Infeasibility Evaluation and Calculation of Interim Performance Based Effluent Limits – Morton International, Inc.

A. INTRODUCTION

This report documents the infeasibility analysis and interim performance based limits (IPBLs) calculations the Water Board staff has conducted for reissuance of Morton International, Inc., Morton Salt Division, Newark Facility (hereinafter the Discharger), NPDES permit (No. CA0005185). The analysis is based on evaluating the probability distribution of the Discharger's effluent data collected between 2001 and 2004 (1998–2004 for lead and zinc). The statistical software MiniTab (and macro MDLNORM by Dr. Hesel) was used to determine statistical results.

Seven pollutants are analyzed here because they demonstrate reasonable potential (RP), as discussed in a separate analysis (see the RPA spreadsheet). RP was triggerred either because the maximum effluent concentration (MEC) exceeded the minimum water quality objective (WQO), or the maximum background concentration exceeded the maximum background concentration (B):

Table 1. Pollutants Demonstrating Reasonable Potential

CTR No.	Pollutant	WQO/WQC (µg/L)	Basis[1]	MEC (µg/L)	Maximum Ambient Background Conc. (µg/L)	Reasonable Potential
6	Copper	13	BP, SSO	46.1	57.7	MEC>WQO
7	Lead	8.5	CTR, sw	110	4.6	MEC>WQO
10	Selenium	5.0	NTR, fw	41	144	MEC>WQO
13	Zinc	91	CTR, sw	113	117	MEC>WQO
14	Cyanide	1	NTR, sw	< 2	30	B>WQO
	TCDD TEQ	1.4×10^{-8}	CTR, hh	5.9×10^{-6}	6.01×10^{-5}	MEC>WQO
68	Bis(2-Ethylhexyl)Phthalate	5.9	CTR, hh	<2	7.0	B>WQO

1. CTR = California Toxic Rule; BP = Basin Plan, NTR = National Toxics Rule, SSO = site-specific objective, sw = salt water, fw = fresh water, hh = human health

B. METHOD

The four steps used in the infeasibility analyses and IPBL calculations are described below:

1. **Which frequency distribution model does effluent data most accurately follow—Normal or Log-Normal?**

   The best distribution was evaluated by considering the following criteria, and using best judgment:
   a) Which AD (Anderson Darling coefficient) is lowest? (< 1.01?)
   b) Which P-value is greatest ? (> 0.05?)
   c) Which symmetry plot best follows a straight line?

2. Determine Mean, 95th and 99th Percentile of Effluent Data

   a) For Normal Distribution:
      95th Percentile = Mean + 1.645 * SD (where SD is Standard Deviation)
      99th Percentile = Mean + 2.326 * SD
   b) For Log-Normal Distribution:
      95th Percentile = exp (Transformed_Mean + 1.645 Transformed_SD)
      99th Percentile = exp (Transformed_Mean + 2.326 * Transformed_SD)

3. Is it feasible for discharger to comply with Average Monthly Effluent Limit (AMEL) and Maximum Daily Effluent Limit (MDEL)?

   If any one or more of the following three conditions exist, then infeasibility is concluded:
   a) 95th Percentile > AMEL
   b) 99th Percentile > MDEL
   c) Mean of Non-Transformed Data > Long Term Average (LTA)

   (Mean of non-transformed data is compared to LTA, since it is the best estimate of a true average. Converting the transformed mean back to the original scale will not accurately estimate the true average, because of transformation bias.)

4. Determine Performance Based Effluent Limits (IPBLs) if enough data

   If infeasibility is concluded, set IPBL to the 99.87th Percentile of effluent data:
   a) For normal distribution:
      IPBL = Mean + 3 * SD
   b) For log-normal distribution:
      IPBL = exp(Transformed_Mean + 3 * Transformed_SD)

C. SUMMARY

The following table summarizes the feasibility determinations and IPBLs for each pollutant (all units in micrograms per liter). For all pollutants evaluated, it was found there is a significant statistical likelihood the Discharger will not be able to immediately comply with the final water quality based effluent limitations (WQBELs), based on recent plant performance, or due to uncertainty associated with the large magnitude of the available method detection limits (MDLs). Section D below describes the results of the analyses for each pollutant in greater detail. (The WQBELs (Average Monthly Efflunet Limits (AMELs) and Maximum Dailiy Effluent Limits (MDELs)), are calculated in the RPA spreadsheet.)

Table 2. Effluent Data

		Cu		Pb		Ni		Se		Zn
Date	<	ug/l	<	ug/l	<	ug/l	<	ug/l		ug/L
3/9/1998			<	100						49
9/28/1998				1.9						42
3/8/1999			<	0.5						5.3
9/6/1999			<	3					<	20
3/13/2000			<	3					<	20
9/4/2000			<	3					<	20
3/12/2001			<	3					<	20
9/4/2001	<	10		110	<	20				8.7
9/10/2001								41	<	20
12/26/2001		22.2		1.5		12		34		41
3/10/2002		1.9		0.15		1		2.2		1
6/23/2002		29.4		8.7		10		31.4		29
9/22/2002		30.5	<	0.01		13		32.1	<	0.3
10/14/2002										
12/9/2002		46.1		10.5				39.8	<	0.3
3/23/2003		27.2		2.3		16		23		18
10/27/2003		30.6		0.5		9.2		32.2		8.7
2/8/2004		25.1		0.9		7.2				113

Table 3. Summary of Infeasibility Analysis

Constituent	Mean / LTA	95th / AMEL	99th / MDEL	IPBL	Feasible to Comply
Copper	24.1 > 6.6	46.2> 10.2	58 > 20.4	72.6	No
Lead	12 > 4.5	28 > 4.5	113 > 14.2	113	No
Selenium	29.5 > 2.6	48.6 > 4.1	58.1 > 8.2	70.0	No
Zinc	21.5 < 32	104 > 36	315 > 100	315	No
Cyanide	Effluent data all ND			5	No
TCDD TEQ	MEC>WQC			NA	No
Bis(2-ethylhexyl)phthalate	All 2 measurements < 2 µg/L (AMEL = 5.9 µg/L, MDEL = 12 µg/L)			NA	Yes

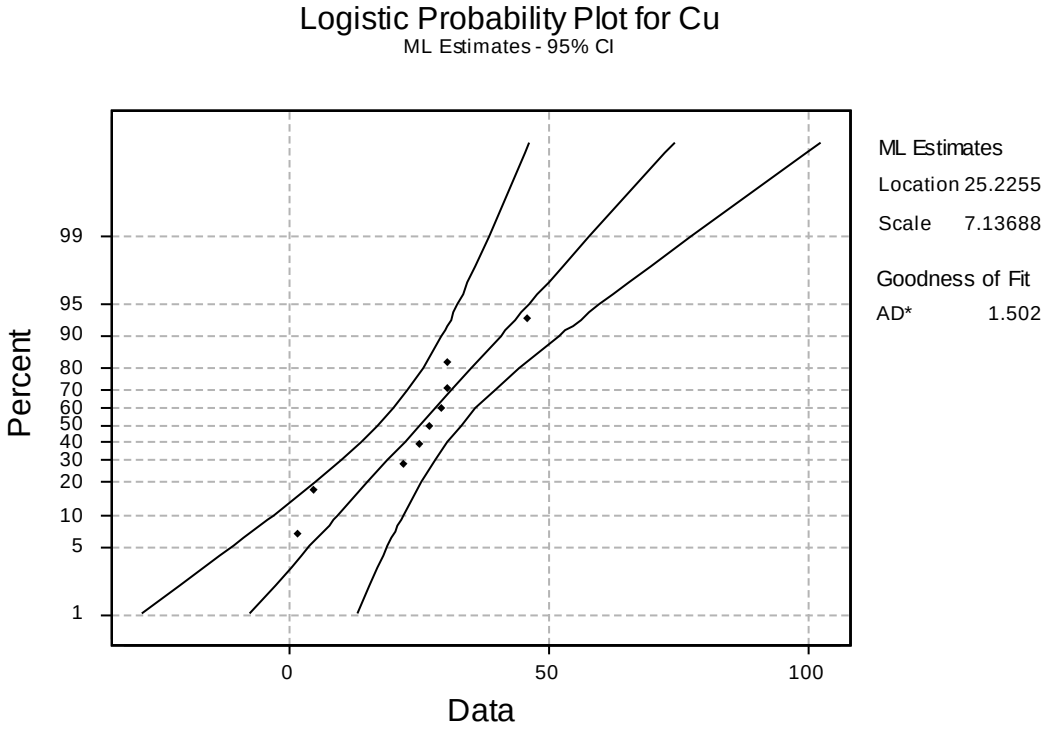
D. RESULTS

(1) COPPER

Logistic Distribution is best model (AD=1.502)
95th percentile = 46.2 > 10.2 (AMEL)
99th percentile = 58 > 20.4 (MDEL)
Mean = 24.1 > 6.6 (LTA)

Therefore, infeasible to achieve immediate compliance with WQBELs.

IPBL = 99.87th percentile = 72.6 ug/L



(2) LEAD

Log-Normal Distribution Best
Log Mean = -0.065
Log SD = 2.067
95th = exp(-0.065 + 1.645 * 2.067) = 28 > AMEL(4.5)
99th = exp(-0.065+ 2.326 * 2.067) = 113 > MDEL(14.2)
Mean of Untransformed Data = 12 > LTA(4.5)

Infeasibility Concluded Since:
95th >AMEL
99th > MDEL
Mean > LTA

99.87th percentile = exp(-0.065 + 3 * 2.067) = 462

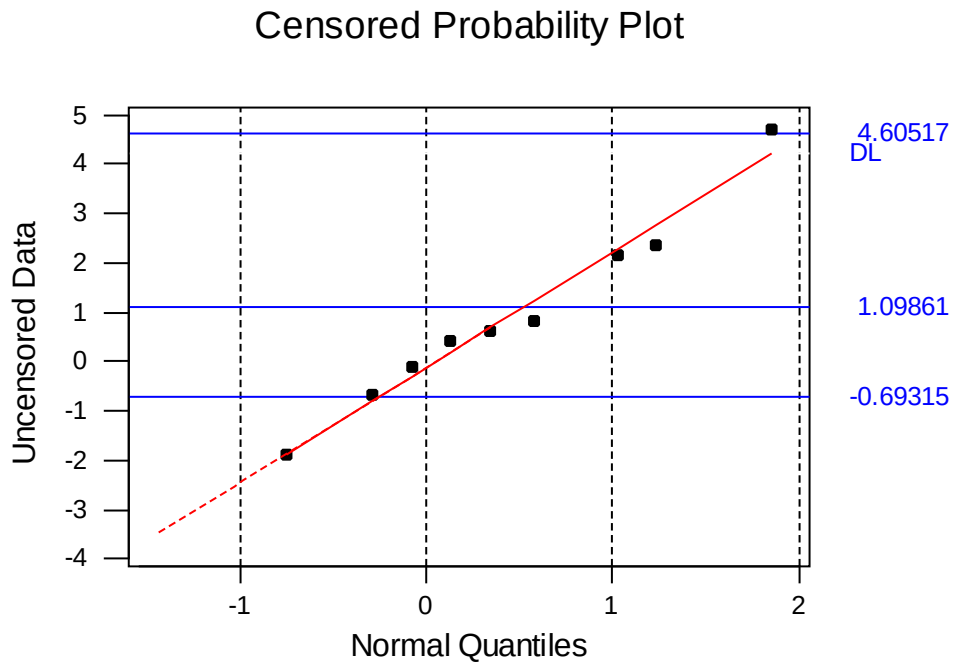
Since the 99.87th percentile is exceptionally large (greater than MDEL by a factor of 33), in our judgment, the 99.87th percentile as a IPBL would pose an unacceptable risk to the environment. Therefore, the IPBL is set to the lower 99th percentile. This parallels the SIP's method of using a 99th percentile occurrence probability for defining MDELs. Therefore:

IPBL = 99th percentile = 113 ug/L

Descriptive Statistics: ESTIMATE

Variable	N	Mean	Median	TrMean	StDev	SE Mean
ESTIMATE	16	-0.065	-0.166	-0.162	2.067	0.517

Variable	Minimum	Maximum	Q1	Q3
ESTIMATE	-3.472	4.700	-1.724	0.808



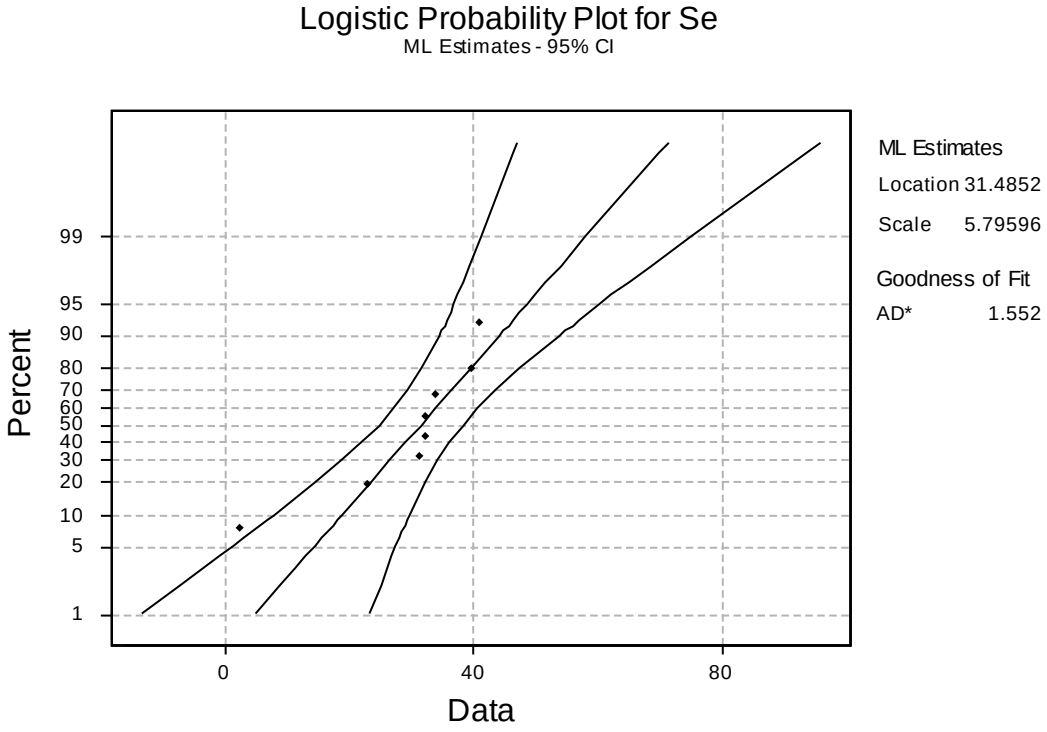
(3) Selenium

Logistic Distribution Best (AD=1.552)

95th percentile = 28 > 4.1 (AMEL)
99th percentile = 113 > 8.2 (MEDL)
Mean = 29.5 > 2.6 (LTA)

Therefore, infeasible to achieve immediate compliance with WQBELs.

IPBL = 99.87th percentile = 70.0 ug/L



(4) Zinc

Log-Normal Distribution Assumed

LogMean = 1.975
LogSD = 1.625
95th = exp(1.975 + 1.645 * 1.625) = 104 > AMEL(36)
99th = exp(1.975 + 2.326 * 1.625) = 315 > MDEL(100)
Mean of Untransformed Data = 21.5 > LTA(32)

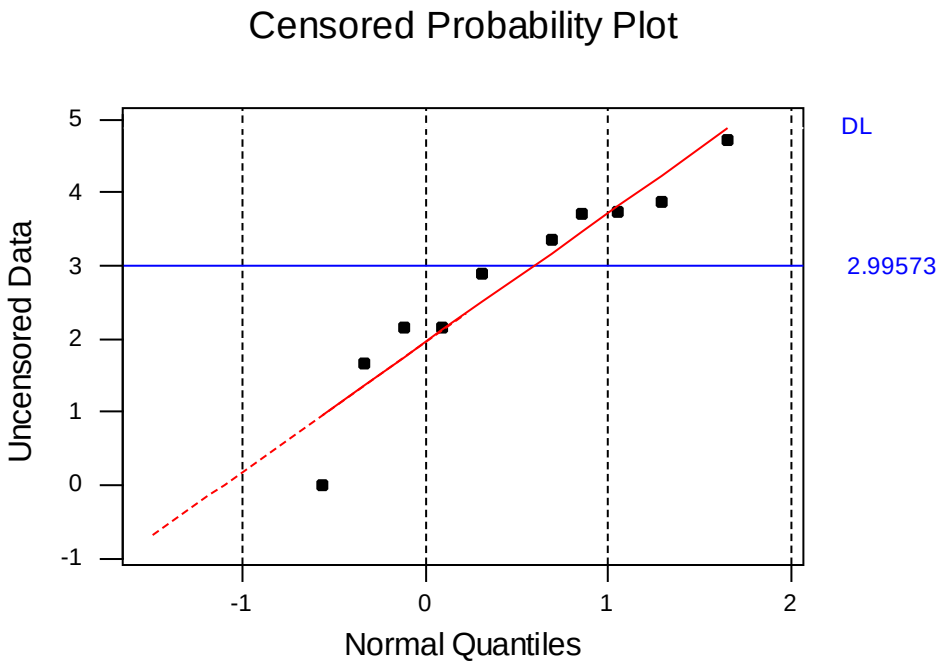
Feasibility Concluded Since:
95th >AMEL
99th > MDEL
Mean > LTA
therefore infeasible to achieve immediate compliance

IPBL = 99th percentile = 315 ug/L

Descriptive Statistics: ESTIMATE

Variable	N	Mean	Median	TrMean	StDev	SE Mean
ESTIMATE	17	1.975	2.163	1.970	1.625	0.394

Variable	Minimum	Maximum	Q1	Q3
ESTIMATE	-0.709	4.727	0.335	3.540



(5) Dioxin-TEQ (TCDD TEQ)

Because the MEC ($6.01x10^{-5}$ ug/L) of just two measurements is above the WQO ($1.4 x10^{-8}$ ug/L), it is not feasible for the Discharger to immediately comply with the WQBELs.

At this time an interim limit cannot be determined for Dioxin TEQ since neither a previous permit limit exists, nor is there enough information to determine an interim limit based on current treatment facility performance. Because the monitoring data consists of only two measurements (with one a non-detect), the Board cannot determine an IPBL with a meaningful statistical analysis. The Board staff will establish performance-based limits for dioxin TEQ, as appropriate, when additional data is collected.

(6) Cyanide

Because all cyanide effluent measurements are non-detects and the detection limits are above the WQBELs, the Board cannot determine whether it is feasibile for the Discharger to immediately comply with the WQBELs. Therefore, consistent with a 2002 court ruling, the Board concludes infeasibility.

Because the previous permit does not include a limitation for cyanide, the interim limit must be set to the IPBL. Because the monitoring data consisted of all non-detect values, the Board cannot determine an IPBL with a meaningful statistical analysis, but must base it at levels which the Discharger can demonstrate compliance. In accordance with compliance determination rules specified in Section 2.4.5 of the SIP, the interim limitation is therefore set at the ML listed in Appendix 4 of the SIP as follows: 5 µg/L.

(7) Bis(2-ethylhexyl)phthalate

Because the monitoring data for bis(2-ethylhexyl)phthalate (BEHP) consists of two non-detect values with a MDL of 2 µg/L, which is less than the 5.9 µg/L AMEL and 12 µg/L MDEL, the Board concludes it is feasible for the Discharger to immediately comply with the WQBELs.