPECTION AND TESTING	242-A	MELDROM	WRIGHT
EL22046	A	5	8/25/2004	CATERPILLAR STANDBY DIESEL GENERATOR AND ATS INSPECTION AND SERVICE	242-A	MELDROM	WRIGHT
EL22047	B	2	11/22/2006	CATERPILLAR DIESEL GENERATOR, 200 KW INSPECTON AND OPERATION		242-A	MELDROM WRIGHT
EL22052	D	0	6/27/2005	DS SERIES CIRCUIT BREAKER INSPECTION AND TESTING		242-A	MELDROM WRIGHT
EL22054	A	6	11/22/2006	242-A MITSUBISHI 2033C UNINTERRUPTIBLE POWER SUPPLY (UPS) BATTERY INSPECTION	242-A	MELDROM	WRIGHT
EL22055	A	3	11/22/2006	242-A MITSUBISHI 2033-C UNINTERRUPTIBLE POWER SUPPLY (UPS) FUNCTIONAL AND LOAD TEST	242-A	MELDROM	WRIGHT
EL23030	C	0	12/22/2006	SUPPLY AND EXHAUST FANS INSPECTION	242-A	MELDROM	WRIGHT
EL24015	A	6	8/23/2006	REGENERATIVE AIR DRYER INSPECTION AND MAINTENANCE	242-A	MELDROM	WRIGHT
TF-AOP-EVAP-001	C	1	1/11/2007	EMERGENCY SHUTDOWN OF UTILITY SUPPORT SYSTEMS		242-A	RINGO HASTY
TF-AOP-EVAP-002	C	3	1/10/2007	RESPONSE TO 242-A EVAPORATOR LOSS OF ELECTRICAL POWER		242-A	RINGO HASTY
TF-AOP-EVAP-003	C	1	8/15/2006	RESPONSE TO 242-A EVAPORATOR LOSS OF RAW WATER SYSTEM		242-A	RINGO HASTY
TF-AOP-EVAP-004	C	2	1/10/2007	RESPONSE TO 242-A EVAPORATOR LOSS OF K1 VENTILATION SYSTEM	242-A	RINGO	HASTY
TF-AOP-EVAP-005	C	1	8/15/2006	RESPONSE TO 242-A EVAPORATOR LOSS OF STEAM SYSTEM	242-A	RINGO	HASTY
TF-AOP-EVAP-006	C	6	8/15/2006	242-A EVAPORATOR LOSS OF COMPLRESSED AIR SYSTEM		242-A	RINGO HASTY
TF-AOP-EVAP-007	C	0	7/26/2006	242-A EVAPORATOR LOSS OF MCS CONTROL	242-A	RINGO	HASTY
TF-AOP-EVAP-008	C	2	1/4/2007	242-A EVAPORATOR PRESSURE HAZARDS	242-A	RINGO	HASTY
TF-AOP-EVAP-009	C	0	6/19/2006	RESPONSE TO PROCESS UPSET	242-A	RINGO	HASTY
TF-AOP-EVAP-013	C	1	8/15/2006	RESPOND TO VOLCANIC ERUPTION AND ASHFALL AT 242-A EVAPORATOR		242-A	RINGO HASTY

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:
TF-CC-690-001	J	7	2/16/2006	RC3-1RAD MONITOR LOOP VERIFICATION	242-A	RINGO	HASTY
TF-CC-690-006	J	0	1/17/2007	K1 STACK 296 A-21 FLOW MONITOR LOOP AND PUMP ROOM VERIFICATION AND CALIBRATION		242-A	RINGO HASTY
TF-CC-690-008	J	0	11/1/2005	RC-1 RAD MONITOR CHANNEL CALIBRATION	242-A	RINGO	HASTY
TF-ERP-EVAP-001	D	0	11/22/2006	242-A EVAPORATOR TAKE COVER	242-A	RINGO	HASTY
TF-ERP-EVAP-002	D	0	8/28/2006	242-A EVAPORATOR EVACUATION	242-A	RINGO	HASTY
TF-ERP-EVAP-004	E	0	7/25/2006	242-A EVAPORATOR BOMB THREAT	242-A	RINGO	HASTY
TF-ERP-EVAP-005	D	0	10/5/2006	EMERGENCY RESPONSE TO RADIOLOGICAL RELEASE AT 242-A EVAPORATOR		242-A	JARECKI HASTY
TF-ERP-EVAP-006	F	0	8/8/2006	242-A EVAPORATOR FIRE	242-A	RINGO	HASTY
TF-ERP-EVAP-008	E	0	9/21/2006	242-A EVAPORATOR SEISMIC EVENT	242-A	RINGO	HASTY
TF-ERP-EVAP-014	D	0	12/4/2006	242-A EVAPORATOR HIGH WINDS/TORNADO	242-A	JARECKI	HASTY
TF-FT-680-005	H	8	1/4/2007	SAMPLE CUBICLE LEAKDETECTOR LDE-SMPL-1, LDE-SMPL-2 FUNCTIONAL TEST	242-A	RINGO	HASTY
TF-OPS-022	B	4	1/4/2007	INSPECTIONS AND SOURCE CHECKS FOR 242-A STACK CAMS AND EFFLUENT RECORD SAMPLERS		242-A	RINGO HASTY
TF-OR-A-01	K	6	11/30/2006	242-A EVAPORATOR CONTROL ROOM ROUNDS	242-A	RINGO	HASTY
TF-OR-A-02	N	4	9/29/2006	242-A EVAPORATOR BACKSIDE ROUNDS	242-A	RINGO	HASTY
TF-OR-OSR-01	G	13	1/27/2005	242-A EVAPORATOR ENVIRONMENTAL VERIFICATION SURVEILLANCE	242-A	RINGO	HASTY
TF-OR-PWR-03	J	9	10/19/2006	242-A EVAPORATOR STATIONARY OPERATING ENGINEER ROUNDS		242-A	RINGO HASTY
TO-020-755	F	8	8/4/2006	RECORD STATUS OF FACILITY ALARM PANELS	242-A/WFO	JARECKI	HASTY
TO-230-225	C	1	9/25/2006	EVAPORATOR CAMPAIGN MONITORING FOR 241-AW TO 241-AP TRANSFER AND JETTING EVAPORATOR PUMP ROOM SUMP		242-A/WFO	PARNELLBADDEN
TO-600-005	A	4	1/22/2007	242-A EVAPORATOR OPERABILITY CHECKS	242-A	RINGO	HASTY
TO-600-010	O	18	1/4/2007	242-A EVAPORATOR INITIAL VALVING VERIFICATION	242-A	RINGO	HASTY
TO-600-015	H	7	1/8/2007	PERFORM INITIAL ELECTRICAL VERIFICATION FOR 242-A EVAPORATOR STARTUP		242-A	RINGO HASTY
TO-600-020	N	4	1/5/2007	PERFORM 242-A EVAPORATOR SYSTEM STATUS CHECK AND PRE-START OPERATIONS		242-A	RINGO HASTY

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:
TO-600-030	N	5	1/5/2007	START UP 242-A EVAPORATOR SYSTEM	242-A	RINGO	HASTY
TO-600-040	K	6	1/9/2007	MONITOR 242-A EVAPORATOR OPERATION	242-A	RINGO	HASTY
TO-600-055	J	3	2/2/2007	START UP AND SHUT DOWN 242-A STEAM SYSTEM	242-A	RINGO	HASTY
TO-600-060	N	5	1/5/2007	SHUT DOWN 242-A EVAPORATOR SYSTEM	242-A	RINGO	HASTY
TO-600-100	L	1	1/8/2007	CALCULATE 242-A MATERIAL BALANCE	242-A	RINGO	HASTY
TO-600-101	H	2	1/5/2007	PERFORM TANK FARM MATERIAL BALANCE DURING EVAPORATOR OPERATIONS	242-A	RINGO	HASTY
TO-600-130	G	3	1/9/2007	OPERATE 242-A-81 RAW WATER STRAINER SYSTEM	242-A	RINGO	HASTY
TO-600-140	H	3	8/10/2005	OPERATE 242-A OVERHEAD CRANE	242-A	RINGO	HASTY
TO-600-160	I	4	11/1/2006	CHANGE 242-A PROCESS CONDENSATE FILTER F-C-1	242-A	RINGO	HASTY
TO-600-180	H	1	1/9/2007	CHANGE RAW WATER AND PROCESS CONDENSATE FILTERS, AND CLEAN IN-LINE STRAINER	242-A	RINGO	HASTY
TO-600-190	H	2	1/5/2007	REMOVE ORGANICS FROM TK-C-100 AND SAMPLE	242-A	RINGO	HASTY
TO-600-200	A	1	1/9/2007	SETUP VALVE HV-CA1-10 FOR CALIBRATION	242-A	RINGO	HASTY
TO-600-210	H	8	1/4/2007	OPERATE PB-1 AND PB-2 SEAL WATER FILTER SYSTEM	242-A	RINGO	HASTY
TO-600-300	F	5	1/4/2007	PERFORM CLOSEOUT INSPECTION IN EVAPORATOR ROOM AND PUMP ROOM		242-A	RINGO HASTY
TO-600-510	H	1	1/9/2007	REBOOT FAILED DCM OR PCM	242-A	RINGO	HASTY
TO-600-520	I	5	1/9/2007	SHUTDOWN AND START UP MCS AND UPS SYSTEMS	242-A	RINGO	HASTY
TO-600-530	G	2	9/7/2004	INHIBIT/RESTORE MCS ALARMS AT THE 242-A EVAPORATOR	242-A	RINGO	HASTY
TO-600-540	G	3	12/31/2003	DE-ENERGIZE AND RE-ENERGIZE MCC-1, MCC-2, AND MCC-3 AT THE 242-A EVAPORATOR		242-A	RINGO HASTY
TO-600-545	A	8	1/9/2007	PERFORM SCHEDULED ELECTRICAL POWER OUTAGE AT 242-A EVAPORATOR		242-A	RINGO HASTY
TO-600-999	E	5	1/9/2007	242-A EVAPORATOR SYSTEM VALVE EXERCISING	242-A	RINGO	HASTY
TO-610-200	I	1	1/10/2007	OPERATE 242-A STANDBY POWER GENERATOR	242-A	RINGO	HASTY
TO-610-210	G	1	11/1/2006	OPERATE 242-A STANDBY POWER GENERATOR FOR LOAD TESTING		242-A	RINGO HASTY
TO-620-020	M	3	1/4/2007	OPERATE THE 242-A EVAPORATOR VENTILATION SYSTEM		242-A	RINGO HASTY
TO-620-040	J	4	2/15/2006	OPERATE 242-A VESSEL VENT SYSTEM	242-A	RINGO	HASTY

Procedure Number:	Rev:	Mod:	Release Date:	Procedure Title:	Project Code:	Procedure Owner:	Functional Owner:
TO-620-120	J	4	8/17/2006	TRANSFER EQUIPMENT/MATERIAL THROUGH THE 242-A LOADOUT ROOM AND DOORS		242-A	RINGO HASTY
TO-620-160	K	3	1/5/2007	OPERATE 242-A EVAPORATOR COMPRESSED AIR SYSTEM		242-A	RINGO HASTY
TO-620-200	I	1	9/11/2006	VESSEL VENT AMMONIA MONITOR	242-A	RINGO	HASTY
TO-630-001	K	5	1/4/2007	OBTAIN 242-A FEED AND SLURRY SAMPLES	242-A	RINGO	HASTY
TO-630-020	I	1	1/5/2007	SAMPLE PROCESS CONDENSATE FROM TK-C-100	242-A	RINGO	HASTY
TO-630-040	K	2	1/10/2007	SAMPLE 242-A STEAM CONDENSATE	242-A	RINGO	HASTY
TO-630-060	L	1	1/10/2007	SAMPLE COOLING WATER FROM 242-A, FLUSH RC-2 RECEIVER CARBOY, MONITORING PIG	242-A	RINGO	HASTY
TO-630-080	L	0	1/31/2007	OPERATE 242-A RC-3 SAMPLING SYSTEM	242-A	RINGO	HASTY
TO-640-020	K	14	2/2/2007	OPERATE 242-A PROCESS CONDENSATE SYSTEM	242-A	RINGO	HASTY
TO-650-050	H	2	1/5/2007	FLUSH EVAPORATOR FEED LINE	242-A	RINGO	HASTY
TO-650-085	F	3	1/8/2007	TRIPLE RINSE 242-A PUMP ROOM SUMP	242-A	RINGO	HASTY
TO-650-140	J	9	1/5/2007	FLUSH 242-A EVAPORATOR VESSEL AND RECIRCULATION LOOP		242-A	RINGO HASTY
TO-660-141	H	1	1/8/2007	INJECT ANTI-FOAM CHEMICALS INTO THE 242-A VAPOR/LIQUID SEPERATOR C-A-1	242-A	RINGO	HASTY
TO-660-150	B	7	1/8/2007	WEIGHT FACTOR DIP TUBE FLUSH	242-A	RINGO	HASTY
WMH-18018	B	1	11/30/2006	CHEM-TEC ADJUSTABLE FLOW SWITCH MODEL 500	242-A	MELDROM	WRIGHT
WMP-18006	B	2	1/24/2007	PRESSURE/VACUUM GAUGE DIFFERENTIAL PRESSURE/VACUUM GAUGE CALIBRATION	242-A	MELDROM	WRIGHT
WMP-18012	B	1	1/24/2007	AIR ROTOMETER	242-A	MELDROM	WRIGHT
WMP-18019	B	1	11/30/2006	ROCKWELL TYPE GAS METER	242-A	MELDROM	WRIGHT

ATTACHMENT 14

242-A PROCEDURE LIST

(6 Pages)

ATTACHMENT 14
242-A Procedure List

Item	Procedure Number	Procedure Title
1	TF-ERP-EVAP-001	242-A Evaporator Take Cover
2	TF-ERP-EVAP-002	242-A Evaporator Evacuation
3	TF-ERP-EVAP-004	242-A Evaporator Bomb Threat/Suspicious Object
4	TF-ERP-EVAP-005	242-A Respond to Evaporator High Radiation Area
5	TF-ERP-EVAP-006	242-A Evaporator Fire
6	TF-ERP-EVAP-008	242-A Evaporator Seismic Event
7	TF-ERP-EVAP-014	Emergency Response Procedure 014 - 242-A Evaporator High winds/Tornado
8	ARP-T-601-010	Respond to Graphic #10 Alarms at the 242-A Evaporator
9	ARP-T-601-011	Respond to Graphic #11 Alarms at the 242-A Evaporator
10	ARP-T-601-012	Respond to Graphic #12 Alarms at the 242-A Evaporator
11	ARP-T-601-013	Respond to Graphic #13 Alarms at the 242-A Evaporator
12	ARP-T-601-014	Respond to Graphic #14 Alarms at the 242-A Evaporator
13	ARP-T-601-015	Respond to Graphic #15 Alarms at the 242-A Evaporator
14	ARP-T-601-016	Respond to Graphic #16 Alarms at the 242-A Evaporator
15	ARP-T-601-017	Respond to Graphic #17 Alarms at the 242-A Evaporator
16	ARP-T-601-018	Respond to Graphic #18 Alarms at the 242-A Evaporator
17	ARP-T-601-019	Respond to Graphic #19 Alarms at the 242-A Evaporator
18	ARP-T-601-020	Respond to Graphic #20 Alarms at the 242-A Evaporator
19	ARP-T-601-021	Respond to Graphic #21 Alarms at the 242-A Evaporator
20	ARP-T-601-023	Respond to Graphic #23 Alarms at the 242-A Evaporator
21	ARP-T-601-024	Respond to Graphic #24 Alarms at the 242-A Evaporator
22	ARP-T-601-044	Respond to Graphic #44 Alarms at the 242-A Evaporator
23	ARP-T-601-064	Respond to Graphic #64 Alarms at the 242-A Evaporator
24	ARP-T-601-081	Respond to Faceplate #81 Alarms at the 242-A Evaporator
25	ARP-T-601-270	Respond to Graphic #270 Alarms at the 242-A Evaporator
26	ARP-T-601-272	Respond to Graphic #272 Alarms at the 242-A Evaporator
27	ARP-T-601-273	Respond to Graphic #273 Alarms at the 242-A Evaporator
28	ARP-T-601-274	Respond to Graphic #274 Alarms at the 242-A Evaporator
29	ARP-T-601-290	Respond to Graphic #290 Alarms at the 242-A Evaporator
30	ARP-T-601-292	Respond to Graphic #292 Alarms at the 242-A Evaporator
31	ARP-T-601-294	Respond to Graphic #294 Alarms at the 242-A Evaporator
32	ARP-T-601-295	Respond to Graphic #295 Alarms at the 242-A Evaporator
33	ARP-T-601-300	Respond to Graphic #300 Alarms at the 242-A Evaporator
34	ARP-T-601-301	Respond to Graphic #301 Alarms at the 242-A Evaporator
35	ARP-T-601-302	Respond to Graphic #302 Alarms at the 242-A Evaporator
36	ARP-T-601-303	Respond to Graphic #303 Alarms at the 242-A Evaporator
37	ARP-T-601-304	Respond to Graphic #304 Alarms at the 242-A Evaporator
38	ARP-T-601-320	Respond to Graphic #320 Alarms at the 242-A Evaporator
39	ARP-T-601-321	Respond to Graphic #321 Alarms at the 242-A Evaporator
40	ARP-T-601-322	Respond to Graphic #322 Alarms at the 242-A Evaporator
41	ARP-T-601-323	Respond to Graphic #323 Alarms at the 242-A Evaporator
42	ARP-T-601-340	Respond to Graphic #340 Alarms at the 242-A Evaporator
43	ARP-T-601-341	Respond to Graphic #341 Alarms at the 242-A Evaporator
44	ARP-T-601-343	Respond to Graphic #343 Alarms at the 242-A Evaporator
45	ARP-T-601-344	Respond to Graphic #344 Alarms at the 242-A Evaporator
46	ARP-T-601-AB1	Respond to Panel AB-1 Alarms at the 242-A Evaporator
47	ARP-T-601-AB2	Respond to Panel AB-2 Alarms at the 242-A Evaporator
48	ARP-T-601-EDG	Respond to Local Diesel Generator Alarms at the 242-A Evaporator

ATTACHMENT 14
242-A Procedure List

Item	Procedure Number	Procedure Title
49	DC-AOP-EVAP-001E	Emergency Shutdown of K1 Ventilation System
50	DC-AOP-EVAP-006	Loss of Compressed Air System
51	DC-EVAP-001A	Emergency Shutdown of Electrical Power
52	DC-EVAP-001C	Emergency Shutdown of Raw Water System
53	DC-EVAP-001D	Emergency Shutdown of Sanitary Water System
54	DC-EVAP-001F	Emergency Shutdown of K2 Ventilation System
55	DC-EVAP-001G	Emergency Shutdown of Control Room Ventilation System & Shift Managers Office Heat Pump
56	DC-EVAP-001J	Emergency Shutdown of Fire Protection (Sprinkler) System and Telephone System
57	WMP-242-2.01	Component Status Seals/Administrative Locks
58	WMP-242-2.03	Technical Safety Requirements Tracking
59	WMP-242-4.07	High Radiation Areas Access Control
60	TF-AOP-EVAP-001	Emergency Shutdown of Utility Support Systems
61	TF-AOP-EVAP-002	242-A Evaporator Loss of Electrical Power
62	TF-AOP-EVAP-003	Response to 242-A Evaporator Loss of Raw Water System
63	TF-AOP-EVAP-004	Response to 242-A Evaporator Loss of K-1 Ventilation System
64	TF-AOP-EVAP-005	Response to 242-A Evaporator Loss of Steam System
65	TF-AOP-EVAP-006	242-A Evaporator Loss of Compressed Air System
66	TF-AOP-EVAP-007	242-A Evaporator Loss of MCS Control
67	TF-AOP-EVAP-008	242-A Evaporator Pressure Hazards
68	TF-AOP-EVAP-009	Response to Process Upset
69	TF-AOP-EVAP-013	Respond to Volcanic Ashfall at the 242-A Evaporator (Replaced EP-685-030)
70	TF-OR-A-01	242-A Evaporator Control Room Rounds
71	TF-OR-A-02	242-A Evaporator Backside Rounds
72	TF-OR-OSR-01	242-A Evaporator Environmental Verification Surveillance
73	TF-OR-PWR-03	242-A Evaporator Stationary Operating Engineer Rounds
74	TF-OPS-005	Daily CAM and Record Sampler Inspections
75	TF-OPS-022	Inspections and Source Checks for 242-A Stack Cams and Effluent Record Samplers
76	TF-FT-680-005	Sample Cubicle Leak Detector LDE-SMPL-1, LDE-SMPL-2 Functional Test
77	TF-CC-690-001	RC3-1 Rad Monitor Loop Verification
78	TF-CC-690-006	K1 Stack 296 A-21 Flow Monitor Loop and Pump Room Verification and Calibration
79	TF-CC-690-008	RC-1 Rad Monitor Channel Calibration
80	OSD-T-151-00012	Operating Specifications for the 242-A Evaporator Crystallizer
81	242-30-002	Cold Weather Protection Surveillance
82	242-65G-001	Radiological Catch Container Usage at 242-A Evaporator
83	242-65J-002	Sampling Operations at 242-A Evaporator
84	242-85B-005	Safety Equipment Inspections and Operational Checks
85	TO-020-755	Record Status of Facility Alarm Panels
86	TO-600-005	242-A Evaporator Operability Checks
87	TO-600-010	242-A Evaporator Initial Valving Verification
88	TO-600-015	Perform Initial Electrical Verification for 242-A Evaporator Startup
89	TO-600-020	Perform 242-A Evaporator System Status Check and Prestart Operations
90	TO-600-030	Start Up 242-A Evaporator System

ATTACHMENT 14
242-A Procedure List

Item	Procedure Number	Procedure Title
91	TO-600-040	Monitor 242-A Evaporator Operation
92	TO-600-055	Start Up and Shut Down 242-A Steam System
93	TO-600-060	Shut Down 242-A Evaporator System
94	TO-600-100	Calculate 242-A Material Balance
95	TO-600-101	Perform Tank Farm Material Balance During Evaporator Operations
96	TO-600-123	Startup and Shutdown E-C-1, E-C-2, and E-C-3 Condensers
97	TO-600-130	Operate 242-A-81 Raw Water Strainer System
98	TO-600-140	Operate 242-A Overhead Crane
99	TO-600-160	Change 242-A Process Condensate Filter F-C-1
100	TO-600-180	Change Raw Water and Process Condensate Filters, and Clean In-Line Strainer
101	TO-600-190	Remove Organics From TK-C-100 and Sample
102	TO-600-200	Setup Valve HV-CA1-10 for Calibration
103	TO-600-210	Operate PB-1 and PB-2 Seal Water Filter System
104	TO-600-300	Perform Closeout Inspection In Evaporator Room and Pump Room
105	TO-600-510	Reboot Failed DCM or PCM
106	TO-600-520	Shut Down and Start Up MCS and UPS Systems
107	TO-600-530	Inhibit MCS Alarms at the 242-A Evaporator
108	TO-600-540	De-Energize and Re-Energize MCC-1, MCC-2, and MCC-3 at the 242-A Evaporator
109	TO-600-545	Perform Scheduled Electrical Power Outage at 242-A Evaporator
110	TO-600-900	Setup and Remove MCS Temporary Faceplate Display Groups at the 242-A Evaporator
111	TO-600-999	242-A Evaporator System Valve Exercising
112	TO-610-200	Operate 242-A Standby Power Generator
113	TO-610-210	Operate 242-A Standby Power Generator for Load Testing
114	TO-620-020	Operate the 242-A Evaporator Ventilation System
115	TO-620-040	Operate 242-A Vessel Vent System
116	TO-620-120	Transfer Equipment/Material through the 242-A Loadout Room and Doors
117	TO-620-160	Operate 242-A Evaporator Compressed Air System
118	TO-620-200	Vessel Vent Ammonia Monitor
119	TO-630-001	Obtain 242-A Feed and Slurry Samples
120	TO-630-020	Sample Process Condensate from TK-C-100
121	TO-630-040	Sample 242-A Steam Condensate
122	TO-630-060	Sample Cooling Water from 242-A, Flush RC-2 Receiver Carboy, Monitoring Pig
123	TO-630-080	Operate 242-A RC-3 Sampling System
124	TO-640-020	Operate 242-A Process Condensate System
125	TO-650-050	Flush Evaporator Feed Line
126	TO-650-085	Triple Rinse 242-A Pump Room Sump
127	TO-650-140	Flush 242-A Evaporator Vessel and Recirculation Loop
128	TO-660-141	Inject Anti-Foam Chemicals into the 242-A Vapor/Liquid Separator C-A-1
129	TO-660-150	Weight Factor Dip Tube Flush
130	3-RM-652	RC3 Radiation Monitor/Diversion System Functional Check
131	3-RM-653	K1 Ventilation System Functional Check
132	3-RM-654	RC1 Radiation Monitor Functional Check
133	6-PCD-508	Calibrate Pressure Switches

ATTACHMENT 14
242-A Procedure List

Item	Procedure Number	Procedure Title
134	EL18003	Hanford Generic Stack Sampler Cabinet Functional Check
135	EL18011	Honeywell/Leeds and Northrup Model 7082 ph Analyzer/Controller
136	EL18012	Brooks Maglite Electromagnetic Flowmeter
137	EL18014	Brooks Flow Indicating Transmitters for 242-A
138	EL18021	242-A Liquid Effluent Monitors
139	EL18022	Foxboro E69 Series Current-To-Pneumatic Converters
140	EL18027	Bristol Isolok Series SAB Sampler with Input Module -E or G-
141	EL18037	Fischer Governor 543 and Fischer Controls 546 E/P Transducer
142	EL18040	Foxboro Intelligent Transmitters
143	EL18041	Brooks Model 4023 Differential Inductance Flow Converter
144	EL18042	Valtek Electro Valve Positioner and Transmitter
145	EL18043	Differential Pressure Transmitters for 242-A
146	EL18044	Brooks Model 1110-6200 Indicating Flow Meter Functional Test
147	EL18045	Model 3560 Series III Brooks Mag-Flo Converters
148	EL18046	Canberra Lin/Log Ratemeter Model 1481L
149	EL18047	Sensotec Pressure AMP/IND
150	EL18048	ITT Barton Turbine Meter Series 900
151	EL18049	Princo L3610 Transmitters used at LWPF Retention Basins
152	EL18050	Absolute Pressure Transmitters for 242-A
153	EL18052	Rochester Series SC4372 Temperature Transmitters for 242-A
154	EL18054	Rosemount Model 1151AP/GP Electronic Pressure Transmitter
155	EL18056	Moore Ind., TCA/STD Thermocouple Alarm and Controller
156	EL18057	Barton Model 277A Differential Pressure Indicator
157	EL18058	Honeywell/Leeds and Northrup Model 7082 Conductivity/Resistivity Analyzer/Controller
158	EL18084	Pressure Transmitters for 242-A
159	EL18085	Fischer and Porter Magnetic Flowmeter and Converter (Mini-Mag Design), Model 10D1475
160	EL18090	Rochester Series SC8300 Transmitters for 242A
161	EL18094	Moore (PRV Type) Pressure Transmitter
162	EL18097	IRD Mechanalysis Model 5806 Channel A Calibration
163	EL18100	Foxboro Model 69TA-2R Current-to-Air Transducer
164	EL22035	480 V Switchgear Bus Inspection and Testing
165	EL22046	Caterpillar Standby Diesel Generator and ATS Inspection and Service
166	EL22047	Caterpillar Diesel Generator, 200KW Inspection and Operation
167	EL22052	DS Series Circuit Breaker Inspection and Testing
168	EL22054	242-A Mitsubishi 2033C Uninterruptible Power Supply (UPS) Battery Inspection
169	EL22055	242-A Mitsubishi 2033C Uninterruptible Power Supply (UPS) Functional and Load Test
170	EL23030	Supply and Exhaust Fans Inspection
171	EL24015	Regenerative Air Dryer Inspection and Maintenance
172	S-CC-0002	Pressure Vacuum Breaker Assembly Test Using a Differential Gauge Type Test Kit
173	S-CC-0044	Reduced Pressure Backflow Assembly Test Using a Differential Pressure Gauge Type Test Kit
174	S-CC-0062	Double Check Valve Assembly Test Using a Differential Pressure Gauge Type Test Kit
175	WMH-18018	Chem-Tech Adjustable Flow Switch Model 500

ATTACHMENT 14
242-A Procedure List

Item	Procedure Number	Procedure Title
176	WMP-18006	Pressure/Vacuum Gauge, Differential Pressure/Vacuum Gauge Calibration
177	WMP-18012	Air Rotometer
178	WMP-18019	Rockwell Type Gas Meter
179	3-VB-491	In-Place Testing of HEPA Filter Systems (Vacuum Cleaner)
180	3-VBP-656	242-A Evaporator HEPA Filter In-Place Leak Test (Aerosol Test)
181	3-VB-656A	Appendix A, 242-A Hot Cell Exhauster 296-A-21 HEPA Filter Aerosol Test Data Sheets
182	3-VB-656B	Appendix B, 242-A AS-1 Air Sampler HEPA Filter Aerosol Test Data Sheets
183	3-VB-656C	Appendix C, 242-A Vessel Vent Inlet Filter Aerosol Test Data Sheets
184	3-VB-656D	Appendix D, 242-A Vessel Vent Filter Aerosol Test Data Sheets
185	3-VBP-657	242-A Evaporator Stacks Air Flow Test
186	3-VB-657A	Appendix A, 242-A Hot Cell Exhaust Stack 296-A-21 Air Flow Test Data Sheets
187	3-VB-657B	Appendix B, 242-A Vessel Vent Exhauster Stack 296-A-22 Air Flow Test Data Sheets

Notes:
List as of 2/8/2007

ATTACHMENT 15

WASHINGTON ADMINSTRATIVE CODE 173-303-640

(14 Pages)

WAC 173-303-640

Tank systems.

(1) Applicability.

(a) The regulations in WAC 173-303-640 apply to owners and operators of facilities that use tank systems to treat or store dangerous waste, except as (b), (c), and (d) of this subsection provides otherwise.

(b) Tank systems that are used to store or treat dangerous waste which contain no free liquids and are situated inside a building with an impermeable floor are exempted from the requirements in subsection (4) of this section. To demonstrate the absence or presence of free liquids in the stored/treated waste, the test method described in WAC 173-303-110 (3)(a) must be used.

(c) Tank systems, including sumps, as defined in WAC 173-303-040, that serve as part of a secondary containment system to collect or contain releases of dangerous wastes are exempted from the requirements in subsection (4)(a) of this section.

(d) Tanks, sumps, and other such collection devices or systems used in conjunction with drip pads, as defined in WAC 173-303-040 and regulated under WAC 173-303-675, must meet the requirements of this section.

(2) Assessment of existing tank system's integrity.

(a) For each existing tank system, the owner or operator must determine that the tank system is not leaking or is unfit for use. Except as provided in (b) of this subsection, the owner or operator must obtain and keep on file at the facility a written assessment reviewed and certified by an independent, qualified registered professional engineer, in accordance with WAC 173-303-810 (13)(a), that attests to the tank system's integrity by January 12, 1988, for underground tanks that do not meet the requirements of subsection (4) of this section and that cannot be entered for inspection, or by January 12, 1990, for all other tank systems.

(b) Tank systems that store or treat materials that become dangerous wastes subsequent to January 12, 1989, must conduct this assessment within twelve months after the date that the waste becomes a dangerous waste.

(c) This assessment must determine that the tank system is adequately designed and has sufficient structural strength and compatibility with the waste(s) to be stored or treated, to ensure that it will not collapse, rupture, or fail. At a minimum, this assessment must consider the following:

(i) Design standard(s), if available, according to which the tank system was constructed;

(ii) Dangerous characteristics of the waste(s) that have been and will be handled;

(iii) Existing corrosion protection measures;

(iv) Documented age of the tank system, if available (otherwise, an estimate of the age); and

(v) Results of a leak test, internal inspection, or other tank system integrity examination such that:

(A) For nonenterable underground tanks, the assessment must include a leak test that is capable of taking into account the effects of temperature variations, tank end deflection, vapor pockets, and high water table effects; and

(B) For other than nonenterable underground tanks and for ancillary equipment, this assessment must include either a leak test, as described above, or other integrity examination, that is certified by an independent, qualified, registered professional engineer, in accordance with WAC 173-303-810 (13)(a), that addresses cracks, leaks, corrosion, and erosion.

Note: Three publications may be used, where applicable, as guidelines in conducting other than a leak test:

Tank Inspection, Repair, Alteration, and Reconstruction, API Standard 653, Addendum 4 issued in December 1999; *Guidance for Assessing and Certifying Tank Systems that Store and Treat Dangerous Waste*, Ecology Publication No. 94-114; and *Steel Tank Institute* publication #SP001-00 *Standard for Inspection of In-Service Shop Fabricated Aboveground Tanks for Storage of Combustible and Flammable Liquids* copyright 2000.

(d) If, as a result of the assessment conducted in accordance with (a) of this subsection, a tank system is found to be leaking or unfit for use, the owner or operator must comply with the requirements of subsection (7) of this section.

(e) The owner or operator must develop a schedule for conducting integrity assessments over the life of the tank to ensure that the tank retains its structural integrity and will not collapse, rupture, or fail. The schedule must be based on the results of past integrity assessments, age of the tank system, materials of construction, characteristics of the waste, and any other relevant factors.

(3) Design and installation of new tank systems or components.

(a) Owners or operators of new tank systems or components must obtain (and for facilities that are pursuing or have obtained a final status permit, submit to the department, at time of submittal of Part B information) a written assessment, reviewed and certified by an independent, qualified registered professional engineer, in accordance with WAC 173-303-810 (13)(a), attesting that the tank system has sufficient structural integrity and is acceptable for the storing and treating of dangerous waste. The assessment must show that the foundation, structural support, seams, connections, and pressure controls (if applicable) are adequately designed and that the tank system has sufficient structural strength, compatibility with the waste(s) to be stored or treated, and corrosion protection to ensure that it will not collapse, rupture, or fail. This assessment (which will be used by the department to review and approve or disapprove the acceptability of the tank system design at facilities which are pursuing or have obtained a final status permit) must include, at a minimum, the following information:

(i) Design standard(s) according to which tank system(s) are constructed;

(ii) Dangerous characteristics of the waste(s) to be handled;

(iii) For new tank systems or components in which the external shell of a metal tank or any external metal component of the tank system will be in contact with the soil or with water, a determination by a corrosion expert of:

(A) Factors affecting the potential for corrosion, including but not limited to:

(I) Soil moisture content;

(II) Soil pH;

(III) Soil sulfides level;

(IV) Soil resistivity;

(V) Structure to soil potential;

(VI) Influence of nearby underground metal structures (e.g., piping);

(VII) Existence of stray electric current;

(VIII) Existing corrosion-protection measures (e.g., coating, cathodic protection); and

(B) The type and degree of external corrosion protection that are needed to ensure the integrity of the tank system during the use of the tank system or component, consisting of one or more of the following:

(I) Corrosion-resistant materials of construction such as special alloys, fiberglass reinforced plastic, etc.;

(II) Corrosion-resistant coating (such as epoxy, fiberglass, etc.,) with cathodic protection (e.g., impressed current or sacrificial anodes); and

(III) Electrical isolation devices such as insulating joints, flanges, etc.

Note: The practices described in the National Association of Corrosion Engineers (NACE) standard, "Recommended Practice (RP-02-85) – Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems," and the American Petroleum Institute (API) Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems," may be used, where applicable, as guidelines in providing corrosion protection for tank systems.

(iv) For underground tank system components that are likely to be adversely affected by vehicular traffic, a determination of design or operational measures that will protect the tank system against potential damage; and

(v) Design considerations to ensure that:

(A) Tank foundations will maintain the load of a full tank;

(B) Tank systems will be anchored to prevent flotation or dislodgment where the tank system is either placed in a saturated zone, or is located less than five hundred feet from a fault which has had displacement in Holocene times; and

(C) Tank systems will withstand the effects of frost heave.

(b) The owner or operator must develop a schedule for conducting integrity assessments over the life of the tank to ensure that the tank retains its structural integrity and will not collapse, rupture or fail. The schedule must be based on the results of past integrity assessments, age of the tank system, materials of construction, characteristics of the waste, and any other relevant factors.

(c) The owner or operator of a new tank system must ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation. Prior to covering, enclosing, or placing a new tank system or component in use, an independent, qualified installation inspector or an independent, qualified, registered professional engineer, either of whom is trained and experienced in the proper installation of tank systems or components, must inspect the system for the presence of any of the following items:

(i) Weld breaks;

(ii) Punctures;

(iii) Scrapes of protective coatings;

(iv) Cracks;

(v) Corrosion;

(vi) Other structural damage or inadequate construction/installation.

All discrepancies must be remedied before the tank system is covered, enclosed, or placed in use.

(d) New tank systems or components that are placed underground and that are backfilled must be provided with a backfill material that is a noncorrosive, porous, homogeneous substance and that is installed so that the backfill is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported.

(e) All new tanks and ancillary equipment must be tested for tightness prior to being covered, enclosed, or placed in use. If a tank system is found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the tank system being covered, enclosed, or placed into use.

(f) Ancillary equipment must be supported and protected against physical damage and excessive stress

due to settlement, vibration, expansion, or contraction.

Note: The piping system installation procedures described in American Petroleum Institute (API) Publication 1615 (November 1979), "Installation of Underground Petroleum Storage Systems," or ANSI Standard B31.3, "Petroleum Refinery Piping," and ANSI Standard B31.4 "Liquid Petroleum Transportation Piping System," may be used, where applicable, as guidelines for proper installation of piping systems.

(g) The owner or operator must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided under (a)(iii) of this subsection, or other corrosion protection if the department believes other corrosion protection is necessary to ensure the integrity of the tank system during use of the tank system. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation.

(h) The owner or operator must obtain and keep on file at the facility written statements by those persons required to certify the design of the tank system and supervise the installation of the tank system in accordance with the requirements of (b) through (g) of this subsection, that attest that the tank system was properly designed and installed and that repairs, pursuant to (c) and (e) of this subsection, were performed. These written statements must also include the certification statement as required in WAC 173-303-810 (13)(a).

(4) Containment and detection of releases.

(a) In order to prevent the release of dangerous waste or dangerous constituents to the environment, secondary containment that meets the requirements of this subsection must be provided (except as provided in (f) and (g) of this subsection):

(i) For all new tank systems or components, prior to their being put into service;

(ii) For all existing tank systems used to store or treat Dangerous Waste Nos. F020, F021, F022, F023, F026, and F027, within two years after January 12, 1989;

(iii) For those existing tank systems of known and documented age, within two years after January 12, 1989, or when the tank system has reached fifteen years of age, whichever comes later;

(iv) For those existing tank systems for which the age cannot be documented, within eight years of January 12, 1989; but if the age of the facility is greater than seven years, secondary containment must be provided by the time the facility reaches fifteen years of age, or within two years of January 12, 1989, whichever comes later; and

(v) For tank systems that store or treat materials that become dangerous wastes subsequent to January 12, 1989, within the time intervals required in (a)(i) through (iv) of this subsection, except that the date that a material becomes a dangerous waste must be used in place of January 12, 1989.

(b) Secondary containment systems must be:

(i) Designed, installed, and operated to prevent any migration of wastes or accumulated liquid out of the system to the soil, ground water, or surface water at any time during the use of the tank system; and

(ii) Capable of detecting and collecting releases and accumulated liquids until the collected material is removed.

(c) To meet the requirements of (b) of this subsection, secondary containment systems must be at a minimum:

(i) Constructed of or lined with materials that are compatible with the waste(s) to be placed in the tank system and must have sufficient strength and thickness to prevent failure owing to pressure gradients (including static head and external hydrological forces), physical contact with the waste to which it is exposed, climatic conditions, and the stress of daily operations (including stresses from nearby vehicular traffic);

(ii) Placed on a foundation or base capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift;

(iii) Provided with a leak-detection system that is designed and operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous waste or accumulated liquid in the secondary containment system within twenty-four hours, or at the earliest practicable time if the owner or operator can demonstrate to the department that existing detection technologies or site conditions will not allow detection of a release within twenty-four hours; and

(iv) Sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation. Spilled or leaked waste and accumulated precipitation must be removed from the secondary containment system within twenty-four hours, or in as timely a manner as is possible to prevent harm to human health and the environment, if the owner or operator can demonstrate to the department that removal of the released waste or accumulated precipitation cannot be accomplished within twenty-four hours.

Note: If the collected material is a dangerous waste under WAC 173-303-070, it is subject to management as a dangerous waste in accordance with all applicable requirements of WAC 173-303-170 through 173-303-400 and WAC 173-303-600 through173-303-695 . If the collected material is discharged through a point source to waters of the United States, it is subject to the requirements of sections 301, 304, and 402 of the Clean Water Act, as amended. If discharged to a publicly owned treatment works (POTW), it is subject to the requirements of section 307 of the Clean Water Act, as amended. If the collected material is released to the environment, it may be subject to the reporting requirements of 40 CFR Part 302.

(d) Secondary containment for tanks must include one or more of the following devices:

(i) A liner (external to the tank);

(ii) A vault;

(iii) A double-walled tank; or

(iv) An equivalent device as approved by the department.

(e) In addition to the requirements of (b), (c), and (d) of this subsection, secondary containment systems must satisfy the following requirements:

(i) External liner systems must be:

(A) Designed or operated to contain one hundred percent of the capacity of the largest tank within its boundary;

(B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity must be sufficient to contain precipitation from a twenty-five-year, twenty-four-hour rainfall event.

(C) Free of cracks or gaps; and

(D) Designed and installed to surround the tank completely and to cover all surrounding earth likely to come into contact with the waste if the waste is released from the tank(s) (i.e., capable of preventing lateral as well as vertical migration of the waste).

(ii) Vault systems must be:

(A) Designed or operated to contain one hundred percent of the capacity of the largest tank within its boundary;

(B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such

additional capacity must be sufficient to contain precipitation from a twenty-five-year, twenty-four-hour rainfall event;

(C) Constructed with chemical-resistant water stops in place at all joints (if any);

(D) Provided with an impermeable interior coating or lining that is compatible with the stored waste and that will prevent migration of waste into the concrete;

(E) Provided with a means to protect against the formation of and ignition of vapors within the vault, if the waste being stored or treated:

(I) Meets the definition of ignitable waste under WAC 173-303-090(5); or

(II) Meets the definition of reactive waste under WAC 173-303-090(7), and may form an ignitable or explosive vapor.

(F) Provided with an exterior moisture barrier or be otherwise designed or operated to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure.

(iii) Double-walled tanks must be:

(A) Designed as an integral structure (i.e., an inner tank completely enveloped within an outer shell) so that any release from the inner tank is contained by the outer shell;

(B) Protected, if constructed of metal, from both corrosion of the primary tank interior and of the external surface of the outer shell; and

(C) Provided with a built-in continuous leak detection system capable of detecting a release within twenty-four hours, or at the earliest practicable time, if the owner or operator can demonstrate to the department, and the department concludes, that the existing detection technology or site conditions would not allow detection of a release within twenty-four hours.

Note: The provisions outlined in the Steel Tank Institute's (STI) "Standard for Dual Wall Underground Steel Storage Tanks" may be used as guidelines for aspects of the design of underground steel double-walled tanks.

(f) Ancillary equipment must be provided with secondary containment (e.g., trench, jacketing, double-walled piping) that meets the requirements of (b) and (c) of this subsection except for:

(i) Aboveground piping (exclusive of flanges, joints, valves, and other connections) that are visually inspected for leaks on a daily basis;

(ii) Welded flanges, welded joints, and welded connections, that are visually inspected for leaks on a daily basis;

(iii) Sealless or magnetic coupling pumps and sealless valves, that are visually inspected for leaks on a daily basis; and

(iv) Pressurized aboveground piping systems with automatic shutoff devices (e.g., excess flow check valves, flow metering shutdown devices, loss of pressure actuated shutoff devices) that are visually inspected for leaks on a daily basis.

(g) The owner or operator may obtain a variance from the requirements of this subsection if the department finds, as a result of a demonstration by the owner or operator that alternative design and operating practices, together with location characteristics, will prevent the migration of any dangerous waste or dangerous constituents into the ground water, or surface water at least as effectively as secondary containment during the active life of the tank system or that in the event of a release that does migrate to ground water or surface water, no substantial present or potential hazard will be posed to human health or the environment. New underground tank systems may not, per a demonstration in accordance with (g)(ii) of this subsection, be exempted from the secondary containment requirements of this section.

(i) In deciding whether to grant a variance based on a demonstration of equivalent protection of ground water and surface water, the department will consider:

(A) The nature and quantity of the wastes;

(B) The proposed alternate design and operation;

(C) The hydrogeologic setting of the facility, including the thickness of soils present between the tank system and ground water; and

(D) All other factors that would influence the quality and mobility of the dangerous constituents and the potential for them to migrate to ground water or surface water.

(ii) In deciding whether to grant a variance based on a demonstration of no substantial present or potential hazard, the department will consider:

(A) The potential adverse effects on ground water, surface water, and land quality taking into account:

(I) The physical and chemical characteristics of the waste in the tank system, including its potential for migration;

(II) The hydrogeological characteristics of the facility and surrounding land;

(III) The potential for health risks caused by human exposure to waste constituents;

(IV) The potential for damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and

(V) The persistence and permanence of the potential adverse effects.

(B) The potential adverse effects of a release on ground water quality, taking into account:

(I) The quantity and quality of ground water and the direction of ground water flow;

(II) The proximity and withdrawal rates of ground water users;

(III) The current and future uses of ground water in the area; and

(IV) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground water quality.

(C) The potential adverse effects of a release on surface water quality, taking into account:

(I) The quantity and quality of ground water and the direction of ground water flow;

(II) The patterns of rainfall in the region;

(III) The proximity of the tank system to surface waters;

(IV) The current and future uses of surface waters in the area and any water quality standards established for those surface waters; and

(V) The existing quality of surface water, including other sources of contamination and the cumulative impact on surface-water quality.

(D) The potential adverse effects of a release on the land surrounding the tank system, taking into account:

(I) The patterns of rainfall in the region; and

(II) The current and future uses of the surrounding land.

(iii) The owner or operator of a tank system, for which a variance from secondary containment had been granted in accordance with the requirements of (g)(i) of this subsection, at which a release of dangerous waste has occurred from the primary tank system but has not migrated beyond the zone of engineering control (as established in the variance), must:

(A) Comply with the requirements of subsection (7) of this section, except subsection (7)(d) of this section; and

(B) Decontaminate or remove contaminated soil to the extent necessary to:

(I) Enable the tank system for which the variance was granted to resume operation with the capability for the detection of releases at least equivalent to the capability it had prior to the release; and

(II) Prevent the migration of dangerous waste or dangerous constituents to ground water or surface water.

(C) If contaminated soil cannot be removed or decontaminated in accordance with (g)(iii)(B) of this subsection, comply with the requirements of subsection (8) of this section.

(iv) The owner or operator of a tank system, for which a variance from secondary containment had been granted in accordance with the requirements of (g)(i) of this subsection, at which a release of dangerous waste has occurred from the primary tank system and has migrated beyond the zone of engineering control (as established in the variance), must:

(A) Comply with the requirements of subsection (7)(a), (b), (c), and (d) of this section; and

(B) Prevent the migration of dangerous waste or dangerous constituents to ground water or surface water, if possible, and decontaminate or remove contaminated soil. If contaminated soil cannot be decontaminated or removed or if ground water has been contaminated, the owner or operator must comply with the requirements of subsection (8)(b) of this section; and

(C) If repairing, replacing, or reinstalling the tank system, provide secondary containment in accordance with the requirements of (a) through (f) of this subsection or reapply for a variance from secondary containment and meet the requirements for new tank systems in subsection (3) of this section if the tank system is replaced. The owner or operator must comply with these requirements even if contaminated soil can be decontaminated or removed and ground water or surface water has not been contaminated.

(h) The following procedures must be followed in order to request a variance from secondary containment:

(i) The department must be notified in writing by the owner or operator that he intends to conduct and submit a demonstration for a variance from secondary containment as allowed in (g) of this subsection according to the following schedule:

(A) For existing tank systems, at least twenty-four months prior to the date that secondary containment must be provided in accordance with (a) of this subsection.

(B) For new tank systems, at least thirty days prior to entering into a contract for installation.

(ii) As part of the notification, the owner or operator must also submit to the department a description of the steps necessary to conduct the demonstration and a timetable for completing each of the steps. The demonstration must address each of the factors listed in (g)(i) or (ii) of this subsection;

(iii) The demonstration for a variance must be completed within one hundred eighty days after notifying the department of an intent to conduct the demonstration; and

(iv) If a variance is granted under this subsection, the department will require the permittee to construct and operate the tank system in the manner that was demonstrated to meet the requirements for the variance.

(i) All tank systems, until such time as secondary containment that meets the requirements of this section is provided, must comply with the following:

(i) For nonenterable underground tanks, a leak test that meets the requirements of subsection (2)(c)(v) of this section or other tank integrity method, as approved or required by the department, must be conducted at least annually.

(ii) For other than nonenterable underground tanks, the owner or operator must either conduct a leak test as in (i)(i) of this subsection or develop a schedule and procedure for an assessment of the overall condition of the tank system by an independent, qualified registered professional engineer. The schedule and procedure must be adequate to detect obvious cracks, leaks, and corrosion or erosion that may lead to cracks and leaks. The owner or operator must remove the stored waste from the tank, if necessary, to allow the condition of all internal tank surfaces to be assessed. The frequency of these assessments must be based on the material of construction of the tank and its ancillary equipment, the age of the system, the type of corrosion or erosion protection used, the rate of corrosion or erosion observed during the previous inspection, and the characteristics of the waste being stored or treated.

(iii) For ancillary equipment, a leak test or other integrity assessment as approved by the department must be conducted at least annually.

Note: Three publications may be used, where applicable, as guidelines for assessing the overall condition of the tank system: *Tank Inspection, Repair, Alteration, and Reconstruction*, API Standard 653, Addendum 4 issued in December 1999; *Guidance for Assessing and Certifying Tank Systems that Store and Treat Dangerous Waste*, Ecology Publication No. 94-114; and *Steel Tank Institute* publication #SP001-00 *Standard for Inspection of In-Service Shop Fabricated Aboveground Tanks for Storage of Combustible and Flammable Liquids* copyright 2000.

(iv) The owner or operator must maintain on file at the facility a record of the results of the assessments conducted in accordance with (i)(i) through (iii) of this subsection.

(v) If a tank system or component is found to be leaking or unfit for use as a result of the leak test or assessment in (i)(i) through (iii) of this subsection, the owner or operator must comply with the requirements of subsection (7) of this section.

(5) General operating requirements.

(a) Dangerous wastes or treatment reagents must not be placed in a tank system if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, corrode, or otherwise fail.

(b) The owner or operator must use appropriate controls and practices to prevent spills and overflows from tank or containment systems. These include at a minimum:

(i) Spill prevention controls (e.g., check valves, dry disconnect couplings);

(ii) Overfill prevention controls (e.g., level sensing devices, high level alarms, automatic feed cutoff, or bypass to a standby tank); and

(iii) Maintenance of sufficient freeboard in uncovered tanks to prevent overtopping by wave or wind action or by precipitation.

(c) The owner or operator must comply with the requirements of subsection (7) of this section if a leak or spill occurs in the tank system.

(d) All tank systems holding dangerous waste must be marked with labels or signs to identify the waste contained in the tank. The label or sign must be legible at a distance of at least fifty feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the tank system(s). (Note -- If there already is a system in use that performs this function in accordance with local, state or federal regulations, then such system will be adequate.)

(e) All tank systems holding dangerous wastes which are acutely or chronically toxic by inhalation must be designed to prevent escape of vapors, fumes, or other emissions into the air.

(6) Inspections.

(a) The owner or operator must develop and follow a schedule and procedure for inspecting overfill controls.

(b) The owner or operator must inspect at least once each operating day:

(i) Aboveground portions of the tank system, if any, to detect corrosion or releases of waste;

(ii) Data gathered from monitoring any leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design; and

(iii) The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g., dikes) to detect erosion or signs of releases of dangerous waste (e.g., wet spots, dead vegetation).

Note: WAC 173-303-320 requires the owner or operator to remedy any deterioration or malfunction he finds. Subsection (7) of this section requires the owner or operator to notify the department within twenty-four hours of confirming a leak. Also, 40 CFR Part 302 may require the owner or operator to notify the National Response Center of a release.

(c) The owner or operator must inspect cathodic protection systems, if present, according to, at a minimum, the following schedule to ensure that they are functioning properly:

(i) The proper operation of the cathodic protection system must be confirmed within six months after initial installation and annually thereafter; and

(ii) All sources of impressed current must be inspected and/or tested, as appropriate, at least bimonthly (i.e., every other month).

Note: The practices described in the National Association of Corrosion Engineers (NACE) standard, "Recommended Practice (RP-02-85) -- Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems," and the American Petroleum Institute (API) Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems," may be used, where applicable, as guidelines in maintaining and inspecting cathodic protection systems.

(d) The owner or operator must document in the operating record of the facility an inspection of those items in (a) through (c) of this subsection. The owner or operator must keep an inspection log including at least the date and time of the inspection, the printed name and the handwritten signature of the inspector, a notation of the observations made and the date and nature of any repairs or remedial actions taken. The log must be kept at the facility for at least five years from the date of inspection.

(7) Response to leaks or spills and disposition of leaking or unfit-for-use tank systems.

A tank system or secondary containment system from which there has been a leak or spill, or which is unfit for use, must be removed from service immediately, and the owner or operator must satisfy the following requirements:

(a) Cessation of use; prevent flow or addition of wastes. The owner or operator must immediately stop the flow of dangerous waste into the tank system or secondary containment system and inspect the system to determine the cause of the release.

(b) Removal of waste from tank system or secondary containment system.

(i) If the release was from the tank system, the owner/operator must, within twenty-four hours after detection of the leak or, if the owner/operator demonstrates that it is not possible, at the earliest practicable time, remove as much of the waste as is necessary to prevent further release of dangerous waste to the environment and to allow inspection and repair of the tank system to be performed.

(ii) If the material released was to a secondary containment system, all released materials must be removed within twenty-four hours or in as timely a manner as is possible to prevent harm to human health and the environment.

(c) Containment of visible releases to the environment. The owner/operator must immediately conduct a visual inspection of the release and, based upon that inspection:

(i) Prevent further migration of the leak or spill to soils or surface water; and

(ii) Remove, and properly dispose of, any visible contamination of the soil or surface water.

(d) Notifications, reports.

(i) Any release to the environment must be reported to the department and other authorities immediately in accordance with WAC 173-303-145. Any release above the "reportable quantity" must also be reported to the National Response Center pursuant to 40 CFR Part 302.

(ii) Within thirty days (or fifteen days if classified as an emergency) of detection of a release to the environment, a report containing the following information must be submitted to the department:

(A) Likely route of migration of the release;

(B) Characteristics of the surrounding soil (soil composition, geology, hydrogeology, climate);

(C) Results of any monitoring or sampling conducted in connection with the release (if available). If sampling or monitoring data relating to the release are not available within thirty days, these data must be submitted to the department as soon as they become available;

(D) Proximity to downgradient drinking water, surface water, and populated areas; and

(E) Description of response actions taken or planned.

(F) In the event of an emergency, additional information as required by WAC 173-303-360.

(e) Provision of secondary containment, repair, or closure.

(i) Unless the owner/operator satisfies the requirements of (e)(ii) through (iv) of this subsection, the tank system must be closed in accordance with subsection (8) of this section.

(ii) If the cause of the release was a spill that has not damaged the integrity of the system, the owner/operator may return the system to service as soon as the released waste is removed and repairs, if necessary, are made.

(iii) If the cause of the release was a leak from the primary tank system into the secondary containment system, the system must be repaired prior to returning the tank system to service.

(iv) If the source of the release was a leak to the environment from a component of a tank system without secondary containment, the owner/operator must provide the component of the system from which the leak occurred with secondary containment that satisfies the requirements of subsection (4) of this section before it can be returned to service, unless the source of the leak is an aboveground portion of a tank system that can be inspected visually. If the source is an aboveground component that can be inspected visually, the component must be repaired and may be returned to service without secondary containment as long as the requirements of (f) of this subsection are satisfied. If a component is replaced to comply with the requirements of this subitem, that component must satisfy the requirements for new tank systems or components in subsections (3) and (4) of this section. Additionally, if a leak has occurred in any portion of a tank system component that is not readily accessible for visual inspection (e.g., the bottom of an inground or onground tank), the entire component must be provided with secondary containment in accordance with subsection (4) of this section prior to being returned to use.

(f) Certification of major repairs. If the owner/operator has repaired a tank system in accordance with (e) of this subsection, and the repair has been extensive (e.g., installation of an internal liner; repair of a

ruptured primary containment or secondary containment vessel), the tank system must not be returned to service unless the owner/operator has obtained a certification by an independent, qualified, registered, professional engineer in accordance with WAC 173-303-810 (13)(a) that the repaired system is capable of handling dangerous wastes without release for the intended life of the system. This certification must be submitted to the department within seven days after returning the tank system to use.

Note: See WAC 173-303-320 for the requirements necessary to remedy a failure. Also, 40 CFR Part 302 may require the owner or operator to notify the National Response Center of certain releases.

(8) Closure and post-closure care.

(a) At closure of a tank system, the owner or operator must remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as dangerous waste, unless WAC 173-303-070 (2)(a) applies. The closure plan, closure activities, cost estimates for closure, and financial responsibility for tank systems must meet all of the requirements specified in WAC 173-303-610 and 173-303-620.

(b) If the owner or operator demonstrates that not all contaminated soils can be practicably removed or decontaminated as required in (a) of this subsection, then the owner or operator must close the tank system and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (see WAC 173-303-665(6)). In addition, for the purposes of closure, post-closure, and financial responsibility, such a tank system is then considered to be a landfill, and the owner or operator must meet all of the requirements for landfills specified in WAC 173-303-610 and 173-303-620.

(c) If an owner or operator has a tank system that does not have secondary containment that meets the requirements of subsection (4)(b) through (f) of this section and is not exempt from the secondary containment requirements in accordance with subsection (4)(g) of this section, then:

(i) The closure plan for the tank system must include both a plan for complying with (a) of this subsection and a contingent plan for complying with (b) of this subsection.

(ii) A contingent post-closure plan for complying with (b) of this subsection must be prepared and submitted as part of the permit application.

(iii) The cost estimates calculated for closure and post-closure care must reflect the costs of complying with the contingent closure plan and the contingent post-closure plan, if those costs are greater than the costs of complying with the closure plan prepared for the expected closure under (a) of this subsection.

(iv) Financial assurance must be based on the cost estimates in (c)(iii) of this subsection.

(v) For the purposes of the contingent closure and post-closure plans, such a tank system is considered to be a landfill, and the contingent plans must meet all of the closure, post-closure, and financial responsibility requirements for landfills under this chapter (WAC 173-303-610 and 173-303-620).

(9) Special requirements for ignitable or reactive wastes.

(a) Ignitable or reactive waste must not be placed in tank systems unless:

(i) The waste is treated, rendered, or mixed before or immediately after placement in the tank system so that the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable or reactive waste under WAC 173-303-090, and 173-303-395 (1)(b) is complied with; or

(ii) The waste is stored or treated in such a way that it is protected from any material or conditions which may cause the waste to ignite or react; or

(iii) The tank system is used solely for emergencies.

(b) The owner or operator of a facility which treats or stores ignitable or reactive waste in tanks must locate the tanks in a manner equivalent to the National Fire Protection Association's buffer zone requirements for tanks, contained in Tables 2-1 through 2-6 of the NFPA-30 *Flammable and Combustible Liquids Code* -1981, or as required by state and local fire codes when such codes are more stringent. The

owner or operator must also comply with the requirements of WAC 173-303-395 (1)(d).

(10) Special requirements for incompatible wastes.

(a) Incompatible wastes, or incompatible wastes and materials, must not be placed in the same tank system, unless WAC 173-303-395 (1)(b) is complied with.

(b) Dangerous waste must not be placed in a tank system that has not been decontaminated and that previously held an incompatible waste or material, unless WAC 173-303-395 (1)(b) is complied with.

(11) Air emission standards. The owner or operator must manage all hazardous waste placed in a tank in accordance with the applicable requirements of 40 CFR Subparts AA, BB, and CC, which are incorporated by reference at WAC 173-303-690 through173-303-692 .

[Statutory Authority: Chapters 70.105, 70.105D, and 15.54 RCW and RCW 70.105.007. 04-24-065 (Order 03-10), § 173-303-640, filed 11/30/04, effective 1/1/05; 00-11-040 (Order 99-01), § 173-303-640, filed 5/10/00, effective 6/10/00. Statutory Authority: Chapters 70.105 and 70.105D RCW. 95-22-008 (Order 94-30), § 173-303-640, filed 10/19/95, effective 11/19/95; 94-01-060 (Order 92-33), § 173-303-640, filed 12/8/93, effective 1/8/94. Statutory Authority: Chapter 70.105 RCW. 89-02-059 (Order 88-24), § 173-303-640, filed 1/4/89; 86-12-057 (Order DE-85-10), § 173-303-640, filed 6/3/86; 84-09-088 (Order DE 83-36), § 173-303-640, filed 4/18/84. Statutory Authority: Chapter 70.105 RCW and RCW 70.95.260. 82-05-023 (Order DE 81-33), § 173-303-640, filed 2/10/82. Formerly chapter 173-302 WAC.]

ATTACHMENT 16

CARBOCRYLIC PRODUCT DATA

(35 Pages)

carboline

PHENOLINE® 305 PRIMER AND PHENOLINE® 305 CONCRETE PRIMER

350 HANLEY INDUSTRIAL COURT • ST. LOUIS, MO 63144 • 314-644-1000

SELECTION DATA

GENERIC TYPE: Modified phenolic. Part A and Part B mixed prior to application.

GENERAL PROPERTIES: Phenoline 305 Primer and Phenoline 305 Concrete Primer are heavy duty, high build primers for steel and concrete. Both have excellent adhesion to steel and concrete, respectively. They have excellent resistance to a wide range of solvents, caustics and entrained acid vapors when topcoated with Phenoline 305 Finish. Phenoline 305 Primer and Phenoline 305 Concrete Primer are easily repaired and have excellent resistance to hydraulic fluids. A system of Phenoline 305 Primer/Phenoline 305 Finish or Phenoline 305 Concrete Primer/Phenoline 305 Finish meets the applicable performance criteria of ANSI N5.12-1974.

RECOMMENDED USES: For protection of concrete and steel surfaces. Because of their excellent physical properties, they are excellent for severe chemical environments. Both are high build primers for steel, concrete, tank exteriors and floors in highly corrosive areas.

Phenoline 305 Primer/Phenoline 305 Finish is an excellent system for use by manufacturers of industrial equipment and components. Phenoline 305 Concrete Primer/Phenoline 305 Finish is a superb system for resistance to splash, spillage and fumes on concrete.

NOT RECOMMENDED FOR: General immersion service or continuous spillage of hot or concentrated acids.

CHEMICAL RESISTANCE GUIDE: (Topcoated with Phenoline 305 Finish)

Exposure	Splash and Spillage	Fumes
Acids	Good	Excellent
Alkalies	Excellent	Excellent
Solvents	Excellent	Excellent
Salt	Excellent	Excellent
Water	Excellent	Excellent

TEMPERATURE RESISTANCE: (Non-immersion)
Continuous: 200°F (93°C)
Non-continuous: 250°F (121°C)

FLEXIBILITY: Fair WEATHERING: Good

ABRASION RESISTANCE: Very Good

SUBSTRATES: Phenoline 305 Primer may be applied over clean, properly prepared steel. Phenoline 305 Concrete Primer may be applied over clean, properly prepared concrete.

TOPCOAT REQUIRED: Topcoat with Phenoline 305 Finish, epoxies and others as recommended.

COMPATIBILITY WITH OTHER COATINGS: Apply directly to the substrate.

SPECIFICATION DATA

THEORETICAL SOLIDS CONTENT OF MIXED MATERIAL:

	By Volume
Phenoline 305 Primer	59% ± 2%
Phenoline 305 Concrete Primer	61% ± 2%

RECOMMENDED DRY FILM THICKNESS PER COAT: 4 mils (100 microns)

THEORETICAL COVERAGE PER MIXED KIT:* (1 gal. kit yields 1.25 gal.)

Phenoline 305 Primer:
1183 mil sq. ft. (23.6 sq. m/l at 25 microns)
296 sq. ft. at 4 mils (5.9 sq. m/l at 100 microns)

Phenoline 305 Concrete Primer:
1223 mil sq. ft. (24.4 sq. m/l at 25 microns)
306 sq. ft. at 4 mils (6.1 sq. m/l at 100 microns)

*NOTE: Material losses during mixing and application will vary and must be taken into consideration when estimating job requirements.

SHELF LIFE: 24 months minimum

COLORS: Yellow only

GLOSS: N.A.

ORDERING INFORMATION

Prices may be obtained from Carboline sales representative or main office.

APPROXIMATE SHIPPING WEIGHT:

	1 Gal. Kit (1.25 Gal.)	5 Gal. Kit (6.25 Gal.)
Phenoline 305 Primer	17 lbs. (7.7 kg)	80 lbs. (36.4 kg)
Phenoline 305 Concrete Primer	17 lbs. (7.7 kg)	80 lbs. (36.4 kg)
Phenoline Thinner	9 lbs. (4.1 kg)	45 lbs. (20.5 kg)

FLASH POINT: (Pensky-Martens Closed Cup)

Phenoline 305 Primer Part A	96°F (36°C)
Phenoline 305 Primer Part B	54°F (12°C)
Phenoline Concrete Primer Part B	59°F (15°C)
Phenoline Thinner	77°F (25°C)

Aug. 83 Replaces March 81-N

To the best of our knowledge the technical data contained herein are true and accurate at the date of issuance and are subject to change without prior notice. User must contact Carboline to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of products. Prices and cost data if shown, are subject to change without prior notice. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY THE SELLER, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

APPLICATION INSTRUCTIONS

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions, and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

606/607

SURFACE PREPARATION: Remove any oil or grease from surface to be coated with clean rags soaked in Carboline Thinner #2 or toluol in accordance with SSPC-SP 1.

Steel: Dry abrasive blast to a Commercial Grade Finish in accordance with SSPC-SP 6-82 to a degree of cleanliness in accordance with NACE #3 to obtain a 2-3 mil (50-75 micron) blast profile.

Concrete: The concrete surface should be at least as rough as medium grit sandpaper. The surface should be free of laitance. This can be accomplished by sandblasting, acid etch or mechanical abrasion. Do not coat concrete treated with hardening solutions unless test patch indicates satisfactory adhesion. Holes in the concrete surface may require patching or surfacing prior to the primer application. Do not apply coating unless concrete has cured at least 28 days at 70°F (21°C) and 50% R.H. or equivalent time.

MIXING: Power mix separately, then combine and mix in the following proportions:

	1 Gal. Kit	5 Gal. Kit
Phenoline 305 Primer Part A	1 gallon	5 gallons
Phenoline 305 Primer Part B or Phenoline Concrete Primer Part B	1 quart can	5 quart can
	1.25 gallon	6.25 gallon

Thin as required up to 20% by volume with Phenoline Thinner. Amount of thinner will vary depending on weather conditions.

POT LIFE: One and one-half hours at 75°F (24°C) and less at higher temperatures. Pot life ends when coating loses body and begins to sag.

APPLICATION TEMPERATURES:

	Material	Surfaces
Normal	65-85°F (18-29°C)	65-85°F (18-29°C)
Minimum	55°F (13°C)	50°F (10°C)
Maximum	90°F (32°C)	120°F (49°C)
	Ambient	**Humidity**
Normal	65-85°F (18-29°C)	N/A
Minimum	50°F (10°C)	0%
Maximum	110°F (43°C)	90%

Do not apply when the surface temperature is less than 5°F (2°C) above the dew point.

Special thinning and application techniques may be required above or below normal conditions.

SPRAY: Use sufficient air volume for correct operation of equipment.

Use a 50% overlap with each pass of the gun. On irregular surfaces, coat the edges first, making an extra pass later.

Conventional: Use a 3/8" minimum I.D. material hose. Hold gun approximately 12-14 inches from the surface and at a right angle to the surface.

Mfr. & Gun	Fluid Tip	Air Cap
Binks #18 or #62	66	63PB
DeVilbiss P-MBC or JGA	E	704
	approx. .070" I.D.	

Airless: Use a 3/8" minimum I.D. material hose. Hold gun approximately 18-20 inches from the surface and at a right angle to the surface.

Mfr. & Gun	Pump*
DeVilbiss JGB-507	QFA-519
Graco 205-591	President 30:1 or Bulldog 30:1
Binks Model 700	Mercury 5C or B8-36 37:1

*Teflon packings are recommended and are available from manufacturer.

Use a .019-.023" tip with 2200 psi.

BRUSH OR ROLLER: Use natural bristle brush. For touch-up only. For roller applications, use a lambs wool roller with phenolic core. Two coats may be required to obtain proper film thickness.

REPAIR PROCEDURES: Small surface defects can be repaired by hand sanding. Small areas damaged to substrate require power sanding or grinding. In both cases, feather edge to surrounding coating, solvent wipe, and touch-up with brush. Avoid rebrushing. Large damaged areas require reblasting or mechanical cleaning to original specifications, feather edging and reapplication of the original system.

DRYING TIMES:

Temperature	Between Coats	Final Cure
50°F (10°C)	72 hours	12 days
60°F (16°C)	36 hours	8 days
75°F (24°C)	18 hours	4 days
90°F (32°C)	12 hours	2 days

CLEAN UP: Use Carboline Thinner #2 or xylol.

STORAGE CONDITIONS:
Temperature: 45-110°F (7-43°C) Humidity: 0-100%

CAUTION: CONTAINS FLAMMABLE SOLVENTS. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CONFINED AREAS WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. IN AREAS WHERE EXPLOSION HAZARDS EXIST, WORKMEN SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NONSPARKING SHOES.

350 HANLEY INDUSTRIAL COURT carboline ST. LOUIS, MO. 63144 • 314-644-1000

product data sheet

carboline

PHENOLINE® 305 FINISH

350 HANLEY INDUSTRIAL COURT • ST. LOUIS, MO. 63144 • 314-644-1000

607

SELECTION DATA

GENERIC TYPE: Modified phenolic. Part A and Part B mixed prior to application.

GENERAL PROPERTIES: A heavy-duty topcoat, PHENOLINE 305 Finish sets to a hard, tough, smooth finish having very good abrasion resistance. The surface is glossy and easily cleaned. Has excellent resistance to a wide range of solvents, caustics, cleaning solutions and acid entrained vapors of high concentration. PHENOLINE 305 Finish has outstanding chemical, physical and application properties. PHENOLINE 305 Finish is easily repaired, has excellent resistance to hydraulic fluids and meets the applicable performance criteria of the American National Standards Institute ANSI N101.2-1972 and ANSI N6.12-1974. It has performed satisfactorily in radiation resistance and decontamination testing at Oak Ridge National Laboratory.

RECOMMENDED USES: PHENOLINE 305 Finish is an excellent coating for the protection of steel and concrete surfaces in nuclear power plants. Because of its glossy appearance and excellent physical properties, PHENOLINE 305 Finish is an excellent topcoat for use by manufacturers of industrial equipment and components. Also used in chemical processing plants, pulp and paper mills for the protection of structural steel and concrete against severe splash, spillage and fume conditions. The addition of 50 mesh silica provides a non-skid surface, making an excellent floor coating.

NOT RECOMMENDED FOR: Immersion service or continuous spillage of hot or concentrated acids.

CHEMICAL RESISTANCE GUIDE:

Exposure	Splash and Spillage	Fumes
Acids	Very Good	Excellent
Alkalies	Excellent	Excellent
Solvents	Excellent	Excellent
Salt	Excellent	Excellent
Water	Excellent	Excellent

TEMPERATURE RESISTANCE: (non-immersion)
Continuous: 200°F (93°C)
Non-continuous 250°F (121°C)

FLEXIBILITY: Fair **WEATHERING:** Very Good

ABRASION RESISTANCE: Very good

SUBSTRATES: Apply over suitably primed metal or cementitious surfaces. Surfacer may be required for concrete surfaces, depending on roughness and texture.

TOPCOAT REQUIRED: Normally none

COMPATIBILITY WITH OTHER COATINGS: May be applied over inorganic zincs, catalyzed epoxies, modified phenolics or others as recommended. Acceptable primers are CARBO ZINC® 11, CARBO ZINC 12, CARBOLINE® 195 Surfacer, CARBOLINE 295WB Surfacer, PHENOLINE 305 Primer, PHENOLINE 305 Concrete Primer, PHENOLINE 307 or others as recommended. A mist coat may be required when applied over inorganic zinc.

SPECIFICATION DATA

THEORETICAL SOLIDS CONTENT OF MIXED MATERIAL:

	By Volume
PHENOLINE 305 Finish	64% ± 2%

RECOMMENDED DRY FILM THICKNESS PER COAT:
4-6 mils (100-150 microns)

THEORETICAL COVERAGE PER MIXED KIT*:

1 gal. kit (yields 1.25 gal.)
1283 mil sq. ft. (25.6 m/l at 25 microns)
320 sq. ft. at 4 mils (6.4 sq. m/l at 100 microns)

5 gal. kit (yields 6.25 gal.)
6416 mil sq. ft. (25.6 sq. m/l at 25 microns)
1603 sq. ft. at 4 mils (6.4 sq. m/l at 100 microns)

*NOTE: Material losses during mixing and application will vary and must be taken into consideration when estimating job requirements.

SHELF LIFE: 24 months minimum

COLORS: Available in a variety of colors. Consult your local Carboline representative or Carboline Customer Service for availability.

GLOSS: Glossy

ORDERING INFORMATION

Prices may be obtained from Carboline sales representative or main office.

APPROXIMATE SHIPPING WEIGHT:

	1 Gal. Kit (1.25 gal.)	5 Gal. Kit (6.25 gal.)
PHENOLINE 305 Finish	17 lbs. (7.7 kg)	80 lbs. (36.3 kg)
PHENOLINE Thinner	9 lbs. (4.1 kg)	45 lbs. (20.5 kg)
CARBOLINE Thinner #2	9 lbs. (4.1 kg)	45 lbs. (20.5 kg)

FLASH POINT: (Pensky-Martens Closed Cup)

PHENOLINE 305 Finish Part A	68°F (20°C)
PHENOLINE 305 Finish Part B	60°F (16°C)
PHENOLINE Thinner	77°F (25°C)
CARBOLINE Thinner #2	30°F (-1°C)

March 84 Replaces May 83

To the best of our knowledge the technical data contained herein are true and accurate at the date of issuance and are subject to change without prior notice. User must contact Carboline to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of products. Prices and cost data if shown, are subject to change without prior notice. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY THE SELLER, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OR LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

APPLICATION INSTRUCTIONS

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions, and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

607

SURFACE PREPARATION: Remove any oil or grease from surface to be coated with clean rags soaked in CARBOLINE Thinner #2 or toluol in accordance with SSPC-SP1-82.

Steel/Concrete: Apply over clean, dry, recommended primer or surfacer. Application over inorganic zincs may require a mist coat.

MIXING: Mix separately, then combine and mix thoroughly in the following proportions:

	1 Gal. Kit	5 Gal. Kit
PHENOLINE 305 Finish Part A	1 Gal.	5 Gal.
PHENOLINE 305 Finish Part B	1 Qt.	1.25 Gal.
	1.25 gal.	6.25 gal.

Thin up to 25% by volume with PHENOLINE Thinner.

NOTE: Use of thinners other than those supplied or approved by Carboline may adversely affect product performance and void product warranty, whether express or implied.

POT LIFE: One and one half hours at 75°F (24°C) and less at higher temperatures. Pot life ends when coating loses body and begins to sag.

APPLICATION TEMPERATURES:

	Material	Surfaces
Normal	65-85°F (18-29°C)	65-85°F (18-29°C)
Minimum	55°F (13°C)	50°F (10°C)
Maximum	90°F (32°C)	120°F (49°C)

	Ambient	Humidity
Normal	65-85°F (18-29°C)	30-60%
Minimum	50°F (10°C)	0%
Maximum	110°F (43°C)	90%

Do not apply when the surface temperature is less than 5°F (2°C) above the dew point.

Special thinning and application techniques may be required above or below normal conditions and when applying over inorganic zinc primers.

SPRAY: Use sufficient air volume for correct operation of equipment.

Use a 50% overlap with each pass of the gun. On irregular surfaces, coat the edges first, making an extra pass later.

NOTE: The following equipment has been found suitable; however, equivalent equipment may be substituted.

Conventional: Use a 3/8" minimum I.D. material hose. Hold gun approximately 12-14 inches from the surface and at a right angle to the surface.

Mfr. & Gun	Fluid Tip	Air Cap
Binks #18 or #62	66	63PB
DeVilbiss P-MBC or JGA	E	704

approx. .070" I.D.

Airless: Use a 3/8" minimum I.D. material hose. Hold gun approximately 18-20 inches from the surface and at a right angle to the surface.

Mfr. & Gun	Pump*
DeVilbiss JGB-507	QFA-519
Graco 205-591	President 30:1 or Bulldog 30:1
Binks Model 700	88-36 37:1

*Teflon packings are recommended and are available from pump manufacturer.

Use a .015-.017" tip with 2200 psi.

BRUSH OR ROLLER: For touch-up only. Use natural bristle brush applying with full coat. Avoid rebrushing. Use lambswool roller with phenolic core. Avoid rerolling. Two coats may be required for proper hiding and film build.

APPLICATION FOR NON-SKID SURFACES:
For non-skid surfaces, mix Part A and Part B as usual and add, under agitation, 2½ pints (approximately 4.33 lbs.) of 50 mesh Ottawa Silica for each one-gallon kit of PHENOLINE 305 Finish. Thin up to 25% by volume with PHENOLINE Thinner. Keep material under mild agitation during application.

Conventional: Use a ½" minimum I.D. material hose and an agitated bottom outlet pot with ¼" minimum I.D. outlet equipped with dual regulators. Hold gun approximately 12-14 inches from the surface and at a right angle to the surface.

Mfr. & Gun	Fluid Tip	Air Cap
Binks Model 18 or 62	68	68 PB
DeVilbiss P-MBC or JGA	AC	62

approx. 110" I.D.

Airless: Not recommended (abrades tip).

DRYING TIMES:

Temperature	Between Coats	Final Cure
50°F (10°C)	72 hrs.	12 days
60°F (16°C)	36 hrs.	8 days
75°F (24°C)	18 hrs.	4 days
90°F (32°C)	12 hrs.	2 days

CLEAN UP: Use CARBOLINE Thinner #2 or xylol.

STORAGE CONDITIONS:
Temperature: 45-110°F (7-43°C) Humidity: 0-100%

For specific recommendations, consult Carboline Technical Service.

CAUTION: CONTAINS FLAMMABLE SOLVENTS. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CONFINED AREAS WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. IN AREAS WHERE EXPLOSION HAZARDS EXIST, WORKMEN SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NONSPARKING SHOES.

350 HANLEY INDUSTRIAL COURT carboline ST. LOUIS, MO. 63144 • 314-644-1000

MSDS

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 1 of 3

SECTION I - PRODUCT: PHENOLINE 305 FINISH PART A [0607A1NL]
Date: 12/29/95 Replaces 04/18/94

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
ALUMINUM SILICATE	1332-58-7	25%	10mg/m3	NE	NE
COLOR PIGMENT	MIXTURE	20%	3.5MG/M3	NE	NE
MIBK	108-10-1	10%	50 PPM	75 PPM	NE
GLYCIDYL ETHER	NE	5%	2.0 PPM	NE	NE
DIBUTYL PHTHALATE	84-74-2	5%	5.0 MG/M3	NE	NE
TOLUENE	108-88-3	5%	100 PPM	150 PPM	NE
VMP NAPHTHA	8032-32-4	5%	300 PPM	400 PPM	NE
XYLENE	1330-20-7	5%	100 PPM	150 PPM	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
ALUMINUM SILICATE	NOT AVAILABLE	NO/NO
COLOR PIGMENT	NOT AVAILABLE	NO/NO
MIBK	NOT AVAILABLE	NO/YES/1,2,3/ 5000#/U161
GLYCIDYL ETHER	POSSIBLE SKIN SENSITIZER	NO/NO
DIBUTYL PHTHALATE	NOT AVAILABLE	NO/YES/1,2/10
TOLUENE	2500 MG/KG RAT,ORAL 18000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U220
VMP NAPHTHA	NOT AVAILABLE	NO/NO/1,2,3
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U239

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 2, FLAMMABILITY 3, REACTIVITY 0, PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 232F(111C)-300F(148C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 17 %. VOLATILE BY VOLUME: 28 %. PRODUCT WT/GAL: 11.5 LBS/U.S.GAL. 1.38 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 68 F(20C) (Setaflash) LEL 0.9 %

PRODUCT: PHENOLINE 305 FINISH PART A (0607A1NL)
Date: 12/29/95 Replaces 04/18/94

UEL 7.5 %.
OSHA-PAINT/FLAMMABLE/LIQUID/3/UN1263/PGII, DOT-PAINT,3,UN1263,PGII, CANADIAN TDGA: PAINT,3,UN1263,PGII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation.
CONTACT: May cause eye irritation. May cause skin irritation. May cause allergic skin reaction.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If sensitized to amines, epoxies or other chemicals do not use. See a physician if a medical condition exists.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and

PRODUCT: PHENOLINE 305 FINISH PART A (0607A1NL)
Date: 12/29/95 Replaces 04/18/94

equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved air-purifying respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Banley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

CARBOLINE CO. MATERIAL SAFETY DATA SHEET
PRODUCT: PHENOLINE 305 FINISH PART A (0607A1NL)
Date: 12/29/95 Replaces 04/18/94

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
EPOXY RESIN	25036-25-3	35%
EPOXY RESIN	NK	10%

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 1 of 4

SECTION I - PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
POLYAMINE ADDUCT	NE	20%	NE	NE	NE
DETA	111-40-0	20%	1.0 PPM	NE	NE
PM SOLVENT	107-98-2	20%	100 PPM	150 PPM	NE
VMP NAPHTHA	8032-32-4	15%	300 PPM	400 PPM	NE
ISOPROPANOL	67-63-0	15%	400 PPM	500 PPM	NE
MIBK	108-10-1	15%	50 PPM	75 PPM	NE
XYLENE	1330-20-7	10%	100 PPM	150 PPM	NE
ETHYL BENZENE	100-41-4	5%	100 PPM	125 PPM	NE
TMBDA	97-84-7	5%	NE	NE	NE
PROPYLDIAMINE	109-76-2	5%	NE	NE	NE
NONYL PHENOL	25154-52-3	5%	NE	NE	NE
AROMATIC SOLVENT	64742-95-6	5%	25PPM	NE	NE
PHENOL	108-95-2	1%	5PPM	NE	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
POLYAMINE ADDUCT	NOT AVAILABLE	NO/NO/1
DETA	2140MG/KG RAT,ORAL 660MG/KG RABBIT, SKIN	NO/NO/1,2
PM SOLVENT	15000 PPM/4HRS RAT,INHALATION	NO/NO/1,2,3
VMP NAPHTHA	NOT AVAILABLE	NO/NO/1,2,3
ISOPROPANOL	4720MG/KG RAT,ORAL 16000PPM/8HRS RAT,INHALATION	NO/NO/3
MIBK	NOT AVAILABLE	NO/YES/1,2,3/ 5000#/U161
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U239
ETHYL BENZENE	NOT AVAILABLE	NO/YES/1,2,3
TMBDA	NOT AVAILABLE	NO/NO/1,2
PROPYLDIAMINE	NOT AVAILABLE	NO/NO/1,2
NONYL PHENOL	1620MG/KG ORAL 2140 MG/KG SKIN	NO/NO
AROMATIC SOLVENT	4700MG/KG RAT,ORAL 3670PPM/8HRS RAT,INHALATION	NO/YES/1/2/3
PHENOL	317MG/KG ORAL 316MG/M3 INHALATION	YES/YES/1,2/ 1000#/U188

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

WHMIS CLASSIFICATION: B2 -- D1 -- D2B -- E
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 3, REACTIVITY 1,
PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 180F(82C)-346F(174C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 59 %. VOLATILE BY VOLUME: 65 %. PRODUCT WT/GAL: 7.5 LBS/U.S.GAL. 0.90 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 60 F(15C) (Setaflash) LEL 0.9 % UEL 13.8 %.
OSHA-PAINT/FLAMMABLE/LIQUID/3/UN1263/PGII, DOT-PAINT,3,UN1263,PGII, CANADIAN TDGA: PAINT,3,UN1263,PGII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: May cause allergic respiratory reaction, effects may be permanent. Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. Can cause nose and throat irritation. May cause lung irritation.
CONTACT: May be harmful if absorbed through the skin. Can cause eye burns. Can cause skin burns. May cause allergic skin reaction.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If sensitized to amines, epoxies or other chemicals do not use. See a physician if a medical condition exists.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved air-purifying respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

CARBOLINE CO. MATERIAL SAFETY DATA SHEET
PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct

No materials meet this criteria

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 1 of 3

SECTION I - PRODUCT: PHENOLINE 305 PRIMER PART A (D606A1ML)
Date: 06/03/92 Replaces 05/18/89 - VLF

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
COLOR PIGMENT	MIXTURE	20%	3.5MG/M3	NE	NE
MICA	12001-26-2	20%	3mg/m3	NE	NE
ALUMINUM SILICATE	1332-58-7	15%	10mg/m3	NE	NE
MIBK	108-10-1	10%	50 PPM	75 PPM	NE
GLYCIDYL ETHER	NE	5%	2.0 ppm	NE	NE
DIBUTYL PHTHALATE	84-74-2	5%	5.0 mg/m3	NE	NE
TOLUENE	108-88-3	5%	100 PPM	150 PPM	NE
XYLENE	1330-20-7	5%	100 PPM	150 PPM	NE
PM SOLVENT	107-98-2	5%	100 PPM	150 PPM	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
COLOR PIGMENT	NOT AVAILABLE	NO/NO
MICA	NOT AVAILABLE	NO/NO
ALUMINUM SILICATE	NOT AVAILABLE	NO/NO
MIBK	NOT AVAILABLE	NO/YES/1,2,3/ CERCLA 5000#
GLYCIDYL ETHER	NOT AVAILABLE	NO/NO
DIBUTYL PHTHALATE	NOT AVAILABLE	NO/YES/1,2
TOLUENE	2500 MG/KG RAT,ORAL 18000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3
PM SOLVENT	15000 PPM/4HRS RAT,INHALATION	NO/NO/1,2,3

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 2, FLAMMABILITY 3, REACTIVITY 0,
PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 232F(111C)-284F(140C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 18 %. VOLATILE BY VOLUME: 32 %. PRODUCT WT/GAL: 12.5 LBS/U.S.GAL. 1.50 sp gr.

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 1 of 4

SECTION I - PRODUCT: PHENOLINE 305 PRIMER PT B (0606B1PL)
Date: 06/03/92 Replaces 02/07/90 - VLF

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
PM SOLVENT	107-98-2	20%	100 PPM	150 PPM	NE
ISOPROPANOL	67-63-0	20%	400 PPM	500 PPM	NE
POLYAMINE ADDUCT	NE	15%	NE	NE	NE
DETA	111-40-0	15%	1.0 PPM	NE	NE
VMP NAPHTHA	8032-32-4	15%	300 PPM	400 PPM	NE
MIBK	108-10-1	15%	50 PPM	75 PPM	NE
XYLENE	1330-20-7	10%	100 PPM	150 PPM	NE
TMEDA	97-84-7	5%	NE	NE	NE
PROPYLDIAMINE	109-76-2	5%	NE	NE	NE
NONYL PHENOL	25154-52-3	5%	NE	NE	NE
PHENOL	108-95-2	1%	5PPM	NE	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
PM SOLVENT	15000 PPM/4HRS RAT, INHALATION	NO/NO/1,2,3
ISOPROPANOL	4720MG/KG RAT, ORAL 16000PPM/8HRS RAT, INHALATION	NO/NO/3
POLYAMINE ADDUCT	NOT AVAILABLE	NO/NO/1
DETA	2140MG/KG RAT, ORAL 660MG/KG RABBIT, SKIN	NO/NO/1,2
VMP NAPHTHA	NOT AVAILABLE	NO/NO/1,2,3
MIBK	NOT AVAILABLE	NO/YES/1,2,3/ CERCLA 500#
XYLENE	4300MG/KG RAT, ORAL 15000 PPM/4HRS RAT, INHALATION	NO/YES/1,2,3
TMEDA	NOT AVAILABLE	NO/NO/1,2
PROPYLDIAMINE	NOT AVAILABLE	NO/NO/1,2
NONYL PHENOL	NOT AVAILABLE	NO/NO
PHENOL	NOT AVAILABLE	YES/YES/1,2

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particloates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D1 -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 4, FLAMMABILITY 3, REACTIVITY 0,
PERSONAL PROTECTION CODE H, NFPA FIRE FIGHTING PHASE 4

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 2 of 4

PRODUCT: PHENOLINE 305 PRIMER PT B (06D6B1PL)
Date: 06/03/92 Replaces 02/07/90 - VLF

SECTION III - PHYSICAL DATA:

BOILING RANGE: 180F(82C)-300F(148C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 68 %. VOLATILE BY VOLUME: 73 %. PRODUCT WT/GAL: 7.3 LBS/U.S.GAL. 0.88 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 54 F(12C) (Setaflash) LEL 0.9 % UEL 13.8 %.
OSHA-FLAMMABLE LIQUID CLASS IB, DOT-PAINT FLAMMABLE LIQUID UN1263, CANADIAN TDGA: PAINT FLAMMABLE LIQUID CLASS 3 DIVISION 2
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: May cause allergic respiratory reaction, effects may be permanent. Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. Can cause nose and throat irritation. May cause lung irritation.
CONTACT: May be harmful if absorbed through the skin. Can cause eye burns. Can cause skin burns. May cause allergic skin reaction.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If sensitized to amines, epoxies or other chemicals do not use. See a physician if a medical condition exists.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 3 of 4

PRODUCT: PHENOLINE 305 PRIMER PT B (0606BLFL)
Date: 06/03/92 Replaces 02/07/90 - VLF

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use (OSHA) approved air-purifying respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

CAROLINE CO. MATERIAL SAFETY DATA SHEET NON-HAZARDOUS
PRODUCT: PERMOLINE 305 PRIMER PT B [0606B:PL]
Date: 06/03/92 Replaces 02/07/90 - VLF

Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct

No materials meet this criteria

CARBOLINE COMPANY

carboline®

Facsimile Transmittal Sheet

To:	Toni
Fax:	5099469800
Subject:	MSDS
Date:	12/27/2007 03:10:36 PM
Pages:	15 , including cover page
From:	Mike Beckman
E-mail:	
Phone:	
Fax:	
Department:	
Address:	

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 1 of 3

SECTION I - PRODUCT: PHENOLINE 305 FINISH PART A (0607A1NL)
Date: 12/29/95 Replaces 04/18/94

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
ALUMINUM SILICATE	1332-58-7	25%	10mg/m3	NE	NE
COLOR PIGMENT	MIXTURE	20%	3.5MG/M3	NE	NE
MIBK	108-10-1	10%	50 PPM	75 PPM	NE
GLYCIDYL ETHER	NE	5%	2.0 PPM	NE	NE
DIBUTYL PHTHALATE	84-74-2	5%	5.0 MG/M3	NE	NE
TOLUENE	108-88-3	5%	100 PPM	150 PPM	NE
VMP NAPHTHA	8032-32-4	5%	300 PPM	400 PPM	NE
XYLENE	1330-20-7	5%	100 PPM	150 PPM	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
ALUMINUM SILICATE	NOT AVAILABLE	NO/NO
COLOR PIGMENT	NOT AVAILABLE	NO/NO
MIBK	NOT AVAILABLE	NO/YES/1,2,3/ 5000#/U161
GLYCIDYL ETHER	POSSIBLE SKIN SENSITIZER	NO/NO
DIBUTYL PHTHALATE	NOT AVAILABLE	NO/YES/1,2/10
TOLUENE	2500 MG/KG RAT,ORAL 18000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U220
VMP NAPHTHA	NOT AVAILABLE	NO/NO/1,2,3
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U239

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 2, FLAMMABILITY 3, REACTIVITY 0, PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 232F(111C)-300F(148C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 17 %. VOLATILE BY VOLUME: 28 %. PRODUCT WT/GAL: 11.5 LBS/U.S.GAL. 1.38 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 68 F(20C) (Setaflash) LEL 0.9 %

PRODUCT: PHENOLINE 305 FINISH PART A (0607A1NL)
Date: 12/29/95 Replaces 04/18/94

UEL 7.5 %.
OSHA-PAINT/FLAMMABLE/LIQUID/3/UN1263/PGII, DOT-PAINT,3,UN1263,PGII, CANADIAN TDGA: PAINT,3,UN1263,PGII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation.
CONTACT: May cause eye irritation. May cause skin irritation. May cause allergic skin reaction.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If sensitized to amines, epoxies or other chemicals do not use. See a physician if a medical condition exists.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and

PRODUCT: PHENOLINE 305 FINISH PART A (0607A1NL)
Date: 12/29/95 Replaces 04/18/94

equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved air-purifying respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

CARBOLINE CO. MATERIAL SAFETY DATA SHEET
PRODUCT: PHENOLINE 305 FINISH PART A (0607A1NL)
Date: 12/29/95 Replaces 04/18/94

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
EPOXY RESIN	25036-25-3	35%
EPOXY RESIN	NE	10%

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 1 of 4

SECTION I - PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
POLYAMINE ADDUCT	NE	20%	NE	NE	NE
DETA	111-40-0	20%	1.0 PPM	NE	NE
PM SOLVENT	107-98-2	20%	100 PPM	150 PPM	NE
VMP NAPHTHA	8032-32-4	15%	300 PPM	400 PPM	NE
ISOPROPANOL	67-63-0	15%	400 PPM	500 PPM	NE
MIBK	108-10-1	15%	50 PPM	75 PPM	NE
XYLENE	1330-20-7	10%	100 PPM	150 PPM	NE
ETHYL BENZENE	100-41-4	5%	100 PPM	125 PPM	NE
TMBDA	97-84-7	5%	NE	NE	NE
PROPYLDIAMINE	109-76-2	5%	NE	NE	NE
NONYL PHENOL	25154-52-3	5%	NE	NE	NE
AROMATIC SOLVENT	64742-95-6	5%	25PPM	NE	NE
PHENOL	108-95-2	1%	5PPM	NE	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
POLYAMINE ADDUCT	NOT AVAILABLE	NO/NO/1
DETA	2140MG/KG RAT,ORAL 660MG/KG RABBIT, SKIN	NO/NO/1,2
PM SOLVENT	15000 PPM/4HRS RAT,INHALATION	NO/NO/1,2,3
VMP NAPHTHA	NOT AVAILABLE	NO/NO/1,2,3
ISOPROPANOL	4720MG/KG RAT,ORAL 16000PPM/8HRS RAT,INHALATION	NO/NO/3
MIBK	NOT AVAILABLE	NO/YES/1,2,3/ 5000#/U161
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U239
ETHYL BENZENE	NOT AVAILABLE	NO/YES/1,2,3
TMBDA	NOT AVAILABLE	NO/NO/1,2
PROPYLDIAMINE	NOT AVAILABLE	NO/NO/1,2
NONYL PHENOL	1620MG/KG ORAL 2140 MG/KG SKIN	NO/NO
AROMATIC SOLVENT	4700MG/KG RAT,ORAL 3670PPM/8HRS RAT,INHALATION	NO/YES/1/2/3
PHENOL	317MG/KG ORAL 316MG/M3 INHALATION	YES/YES/1,2/ 1000#/U188

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

WHMIS CLASSIFICATION: B2 -- D1 -- D2B -- E
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 3, REACTIVITY 1, PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 180F(82C)-346F(174C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 59 %. VOLATILE BY VOLUME: 65 %. PRODUCT WT/GAL: 7.5 LBS/U.S.GAL. 0.90 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 60 F(15C) (Setaflash) LEL 0.9 % UEL 13.8 %.
OSHA-PAINT/FLAMMABLE/LIQUID/3/UN1263/PGII, DOT-PAINT,3,UN1263,PGII, CANADIAN TDGA: PAINT,3,UN1263,PGII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: May cause allergic respiratory reaction, effects may be permanent. Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. Can cause nose and throat irritation. May cause lung irritation.
CONTACT: May be harmful if absorbed through the skin. Can cause eye burns. Can cause skin burns. May cause allergic skin reaction.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If sensitized to amines, epoxies or other chemicals do not use. See a physician if a medical condition exists.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved air-purifying respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

CARBOLINE CO. MATERIAL SAFETY DATA SHEET
PRODUCT: PHENOLINE 305 FINISH PART B (0607B1NL)
Date: 12/28/95 Replaces 09/07/93

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
No materials meet this criteria		

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 1 of 3

SECTION I - PRODUCT: PHENOLINE 305 PRIMER PART A (D606A1ML)
Date: 06/03/92 Replaces 05/18/89 - VLF

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
COLOR PIGMENT	MIXTURE	20%	3.5MG/M3	NE	NE
MICA	12001-26-2	20%	3mg/m3	NE	NE
ALUMINUM SILICATE	1332-58-7	15%	10mg/m3	NE	NE
MIBK	108-10-1	10%	50 PPM	75 PPM	NE
GLYCIDYL ETHER	NE	5%	2.0 ppm	NE	NE
DIBUTYL PHTHALATE	84-74-2	5%	5.0 mg/m3	NE	NE
TOLUENE	108-88-3	5%	100 PPM	150 PPM	NE
XYLENE	1330-20-7	5%	100 PPM	150 PPM	NE
PM SOLVENT	107-98-2	5%	100 PPM	150 PPM	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
COLOR PIGMENT	NOT AVAILABLE	NO/NO
MICA	NOT AVAILABLE	NO/NO
ALUMINUM SILICATE	NOT AVAILABLE	NO/NO
MIBK	NOT AVAILABLE	NO/YES/1,2,3/ CERCLA 500#
GLYCIDYL ETHER	NOT AVAILABLE	NO/NO
DIBUTYL PHTHALATE	NOT AVAILABLE	NO/YES/1,2
TOLUENE	2500 MG/KG RAT,ORAL 18000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3
PM SOLVENT	15000 PPM/4HRS RAT,INHALATION	NO/NO/1,2,3

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 2, FLAMMABILITY 3, REACTIVITY 0,
PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 232F(111C)-284F(140C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 18 %. VOLATILE BY VOLUME: 32 %. PRODUCT WT/GAL: 12.5 LBS/U.S.GAL. 1.50 sp gr.

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 1 of 4

SECTION I - PRODUCT: PHENOLINE 305 PRIMER PT B (0606B1PL)
Date: 06/03/92 Replaces 02/07/90 - VLF

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
PM SOLVENT	107-98-2	20%	100 PPM	150 PPM	NE
ISOPROPANOL	67-63-0	20%	400 PPM	500 PPM	NE
POLYAMINE ADDUCT	NE	15%	NE	NE	NE
DETA	111-40-0	15%	1.0 PPM	NE	NE
VMP NAPHTHA	8032-32-4	15%	300 PPM	400 PPM	NE
MIBK	108-10-1	15%	50 PPM	75 PPM	NE
XYLENE	1330-20-7	10%	100 PPM	150 PPM	NE
TMBDA	97-84-7	5%	NE	NE	NE
PROPYLDIAMINE	109-76-2	5%	NE	NE	NE
NONYL PHENOL	25154-52-3	5%	NE	NE	NE
PHENOL	108-95-2	1%	5PPM	NE	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
PM SOLVENT	15000 PPM/4HRS RAT,INHALATION	NO/NO/1,2,3
ISOPROPANOL	4720MG/KG RAT,ORAL 16000PPM/8HRS RAT,INHALATION	NO/NO/3
POLYAMINE ADDUCT	NOT AVAILABLE	NO/NO/1
DETA	214MG/KG RAT,ORAL 66MG/KG RABBIT, SKIN	NO/NO/1,2
VMP NAPHTHA	NOT AVAILABLE	NO/NO/1,2,3
MIBK	NOT AVAILABLE	NO/YES/1,2,3/ CERCLA 500#
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3
TMBDA	NOT AVAILABLE	NO/NO/1,2
PROPYLDIAMINE	NOT AVAILABLE	NO/NO/1,2
NONYL PHENOL	NOT AVAILABLE	NO/NO
PHENOL	NOT AVAILABLE	YES/YES/1,2

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D1 -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 4, FLAMMABILITY 3, REACTIVITY 0,
PERSONAL PROTECTION CODE H, NFPA FIRE FIGHTING PHASE 4

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 2 of 4

PRODUCT: PHENOLINE 305 PRIMER PT B (06D6B1PL)
Date: 06/03/92 Replaces 02/07/90 - VLF

SECTION III - PHYSICAL DATA:

BOILING RANGE: 180F(82C)-300F(148C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 68 %. VOLATILE BY VOLUME: 73 %. PRODUCT WT/GAL: 7.3 LBS/U.S.GAL. 0.88 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 54 F(12C) (Setaflash) LEL 0.9 % UEL 13.8 %.
OSHA-FLAMMABLE LIQUID CLASS IB, DOT-PAINT FLAMMABLE LIQUID UN1263, CANADIAN TDGA: PAINT FLAMMABLE LIQUID CLASS 3 DIVISION 2
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: May cause allergic respiratory reaction, effects may be permanent. Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. Can cause nose and throat irritation. May cause lung irritation.
CONTACT: May be harmful if absorbed through the skin. Can cause eye burns. Can cause skin burns. May cause allergic skin reaction.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If sensitized to amines, epoxies or other chemicals do not use. See a physician if a medical condition exists.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

CARBOLINE CO. MATERIAL SAFETY DATA SHEET PAGE 3 of 4

PRODUCT: PHENOLINE 305 PRIMER PT B (0606BLPL)
Date: 06/03/92 Replaces 02/07/90 - WLF

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use (OSHA) approved air-purifying respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

CAROLINE CO. MATERIAL SAFETY DATA SHEET NON-HAZARDOUS
PRODUCT: PERMOLINE 305 PRIMER PT B [0606B:PL]
Date: 06/03/92 Replaces 02/07/90 - VLF

Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct

No materials meet this criteria

ATTACHMENT 17
PERSONNEL QUALIFICATION

(14 PAGES)

TIMOTHY J. OLIVER, P.E.

IQRPE

RCRA permitting
RCRA enforcement
Hazardous waste treatment systems

SUMMARY OF QUALIFICATIONS

Mr. Oliver is a licensed professional environmental engineer with over 16 years of experience. His specific area of technical expertise is focused on hazardous waste treatment, storage, and disposal systems; including the design, development, permitting, construction, and operation of thermal treatment systems. Mr. Oliver has served as the IQRPE certifying the design, construction, modification, and closure of numerous hazardous waste management units subject to RCRA permitting requirements.

EDUCATION

B.S., Chemical Engineering, Northwestern University, 1991

REGISTRATIONS/CERTIFICATIONS

Licensed Professional Engineer, Washington (No. 41543)
Licensed Professional Engineer, Oregon (No. 59720)
Licensed Professional Engineer, Utah, (No. 5676180-2202)
Licensed Professional Engineer, Colorado (No. 38253)
Licensed Professional Engineer, Texas (No. 83510)
Licensed Professional Engineer, Louisiana (No. 28068)
Licensed Professional Engineer, Arkansas (No. 9998)

QUALIFICATIONS/TRAINING

40-hour OSHA hazardous waste operations (HAZWOPER) with annual 8-hour refresher training
8-hour OSHA HAZWOPER supervisor course

RELEVANT EXPERIENCE

Project Manager/Certifying Engineer, Hanford 242-A Evaporator System Integrity Assessment. Mr. Oliver is directing a team of mechanical engineers in completing an independent integrity assessment for this high-level waste treatment process in accordance with Washington Administrative Code and RCRA Permit requirements. The integrity assessment includes the development and implementation of visual, hydrostatic, and ultrasonic testing procedures in order to assess the integrity of secondary containment systems and the adequacy of the basis of design, structural support features, waste compatibility, corrosion protection, and ongoing inspection activities with regards to the current operation of the system.

Project Manager/Certifying Engineer, Hanford Tank Farm Closure Demonstration Bulk Vitrification System IQRPE. Certifying Engineer for design review and installation inspection and certification for RCRA-permitted, multiple tank system handling low activity mixed radioactive wastes. Verified proper design of foundations and structural design, reviewed geological investigation information and site preparation plans. Certified design of waste staging tanks, pump skid, hose-in-hose transfer line assemblies, and pollution abatement system. Reviewed proper materials of construction, design specifications, and secondary containment. Managed project staffing and assignment of specialty reviews to other disciplines.

Project Manager, Johnston Atoll Chemical Agent Disposal System IQRPE Closure Certification. Mr. Oliver directed the team responsible for IQRPE certification of the closure activities outlined in the JACADS RCRA Closure and Corrective Action Plan. As part of these activities, Mr. Oliver is directing a team of licensed professional engineers and engineering technicians in the completion of various quality control activities necessary to document completion of closure engineering change proposals, work orders, document change notices, and demolition drawings.

Project Manager/Certifying Engineer, Pine Bluff Chemical Agent Disposal IQRPE Facility Construction Certification. Mr. Oliver conducted periodic inspections and evaluations of this chemical weapons treatment system to ensure that it is properly constructed and tested in accordance with the design drawings and specifications and the permit issued by the Arkansas Department of Environmental Quality. This includes thorough walkdowns of all agent collection system equipment (piping, tanks, secondary containment); pollution abatement system equipment (scrubbers, quenchers,

demisters, valves, instrumentation); brine reduction system equipment (dryers, demisters, tanks), piping, and electrical wiring to identify design discrepancies, flaws in workmanship, and incomplete QA/QC documentation.

Project Manager/Certifying Engineer, Johnston Atoll Chemical Agent Disposal System IQRPE Tank System Modifications. Mr. Oliver was the certifying engineer responsible for the installation of a concrete collection and removal tank system and modifications to the secondary containment system for the spent decontamination solution tank in accordance with the requirements of 40 CFR Part 265.192. This project included a review of various vendor documentation, installation work orders, document change notices, demolition drawings, and engineering calculations; conducting visual inspection of the completed activities, and preparing certification reports.

Certifying Engineer, Umatilla Chemical Agent Disposal Facility Construction Certification and Modifications. Mr. Oliver conducted periodic inspections and evaluations of this chemical weapons treatment and incineration system to ensure that it is properly constructed and tested in accordance with the design drawings and specifications and the permit issued by the Oregon Department of Environmental Quality. This included thorough walkdowns of all pollution abatement system equipment (scrubbers, quenchers, demisters, valves, instrumentation), piping, and electrical wiring to identify design discrepancies, flaws in workmanship, and incomplete QA/QC documentation. In 2002, Mr. Oliver submitted 6 different construction certification packages for the pollution abatement systems at the facility. All were approved and accepted by ODEQ. Mr. Oliver is currently continuing to provide certification of facility construction modifications by preparing certification letter reports for activities throughout the facility as outlined in individual engineering change proposals, including repairs to carbon steel tank systems and stainless steel piping systems.

RCRA Thermal Treatment Unit Permitting Support. From 1992 until 2001, Mr. Oliver was the lead engineer supporting U.S. EPA Region 10 in reviewing documents related to the Part B permitting process for several facilities, including (1) a hazardous waste boiler at the BF Goodrich/Novia/Kalama facility in Kalama, Washington; (2) a plasma arc furnace at the PEcoS/ATG, Inc. facility for the destruction of low level radioactive mixed waste near the Department of Energy's Hanford Reservation; (3) the Advanced Mixed Waste Treatment Facility (a continuous solid feed incinerator) at the Idaho National Engineering and Environmental Laboratory (INEEL); and (4) the Waste Experimental Reduction Facility (a batch-feed incinerator) at INEEL. Mr. Oliver led a project team of several engineers and risk assessment and air modeling experts in the review of the Part B permit application materials, trial burn plans, risk assessment work plans, and risk assessment and trial burn reports; as well as trial burn test oversight activities. Mr. Oliver was responsible for reviewing all of the documents to ensure compliance with U.S. EPA regulations and guidance documents as well as good engineering practice. Specifically, Mr. Oliver was responsible for ensuring that all of the components of the permitting process, stack sampling, operating parameters and equipment specifications, continuous monitoring equipment, and waste feed handling were conducted by each facility properly to provide U.S. EPA with the information necessary to develop a workable permit.

EMPLOYMENT HISTORY

2002 to Present Senior Project Manager, Cooper Zietz Engineers, Inc.
1988 to 2003 Senior Project Manager, Tetra Tech EM Inc.

VAIRAVASAMY ARUMUGAM, Ph.D., P.E.

Senior Environmental Engineer **Process Design Review**

SUMMARY OF QUALIFICATIONS

Dr. Vairavasamy Arumugam has over 26 years of experience in environmental engineering, including extensive experience conducting engineering reviews for remediation projects at Department of Energy, Department of Defense, and other sites throughout the Northwest, California, and Alaska. His work has involved design, construction, facility inspection, treatability study planning, and performing pilot-plant studies.

EDUCATION

Washington State University, Environmental Engineering, Ph.D., 1989
Southern Illinois University, Environmental Engineering, M.S., 1985
Indian Institute of Technology (India), Environmental Engineering, M.Tech., 1972
University of Madras (India), Civil Engineering, B.S., 1966

REGISTRATIONS/CERTIFICATIONS

Certificate in Alaska Cold Regions Engineering, University of Washington, Seattle, 1996
Professional Engineer (Civil Engineering), Washington (27077)

RELEVANT EXPERIENCE

Project Engineer, Department of Energy Radioactive and Mixed Waste Cleanup Projects. Dr. Arumugam has more than 5 years of experience in low-level radioactive and mixed waste regulations, treatment, and disposal. His experience includes providing technical expertise for waste management and environmental restoration projects at several U.S. Department of Energy (DOE) sites including Hanford, the Idaho National Engineering Laboratory. Representative technical assignments include reviewing regulatory approaches, design, and construction documents for treatment and disposal of low-level radioactive and mixed wastes; reviewing and scoping approaches for developing treatability studies for treating mixed wastes; reviewing waste acceptance criteria for radioactive and mixed wastes; reviewing waste reduction and minimization plans; and reviewing and providing technical expertise for innovative technologies such as in site vitrification of contaminated soils, ex situ vitrification process (Plasma Hearth Process), biological destruction of toxic waste, and polyethene encapsulation of radionuclides and heavy metals for radioactive and mixed wastes. In addition, Dr. Arumugam reviewed numerous RI/FS documents for 100, 200, 300, and 1100 Area sites, including the draft engineering report for the prototype surface barrier design at 200-BP-1 operable unit. Dr. Arumugam also provided support to EPA in resolving several design issues at meetings with DOE and Washington Department of Ecology.

Project Engineer, 300-Area Treated Effluent Disposal Facility Value Engineeering Study. Dr. Arumugam participated in a value engineering study for the 300-Area Treated Effluent Disposal Facility at the Hanford Site to evaluate the schedule for early completion of the wastewater treatment facility. He also reviewed the value engineering study report prepared by the U.S. Army Corps of Engineers and provided suggestions to accelerate the schedule.

Project Engineer, Interim Ordnance Cleanup Program Preliminary Remedial Design, Idaho National Engineering Laboratory. Dr. Arumugam reviewed the engineering design for technical adequacy and completeness. He identified several deficiencies for clarification and correction and suggested recommendations to modify the document for conformance with regulatory guidelines.

Project Engineer, Hanford Site Treatability Study Reviews. Dr. Arumugam has reviewed numerous treatability study work plans and reports for the Hanford Site. These include: 100 Area Groundwater Biodenitrification Bench-Scale Treatability; 100 Area Soil Washing Treatability Test Plan; 100 Area Excavation Treatability Test Plan; 100 Area Groundwater Treatment Tests for Ex-Situ Removal of Chromate, Nitrate, and Uranium (VI); 100 Area Soil Washing Bench-Scale Test Procedure; 100-HR-3 Groundwater Treatability Test Plan using biodenitrification, chemical reduction/precipitation, and ion exchange; 300-FF-1 Operable Unit Remedial Investigation Phase II Report: Physical Separation of Soils Treatability Study; Testing and Monitoring Plan for the Permanent Isolation Surface Barrier Prototype;

VAIRAVASAMY ARUMUGAM, Ph.D.
Senior Environmental Engineer

Pilot-Scale Treatability Test Plan for 200-BP-5 Operable Unit (pump and treat using ion exchange for removal of radionuclides); and the 100 Area Soil Washing Bench Scale Test Data

Project Engineer, Engineering Evaluation and Cost Analysis, Various Sites. Dr. Arumugam's experience includes performing technical and economical analyses for six superfund sites within the State of Oregon. This included the evaluation of soil contaminant distribution, estimating contaminated soil volume, performing the cost analysis for excavation/treatment and disposal alternatives, and preparing a summary report from the findings of the evaluation. Dr. Arumugam also prepared cost estimate for the remediation and restoration of two remedial action subsites (RASS) at Naval Weapons Station Concord, California. Dr. Arumugam completed these tasks using the Navy's work breakdown structure, EXCEL spread sheets, and RS MEANS to prepare the cost estimates. Dr. Arumugam also prepared cost estimate for the remediation and restoration of the Quarry Loch Site based on various alternatives to reduce or eliminate the risk of free-phase product migrating into Pearl Harbor waters.

Project Engineer, Remedial Investigation and Feasibility Studies. Between 1990 and 2006, Dr. Arumugam supported U.S. EPA Regions 9 and 10 with technical review of remedial investigation and feasibility study (RI/FS) documents submitted for the 1990 Bay Road site in East Palo Alto, California; the Jasco Chemical Corporation in Mountain View, California; the Mountain Home Air Force Base; the U.S. Department of Energy Hanford Site; the Bonneville Power Administration Ross Complex; the Fairchild Air Force Base; and the Naval Submarine Base Bangor, Washington. Dr. Arumugam's work on these projects has included reviewing project work plans, field sampling plans, project management plans, and RI/FS reports. During these reviews, Dr. Arumugam identified technical deficiencies and made recommendations for modifying the documents. Dr. Arumugam also prepared the feasibility study report, remedial action plan, and record of decision for the FISCO Alameda Annex site; the initial screening of technologies report and feasibility study reports for Treasure Island; and prepared a technical memorandum recommending limited treatability studies on bioremediation and chemical oxidation technologies for petroleum contaminated soils and groundwater respectively. He also supported the development of the Parcel C and D Information Package, Phase II Groundwater Data Gaps Investigation, Hunters Point Shipyard. Dr. Arumugam also prepared a focused remedial option evaluation report including detailed cost estimate for remediation of soil and groundwater for U.S Coast Guard Group Port Angeles, Port Angeles, Washington.

Project Engineer, Corrective Action Planning Document Review, Umatilla Chemical Depot. For this project, Dr. Arumugam reviewed the 60 percent and 90 percent remedial design submittal contaminated soil remediation deactivation furnace site prepared by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington. His review included the remedial action work plan, specifications, design analysis, and current working estimate. Several design deficiencies were brought out from the document by Dr. Arumugam and were resolved in meetings to make the project success.

EMPLOYMENT HISTORY

2006 to present	Senior Environmental Engineer, Cooper Zietz Engineers, Inc.
1990 to 2006	Environmental Engineer, Tetra Tech EM Inc.
1989 to 1990	Environmental Engineer, Environmental and Ecological Engineers, Inc.,
1989	Environmental Engineer, Brown and Caldwell
1981 to 1983	Environmental Engineer, Saudi Trumpane/Arabian Erectors, Ltd. (Saudi Arabia)
1966 to 1980	Environmental Engineer, Kirloskar Consultants, Ltd. (India)

L. Scott Henderson, P.E.

IQRPE

RCRA permitting
RCRA enforcement
Hazardous waste treatment systems

SUMMARY OF QUALIFICATIONS

Mr. Henderson is a mechanical engineer with over 14 years of environmental experience. His specific area of technical expertise is focused on thermal treatment operations in the treatment of hazardous, medical, and chemical wastes, including regulations; the design, development, and construction of thermal treatment systems, the planning and completion of trial burn tests, and the planning of multipathway risk assessments. Mr. Henderson has supported IQRPE activities at Hanford and for the Pine Bluff Chemical Agent Disposal Facility. Mr. Henderson has also been involved with several engineering studies, permit modifications, and development and review of human health and ecological risk assessment protocols for Army chemical weapons destruction facilities and other incineration facilities. Mr. Henderson has operational experience in incineration facilities, and has been directly responsible for personnel, equipment operation, and maintenance of incineration systems.

EDUCATION

B.S., Mechanical Engineering, Washington State University, 1992
Certified Incinerator Operator (BAAQMD/EPA/ASME)
Qualified Incinerator Operator Instructor (BAAQMD/EPA/ASME)

REGISTRATIONS/CERTIFICATIONS

Licensed Professional Engineer, Washington (No. 39482)

QUALIFICATIONS/TRAINING

40-hour OSHA hazardous waste operations (HAZWOPER) with annual 8-hour refresher training
8-hour OSHA HAZWOPER supervisor course

RELEVANT EXPERIENCE

Secondary Containment System Integrity Assessment, TP-01 Size Reduction and Screening System Pacific Ecosolutions, Inc. Mr. Henderson completed an independent integrity assessment of the secondary containment system of TP-01 in Washington Administrative Code and RCRA Permit requirements. Independent inspection services included: (1) review of the RCRA Permit and associated documentation regarding the TP-01 system; (2) on-site inspection of the TP-01 system and interviews with facility personnel; (3) NDE testing; (4) review of system operations data; (5) preparation of a future tank integrity assessments schedule; and (6) preparation of an independent certification report.

Hanford 242-A Evaporator System Integrity Assessment, Staff Mechanical Engineer. Mr. Henderson is part of a team of chemical and mechanical engineers completing an independent integrity assessment for this high-level waste treatment process in accordance with Washington Administrative Code and RCRA Permit requirements. The integrity assessment includes the development and implementation of visual, hydrostatic, and ultrasonic testing procedures in order to assess the integrity of secondary containment systems and the adequacy of the basis of design, structural support features, waste compatibility, corrosion protection, and ongoing inspection activities with regards to the current operation of the system. Mr. Henderson is responsible for assessing the evaporator, condensers, heat exchangers, pumps, piping, tanks and ancillary equipment associated with the facility in order to develop test protocols and testing locations.

Pine Bluff Chemical Agent Disposal Facility. Staff Mechanical Engineer. Staff engineer for process systems as part of construction oversight activities and professional engineering certification of construction of a $400 million incineration facility for the disposal of chemical weapon stockpiles stored at the Pine Bluff Arsenal. Mr. Henderson conducted construction inspections during construction. This included document reviews and walkdowns of pollution abatement system equipment (scrubbers, quenchers, demisters, valves, instrumentation); brine reduction system equipment (dryers, demisters, tanks), piping, and electrical wiring to identify design discrepancies, flaws in workmanship, and incomplete QA/QC documentation.

Toole Chemical Agent Disposal Facility, Staff Mechanical Engineer. Mr. Henderson developed calculation protocols to estimate emissions from TOCDF and Chemical Agent Munition Destruction System (CAMDS) nerve and blister agent thermal destruction facilities. These calculations were used to complete both human health and ecological risk assessments.

Cooper Zietz Engineers, Inc.

Data were combined from a variety of sources including available test data for the TOCDF and CAMDS facilities, as well as integrating data from JACADS for agents and operations for which source test data is not currently available.

Chemical Agent Munitions Disposal System. Mr. Henderson assessed the impact of the proposed Class 3 permit modification requested by the CAMDS facility to alter operational limits. The facility is the research facility used to develop destruction technology and protocols for nerve and blister agents. This technology has been used in the design, construction, and operation of the TOCDF, JACADS, and other similar facilities. Mr. Henderson performed a detailed engineering study an analysis of MPFs operating at the CAMDS, TOCDF, and JACADS. He studied existing operations and emission data to determine the relationship between the desired operational parameters and emissions. Coupled with a study of applicable guidance and regulations, existing and former permits held by the facility, and actual operating data, Mr. Henderson prepared recommendations regarding the permit modification request.

Umatilla Chemical Agent Disposal Facility. Mr. Henderson was also the technical lead and project manager of a technical support project that evaluates the impacts of multiple permit modifications at the Umatilla Chemical Agent Disposal Facility (UMCDF). Such modifications include changes to incinerator equipment, CEMS, waste storage and characterization, facility risk assessments, and surrogate and agent trial burn plans and tests. He prepared technical reports that include the regulatory and scientific background of the permit modification requests as well as concerns about and anticipated impacts of the permit modification requests. Mr. Henderson met regularly with county commissioners and makes presentations at public meetings regarding these technical reports.

Mr. Henderson has also participated in trial burn oversight at the UMCDF. Mr. Henderson provided trial burn oversight support to the Oregon Department of Ecology and USEPA for the LIC1 and MPF trial burns, observing the low temperature test condition. Oversight activities included CEMS and VOST audits, oversight of VOST, dioxin/furan, semivolatiles, and particulate/HCl trains. Due to scheduling conflicts, Mr. Henderson was unable to fully participate in the LIC2 test; however, he was able to assist personnel observing the LIC2 trial burn test in reviewing test plans, assisting them in ordering the proper protocol gases and assisting them in how they should conduct the CEMS audits at the facility.

Plant and Process Engineering. Mr. Henderson has extensive experience in plant engineering and operations management. He was the operations manager for the Integrated Environmental Systems (IES) incineration plant in Oakland, California. That facility is the only remaining commercial, full-scale, medical waste incinerator operation in California. In addition to medical waste, the facility was permitted to incinerate controlled substances, pharmaceuticals, and outdated military surplus. Mr. Henderson managed all operational and ancillary equipment at the facility, including T-BACT incinerators and an innovative medical waste alternative treatment technology (microwave disinfection) as well as an automation system he designed to unload and process incoming wastes. He also developed and implemented all inspection and maintenance programs and operator training necessary to operate and maintain this equipment. Mr. Henderson's experience at IES is detailed in the following paragraphs.

Mr. Henderson completed a comprehensive retrofitting the facility, including the installation of new incinerators. Installation of new units was needed to meet the anticipated MACT standard for medical waste incinerators. Mr. Henderson developed a team of consultants, engineers, and equipment manufacturer's to develop specifications for the new system that would comply with these standards, which he then actively managed and participated in. Mr. Henderson's chief contributions included developing performance specifications for the new incinerators, APCS, and ancillary incinerator support equipment, and designing facility modifications to accommodate the new units, such as installing new equipment foundations, sizing and specifying natural gas, water, and electric supplies to the new units. Mr. Henderson prepared proposal requests and selected an incinerator manufacturer, APCS manufacturer, and contractors to perform the infrastructure upgrades, and managed their work to ensure that all necessary specifications were met. Mr. Henderson also selected and managed geotechnical engineers and civil engineers who designed the new equipment foundations. Mr. Henderson also selected and managed architectural engineers who were responsible for modifying the plant building to allow installation of the new incinerators to his specifications.

EMPLOYMENT HISTORY

2006 to Present	Senior Mechanical Engineer, Cooper Zietz Engineers, Inc.
2003 to 2006	Project Engineer, Floyd Snider
1997 to 2003	Project Engineer, Tetra Tech EM Inc.
1992 to 1997	Operations Manager/Plant Engineer, Integrated Environmental Systems, Inc.

TechnoGeneral Services Company *Qualified Quality Inspector*

FLOYD L SNYDER

EDUCATION & CERTIFICATIONS

City University, Bellevue, Washington	MBA / *Engineering Technology*
Oregon State College, LaGrande, Oregon	BS / *General Studies*
Columbia Basin College, Pasco, Washington	AAS / *QA/QC*
Columbia Basin College, Pasco, Washington	AAS / *NDE*

American Welding Society	Senior Certified Welding Inspector
American Concrete Institute	Concrete Technician Grade I
State of Washington	Cross-connection Control Specialist
International Conference of Building Officials	
American Standard of Testing Materials	
National Electrical Code	
National Fire Protection Association	

Level III in Civil, Structural, Concrete, HVAC and Protective Coating
Level II in Mechanical, Electrical, Pressure Testing, Liquid Penetrant and NDE/ASME III visual inspection
ASNT-TC-1A

PROFESSIONAL SUMMARY

Over fifteen years of experience in the engineering and quality field. Multi-discipline knowledge and certifications. Worked with the following codes and standards as a designer and inspector. Proficient with Microsoft Office products, with extensive use of Excel and Word. I have provided training both formal and informal. Coordinated training programs as a supervisor and instructor for the Army and Quality Training and Resource Center (QTRC) at the Hanford Site for various subjects, which included lesson plans student materials and training schedules.

PROFESSIONAL EXPERIENCE

TECHNOGENERAL SERVICES COMPANY, RICHLAND WA. 3/2006-PRESENT
QUALITY ASSURANCE ENGINEER

- ✓ Provided QII support for the 242-A Evaporator Assessment project at Hanford.
- ✓ Provided quality inspections in support or Thomas Jefferson Laboratory task order for pressure vessel integrity assessment located in Newport News, VA.

FLUOR HANFORD INC., RICHLAND WA. 02/80 – 1/2003
QUALITY ASSURANCE ENGINEER

- ✓ Qualified Independent Inspector for Integrity assessment of 242-A Evaporator
- ✓ Primary QA performing surveillance, inspection, and monitoring of the QA program on the Emergency Cooling Water Facility and Secure Automated Facility at the Hanford site.
- ✓ Guidance for Acceptance Test Procedures as test director, recorder, and witness for Fire Detection, Fire Protection, Heating Ventilation and Air Conditioning, and other control systems.
- ✓ Problem solving by reviewing construction submittals for compliance to the design requirements. By verifying product compliance at time of delivery and verifying installation to design and manufactures requirements.
- ✓ Supervision by directing and providing performance evaluations of discipline personnel as a level III.
- ✓ Instructions and advice to construction by coordination of problems with designers and providing the necessary change documents.
- ✓ Coordinate project closure by reviewing engineering, construction, and quality documents for completeness, identifying open items and proposing means of closure.

TechnoGeneral Services Company

Snyder, Floyd
Qualified Quality Inspector

- ✓ Management Assessment audit of the company Qualification and Certification program to NQA-1 and 10 CFR 830.
- ✓ Authored procedures for Acceptance Inspection QA Program.
- ✓ In-process surveillance, monitoring, and inspection of suppliers and subcontractors both onsite and offsite.
- ✓ Supervision of Quality Control Inspectors activities by surveillance and overview as the discipline Level III.
- ✓ Authored training plans and provided training as the trainer for inspection and emergency first aide.
- ✓ Final Acceptance Inspection of Projects, review of quality program and monitor compliance to the national and local codes, and other government agencies for the Dept. of Energy.
- ✓ Write design changes, nonconformance reports, inspection reports, provide testing and constructability reviews of projects.
- ✓ Review of welding procedures and qualifications in accordance to both American Society Mechanical Engineers and American Welding Society.

ADDITIONAL INFORMATION

- ✓ American Welding Society, Member
- ✓ American Society of Mechanical Engineers, Member
- ✓ Instrumental in implementing computers in the QA department by providing one-on-one help and instruction.
- ✓ RCRA 40 hr hazardous waste, Hazardous waste manager/supervisor, Hazardous material driver's training and Radiation worker training.
- ✓ Have had DOE clearance

TechnoGeneral Services Company *Electrical Engineer*

CLYDE D. ACREE, P.E.

EDUCATION AND CERTIFICATIONS

B.S. Engineering Science (Nuclear/Electrical)
B.S. Physics
A.A.S. Electronics Technology

Washington State Registered Professional Engineer, Electrical, #17839

PROFESSIONAL EXPERIENCE

Mr. Acree is a versatile, licensed engineering and management professional with over 25 years of technical, engineering and administrative experience including in-depth knowledge of technical program development and implementation, engineering processes, engineering design, engineering analysis, maintenance and operations. Excellent writing and communication skills.

INSTRUMENTATION & DATA ACQUISITION SYSTEM ENGINEERING (12 YEARS)

Planned, conceptually designed, developed, prepared specifications, provided procurement evaluation, designed, programmed, & tested; plant data acquisition systems, process control systems, machinery control systems, closed circuit television systems, security systems, special instrumentation, Supervisory Control and Data Acquisition (SCADA) computer systems, operator's control consoles, connecting instrumentation, power supplies, and building-space.

- ✓ Prepared design drawings for Single Shell Tank Leak Detection System to install new temperature sensing instrumentation.
- ✓ Guided Conceptual Design for the AW Tank Farm Leak Detection and Master Pump Shutdown System (Project W-314) and was instrumental in establishing the basic architectural concept of using Programmable Logic Controllers (PLCs) to eliminate the old relaying systems and to establish the capability for multiple transfer route operations & control.
- ✓ Developed a 4-axis Automated Scanning Machine (prototype, detailed design, software, & testing), using an ultrasonic surface mapper and adapted to Radioactive Hot Cell operations
- ✓ Developed the procurement Specification for the Plutonium Reclamation Facility Instrument & Control Computer System (specification, bid evaluation and Vendor selection)
- ✓ Created a Human Factors study for Operator's Consoles for: Project B-620, Project W-030 and the PFP Security System
- ✓ Developed a Closed Circuit Television (CCTV) Automated Video Recording System for PUREX (design, software, procurement, installation, testing)
- ✓ Developed the AP Tank Farm Valve Position Display System for Project B-320 (design, software, procurement, installation, testing)
- ✓ Created the procurement Specification for the PFP CCTV Video Switching System Upgrade (specification, bid evaluation and Vendor selection)
- ✓ Evaluated bid packages for the procurement of a SCADA process control systems for oil production and for the procurement of a computerized rotating machine monitoring computer system.

SYSTEMS ENGINEERING (6+ YEARS)

Carried out Systems Engineering activities for the Tank Farm Contractor. Additionally, carried out Project Manager activities required to create a requirements management system database for the Tank Farm Contractor. Provided Buyer's Technical Representative (BTR) services for the Requirements Management Unit for five years. Prepared budgets, schedules, and Statements of Work to procure Contractor Services ($200,000 to $500,000 dollars worth of contracts each year) for Systems Engineering and Requirements Analysis efforts.

- ✓ Prepared numerous documents (see Sample Products Produced) to support the application of the Systems Engineering Process at CHG.
- ✓ Designed, developed, and implemented the database for the new Integrated Requirements Management System.
- ✓ Reorganized & updated the Engineering "Technical Resources" web site. Created the Integrated Requirements Management System Database Training web site on the CH2M HILL Hanford Company Intranet.
- ✓ Planned & carried out studies in different requirement management areas to show how to utilize the

DOORS database for requirements management.

- ✓ The TWRS Mission Analysis Report (1998), The CH2M Hill Hanford Group Project Execution Plan (2000)
- ✓ RPP Architecture Tree document (2001), RPP Function Tree document (2001), TWRS Interface Control Document Key Diagram (1999)
- ✓ Integrated Requirements Management System documentation (2001), The Requirements Management Database Tool Strategy (1998), The Integrated Requirements Management System Project Execution Plan (1998)
- ✓ Double Shell Tank Farms Instrumentation Assessment against requirements for Project W-314(1996)

MANAGEMENT (6 YEARS)

Carried out all aspects of management for both Unit Manager and Director levels of management.

- ✓ As a Superintendent, I consolidated the start-up staff for a new computer system that controlled a new set of cross-country pipelines (48" & 60") in Saudi Arabia.
- ✓ This entailed the planning & scheduling of a $ 7 million/yr budget for a staff of 30.
- ✓ Also, the technical (software & hardware) direction, procedure development and maintenance planning for the organization
- ✓ As a Supervisor, I consolidated the start-up staff from several new computer system installations into a cohesive software and hardware computer maintenance unit for the Dhahran area in Saudi Arabia.
- ✓ This position of supervisor planned & scheduled a $3 million/yr budget and,
- ✓ As the Manager, I provided the staffing (10), budgeting, administration & technical direction for the Instrument/Systems Development & Testing Laboratory & the associated Engineering unit.
- ✓ The Laboratory, adapted and tested nuclear instrumentation & monitoring systems; safeguards and security systems; large tankage monitoring & leak detection systems; and general plant instrumentation systems for the 200 areas facilities.

OPERATIONS ENGINEERING (5 YEARS)

- ✓ Carried out Start-up Engineer activities for the Fast Flux Test Facility Nuclear Reactor and
- ✓ Underwent extensive training in sodium reactor theory and operations to prepare for initial "cold start" Control Room Operations.
- ✓ Began turnover testing and acceptance activities. Prepared operations & test procedures for the FFTF Sodium Reactor & associated plants.
- ✓ Provided the planning, budgeting, operations, maintenance, and experimental procedures setup for a Van De Graff 2-Mev Proton beam accelerator and a Van De Graff 14-Mev Neutron generator.
- ✓ FFTF Equipment Operating Procedures
- ✓ Experimental test apparatus

RESUME

Education: Marine/Mechanical Diploma Engineer (Degree equivalent to Professional Engineer Degree)
Technische Hochschule, Hanover, West Germany 1966
Post-Graduate work Polytechnic Institute of New York, New York – 1974-76

Registrations: Professional Engineer – New York, Washington, Germany - Current

PROFESSIONAL EXPERIENCE

TechnoGeneral Services Company
Pasco, WA (2003-
Senior Consulting Engineer supporting ATI in improving their process for welding multiple canister over pack containers for the Fluor Hanford Spent Nuclear Fuel Project.

CH2M HILL Hanford Group, Inc.
Richland, WA (1986-2003)
During this time period, Mr. Rifaey provided support to a succession of Hanford contractors that had responsibility for the Hanford tank farms. Duties varied according to contractor needs covering a variety of activities. Contractors supported during this time period include Westinghouse Hanford Company, Lockheed Martin Hanford, Inc., and CH2M HILL Hanford Group, Inc. Specific duties performed includes:

- Technology Engineering - Technical advisor to the CH2M HILL Supplemental Treatment Pretreatment Program for Low Activity Waste technology identification, selection, and evaluation.

- Project Manager/Engineer – Developed conceptual designs and reviewed all stages of design for tank farm waste retrieval projects including: quarter-scale cold test facility, cross-site transfer system, solids and sludge pumping sluicing systems, robotic retrieval systems, underground piping and tank structural performance, and alternate grout and Vitrification waste treatment technologies. Managed project activities for remote (wireless) radiation instrumentation systems on retrieval piping. Mentored design engineers on functional requirements development and design preparation. Supported project management of supplemental treatment projects by development and review of cost and schedule estimates, and project execution documentation.

- Plant Engineering Manager – Performed engineering review for a variety of new mechanical and nuclear systems designs on Hanford radioactive tank farm facilities. Presented technical baseline interpretations for Unreviewed safety question analyses and readiness reviews. Provided deputy support to Plant Engineering manager overseeing 65+facility support engineering group.

- Design Authority/Equipment Engineering Manager – Managed highly experienced engineers who oversaw control of the tank farm technical baseline and who ensured new systems were appropriately designed and tested. Managed personnel performing the following: development and oversight of safety management systems (e.g., Technical Safety Requirements and Safety Equipment Lists); coordination of technical re-base lining of existing tank farm designs; provided calibration, preventive and corrective

maintenance technical direction; and coordinated support for other technical baseline systems, (e.g., Master Equipment List and Fire Hazards Analyses).

- West Tank Farms Plant Engineering Manager – Managed cognizant and support engineers assigned plant-engineering responsibilities at the West Tank Farm Project. Engineers were responsible for oversight of technical hardware systems, configuration management of design media, preparation of technical direction for repair activities, spare parts technical cognizance, startup testing, operations and maintenance field support, and review of new and modified systems for safety issues and upgrades.

- Grout Treatment Facility Process Engineering Manager – Managed 15 + cognizant and support engineers assigned plant engineering responsibilities at the Group Treatment Facility. Engineers were responsible for oversight of technical hardware systems, configuration management of design media, preparation of technical direction for repair activities, spare parts technical cognizance, startup testing, operations and maintenance field support, and review of new and modified systems for safety issues and upgrades. Oversight included production of technical manuals, safety analysis reports, training media, and facility operations plans.

- Principal Engineer – Performed thermal analysis for modifying the Fast Flux Test Facility reactor core and prepared the necessary Final Safety Analysis Report modifications for the revised core. Served as a technical consultant to the Quality Assurance Director. Performed equipment qualifications study for several N-Reactor equipment upgrades, conducted engineering studies on high-level radioactive waste package and container design, and provided technical direction to the A/E firm responsible for development of waste package conceptual designs. Provided design review and technical direction for facility issues and designs associated with the Basalt Waste Isolation Project and the SP-100 Space Reactor Project.

Long Island Lighting Company
New York, NY 1983-1986
Consulting Engineer, Shoreham Nuclear Power Station – Reviewed, evaluated, and recommended necessary changes to the plant technical basis for input to technical specifications to be submitted to the NRC. Reviewed and evaluated plant surveillance, test, and operating procedures/results to ensure compliance with technical specification requirements. Established performance criteria for pump and valve operability testing. Evaluated operability test results to demonstrate compliance with ASME Section XI Subsections IWP and IWV. Reviewed and resolved operating incidents and provided design input to Plant Modification and Radiochemistry Sections. Reviewed ASME requirements for the new emergency diesel generator system, performed the required design review related to the safety impact of the plant modifications and performed design review of the post-accident sampling system, off-gas system and Argon 41 release into the drywell.

Burns and Roe, Inc.
New York, NY 1973-1983
Principal/Senior Supervising Engineer, Washington Public Power Supply System Unit #2 – As a principal engineer and group supervisor, Woodbury, NY, performed a broad range of activities associated with the mechanical/nuclear engineering and design of nuclear power plants, including technical and economic studies for the selection of turbine generators and auxiliaries, rad-waste handling, balance of plant systems, engineering criteria and conceptual designs, review and approval of flow diagrams and layout drawings, and preparation of proposals. In

addition, performed special technical studies such as heat balance, heat transfer problems, and plant performance. As a principal engineer and mechanical/nuclear group supervisor, Richland Washington, provided on-site technical expertise, system trouble shooting and resolving mechanical/nuclear engineering problems with the site contractors, construction management and startup and operations organization.

Gibbs and Hill, Inc.
New York, NY 1972-1973
Mechanical Engineer – Performed design of instrumentation and control systems including preparation of system logic diagrams, schematic diagrams and input/output signal lists. Also performed power plant performance computations, sizing and specification of control values, flow diagram preparation and pipe sizing for both peaking and base-loaded power plants.

Paul L. Geirenger and Associates
New York, NY 1970-1972
Mechanical Engineer – Performed design, preparation of schematic diagrams and piping and equipment layout for an oil-fired, 110 MW, Mayor B. V. Clearly Station Unit 9 combined cycle power plant. Responsible for optimizing system economics and design and layout of heating and cooling plants for the Stonybrook University power plant.

COGELEC Industries, Inc.
Montreal, Quebec, Canada 1969-1970
Design Engineer – Prepared standards, performed design verification, purchased material for application in high voltage switchgear and substations.

Canadian Marconi
Montreal, Quebec, Canada 1969-1969
Mechanical Engineer – Performed environmental testing of Class III Military equipment, humidity and saltwater spray erosion studies and research.

Kieler Howartswerke Shipyard
Kiel, West Germany 1966-1968
Mechanical and Marine Engineer – Responsible for mechanical systems design, equipment specification, heat balance calculations and system economics for steam propulsion engines (boilers, turbines, heat exchangers, pumps, auxiliary engineers, etc.) up to 33,000 hp. Designed remote control systems for main turbines and auxiliary equipment and application of mechanical, hydraulic, pneumatic and electronic servomechanisms to those systems. Responsible for procurement of instruments for local and remote measurements for application to main and auxiliary engines up to 200,000-ton tankers. For each of these activities, supervised field installation, prepared the operating manuals, performed construction management and system lineup and acceptance testing.

ATTACHMENT 18

242-A EVAPORATOR UNIT COMPONENT MATERIAL AND COMPONENT QUALIFICATIONS

(22 PAGES)

242-A Facility Piping and Component Materials

Component ID	Description	Material Specification	P&ID
C-A-1	Vapor - Liquid Separator	14' OD x 18' long x ⅜" thick, 304L SS	H-2-98988, Sheet 1 of 1
E-A-1	Reboiler	Primary shell is 40½" OD x 14' ⅛" long x ¼" thick 304L SS, secondary shell is 50" OD X 14' ⅛" long x 5/16" thick 304L SS. Tube sheets are 40½" OD x 1¼" thick, 304L bundle consists of 364 1½" OD x 14 ga. seamless SS tubes (Figure B.1lb, E-A-1 Reboiler)	H-2-98988, Sheet 2 of 2
E-C-1	Primary Condenser	Shell is 85" ID x 1' 7" long x 1%" thick CS. Tube sheets are 905/8" OD x 2 7/16" thick CS. Tube bundle consists of 2,950 %" OD x 12' long x 0.'8" thick seamless CS tubes (Figure B.3, E-C-1 Condenser).	H-2-98999
E-C-2	Inter-Condenser	Shell is 16" ID x 87" long x 5/16" thick CS (1/1611 corrosion allowance). Tube sheets are 16" OD x 1" thick CS. Tube bundle consists of 144%" OD x 66' long x 16 ga. seamless CS tubes. (NOTE: DIMENSIONAL DISCREPANCIES BETWEEN ASME DATA REPORT AND MANUFACTU	H-2-98999
E-C-3	After-Condenser / Final-Condenser	Shell is 8 5/8" ID x 93 7/8" long x 0.322t1 thick CS (1/16" corrosion allowance). Tube sheets are 8 5/811 OD x 1" thick CS. Tube bundle consists of 45 3/4" OD x 72' long x 16 ga. seamless CS tubes. (NOTE: DIMENSIONAL DISCREPANCIES BETWEEN ASME DATA REPORT	H-2-98999
F-C-1	Condensate Filter	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
F-C-2	Condesate filter	Specification required	H-2-98999
F-C-3	Duplex Filter	Information Not Available to IQRPE	H-2-98990, SH1
J-EC2-1	EDUCTOR	Specification required	H-2-98999
P-B-1	Recircluation Pump	ASTM A296 Gr CF-8 and Gr GF-8, 14,000 gpm capacity.	H-2-98988, Sheet 2 of 2
P-B-2	Bottoms Pump	Variable speed, max. capacity 125 gpm, mechanical seals: 316 SS, shaft 316 SS, impeller and casing: CD4MCU	H-2-98989
P-C100	CONDENSATE PUMP	Standard end section, single stage, centrifugal pump. CS shaft and impeller with SS shaft sleeve. 10 hp/3,500 RPM motor, capacity is 50 gpm at 110' head.	H-2-98990, SH1
Recirculation Pump water seal	Recirculation Pump water seal	Specification required	H-2-98988, Sheet 1 of 1
SAMP-F-1	Sampler	Specification required	H-2-98988, Sheet 2 of 2
SAMP-F-2	Sampler	Specification required	H-2-98989
SEAL POT		18" OD x 24" deep SCH 40 CS pipe	H-2-98990, SH1
TK-C-100	CONDENSATE COLLECTION TANK	14' OD X 19' 9 7/8" tall x 5/16" thick, 17,800 gal 347 and 304L SS.	H-2-98990, SH1
TK-C-500	Corrosion Inhibitor Tank	3 gallons, specification required	H-2-98999

242-A Facility Piping and Component Materials

Component ID	Description	Material Specification	P&ID
¼" Decon-816-M9	Decon	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98990, SH1
½" DR 378 M42	PC drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
½" DR-337-M42	drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
½" DR-349-M42	PC	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
½" DR-363-M42	drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
½" DR-378-M42	process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
½" DRAIN – M5	SC drain (SS6)	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
½" DR-M42	PC sample, F-C-3 Drain line, process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1 / H-2-98995
½" PC-563-M42	process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
½" RW-M9	Raw Water System	SCH 40 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
½" SEAL CAVITY DRAIN (no code specified)	pump P-B-2 seal cavity drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98998, SH2
½" SEAL WTR OUT (no code specified)	pump P-B-2 seal water	Line designator, material not specified	H-2-98995, SH1 / H-2-98989
¾" PC-551-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
¾" SL-131-M9	Slurry - Sample line (SAMP-F-2)	SCH 40 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
¾" DECON-815-M42	decon	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
¾" PC-552-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
¾" SN-250-M9	Recirc - Sample line (SAMP-F-1)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
1 ½" DR (no code specified)	drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98989

242-A Facility Piping and Component Materials

Component ID	Description	Material Specification	P&ID
1 ½" SEAL WTR OUT (no code specified)	pump P-B-1 seal water	Line designator, material not specified	H-2-98995, SH1 / H-2-98998, SH2
1" DR-M9	Drain system	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
1/2" Line (unidentified) from TK-C-100 through Valve 4-28 to 1/2" air atomizing nozzle	Corrosion inhibitor	Line designator, material not specified	H-2-98999
1/2" PC-563-M42	Seal loop drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
1/2" PC SAMPLE BYPASS RETURN	PC	0.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1 & SH2
1" PC SAMPLE RETURN	PC	0.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1 & SH2
1" DR-M42	process condensate drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
1" overflow M-42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
1" SC DRAIN-M2	steam condensate drain (SS6)	SCH40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
1½" PC-553-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
2 ½" VAC-1501-M42	steam / air	SCH 40, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98999
2" SL-M9	Slurry	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
2"DR-M8	drain	ASTM A312, TP304L	H-2-98995, SH2
2"Flex	PC	Specification required	H-2-98990, SH1
2" DR-420-M27	drain	SS ASTM A312, Type 304L	H-2-98995, SH1 / H-2-98998, SH2
2" PC-556-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
2" PC-559-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
2" PC-562-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
2" DR-348-M42	condensate room drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1

242-A Facility Piping and Component Materials

Component ID	Description	Material Specification	P&ID
2" DR-351-M27	drain	SS ASTM A312, Type 304L	H-2-98995, SH2
2" DR-402-M8	drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH2
2" EL-901-M-42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
2" PC – Sample drain	PC sample drain (RC-3)	Line designator not specified/SS	H-2-98990, SH2 / H-2-98995
2" PC-554-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
2" PC-559-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
2" PC-SAMPLE DRAIN	process condensate sample drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98990, SH2
2" SL-M9	Slurry	SCH 10, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
2"VAC-1502-M42	air / condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
28" Recirculation Line	Evaporator / Recirculation	¼" thick, SS	H-2-98988, Sheets 1 of 1 and 2 of 2
3" OVFL-1801-M42	Seal loop	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1 / H-2-98995
3" SL-M9	Slurry	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989 / H-2-98988, Sheet 2 of 2
3" SN-251-M9	Recirc - Sample line (SAMP-F-1)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
3/4" PC-552-M42	Condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
3/4"-PC-551-M42	Condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
3/8" FRW-M31	Filtered raw water	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98988, Sheet 1 of 1
3" DR-338-M42	DR	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1 & SH2
3" DR-359-M42	Drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
3" PC-557-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1

242-A Facility Piping and Component Materials

Component ID	Description	Material Specification	P&ID
3" PC-558-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
3" SL-130-M9	Slurry - Sample line (SAMP-F-2)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS (heat traced, insulated)	H-2-98989 / H-2-98988, Sheet 2 of 2
3" SL-M27	slurry	SCH 40, SS ASTM A312, Type 304L	H-2-98995, SH2 / H-2-98989
4" PC-550-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
4" SC-500-M9	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS. Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
42" Vapor Line	Vapor	5/16" thick, SS	H-2-98988, Sheet 1 of 2
6" DR-335-M9	Drain system	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
Unidentified line from 3" DR-359-M42 through valve 1-3 to 1/2"PC-563-M42 (between 1-2 and 1-5).		SCH 40 CS, Line designator not indicated, assumed M42, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
unidentified line from air atomizing nozzle to 6"VAC-1501-M42	plant air & corrosion inhibitor?	Specification required	H-2-98999

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
VAP	EQUIP	C-A-1	Vapor - Liquid Separator	14' OD x 18' long x ⅜" thick, 304L SS	H-2-98988, Sheet 1 of 1
VV	EQUIP	DU-C-I	DEENTRAINMENT UNIT	Specification required	H-2-98998
VAP	EQUIP	E-A-1	Reboiler	Primary shell is 40½" OD x 14' ⅛" long x ¼" thick 304L SS, secondary shell is 50" OD X 14' ⅛" long x 5/16" thick 304L SS. Tube sheets are 40½" OD x 1¼" thick, 304L bundle consists of 364 1½" OD x 14 ga. seamless SS tubes (Figure B.1lb, E-A-1 Reboiler)	H-2-98988, Sheet 2 of 2
VC	EQUIP	E-C-1	Primary Condenser	Shell is 85" ID x 1' 7" long x 1⅝" thick CS. Tube sheets are 905/8" OD x 2 7/16" thick CS. Tube bundle consists of 2,950 ⅝" OD x 12' long x 0.'8" thick seamless CS tubes (Figure B.3, E-C-1 Condenser).	H-2-98999
VC	EQUIP	E-C-2	Inter-Condenser	Shell is 16" ID x 87" long x 5/16" thick CS (1/1611 corrosion allowance). Tube sheets are 16" OD x 1" thick CS. Tube bundle consists of 144⅝" OD x 66' long x 16 ga. seamless CS tubes. (NOTE: DIMENSIONAL DISCREPANCIES BETWEEN ASME DATA REPORT AND MANUFACTURER SPECIFICATION TO BE MEASURED DURING WALKDOWN.)	H-2-98999
VC	EQUIP	E-C-3	After-Condenser / Final-Condenser	Shell is 8 5/8" ID x 93 7/8" long x 0.322t1 thick CS (1/16" corrosion allowance). Tube sheets are 8 5/811 OD x 1" thick CS. Tube bundle consists of 45 3/4" OD x 72' long x 16 ga. seamless CS tubes. (NOTE: DIMENSIONAL DISCREPANCIES BETWEEN ASME DATA REPORT AND MANUFACTURER SPECIFICATION TO BE MEASURED DURING WALKDOWN.)	H-2-98999
PC	EQUIP	F-C-1	Condensate Filter	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VC	EQUIP	F-C-2	Condesate filter	Specification required	H-2-98999
PC	EQUIP	F-C-3	Duplex Filter	Information Not Available to IQRPE	H-2-98990, SH1
VV	EQUIP	F-C-5-1	HEPA FILTER	Specification required	H-2-98998
VV	EQUIP	F-C-5-2 HEPA	FILTER	Specification required	H-2-98998
VV	EQUIP	F-C-6	PRE-FILTER/DEMISTER	Specification required	H-2-98998
VC	EQUIP	J-EC2-1	EDUCTOR	Specification required	H-2-98999
VAP	EQUIP	P-B-1	Recircluation Pump	ASTM A296 Gr CF-8 and Gr GF-8, 14,000 gpm capacity.	H-2-98988, Sheet 2 of 2
Slurry	EQUIP	P-B-2	Bottoms Pump	Variable speed, max. capacity 125 gpm, mechanical seals: 316 SS, shaft 316 SS, impeller and casing: CD4MCU	H-2-98989
PC	EQUIP	P-C100	CONDENSATE PUMP	Standard end section, single stage, centrifugal pump. CS shaft and impeller with SS shaft sleeve. 10 hp/3,500 RPM motor, capacity is 50 gpm at 110' head.	H-2-98990, SH1
SC	EQUIP	P-RC-1	SC SAMPLE PUMP	Specification required	H-2-98993
VAP	EQUIP	Recirculation Pump water seal	Recirculation Pump water seal	Specification required	H-2-98988, Sheet 1 of 1
VAP	EQUIP	SAMP-F-1	Sampler	Specification required	H-2-98988, Sheet 2 of 2
Slurry	EQUIP	SAMP-F-2	Sampler	Specification required	H-2-98989
PC	EQUIP	SEAL POT		18" OD x 24" deep SCH 40 CS pipe	H-2-98990, SH1
PC	EQUIP	TK-C-100	CONDENSATE COLLECTION TANK	14' OD X 19' 9 7/8" tall x 5/16" thick, 17,800 gal 347 and 304L SS.	H-2-98990, SH1
SC	EQUIP	TK-C-103	FLOW MEASUREMENT TANK:	72" LONG X 42" WIDE X 36" DEEP X ¼" thick, CS, with 304L SS wier plate.	H-2-98993
VC	EQUIP	TK-C-500	Corrosion Inhibitor Tank	3 gallons, specification required	H-2-98999
PC	PIPE/ANC	¼" Decon-816-M9	Decon	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98990, SH1
VAP	PIPE/ANC	¼" AF-301-M9	antifoam	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VV	PIPE/ANC	½" FRW-M31		.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98998
VC	PIPE/ANC	¼" IA-M31	instrument air	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98999
PC	PIPE/ANC	½" I-FC1-4-M31	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	½" I-FC1-5-M31	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	½" I-ILS-4-M31	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	½" I-ILS-6-M31	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
VV	PIPE/ANC	¼" NH3-M31		.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98998
VV	PIPE/ANC	½" SC M9			H-2-98998
VAP	PIPE/ANC	½" I-CAI-M9	FRW, steam, and air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
SC	PIPE/ANC	½" RW Drain-M5	raw water drain		H-2-98993
SC	PIPE/ANC	½" SAMPLE-M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-SAMPLE-M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
RW	PIPE/ANC	½" (ID and code not specified)	drain	Assume SS	H-2-98994

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
PC	PIPE/ANC	½" DR 378 M42	PC drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	½" DR-337-M42	drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
PC/B&SC	PIPE/ANC	½" DR-349-M42	PC	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VV	PIPE/ANC	½" DR-353-M42	drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
PC	PIPE/ANC	½" DR-363-M42	drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
B&SC	PIPE/ANC	½" DR-378-M42	process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
SC/B&SC	PIPE/ANC	½" DRAIN – M5	SC drain (SS6)	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
RW	PIPE/ANC	½" Drain (code not specified)	drain	Assume SS	H-2-98994
SC	PIPE/ANC	½" drain-M5	steam condensate/drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
VV	PIPE/ANC	½" DR-M31		.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98998
PC, B&SC	PIPE/ANC	½" DR-M42	PC sample, F-C-3 Drain line, process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1 / H-2-98995
SC	PIPE/ANC	½" FLUSH – M31	flush line, steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
RW	PIPE/ANC	½" FLUSH-M5	flush	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98994
VAP	PIPE/ANC	½" I-CA1-1-M9	FRW & air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	½" I-CA1-2-M9	FRW & air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	½" I-CA1-3-M9	FRW & air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	½" I-CAI-8-M9	FRW, steam, and air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VV	PIPE/ANC	½" I-M31		.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98998
B&SC	PIPE/ANC	½" PC-563-M42	process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
SC	PIPE/ANC	½" RW – ADD-M2	raw water - add	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
SC	PIPE/ANC	½" RW-629-M5	Raw water	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
VAP	PIPE/ANC	½" RW-M9	Raw Water System	SCH 40 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
RW	PIPE/ANC	½" SAMPLE (no code)	used raw water (sample)	M5: SCH 40 CS	H-2-98994
SC	PIPE/ANC	½" SC-DRAIN-M31	steam condensate drain	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-GRAB SAMPLE – M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-PURGE-M31	steam condensate sample/purge	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-SAMPLE AND RETURN M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-SAMPLE BYPASS-M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-SAMPLE/PURGE	steam condensate sample/purge	Line designator, material not specified	H-2-98993
B&SC	PIPE/ANC	½" SEAL CAVITY DRAIN (no code specified)	pump P-B-2 seal cavity drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98998, SH2
B&SC	PIPE/ANC	½" SEAL WTR OUT (no code specified)	pump P-B-2 seal water	Line designator, material not specified	H-2-98995, SH1 / H-2-98989
RW	PIPE/ANC	½" URW – SAMPLE RETURN-M31	used raw water (sample)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" URW-Drain-M31	used raw water (drain)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" URW-OVERFLOW and VENT-M31	used raw water (overflow & vent)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
RW	PIPE/ANC	½" URW-SAMPLE RETURM-M31 (divert)	used raw water (sample)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" URW-SAMPLE-M31	used raw water (sample)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" URW-SAMPLE-M31 (normal)	used raw water (sample)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" valve vent & drain – M31	used raw water (drain)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
PC	PIPE/ANC	½" VENT-OM42	PC	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VV	PIPE/ANC	¾" DECON-818-M9		SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304LSS	H-2-98998
PC	PIPE/ANC	¾" PC-551-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VAP	PIPE/ANC	¾" SL-131-M9	Slurry - Sample line (SAMP-F-2)	SCH 40 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
VC	PIPE/ANC	¾" DECON-815-M42	decon	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
PC	PIPE/ANC	¾" PC-552-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	¾" RW-520-M42	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VV	PIPE/ANC	¾" RW-614-M5	raw water	SCH 40 ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
SC	PIPE/ANC	¾" SC-Sample-M31	steam condensate	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
VAP	PIPE/ANC	¾" SN-250-M9	Recirc - Sample line (SAMP-F-1)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
VV	PIPE/ANC	¾" VENT DRAIN-M42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
B&SC	PIPE/ANC	1 ½" DR (no code specified)	drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98989
B&SC	PIPE/ANC	1 ½" SEAL WTR OUT (no code specified)	pump P-B-1 seal water	Line designator, material not specified	H-2-98995, SH1 / H-2-98998, SH2
B&SC	PIPE/ANC	1 ½" URW-SAMPLE DRAIN – SST	Used raw water sample drain	Line designator not specified, SST	H-2-98995, SH1 / H-2-98994
VAP	PIPE/ANC	1" DR-M9	Drain system	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
VAP	PIPE/ANC	1" RW-M9	Raw Water System	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
SC	PIPE/ANC	1"SC-500-M2	steam condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
PC	PIPE/ANC	1"V-1203-M42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VC	PIPE/ANC	1/2 PA-M7	Plant air	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
SC	PIPE/ANC	1/2" Flush-M31	flush line	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
VC	PIPE/ANC	1/2" Line (unidentified) from TK-C-100 through Valve 4-28 to 1/2" air atomizing nozzle	Corrosion inhibitor	Line designator, material not specified	H-2-98999
PC	PIPE/ANC	1/2" PC-563-M42	Seal loop drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
SC	PIPE/ANC	1/2"SC-M2	steam condensate	SCH 40/80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
RW	PIPE/ANC	1/2"SC-M31	used raw water	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	1/2"SC-M31	flush?	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
PC	PIPE/ANC	1/2" PC SAMPLE BYPASS RETURN	PC	0.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1 & SH2
RW	PIPE/ANC	1/4" I-ECI-5-M31	RW	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98999
RW	PIPE/ANC	1/4" PA (SPARGE-M31)	Plant air	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	1/4"I-ECI-9-M31	pressure indicator	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
PC	PIPE/ANC	1" PC SAMPLE RETURN	PC	0.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1 & SH2
PC, B&SC	PIPE/ANC	1" DR-M42	process condensate drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
RW	PIPE/ANC	1" DR-SST	drain	Line designator not specified, SST	H-2-98994
VAP	PIPE/ANC	1" FRW-654-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-656-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
VAP	PIPE/ANC	1" FRW-657-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-658-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-659-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-660-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-661-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-662-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-663-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-665-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-668-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
PC, VV	PIPE/ANC	1" overflow M-42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
VAP	PIPE/ANC	1" RW-M9	Raw Water System	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
B&SC	PIPE/ANC	1" SC DRAIN-M2	steam condensate drain (SS6)	SCH40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
SC	PIPE/ANC	1" SC-511-M2	steam condensate	SCH40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
VV	PIPE/ANC	1" SST tubing		Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98998
VC	PIPE/ANC	10" JET-DISCH-M2	steam / air	SCH40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
PC	PIPE/ANC	1½" PC-553-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VV	PIPE/ANC	1½" DR-337-M42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
RW	PIPE/ANC	12"URW-600-M5	Raw water (used?)	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999 / H-2-98994
RW	PIPE/ANC	12" URW-1600-M5	used raw water	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98994
RW	PIPE/ANC	12" URW-1601-M5	used raw water	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98994
VAP	PIPE/ANC	18" STM-470-M9	Steam	10 PSIG, Greater than 12 inch: ASTM A240, GRTP304L	H-2-98988, Sheet 2 of 2
VC	PIPE/ANC	2 ½" VAC-1501-M42	steam / air	SCH 40, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98999
VAP	PIPE/ANC	2" SL-M9	Slurry	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
B&SC	PIPE/ANC	2"DR-M8	drain	ASTM A312, TP304L	H-2-98995, SH2
PC	PIPE/ANC	2"Flex	PC	Specification required	H-2-98990, SH1
SC	PIPE/ANC	2"SC-M2	steam condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
B&SC	PIPE/ANC	2" DR-420-M27	drain	SS ASTM A312, Type 304L	H-2-98995, SH1 / H-2-98998, SH2
PC	PIPE/ANC	2" PC-556-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	2" PC-559-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	2" PC-562-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
B&SC	PIPE/ANC	2" VENT-M24	vent	SCH 40, ASTM A53, Type S, Grade B CS, or ASTM A106, Grade B CS	H-2-98995, SH1
VV	PIPE/ANC	2" AS-1703-M2		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
B&SC	PIPE/ANC	2" DR-348-M42	condensate room drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1
B&SC	PIPE/ANC	2" DR-351-M27	drain	SS ASTM A312, Type 304L	H-2-98995, SH2
B&SC	PIPE/ANC	2" DR-402-M8	drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH2
PC	PIPE/ANC	2" EL-901-M-42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	2" PC – Sample drain	PC sample drain (RC-3)	Line designator not specified/SS	H-2-98990, SH2 / H-2-98995
PC	PIPE/ANC	2" PC-554-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	2" PC-559-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
B&SC	PIPE/ANC	2" PC-SAMPLE DRAIN	process condensate sample drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98990, SH2
PC	PIPE/ANC	2" RW-612-M5	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
Slurry	PIPE/ANC	2" SL-M9	Slurry	SCH 10, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
VAP	PIPE/ANC	2" U-850-M9	Flush water(?)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
PC	PIPE/ANC	2" V -1209-M42	vent	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1, H-2-98993
B&SC	PIPE/ANC	2" VENT-M24	vent	SCH 40, ASTM A53, Type S, Grade B CS, or ASTM A106, Grade B CS	H-2-98995, SH1
VC	PIPE/ANC	2"VAC-1502-M42	air / condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
PC	PIPE/ANC	2"-VE-1059-M9	vent	ASTM A312, GRTP304L SS	H-2-98990, SH1 / H-2-88766, SH1
RW	PIPE/ANC	24"CMP-URW-1601	used raw water	Specification required	H-2-98994
VAP	PIPE/ANC	28" Recirculation Line	Evaporator / Recirculation	¼" thick, SS	H-2-98988, Sheets 1 of 1 and 2 of 2
PC	PIPE/ANC	3" OVFL-1801-M42	Seal loop	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1 / H-2-98995
VAP	PIPE/ANC	3" SL-M9	Slurry	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989 / H-2-98988, Sheet 2 of 2
VAP	PIPE/ANC	3" SN-251-M9	Recirc - Sample line (SAMP-F-1)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
VC	PIPE/ANC	3" V-1202-M42	air / condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC	PIPE/ANC	3/4" PC-552-M42	Condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC	PIPE/ANC	3/4"-PC-551-M42	Condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
RW	PIPE/ANC	3/4"URW-600-M5	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VAP	PIPE/ANC	3/8" FRW-M31	Filtered raw water	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98988, Sheet 1 of 1
PC, B&SC	PIPE/ANC	3" DR-338-M42	DR	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1 & SH2
PC, B&SC	PIPE/ANC	3" DR-359-M42	Drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
PC	PIPE/ANC	3" PC-557-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	3" PC-558-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
RW	PIPE/ANC	3" RW-610-M5	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC	PIPE/ANC	3" RW-611-M5	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VAP	PIPE/ANC	3" SL-130-M9	Slurry - Sample line (SAMP-F-2)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS (heat traced, insulated)	H-2-98989 / H-2-98988, Sheet 2 of 2
B&SC	PIPE/ANC	3" SL-M27	slurry	SCH 40, SS ASTM A312, Type 304L	H-2-98995, SH2 / H-2-98989
VC	PIPE/ANC	3" STM-418-M2	steam	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC/RW	PIPE/ANC	3" URW-1602-M5	URW	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98994 / H-2-98999
VC	PIPE/ANC	3" VAC-1502-M42	air / condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC/VV	PIPE/ANC	3" VV-1001-M42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999, H-2-98998
VC	PIPE/ANC	4" JET DISCH-M2	steam / air	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
SC	PIPE/ANC	4" strainers	strainers	Specification required	H-2-98993
SC	PIPE/ANC	4"SC-500-M2	steam condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
VV	PIPE/ANC	4" VV-AIR INTAKE-M42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
SC	PIPE/ANC	4" OVERFLOW-1802-M2	tank overflow	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
PC	PIPE/ANC	4" PC-550-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VAP/SC	PIPE/ANC	4" SC-500-M9	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS. Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
SC	PIPE/ANC	4" SC-501-M2	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS.	H-2-98993
SC	PIPE/ANC	4" SC-502-M2	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS.	H-2-98993
SC	PIPE/ANC	4" SC-M2	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS.	H-2-98993
VV	PIPE/ANC	4" VV-1000-M42	Vessel Vent	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1 / H-2-98998

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
VAP/VC	PIPE/ANC	42" Vapor Line	Vapor	5/16" thick, SS	H-2-98988, Sheet 1 of 2
VC	PIPE/ANC	6" VAC-1500-M42	steam / air	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VAP	PIPE/ANC	6" DR-335-M9	Drain system	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
VC	PIPE/ANC	6" VAC-1501-M42	air / condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VV	PIPE/ANC	8" VV-1002-M42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
VV	PIPE/ANC	AM N H3-1		Specification required	H-2-98998
VV	PIPE/ANC	Ducting between flex joint and Fan EX-C1 (no designation)		Specification required	H-2-98998
VV	PIPE/ANC	H-C-1	VV HEATER	Specification required	H-2-98998
VV	PIPE/ANC	HV FC5-2	VALVE	Specification required	H-2-98998
VV	PIPE/ANC	HV-FC5-1	VALVE	Specification required	H-2-98998
VC	PIPE/ANC	PSV EC1-2	Pressure safety valve	Specification required	H-2-98999
RW	PIPE/ANC	PSV EC2/EC3-1	Pressure safety valve	Specification required	H-2-98999
SC	PIPE/ANC	Steam Trap Network (242-A-60, 61, 62)		Specification required	H-2-98993
RW	PIPE/ANC	Unidenified line to valve 5-48 from main line (12"URW-600-M5)	Raw water (used?)	Specification required	H-2-98999
SC	PIPE/ANC	Unidentified 1/2" line from valve 2-5A to seal loop, 4" OVERFLOW-1802-M2	overflow	Specification required	H-2-98993
PC	PIPE/ANC	Unidentified line from 3" DR-359-M42 through valve 1 3 to 1/2"PC-563-M42 (between 1-2 and 1-5).		SCH 40 CS, Line designator not indicated, assumed M42, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VC	PIPE/ANC	unidentified line from air atomizing nozzle to 6"VAC-1501-M42	plant air & corrosion inhibitor?	Specification required	H-2-98999
RW	PIPE/ANC	Unidentified line from funnel for flush solution through valve HV RC2-4 (FC)	flush solution	Specification required	H-2-98994
VV	PIPE/ANC	Unidentified line from VV stack monitor		Specification required	H-2-98998
VV	PIPE/ANC	Unidentified lines to/from AM NH3-1		Specification required	H-2-98998
PC	PIPE/ANC	Unidentified p-tap line to PI PC-1	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	Unidentified p-tap line to PI PC-3	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	Unidesignated line from PCV-CA1-10	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1 / H-2-99083
PC	PIPE/ANC	Unknown ¼" line	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1

242-A Evaporator Facility Component Qualification

Component ID	Description	Potential Degradation	Pass / Fail	Qualification
C-A-1	Vapor - Liquid Separator	Interfacial Pitting, SCC	Pass	UT, Leak Test, Visual inspection
C-A-1	Condensate	Erosion, SCC	Pass	UT, Leak Test, Visual inspection
E-A-1	Reboiler Shell	Erosion, SCC	Pass	UT, Leak Test, Visual inspection
E-A-1	Steam Condensate	Erosion, SCC	Pass	UT, Leak Test, Visual inspection
E-C-1	Primary Condenser Shell	Uniform	Pass	UT, Visual inspection
E-C-1	Primary Condenser Tubes	Uniform	Pass	UT, Visual inspection
E-C-2	Inter-Condenser Shell	Uniform	Pass	UT, Visual inspection
E-C-3	After-Condenser / Final-Condenser	Uniform	Pass	UT, Visual inspection
F-C-1	Condensate Filter	Uniform	Pass	Visual Inspection
F-C-2	Condesate filter	Uniform	Pass	Visual Inspection
F-C-3	Duplex Filter	Uniform	Pass	Visual Inspection
J-EC2-1	EDUCTOR	Uniform	Pass	Visual Inspection
P-B-1	Recircluation Pump	General degradation	Pass	Visual Inspection
P-B-2	Bottoms Pump	General degradation	Pass	Visual Inspection
P-C100	CONDENSATE PUMP	General degradation	Pass	Visual Inspection
Recirculation Pump water seal	Recirculation Pump water seal	General degradation	Pass	Visual Inspection
SAMP-F-1	Sampler	General degradation	Pass	Visual Inspection
SAMP-F-2	Sampler	General degradation	Pass	Visual Inspection
SEAL POT		Uniform	Pass	Visual Inspection
TK-C-100	CONDENSATE COLLECTION TANK	Interfacial Pitting	Pass	UT and Visual Inspection
TK-C-500	Corrosion Inhibitor Tank	Interfacial Pitting	Pass	Visual Inspection
¼" Decon-816-M9	Decon	General degradation	Pass	Visual Inspection
½" DR 378 M42	PC drain	Uniform	Pass	Visual Inspection
½" DR-337-M42	drain	Pitting	Pass	Visual Inspection
½" DR-349-M42	PC	Uniform	Pass	Visual Inspection
½" DR-363-M42	drain	Pitting	Pass	Visual Inspection
½" DR-378-M42	process condensate drain	Uniform	Pass	Visual Inspection
½" DRAIN – M5	SC drain (SS6)	Pitting	Pass	Visual Inspection
½" DR-M42	PC sample, F-C-3 Drain line, process condensate drain	Uniform	Pass	Visual Inspection
½" PC-563-M42	process condensate drain	Uniform	Pass	Visual Inspection
½" SEAL CAVITY DRAIN (no code specified)	pump P-B-2 seal cavity drain	Uniform	Pass	Visual Inspection

242-A Evaporator Facility Component Qualification

Component ID	Description	Potential Degradation	Pass / Fail	Qualification
½" SEAL WTR OUT (no code specified)	pump P-B-2 seal water	Pitting	Pass	Visual Inspection
¾" PC-551-M42	PC	Uniform	Pass	Visual Inspection
¾" SL-131-M9	Slurry - Sample line (SAMP-F-2)	Pitting	Pass	Visual Inspection
¾" DECON-815-M42	decon	Uniform	Pass	Visual Inspection
¾" PC-552-M42	PC	Pitting	Pass	Visual Inspection
¾" SN-250-M9	Recirc - Sample line (SAMP-F-1)	Pitting	Pass	Visual Inspection
1 ½" DR (no code specified)	drain	Pitting	Pass	Visual Inspection
1 ½" SEAL WTR OUT (no code specified)	pump P-B-1 seal water	Pitting	Pass	Visual Inspection
1" DR-M9	Drain system	Pitting	Pass	Visual Inspection
1/2" Line (unidentified) from TK-C-100 through Valve 4-28 to 1/2" air atomizing nozzle	Corrosion inhibitor	Pitting	Pass	Visual Inspection
1/2" PC-563-M42	Seal loop drain	Pitting	Pass	Visual Inspection
1/2" PC SAMPLE BYPASS RETURN	PC	Uniform	Pass	Visual Inspection
1" PC SAMPLE RETURN	PC	Uniform	Pass	Visual Inspection
1" DR-M42	process condensate drain	Uniform	Pass	Visual Inspection
1" overflow M-42		Pitting	Pass	Visual Inspection
1" SC DRAIN-M2	steam condensate drain (SS6)	Pitting	Pass	Visual Inspection
1½" PC-553-M42	PC	Uniform	Pass	Visual Inspection
2 ½" VAC-1501-M42	steam / air	Pitting	Pass	Visual Inspection
2" SL-M9	Slurry	Pitting	Pass	UT and Visual Inspection
2"DR-M8	drain	Pitting	Pass	Visual Inspection
2"Flex	PC	Uniform	Pass	Visual Inspection

242-A Evaporator Facility Component Qualification

Component ID	Description	Potential Degradation	Pass / Fail	Qualification
2" DR-420-M27	drain	Uniform	Pass	Visual Inspection
2" PC-556-M42	PC	Uniform	Pass	Visual Inspection
2" PC-559-M42	PC	Uniform	Pass	Visual Inspection
2" PC-562-M42	PC	Uniform	Pass	Visual Inspection
2" DR-348-M42	condensate room drain	Uniform	Pass	Visual Inspection
2" DR-351-M27	drain	Pitting	Pass	Visual Inspection
2" DR-402-M8	drain	Pitting	Pass	Visual Inspection
2" EL-901-M-42		Pitting	Pass	Visual Inspection
2" PC – Sample drain	PC sample drain (RC-3)	Uniform	Pass	Visual Inspection
2" PC-554-M42	PC	Uniform	Pass	Visual Inspection
2" PC-559-M42	PC	Uniform	Pass	Visual Inspection
2" PC-SAMPLE DRAIN	process condensate sample drain	Uniform	Pass	Visual Inspection
2" SL-M9	Slurry	Pitting	Pass	Visual Inspection
2"VAC-1502-M42	air / condensate	Uniform	Pass	Visual Inspection
28" Recirculation Line	Evaporator / Recirculation	Erosion, SCC	Pass	UT and Visual Inspection
3" OVFL-1801-M42	Seal loop	Uniform	Pass	Visual Inspection
3" SL-M9	Slurry	Pitting	Pass	UT and Visual Inspection
3" SN-251-M9	Recirc - Sample line (SAMP-F-1)	Pitting	Pass	Visual Inspection
3/4" PC-552-M42	Condensate	Uniform	Pass	Visual Inspection
3/4"-PC-551-M42	Condensate	Uniform	Pass	Visual Inspection
3" DR-338-M42	DR	Pitting	Pass	Visual Inspection
3" DR-359-M42	Drain	Pitting	Pass	Visual Inspection
3" PC-557-M42	PC	Uniform	Pass	Visual Inspection
3" PC-558-M42	PC	Uniform	Pass	Visual Inspection
3" SL-130-M9	Slurry - Sample line (SAMP-F-2)	Pitting	Pass	Visual Inspection
3" SL-M27	slurry	Pitting	Pass	UT and Visual Inspection
4" PC-550-M42	PC	Pitting	Pass	Visual Inspection
4" SC-500-M9	steam condensate	Uniform	Pass	Visual Inspection
42" Vapor Line	Vapor	Pitting	Pass	UT and Visual Inspection
6" DR-335-M9	Drain system	Pitting	Pass	Visual Inspection

242-A Evaporator Facility Component Qualification

Component ID	Description	Potential Degradation	Pass / Fail	Qualification
Unidentified line from 3" DR-359-M42 through valve 1-3 to 1/2"PC-563-M42 (between 1-2 and 1-5).		Pitting	Pass	Visual Inspection
unidentified line from air atomizing nozzle to 6"VAC-1501-M42	plant air & corrosion inhibitor?	Pitting	Pass	Visual Inspection
Gasket Connections		General degradation	Pass	Visual Inspection
Prorective coating		Mechanical abrasion	Pass	Visual Inspection
Concrete structure		General degradation	Pass	Visual Inspection

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
VAP	EQUIP	C-A-1	Vapor - Liquid Separator	14' OD x 18' long x ⅜" thick, 304L SS	H-2-98988, Sheet 1 of 1
VV	EQUIP	DU-C-I	DEENTRAINMENT UNIT	Specification required	H-2-98998
VAP	EQUIP	E-A-1	Reboiler	Primary shell is 40½" OD x 14' ⅛" long x ¼" thick 304L SS, secondary shell is 50" OD X 14' ⅛" long x 5/16" thick 304L SS. Tube sheets are 40½" OD x 1¼" thick, 304L bundle consists of 364 1½" OD x 14 ga. seamless SS tubes (Figure B.1lb, E-A-1 Reboiler)	H-2-98988, Sheet 2 of 2
VC	EQUIP	E-C-1	Primary Condenser	Shell is 85" ID x 1' 7" long x 1⅝" thick CS. Tube sheets are 905/8" OD x 2 7/16" thick CS. Tube bundle consists of 2,950 ⅝" OD x 12' long x 0.'8" thick seamless CS tubes (Figure B.3, E-C-1 Condenser).	H-2-98999
VC	EQUIP	E-C-2	Inter-Condenser	Shell is 16" ID x 87" long x 5/16" thick CS (1/1611 corrosion allowance). Tube sheets are 16" OD x 1" thick CS. Tube bundle consists of 144⅝" OD x 66' long x 16 ga. seamless CS tubes. (NOTE: DIMENSIONAL DISCREPANCIES BETWEEN ASME DATA REPORT AND MANUFACTURER SPECIFICATION TO BE MEASURED DURING WALKDOWN.)	H-2-98999
VC	EQUIP	E-C-3	After-Condenser / Final-Condenser	Shell is 8 5/8" ID x 93 7/8" long x 0.322t1 thick CS (1/16" corrosion allowance). Tube sheets are 8 5/811 OD x 1" thick CS. Tube bundle consists of 45 3/4" OD x 72' long x 16 ga. seamless CS tubes. (NOTE: DIMENSIONAL DISCREPANCIES BETWEEN ASME DATA REPORT AND MANUFACTURER SPECIFICATION TO BE MEASURED DURING WALKDOWN.)	H-2-98999
PC	EQUIP	F-C-1	Condensate Filter	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VC	EQUIP	F-C-2	Condesate filter	Specification required	H-2-98999
PC	EQUIP	F-C-3	Duplex Filter	Information Not Available to IQRPE	H-2-98990, SH1
VV	EQUIP	F-C-5-1	HEPA FILTER	Specification required	H-2-98998
VV	EQUIP	F-C-5-2 HEPA	FILTER	Specification required	H-2-98998
VV	EQUIP	F-C-6	PRE-FILTER/DEMISTER	Specification required	H-2-98998
VC	EQUIP	J-EC2-1	EDUCTOR	Specification required	H-2-98999
VAP	EQUIP	P-B-1	Recircluation Pump	ASTM A296 Gr CF-8 and Gr GF-8, 14,000 gpm capacity.	H-2-98988, Sheet 2 of 2
Slurry	EQUIP	P-B-2	Bottoms Pump	Variable speed, max. capacity 125 gpm, mechanical seals: 316 SS, shaft 316 SS, impeller and casing: CD4MCU	H-2-98989
PC	EQUIP	P-C100	CONDENSATE PUMP	Standard end section, single stage, centrifugal pump. CS shaft and impeller with SS shaft sleeve. 10 hp/3,500 RPM motor, capacity is 50 gpm at 110' head.	H-2-98990, SH1
SC	EQUIP	P-RC-1	SC SAMPLE PUMP	Specification required	H-2-98993
VAP	EQUIP	Recirculation Pump water seal	Recirculation Pump water seal	Specification required	H-2-98988, Sheet 1 of 1
VAP	EQUIP	SAMP-F-1	Sampler	Specification required	H-2-98988, Sheet 2 of 2
Slurry	EQUIP	SAMP-F-2	Sampler	Specification required	H-2-98989
PC	EQUIP	SEAL POT		18" OD x 24" deep SCH 40 CS pipe	H-2-98990, SH1
PC	EQUIP	TK-C-100	CONDENSATE COLLECTION TANK	14' OD X 19' 9 7/8" tall x 5/16" thick, 17,800 gal 347 and 304L SS.	H-2-98990, SH1
SC	EQUIP	TK-C-103	FLOW MEASUREMENT TANK:	72" LONG X 42" WIDE X 36" DEEP X ¼" thick, CS, with 304L SS wier plate.	H-2-98993
VC	EQUIP	TK-C-500	Corrosion Inhibitor Tank	3 gallons, specification required	H-2-98999
PC	PIPE/ANC	¼" Decon-816-M9	Decon	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98990, SH1
VAP	PIPE/ANC	¼" AF-301-M9	antifoam	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VV	PIPE/ANC	¼" FRW-M31		.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98998
VC	PIPE/ANC	¼" IA-M31	instrument air	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98999
PC	PIPE/ANC	¼" I-FC1-4-M31	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	¼" I-FC1-5-M31	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	¼" I-ILS-4-M31	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	¼" I-ILS-6-M31	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
VV	PIPE/ANC	¼" NH3-M31		.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98998
VV	PIPE/ANC	½" SC M9			H-2-98998
VAP	PIPE/ANC	½" I-CAI-M9	FRW, steam, and air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
SC	PIPE/ANC	½" RW Drain-M5	raw water drain		H-2-98993
SC	PIPE/ANC	½" SAMPLE-M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-SAMPLE-M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
RW	PIPE/ANC	½" (ID and code not specified)	drain	Assume SS	H-2-98994

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
PC	PIPE/ANC	½" DR 378 M42	PC drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	½" DR-337-M42	drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
PC/B&SC	PIPE/ANC	½" DR-349-M42	PC	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VV	PIPE/ANC	½" DR-353-M42	drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
PC	PIPE/ANC	½" DR-363-M42	drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
B&SC	PIPE/ANC	½" DR-378-M42	process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
SC/B&SC	PIPE/ANC	½" DRAIN – M5	SC drain (SS6)	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
RW	PIPE/ANC	½" Drain (code not specified)	drain	Assume SS	H-2-98994
SC	PIPE/ANC	½" drain-M5	steam condensate/drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
VV	PIPE/ANC	½" DR-M31		.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98998
PC, B&SC	PIPE/ANC	½" DR-M42	PC sample, F-C-3 Drain line, process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1 / H-2-98995
SC	PIPE/ANC	½" FLUSH – M31	flush line, steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
RW	PIPE/ANC	½" FLUSH-M5	flush	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98994
VAP	PIPE/ANC	½" I-CA1-1-M9	FRW & air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	½" I-CA1-2-M9	FRW & air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	½" I-CA1-3-M9	FRW & air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	½" I-CAI-8-M9	FRW, steam, and air	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VV	PIPE/ANC	½" I-M31		.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98998
B&SC	PIPE/ANC	½" PC-563-M42	process condensate drain	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
SC	PIPE/ANC	½" RW – ADD-M2	raw water - add	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
SC	PIPE/ANC	½" RW-629-M5	Raw water	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
VAP	PIPE/ANC	½" RW-M9	Raw Water System	SCH 40 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
RW	PIPE/ANC	½" SAMPLE (no code)	used raw water (sample)	M5: SCH 40 CS	H-2-98994
SC	PIPE/ANC	½" SC-DRAIN-M31	steam condensate drain	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-GRAB SAMPLE – M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-PURGE-M31	steam condensate sample/purge	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-SAMPLE AND RETURN M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-SAMPLE BYPASS-M31	steam condensate sample	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
SC	PIPE/ANC	½" SC-SAMPLE/PURGE	steam condensate sample/purge	Line designator, material not specified	H-2-98993
B&SC	PIPE/ANC	½" SEAL CAVITY DRAIN (no code specified)	pump P-B-2 seal cavity drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98998, SH2
B&SC	PIPE/ANC	½" SEAL WTR OUT (no code specified)	pump P-B-2 seal water	Line designator, material not specified	H-2-98995, SH1 / H-2-98989
RW	PIPE/ANC	½" URW – SAMPLE RETURN-M31	used raw water (sample)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" URW-Drain-M31	used raw water (drain)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" URW-OVERFLOW and VENT-M31	used raw water (overflow & vent)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
RW	PIPE/ANC	½" URW-SAMPLE RETURM-M31 (divert)	used raw water (sample)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" URW-SAMPLE-M31	used raw water (sample)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" URW-SAMPLE-M31 (normal)	used raw water (sample)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	½" valve vent & drain – M31	used raw water (drain)	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
PC	PIPE/ANC	½" VENT-OM42	PC	SCH 80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VV	PIPE/ANC	¼" DECON-818-M9		SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304LSS	H-2-98998
PC	PIPE/ANC	¾" PC-551-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VAP	PIPE/ANC	¾" SL-131-M9	Slurry - Sample line (SAMP-F-2)	SCH 40 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
VC	PIPE/ANC	¾" DECON-815-M42	decon	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
PC	PIPE/ANC	¾" PC-552-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	¾" RW-520-M42	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VV	PIPE/ANC	¾" RW-614-M5	raw water	SCH 40 ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
SC	PIPE/ANC	¾" SC-Sample-M31	steam condensate	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
VAP	PIPE/ANC	¾" SN-250-M9	Recirc - Sample line (SAMP-F-1)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
VV	PIPE/ANC	¾" VENT DRAIN-M42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
B&SC	PIPE/ANC	1 ½" DR (no code specified)	drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98989
B&SC	PIPE/ANC	1 ½" SEAL WTR OUT (no code specified)	pump P-B-1 seal water	Line designator, material not specified	H-2-98995, SH1 / H-2-98998, SH2
B&SC	PIPE/ANC	1 ½" URW-SAMPLE DRAIN – SST	Used raw water sample drain	Line designator not specified, SST	H-2-98995, SH1 / H-2-98994
VAP	PIPE/ANC	1" DR-M9	Drain system	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
VAP	PIPE/ANC	1" RW-M9	Raw Water System	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
SC	PIPE/ANC	1"SC-500-M2	steam condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
PC	PIPE/ANC	1"V-1203-M42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VC	PIPE/ANC	1/2 PA-M7	Plant air	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
SC	PIPE/ANC	1/2" Flush-M31	flush line	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98993
VC	PIPE/ANC	1/2" Line (unidentified) from TK-C-100 through Valve 4-28 to 1/2" air atomizing nozzle	Corrosion inhibitor	Line designator, material not specified	H-2-98999
PC	PIPE/ANC	1/2" PC-563-M42	Seal loop drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
SC	PIPE/ANC	1/2"SC-M2	steam condensate	SCH 40/80, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
RW	PIPE/ANC	1/2"SC-M31	used raw water	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	1/2"SC-M31	flush?	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
PC	PIPE/ANC	1/2" PC SAMPLE BYPASS RETURN	PC	0.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1 & SH2
RW	PIPE/ANC	1/4" I-ECI-5-M31	RW	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98999
RW	PIPE/ANC	1/4" PA (SPARGE-M31)	Plant air	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
RW	PIPE/ANC	1/4"I-ECI-9-M31	pressure indicator	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98994
PC	PIPE/ANC	1" PC SAMPLE RETURN	PC	0.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1 & SH2
PC, B&SC	PIPE/ANC	1" DR-M42	process condensate drain	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
RW	PIPE/ANC	1" DR-SST	drain	Line designator not specified, SST	H-2-98994
VAP	PIPE/ANC	1" FRW-654-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-656-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
VAP	PIPE/ANC	1" FRW-657-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-658-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-659-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-660-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-661-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-662-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-663-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-665-M9	Filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
VAP	PIPE/ANC	1" FRW-668-M9	filtered raw water	Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 1 of 1
PC, VV	PIPE/ANC	1" overflow M-42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990 / H-2-98998
VAP	PIPE/ANC	1" RW-M9	Raw Water System	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
B&SC	PIPE/ANC	1" SC DRAIN-M2	steam condensate drain (SS6)	SCH40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
SC	PIPE/ANC	1" SC-511-M2	steam condensate	SCH40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
VV	PIPE/ANC	1" SST tubing		Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98998
VC	PIPE/ANC	10" JET-DISCH-M2	steam / air	SCH40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
PC	PIPE/ANC	1½" PC-553-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VV	PIPE/ANC	1½" DR-337-M42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
RW	PIPE/ANC	12"URW-600-M5	Raw water (used?)	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999 / H-2-98994
RW	PIPE/ANC	12" URW-1600-M5	used raw water	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98994
RW	PIPE/ANC	12" URW-1601-M5	used raw water	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98994
VAP	PIPE/ANC	18" STM-470-M9	Steam	10 PSIG, Greater than 12 inch: ASTM A240, GRTP304L	H-2-98988, Sheet 2 of 2
VC	PIPE/ANC	2 ½" VAC-1501-M42	steam / air	SCH 40, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98999
VAP	PIPE/ANC	2" SL-M9	Slurry	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
B&SC	PIPE/ANC	2"DR-M8	drain	ASTM A312, TP304L	H-2-98995, SH2
PC	PIPE/ANC	2"Flex	PC	Specification required	H-2-98990, SH1
SC	PIPE/ANC	2"SC-M2	steam condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
B&SC	PIPE/ANC	2" DR-420-M27	drain	SS ASTM A312, Type 304L	H-2-98995, SH1 / H-2-98998, SH2
PC	PIPE/ANC	2" PC-556-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	2" PC-559-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	2" PC-562-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
B&SC	PIPE/ANC	2" VENT-M24	vent	SCH 40, ASTM A53, Type S, Grade B CS, or ASTM A106, Grade B CS	H-2-98995, SH1
VV	PIPE/ANC	2" AS-1703-M2		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
B&SC	PIPE/ANC	2" DR-348-M42	condensate room drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1
B&SC	PIPE/ANC	2" DR-351-M27	drain	SS ASTM A312, Type 304L	H-2-98995, SH2
B&SC	PIPE/ANC	2" DR-402-M8	drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH2
PC	PIPE/ANC	2" EL-901-M-42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	2" PC – Sample drain	PC sample drain (RC-3)	Line designator not specified/SS	H-2-98990, SH2 / H-2-98995
PC	PIPE/ANC	2" PC-554-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	2" PC-559-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
B&SC	PIPE/ANC	2" PC-SAMPLE DRAIN	process condensate sample drain	Line designator, material not specified	H-2-98995, SH1 / H-2-98990, SH2
PC	PIPE/ANC	2" RW-612-M5	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
Slurry	PIPE/ANC	2" SL-M9	Slurry	SCH 10, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
VAP	PIPE/ANC	2" U-850-M9	Flush water(?)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
PC	PIPE/ANC	2" V -1209-M42	vent	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1, H-2-98993
B&SC	PIPE/ANC	2" VENT-M24	vent	SCH 40, ASTM A53, Type S, Grade B CS, or ASTM A106, Grade B CS	H-2-98995, SH1
VC	PIPE/ANC	2"VAC-1502-M42	air / condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
PC	PIPE/ANC	2"-VE-1059-M9	vent	ASTM A312, GRTP304L SS	H-2-98990, SH1 / H-2-88766, SH1
RW	PIPE/ANC	24"CMP-URW-1601	used raw water	Specification required	H-2-98994
VAP	PIPE/ANC	28" Recirculation Line	Evaporator / Recirculation	¼" thick, SS	H-2-98988, Sheets 1 of 1 and 2 of 2
PC	PIPE/ANC	3" OVFL-1801-M42	Seal loop	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1 / H-2-98995
VAP	PIPE/ANC	3" SL-M9	Slurry	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989 / H-2-98988, Sheet 2 of 2
VAP	PIPE/ANC	3" SN-251-M9	Recirc - Sample line (SAMP-F-1)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
VC	PIPE/ANC	3" V-1202-M42	air / condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC	PIPE/ANC	3/4" PC-552-M42	Condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC	PIPE/ANC	3/4"-PC-551-M42	Condensate	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
RW	PIPE/ANC	3/4"URW-600-M5	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VAP	PIPE/ANC	3/8" FRW-M31	Filtered raw water	.035 inch Wall Thickness, ASTM A269, GR TP304	H-2-98988, Sheet 1 of 1
PC, B&SC	PIPE/ANC	3" DR-338-M42	DR	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1 & SH2
PC, B&SC	PIPE/ANC	3" DR-359-M42	Drain	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98995, SH1 / H-2-98990, SH1
PC	PIPE/ANC	3" PC-557-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
PC	PIPE/ANC	3" PC-558-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
RW	PIPE/ANC	3" RW-610-M5	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC	PIPE/ANC	3" RW-611-M5	RW	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VAP	PIPE/ANC	3" SL-130-M9	Slurry - Sample line (SAMP-F-2)	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS (heat traced, insulated)	H-2-98989 / H-2-98988, Sheet 2 of 2
B&SC	PIPE/ANC	3" SL-M27	slurry	SCH 40, SS ASTM A312, Type 304L	H-2-98995, SH2 / H-2-98989
VC	PIPE/ANC	3" STM-418-M2	steam	ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC/RW	PIPE/ANC	3" URW-1602-M5	URW	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98994 / H-2-98999
VC	PIPE/ANC	3" VAC-1502-M42	air / condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VC/VV	PIPE/ANC	3" VV-1001-M42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999, H-2-98998
VC	PIPE/ANC	4" JET DISCH-M2	steam / air	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
SC	PIPE/ANC	4" strainers	strainers	Specification required	H-2-98993
SC	PIPE/ANC	4"SC-500-M2	steam condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
VV	PIPE/ANC	4" VV-AIR INTAKE-M42		SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
SC	PIPE/ANC	4" OVERFLOW-1802-M2	tank overflow	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98993
PC	PIPE/ANC	4" PC-550-M42	PC	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VAP/SC	PIPE/ANC	4" SC-500-M9	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS. Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98988, Sheet 2 of 2
SC	PIPE/ANC	4" SC-501-M2	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS.	H-2-98993
SC	PIPE/ANC	4" SC-502-M2	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS.	H-2-98993
SC	PIPE/ANC	4" SC-M2	steam condensate	M9: SCH 10S SS; M2: SCH 40 CS SS/CS. Note: Section of 4" pipe passing through evaporator / condenser room wall is M8, SCH 40S SS.	H-2-98993
VV	PIPE/ANC	4" VV-1000-M42	Vessel Vent	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1 / H-2-98998

242-A Facility Piping and Component Materials

		Component ID	Description	Material Specification	P&ID
VAP/VC	PIPE/ANC	42" Vapor Line	Vapor	5/16" thick, SS	H-2-98988, Sheet 1 of 2
VC	PIPE/ANC	6" VAC-1500-M42	steam / air	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VAP	PIPE/ANC	6" DR-335-M9	Drain system	SCH 10 SS, Less than 12 inch: ASTM A312, GRTP304L SS	H-2-98989
VC	PIPE/ANC	6" VAC-1501-M42	air / condensate	SCH 40, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98999
VV	PIPE/ANC	8" VV-1002-M42		ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98998
VV	PIPE/ANC	AM N H3-1		Specification required	H-2-98998
VV	PIPE/ANC	Ducting between flex joint and Fan EX-C1 (no designation)		Specification required	H-2-98998
VV	PIPE/ANC	H-C-1	VV HEATER	Specification required	H-2-98998
VV	PIPE/ANC	HV FC5-2	VALVE	Specification required	H-2-98998
VV	PIPE/ANC	HV-FC5-1	VALVE	Specification required	H-2-98998
VC	PIPE/ANC	PSV EC1-2	Pressure safety valve	Specification required	H-2-98999
RW	PIPE/ANC	PSV EC2/EC3-1	Pressure safety valve	Specification required	H-2-98999
SC	PIPE/ANC	Steam Trap Network (242-A-60, 61, 62)		Specification required	H-2-98993
RW	PIPE/ANC	Unidenified line to valve 5-48 from main line (12"URW-600-M5)	Raw water (used?)	Specification required	H-2-98999
SC	PIPE/ANC	Unidentified 1/2" line from valve 2-5A to seal loop, 4" OVERFLOW-1802-M2	overflow	Specification required	H-2-98993
PC	PIPE/ANC	Unidentified line from 3" DR-359-M42 through valve 1-3 to 1/2"PC-563-M42 (between 1-2 and 1-5).		SCH 40 CS, Line designator not indicated, assumed M42, ASTM A53, Type E or S, Grade A or B CS, or ASTM A106, Grade A or B CS	H-2-98990, SH1
VC	PIPE/ANC	unidentified line from air atomizing nozzle to 6"VAC-1501-M42	plant air & corrosion inhibitor?	Specification required	H-2-98999
RW	PIPE/ANC	Unidentified line from funnel for flush solution through valve HV RC2-4 (FC)	flush solution	Specification required	H-2-98994
VV	PIPE/ANC	Unidentified line from VV stack monitor		Specification required	H-2-98998
VV	PIPE/ANC	Unidentified lines to/from AM NH3-1		Specification required	H-2-98998
PC	PIPE/ANC	Unidentified p-tap line to PI PC-1	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	Unidentified p-tap line to PI PC-3	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1
PC	PIPE/ANC	Unidesignated line from PCV-CA1-10	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1 / H-2-99083
PC	PIPE/ANC	Unknown ¼" line	Pressure tap	.035 inch Wall Thickness, ASTM A269, Grade TP304	H-2-98990, SH1