APPENDIX E

SEWRPC Memorandum –February 23, 2004– Draft memo of CSO & SSO Pollutant Concentrations for Purposes of Water Quality Modeling – Dated October 29, 2003
[Addresses zinc and copper concentration development in MMSD's SSOs]

SEWRPC STAFF MEMORANDUM

TO: Pat Marchese and Mary Recktenwalt

FROM: Bob Biebel, Ron Printz, Thomas Slawski, and Joseph Boxhorn

DATE: February 23, 2004

SUBJECT: DRAFT MEMO OF CSO & SSO POLLUTANT CONCENTRATIONS FOR PURPOSES OF WATER QUALITY MODELLING DATED OCTOBER 29, 2003

With regard to the subject memorandum and a subsequent request for review of CSO data regarding Total Suspended Solids (TSS), Copper, and Zinc chemistry from Triad Engineering staff on February 20, 2004, attached hereto as Exhibit A, we have developed several recommendations for your consideration.

CSO Trend Analysis

Based upon additional trend analyses performed by Triad Engineering staff attached hereto as Exhibit B, we suggest that the subject memorandum include the linear regression analyses of Zinc and Copper as a function of time. In both cases, the *p* values in the regression statistics are greater than 0.05, showing that there were no statistically significant trends in these factors over time during the period sampled (Exhibit B). With respect to these two variables, the regressions indicate that the average composition of the CSOs has not changed over the period sampled. Hence, these analyses suggest that change over the sampled period in the composition of the CSOs, with respect to Zinc and Copper is not a major consideration in the selection of CSO values for the model and supports the existing approach in the original draft memo.

Zinc and Copper Concentrations for SSO and CSO

Based upon review of additional analyses performed by Triad Engineering, we suggest that the subject memorandum include the linear regression analyses of CSO data from MMSD of Zinc concentration as a function of TSS concentrations and Copper concentrations as a function of TSS concentrations separately (see Exhibit B). The *p* values in the regression statistics are less than 0.0001 for both analyses and shows that there are statistically significant trends between these constituents. The R^2 values in the regression statistics were 0.66 for the Zinc and 0.65 in the Copper analysis, indicating that these trends accounted for about 66 and 65 percent of the variation in each data set, respectively (see Exhibit B). In addition, the linear regression model from each analysis indicates that it matches the recommended CSO mean concentrations of 0.09 and 0.12 mg/L for Zinc and 0.02 mg/L for Copper as shown in Table 1 below. For these reasons, we suggest that the recommended SSO mean concentrations for Zinc and Copper be based upon this linear regression model with TSS concentrations as shown in Tabled 2 below.

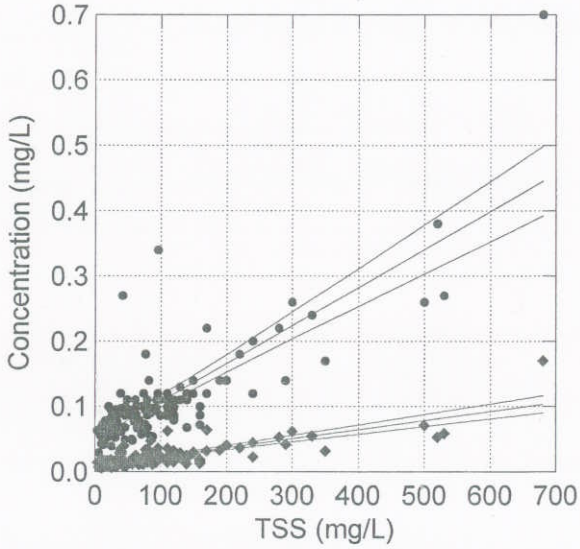


Figure 1.

Regression analysis between TSS versus Zinc and Copper concentrations from the MMSD CSO data, which include 95 percent confidence intervals.

Table 1
Recommended CSO Mean Concentrations For Modeling

Parameter	BOD_5 (mg/L)	Total Suspended Solids (mg/L)	Fecal Coliform (#/100 mL)	Phosphorus (mg/L)	Copper ICP (mg/L)	Zinc ICP (mg/L)	Organic Nitrogen-as N (mg/L)	Ammonia-as N (mg/L)	Nitrate/Nitrite-as N (mg/L)
Source	MMSD sampling	MMSD sampling	MMSD sampling	MMSD sampling	MMSD sampling	MMSD sampling	ORVWSC sampling*	ORVWSC sampling*	ORVWSC sampling*
Menomonee River (all but CT 5/6)	9	56	160,000	0.64	0.02	0.09	1.3	0.70	1.0
Menomonee River (only CT 5/6)	54	116	160,000	1.07	0.02	0.12	5.4	2.0	1.0
Kinnickinnic River	9	56	160,000	0.64	0.02	0.09	1.3	0.70	1.0
Milwaukee River	9	56	160,000	0.48	0.02	0.09	1.3	0.70	1.0

*Kim Mays from the Ohio River Valley Water Sanitation Commission (ORVWSC) provided sampling data August 19, 2003.

Table 2
Recommended SSO Mean Concentrations For Modeling (bolded values indicate recommended changes from the original draft memo)

Parameter	BOD_5 (mg/L)	Total Suspended Solids (mg/L)	Fecal Coliform (#/100 mL)	Phosphorus (mg/L)	**Copper (mg/L)**	**Zinc (mg/L)**	Organic Nitrogen as N (mg/L)	Ammonia as N (mg/L)
Source	MMSD sampling	MMSD sampling	MMSD sampling	MMSD sampling	**MMSD sampling***	**MMSD sampling***	ORVWSC sampling**	ORVWSC sampling**
All Watersheds	31	126	530,000	2.2	**0.02**	**0.13**	3.3	1.3

Assume: 1) Nitrate, nitrite, chlorophyll a, and dissolved oxygen to be negligible. 2) Treat temperature similar to how it is treated for storm water runoff. Note: Fecal coliform concentration was rounded to two significant figures.
*Based upon CSO chemistry data provided by MMSD.
**Kim Mays from the Ohio River Valley Water Sanitation Commission (ORVWSC) provided sampling data August 19, 2003.

* * *

TMS/JEB
#92035 V1 - DRAFT CSO & SSO POLLUTANT CONC MEMO-022304

Exhibit A to Appendix E

EXHIBIT A

From: Jeremy Nitka [jeremy.nitka@triadengineering.com]
Sent: Friday, February 20, 2004 1:25 PM
To: Thomas M. Slawski
Subject: Metals Regression

Tom,

I've attached a draft of some statistics on the Zinc and Copper in the CSOs. There are box plots by watershed, ANOVAs by collector with the pairwise comparisons, and a regression for each parameter versus date. We are interested in using a regression between TSS and Zn/Cu to estimate the concentration of Zn and Cu in the SSOs. The last two tabs in the spreadsheet contain these regressions. Please review the regression and let us know your opinion if we can use it to estimate the zinc and copper in the SSOs

Thanks

Jeremy Nitka, EIT
Project Engineer
Triad Engineering, Inc.
325 E Chicago St 4th Floor
Milwaukee, WI 53202
Ph: 414-291-8840
Fax: 414-291-8841

Exhibit B to Appendix E

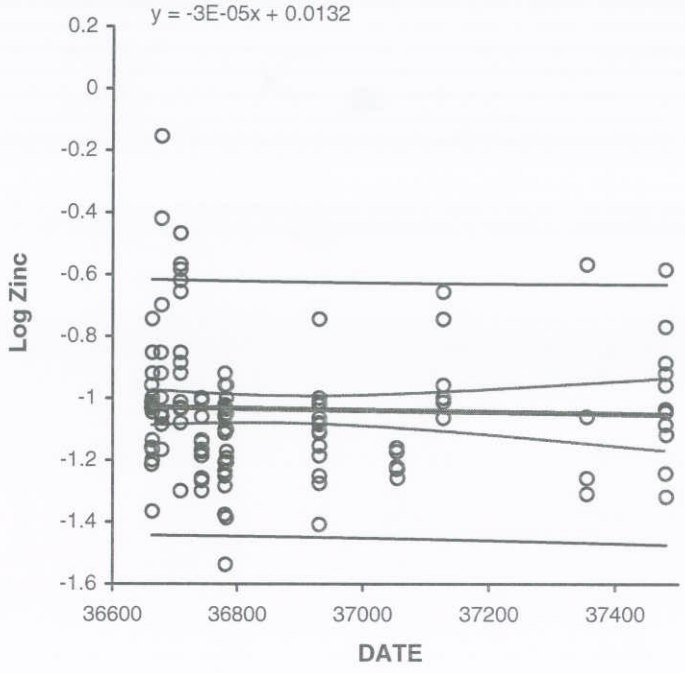
Test	**Linear regression**
	Log Zinc and Copper - All Event Dates and All Collectors
Fit	Log Zinc v DATE
Performed by	Jeremy Nitka
Date	20 February 2004

n	136

R^2	0.00
Adjusted R^2	-0.01
SE	0.2076

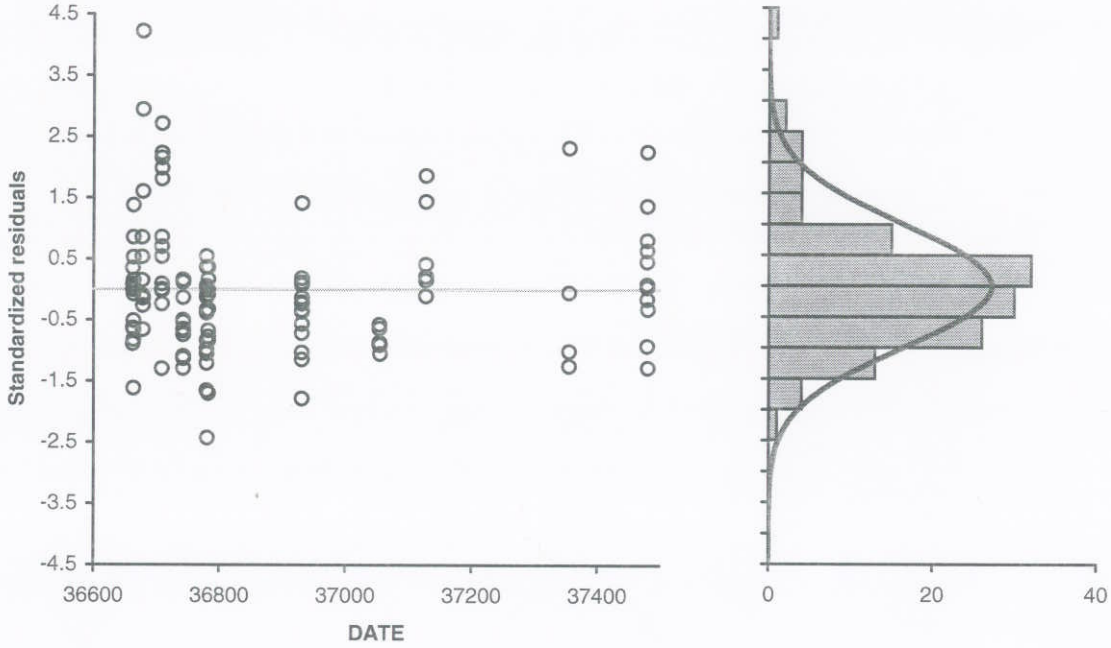
Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	0.0132	2.6434	0.9960	-5.2150 to 5.2414
Slope	0.0000	0.0001	0.6921	-0.0002 to 0.0001

Source of variation	SSq	DF	MSq	F	p
Due to regression	0.007	1	0.007	0.16	0.6921
About regression	5.777	134	0.043		
Total	5.783	135			



Test	**Linear regression**
	Log Zinc and Copper - All Event Dates and All Collectors
Fit	Log Zinc v DATE
Performed by	Jeremy Nitka
Date	20 February 2004

Test	**Linear regression**
	Log Zinc and Copper - All Event Dates and All Collectors
Fit	Log Zinc v DATE
Performed by	Jeremy Nitka
Date	20 February 2004

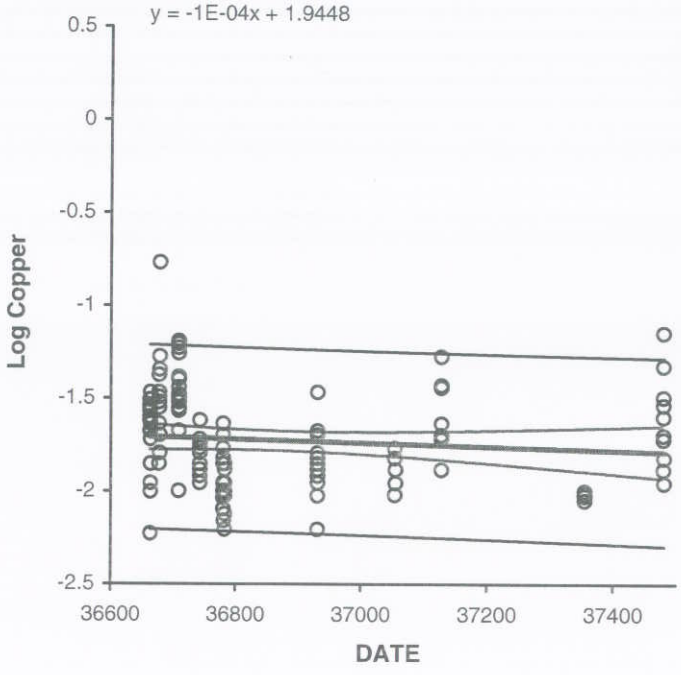


Test	**Linear regression**
	Log Zinc and Copper - All Event Dates and All Collectors
Fit	Log Copper v DATE
Performed by	Jeremy Nitka
Date	20 February 2004

n	136
R^2	0.01
Adjusted R^2	0.00
SE	0.2497

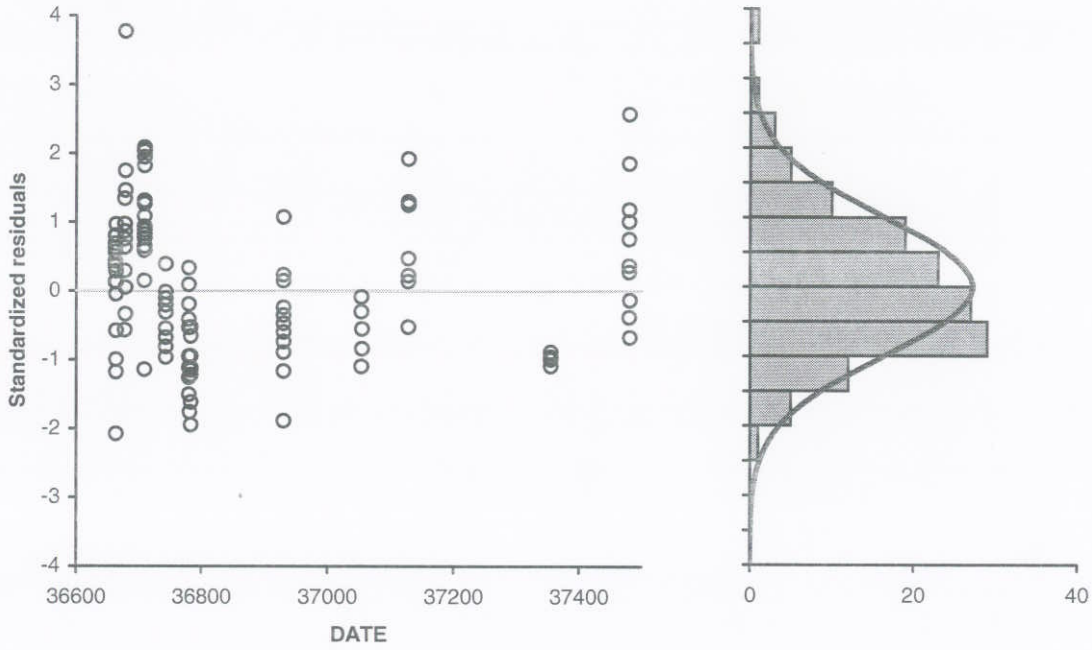
Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	1.9448	3.1791	0.5417	-4.3428 to 8.2324
Slope	-0.0001	0.0001	0.2498	-0.0003 to 0.0001

Source of variation	SSq	DF	MSq	F	p
Due to regression	0.083	1	0.083	1.34	0.2498
About regression	8.355	134	0.062		
Total	8.438	135			



Test	**Linear regression**		
	Log Zinc and Copper - All Event Dates and All Collectors		
Fit	Log Copper v DATE		
Performed by	Jeremy Nitka	**Date**	20 February 2004

Test	**Linear regression**
	Log Zinc and Copper - All Event Dates and All Collectors
Fit	Log Copper v DATE
Performed by	Jeremy Nitka
Date	20 February 2004



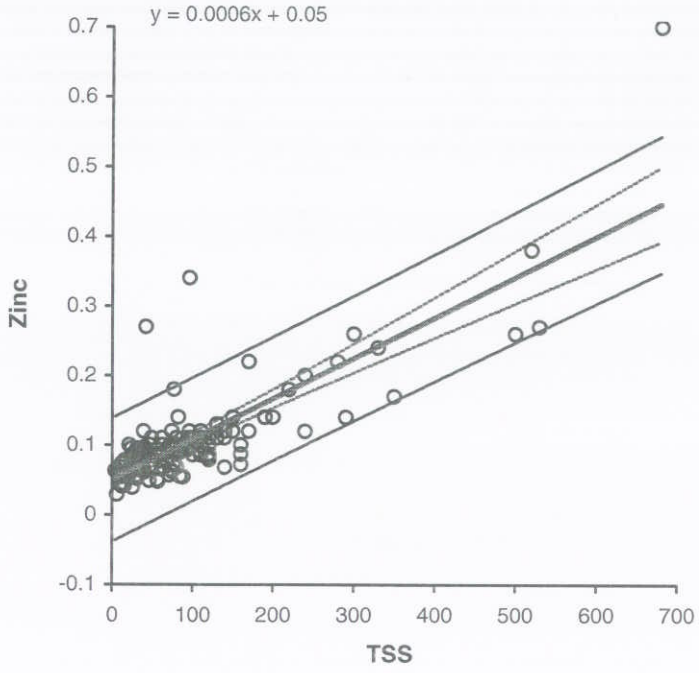
Test	**Linear regression**
	SSO Data with Date and Collector
Fit	Zinc v TSS
Performed by	Jeremy Nitka
Date	20 February 2004

n	134 (cases excluded: 2 due to missing values)

R^2	0.66
Adjusted R^2	0.66
SE	0.0446

Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	0.0500	0.0052	<0.0001	0.0397 to 0.0602
Slope	0.0006	0.0000	<0.0001	0.0005 to 0.0007

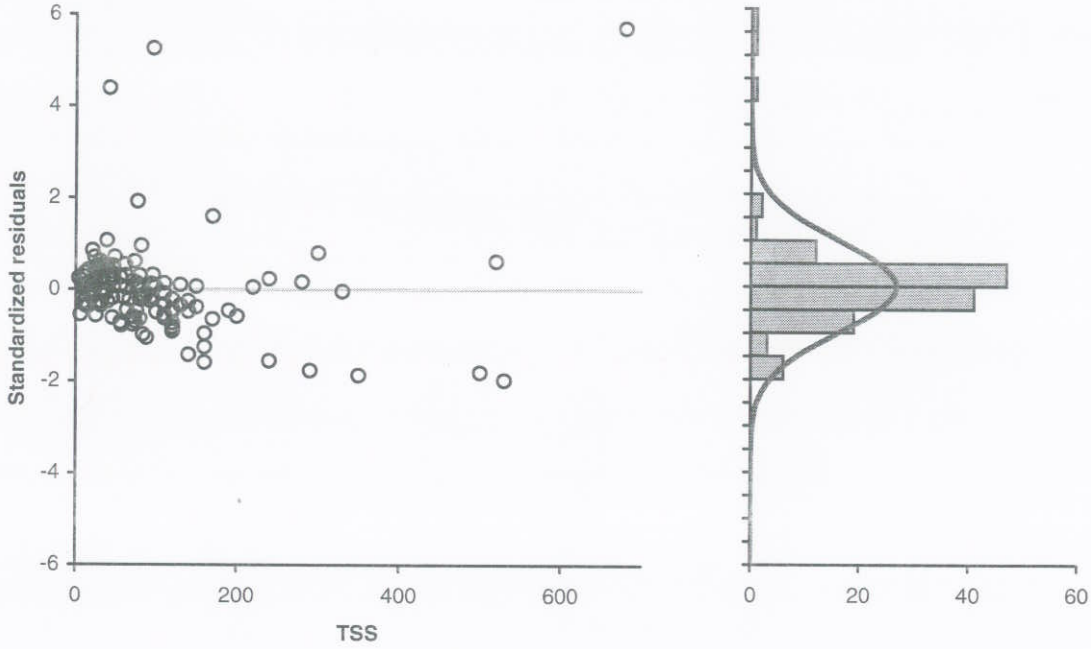
Source of variation	SSq	DF	MSq	F	p
Due to regression	0.513	1	0.513	258.00	<0.0001
About regression	0.263	132	0.002		
Total	0.776	133			



TSS
126
56
116

Test	**Linear regression**
	SSO Data with Date and Collector
Fit	Zinc v TSS
Performed by	Jeremy Nitka
Date	20 February 2004

Test	**Linear regression**
	SSO Data with Date and Collector
Fit	Zinc v TSS
Performed by	Jeremy Nitka
Date	20 February 2004



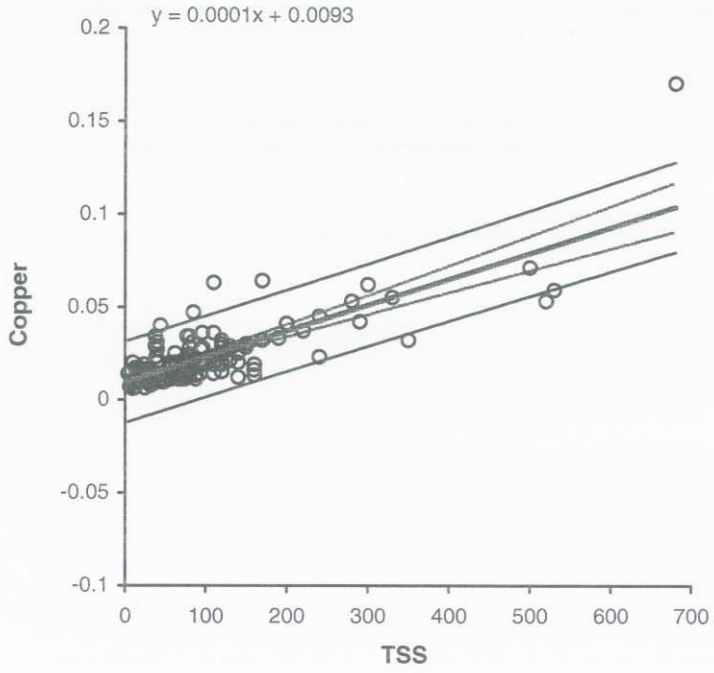
Test	**Linear regression**
	SSO Data with Date and Collector
Fit	Copper v TSS
Performed by	Jeremy Nitka
Date	20 February 2004

n	134 (cases excluded: 2 due to missing values)

R^2	0.65
Adjusted R^2	0.64
SE	0.0110

Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	0.0093	0.0013	<0.0001	0.0068 to 0.0118
Slope	0.0001	0.0000	<0.0001	0.0001 to 0.0002

Source of variation	SSq	DF	MSq	F	p
Due to regression	0.029	1	0.029	240.71	<0.0001
About regression	0.016	132	0.000		
Total	0.045	133			



TSS
126
56
116

Test	**Linear regression**
	SSO Data with Date and Collector
Fit	Copper v TSS
Performed by	Jeremy Nitka
Date	20 February 2004

Test	**Linear regression**
	SSO Data with Date and Collector
Fit	Copper v TSS
Performed by	Jeremy Nitka
Date	20 February 2004