WATER QUALITY MONITORING REPORT
FOR
ROUTINE MONITORING EVENTS
AT
CHICAGO AREA CONFINED DISPOSAL FACILITY
WATER YEAR 2003
(OCTOBER 02 - OCTOBER 03)

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1 Purpose

The purpose of this report is to analyze and summarize the water quality data from samples collected at the Chicago Area Confined Disposal Facility (Chicago CDF) and at the Calumet River and Harbor by the U.S. Army Corps of Engineers (USACE), Chicago District, during the Water Year 2003 monitoring period from October 2002 to October 2003. The report includes data from routine monitoring events that were conducted on May 6, August 11 and September 11 of 2003, and it provides discussions of the sampling procedures, laboratory testing and data quality for these events. The trimester routine monitoring events are conducted to determine if the Chicago CDF is having an adverse impact on the water quality of the Calumet River or Harbor.

2 Background

The Chicago CDF is a diked facility for the disposal and containment of contaminated dredged materials from deep-draft (18 feet or greater) federal navigation projects in Chicago, Illinois, particularly the Calumet River federal project. The Chicago CDF was constructed between 1982–1984, and it is located at the mouth of the Calumet River (Figure 1). The Chicago CDF was constructed by, and is operated and maintained by, the USACE, Chicago District, under authority of the River and Harbor Act of 1970 (Public Law 91-611, Section 123). The Chicago Regional Port Authority and the Chicago Park District have adjoining interests for this project. The facility is roughly triangular in shape, it has a surface area of approximately 43 acres, and it has a capacity of about 1.3 million cubic yards of dredged material. As shown in Table 1, the total amount of dredged sediment that has been placed into the facility since its inception is about 903,100 cubic yards. This table also shows that the Chicago CDF has been used for nine different dredging and disposal events, each of which used mechanical dredging operations. Separate reports have been prepared for eight dredging events, and these reports should be consulted for details on the sampling and analyses performed for the dredging operations. Due to the relatively small volume of material dredged during the obstruction removal event in 2002, a modified program of water and sediment quality monitoring was conducted and a separate dredging report was not prepared.

Table 1: Historical Dredging and Disposal Events for Chicago Area CDF

Year of Disposal Operation	Location of Dredging	Volume of Dredged Material	Dredging By
Oct. – Dec. 1984	Calumet River	100,000 yd^3	USACE
July – Sept. 1985	Calumet River	108,000 yd^3	USACE
May – June 1986	Chicago Harbor & Chicago River	62,000 yd^3	USACE
April – June 1989	Calumet River	70,000 yd^3	USACE
May 1991	Calumet River	3,100 yd^3	KCBX Terminals Co.
December 1994	Calumet River	62,000 yd^3	USACE
Aug. 2000 – Apr. 2001	Calumet River & Harbor Breakwater	206,000 yd^3	USACE
Sept. – Dec. 2001	Calumet Harbor	291,000 yd^3	USACE
June 2002	Calumet River Obstruction Removal	1,000 yd^3	USACE
Total		903,100 yd^3	

3 Sampling and Analytical Procedures

3.1 Water Quality Monitoring Plan

USACE obtained its most recent water pollution control permit (in compliance with the Section 401 certification requirements of the Clean Water Act (CWA)) for the Chicago CDF from the Illinois Environmental Protection Agency (IEPA) under Permit # 2001-EA-4691. This permit was issued on December 7, 2001 and it is valid until December 1, 2006 (Appendix A). Under "Special Condition 2," the permit stipulates that the monitoring shall be conducted in accordance with the Corps of Engineers report entitled "Water Quality Monitoring at the Chicago Area Confined Disposal Facility, Calumet Harbor, IL." Thus, this report was integrated into the permit and it provides the details of the current monitoring plan, including the routine monitoring as well as the more rigorous monitoring that is conducted during dredging events. The report also explains the rationale for changing from the previous monitoring plan to the current monitoring plan.

3.1.1 Current Routine Monitoring

As explained in the permit, for routine monitoring, the sampling frequency is three times per year, and the approximate dates for routine monitoring events are March – May, June – August and September – December. For Water Year 2003, the three routine monitoring events were conducted on May 6, August 11, and September 11, 2003.

It should be noted that a Calumet River dredging event was started in October 2003, and it is currently in progress. Due to inclement weather, it is likely that this dredging event will continue into next year (2004). The sediment from this Calumet River dredging event has been and will continue to be placed into the Chicago CDF, and a separate report on the monitoring conducted for the dredging event will be prepared after the conclusion of the operation.

3.2 Sampling Locations for Routine Monitoring Events

The sampling locations for routine monitoring events at the Chicago CDF are shown in Figure 2. The samples were collected from the following five distinctly different sampling environments for each of the routine monitoring events:

(a) Background – three background samples are collected from Lake Michigan about 1000 feet away from the dike (BACK-001, BACK-002, BACK-003)
(b) Near-Dike – three composite samples are collected in Calumet Harbor near the edge of the dike (ND-COMP-001, ND-COMP-002, ND-COMP-003)
(c) Calumet River – three samples are collected from the Calumet River; downstream, next to, and upstream of the filter cell effluent discharge point (RIV-001, RIV-002, RIV-003)
(d) CDF Pond – three samples are collected from within the CDF pond (CDF-001, CDF-002, CDF-003)
(e) Landing Well – one sample is collected from each of the monitoring wells in the Iroquois Landing area (CH-18-81, CH-19-81, CH-20-81)

The background samples are collected far enough away from the CDF so that the concentrations detected at these locations provide baseline contaminant levels in Calumet Harbor. The near-dike samples are composite samples that are collected in Calumet Harbor near the edge of the CDF dike wall. If the near-dike samples have parameter concentrations that are significantly higher than the respective concentrations in the background samples, then the CDF may be having an impact on the water quality in Calumet Harbor.

During dredging and disposal events, the volume within the CDF is reduced in proportion to the incoming sediment and water by pumping water out of the CDF settling basin. This water is subsequently passed through a filter cell and discharged into the Calumet River. To monitor the effluent from the filter cell during dredging and disposal operations, river samples are collected upstream, adjacent to, and downstream of the filter cell effluent discharge point. These same sampling locations in the Calumet River are also monitored for routine monitoring events for comparison purposes and to reduce data variations that may occur due to changes in the sampling locations.

The CDF pond samples provide an indication of the quality of the water in direct contact with the sediments in the CDF. Depending on the parameter, the CDF pond samples may be expected to have relatively higher concentrations when compared to near-dike or background sample concentrations. Lastly, the landing well data provides an indication of groundwater quality adjacent to the CDF. It should be noted that a geotechnical investigation of the land area adjacent to the CDF prior to construction revealed that the soil was largely composed of fill consisting of silts, sands and clays with intermingled municipal and industrial wastes (Reference 11). This geotechnical investigation also found that the soil contained a large amount of slag, cinders, ash, and foundry sand from the nearby steel mills as well as coal, wood, iron, and miscellaneous trash.

3.3 Laboratory Analyses for Water Quality Samples

The target parameters for routine monitoring events and the required detection limits are shown in Table 2. The target parameters include three metals, three nutrients, and two general water quality parameters. The parameters were selected based on historical results, and they were chosen to provide a standardized and informative data set (Appendix A).

For the May and August sampling events, Montgomery Watson Harza (MWH) subcontracted the laboratory analyses to Trace Analytical Laboratories, Muskegon, Michigan. For the September analyses, the King Co. Inc. subcontracted the laboratory analyses to TriMatrix Laboratories, Inc., Grand Rapids, Michigan. The scope of work provided to MWH for the analytical testing is located in Appendix B. The scope of work for the September sampling event has not been included since it was nearly identical to the scope of work for the May and August events for the routine monitoring parameters. The September sampling event was conducted prior to the start of the current dredging event, as part of the more rigorous monitoring that is conducted during dredging events, and it will be incorporated into the separate dredging report. The Standard Operating Procedure (SOP) checklist is located in Appendix C.

Table 2: Detection Limits for Routine Monitoring Parameters

Parameter	Required Detection Limit
Chromium (total)	0.005 mg/L
Manganese (total)	0.005 mg/L
Zinc (total)	0.005 mg/L
Total Phosphorus	0.01 mg/L
Ammonia as Nitrogen	0.01 mg/L
Total Kjeldahl Nitrogen	0.2 mg/L
Total Suspended Solids	5.0 mg/L
Total Dissolved Solids	5.0 mg/L
PH	1.0 – 14.0

4 Routine Water Quality Monitoring Events, Water Year 2003

4.1 Water Quality Data

The analytical data for the May 6, August 11, and September 11, 2003 monitoring events is provided in the attached compact disk, and this data is summarized in Tables 3A, 3B, and 3C, respectively. These tables provide the concentrations in mg/L for each of the target parameters at the fifteen sampling stations as well as the reporting limits achieved by the laboratory for each of the parameters. Laboratory concentration data values that were measured to be less than or "under" the reporting limit are indicated by the letter "U" in Tables 3A, 3B, and 3C. The analytical results are also shown graphically in Figures 3A-3H. Each figure shows a bar graph of the concentrations of a given target parameter by date for all fifteen of the sampling stations. The sampling stations are subdivided into (a) Background Samples (Back-001, 002, 003), (b) Near-Dike Samples (ND-Comp-001, 002, 003) (c) River Samples (Riv-001, 002, 003), (d) CDF Pond Samples (CDF-001, 002, 003), and (e) Landing Well Samples (CH-18-81, CH-19-81, CH-20-81). For each of the stations, three concentrations are given, which correspond to the three monitoring events, and the reporting limit achieved by the laboratory is also provided.

Table 3A: Analytical Data Summary for Chicago CDF Water Quality Monitoring, 6 May 2003[1]

	Chromium	Manganese	Zinc	TKN	Ammonia	Phosphorus	TDS	TSS
	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
BACK-001	U	0.014	0.006	0.59	0.083	U	170	12
BACK-002	U	U	U	0.52	0.051	0.021	180	U
BACK-003	U	0.025	0.006	0.54	0.044	U	170	U
ND-Comp-001	U	0.0066	U	U	0.075	U	170	U
ND-Comp-002	U	U	U	0.56	0.074	U	170	U
ND-Comp-003	U	0.0053	0.013	0.68	0.061	U	170	U
RIV-001	U	0.013	0.0055	0.66	0.076	U	200	U
RIV-002	U	0.015	U	0.53	0.080	U	200	U
RIV-003	U	0.036	0.0084	0.60	0.093	U	190	U
CDF-001	U	0.120	0.017	1.5	0.240	0.046	400	210
CDF-002	U	0.082	0.011	1.3	0.08	0.037	380	18
CDF-003	U	0.080	0.011	1.4	0.097	0.039	370	24
CH-18-81	0.007	0.047	0.015	0.68	0.110	0.095	620	15
CH-19-81	U	0.041	0.0089	5.6	4.6	0.039	480	58
CH-20-81	U	0.077	0.011	0.65	0.029	0.050	840	U
Reporting limit	0.005	0.005	0.005	0.50	0.010	0.020	10	10

Note 1. Metals data amended June 2003
U = Parameter concentration less than reporting limit

Table 3B: Analytical Data Summary Chicago CDF Water Quality Monitoring, 11 Aug. 2003

	Chromium	Manganese	Zinc	TKN	Ammonia	Phosphorus	TDS	TSS
	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
BACK-001	U	0.006	U	U	0.049	0.012	160	6.5
BACK-002	U	U	U	U	0.052	0.026	160	6.0
BACK-003	U	0.0051	0.015	U	0.057	0.022	170	U
ND-Comp-001	U	U	U	U	0.048	0.012	160	5
ND-Comp-002	U	U	U	U	0.059	0.025	150	U
ND-Comp-003	U	U	U	U	0.053	0.012	160	U
RIV-001	U	U	U	U	0.056	0.014	170	U
RIV-002	U	U	U	U	0.058	0.011	170	U
RIV-003	U	0.0067	U	0.5	0.09	0.011	170	5
CDF-001	0.024	0.86	0.23	1.6	0.11	0.420	420	190
CDF-002	U	0.16	0.023	1.2	0.10	0.110	410	49
CDF-003	U	0.17	0.029	1.2	0.19	0.120	420	46
CH-18-81	0.012	0.24	0.051	2.9	2.000	0.140	640	180
CH-19-81	U	0.041	0.0081	7.5	6.7	0.064	530	43
CH-20-81	U	0.056	U	0.76	0.084	0.020	870	U
Reporting limit	0.005	0.005	0.005	0.5	0.010	0.010	5	5

U = Parameter concentration less than reporting limit

Table 3C: Analytical Data Summary for Chicago CDF Water Quality Monitoring, 11 Sept. 2003

	Chromium	Manganese	Zinc	TKN	Ammonia	Phosphorus	TDS	TSS
	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
BACK-001	U	0.0038	0.008	U	U	U	194	U
BACK-002	U	0.0038	U	U	U	0.005	202	U
BACK-003	U	0.0037	0.0073	0.26	U	0.006	190	U
ND-Comp-001	U	0.0033	0.014	U	U	0.005	206	U
ND-Comp-002	U	0.0033	0.012	0.23	0.010	0.007	202	U
ND-Comp-003	U	0.0037	0.02	0.25	0.010	0.007	202	U
RIV-001	U	0.0037	0.0095	U	0.010	U	198	U
RIV-002	U	0.0034	0.0063	U	0.010	U	196	U
RIV-003	U	0.0046	0.0061	U	0.01	U	206	U
CDF-001	0.0013	0.102	0.021	1.4	0.01	0.100	480	41
CDF-002	0.0012	0.102	0.022	1.7	0.01	0.100	496	34
CDF-003	U	0.112	0.021	1.8	0.04	0.100	486	33
CH-18-81	U	0.047	0.022	2.1	1.800	0.030	648	17
CH-19-81	U	0.056	0.016	7.2	7.4	0.010	574	20
CH-20-81	U	0.095	0.035	U	0.020	0.020	958	U
Reporting limit	0.001	0.001	0.005	0.20	0.010	0.005	5	5

U = Parameter concentration less than reporting limit

4.1.1 pH and Temperature

The field logs with the pH and temperature measurements are provided in Appendices D, E, and F on the attached compact disk. This data has been summarized in Table 4. This table shows that the pH measurements ranged from 5.7 to 11.9, and the greatest deviation from neutral (pH = 7.0) occurred for the pH measurements from the landing wells. Historically, the pH values have been particularly high for well CH-19-81, and this might be caused by the presence of waste or slag material in the soil adjacent to the well. The water temperature readings ranged from a low of 11.7°C in the Calumet River for the May event to a high of 23.9°C in the CDF pond for the August event (Table 4).

Table 4: Field pH and Temperature Summary Water Stations Water Year 2003

Location Group	Parameter	Event	Minimum	Event	Maximum
Background	pH	Sep	7.57 (003)	May	8.88 (003)
Near Dike	pH	Aug	7.01 (003)	May-Aug	8.40 (003-1)
River	pH	Sep	7.60 (002-003)	Aug	8.34 (002)
CDF	pH	Sep	8.02 (001)	May	9.01 (003)
Landing wells	pH	May	5.73 (18)	Aug	11.9 (19)
Background	°C	May	11.9 (001-002)	Aug	23.4 (003)
Near Dike	°C	May	12.4 (001)	Sep	23.2 (003)
River	°C	May	11.7 (001)	Aug	23 (001-002-003)
CDF	°C	May	16.8 (003)	Aug	23.9 (002)
Landing wells	°C	May	14.1 (18)	Aug	21.2 (18)

See the field logs in the appendices for variation within groups.
The number in parenthesis is the station number or numbers from the location group.

4.1.2 Metals

The monitoring results for total chromium, manganese and zinc are shown in Figures 3A, 3B and 3C, respectively. As observed in Figure 3A, the highest total chromium concentration (0.024 mg/L) was measured in sample CDF-001, which was acquired from the CDF pond for the August event. The next highest total chromium concentration (0.012 mg/L) was measured in sample CH-18-81, which was acquired from the landing well sampling environment during the August event. For comparison, chromium was below the reporting limit for all the background samples for all three monitoring events.

Figure 3B shows that the highest manganese concentration (0.86 mg/L) was measured in sample CDF-001, which was acquired from the CDF pond for the August event. The next highest manganese concentration (0.24 mg/L) was measured in landing well CH-18-81 for the August event. Compared to the CDF pond and landing well sampling environments, the river and near-dike samples all had manganese results that were considerably lower (0.036 mg/L or less), and the highest background manganese concentration that was measured was 0.025 mg/L.

As seen in Figure 3C, the highest zinc concentration (0.23 mg/L) was measured in sample CDF-001, which was collected from the CDF pond for the August event. The next highest zinc concentration (0.051 mg/L) was measured in landing well sample CH-18-81, also for the August event. The near dike and river samples from all three events showed zinc results that were comparable or less than the highest background sample, where the highest concentration of zinc in a background sample was measured to be about 0.015 mg/L.

4.1.3 Nutrients

The monitoring results for microbiological nutrients, including Total Kjeldahl Nitrogen (TKN), ammonia nitrogen, and total phosphorus, are shown in Figures 3D, 3E, and 3F,

respectively. As shown in Figure 3D, the highest TKN concentration (7.5 mg/L) was measured in landing well sample CH-19-81 from the August event, and the next highest TKN concentration (7.2 mg/L) was measured in the sample from the same landing well (CH-19-81) from the September event. TKN concentrations in the samples from the CDF pond ranged from about 1.2 to 1.8 mg/L, whereas lower concentrations (0.68 mg/L or less) were detected in the river, near-dike and background samples.

Figure 3E shows that the highest ammonia nitrogen concentration (7.4 mg/L) was measured in landing well sample CH-19-81 from the September event, and the next highest ammonia nitrogen concentration (6.7 mg/L) was measured in the sample from the same landing well (CH-19-81) from the August event. As stated earlier, the high pH values measured in the samples from landing well CH-19-81 might have been caused by waste or slag material in the soil adjacent to this landing well, and this material might have also been responsible for the comparatively high TKN and ammonia concentrations. The CDF pond samples from the three events all had lower ammonia nitrogen concentrations (0.24 to 0.01 mg/L) and so did the river, near-dike and background samples, which had concentrations of 0.093 mg/L or less. The background sample with the highest ammonia nitrogen concentration (0.083 mg/L) was measured in a sample from the May event.

As observed in Figure 3F, the highest phosphorus concentration (0.42 mg/L) was measured in a CDF pond sample from the August event. The CDF pond samples had concentrations that ranged from 0.037 to 0.42 mg/L. All the river and near-dike samples had phosphorous concentrations that were 0.025 mg/L or less. The highest phosphorous concentration detected in a background sample was 0.026 mg/L, and this sample was collected during the August event.

4.1.4 Solids

The monitoring results for Total Dissolved Solids and Total Suspended Solids are shown in Figures 3G and 3H, respectively. As seen in these figures, the dissolved and suspended solids were generally higher in the landing well and CDF pond samples. Figure 3G shows that the concentration of Total Dissolved Solids in the landing well and CDF pond samples ranged from 370 to 958 mg/L, and the highest Total Dissolved Solids concentration in a background sample was 202 mg/L (September event).

Figure 3H shows that the highest Total Suspended Solids concentration of 210 mg/L was measured from a CDF pond sample collected during the May event, and the next highest Total Suspended Solids sample concentration of 190 mg/L was measured from a CDF pond sample collected during the August event. For comparison purposes, the concentrations of Total Suspended Solids in the river and near dike samples were 5 mg/L or less, and the concentrations of most of the samples were less than the reporting limit. The highest Total Suspended Solids concentration in a background sample was 12 mg/L, and this was measured in a sample collected during the May event.

4.2 Quality Assurance/Quality Control (QA/QC)

The purpose of the data collection and analyses is to determine if the CDF is operating effectively by preventing pollutants from entering the Calumet River or Harbor. Data quality objectives include reviewing enough data for bias and precision to determine if it is accurate. This is done by reviewing the laboratory quality control reports for conformance with the scope of work requirements. Data quality assessments were written for the three monitoring events and are included along with the final laboratory and QA/QC reports in Appendices D-F on the compact disk. Holding time preservation requirements were met for all samples. Temperature preservation requirements were met for the three sampling events. All reporting limits were met or were otherwise acceptable. For the May sampling event, the reporting limit for the metals was initially too high, but these samples were subsequently re-analyzed to meet the required reporting limit. The data quality assessments, results, quality control data, and raw data are provided in the appendices. The data was determined to be suitable for its intended purpose and objectives.

4.3 Statistical Analysis

One of the goals of the monitoring plan is to generate a statistically analyzable data set for each monitoring event. To meet this goal, three samples are collected from different locations within each of the five distinct sampling environments, (1) the background water of Calumet Harbor (BACK), (2) near-dike harbor composites (ND-Comp), (3) Calumet River (RIV), (4) CDF pond (CDF), and (5) landing wells (CH) (see Figure 2). A statistical analysis is then performed on the water quality parameter results provided by the analytical laboratory. Appendices D, E and F (on the compact disk) contain the statistical analysis printouts for the May, August and September 2003 sampling events, respectively. For each sampling event, these printouts summarize the concentration data and statistical analysis for each of the eight water quality parameters, chromium, manganese, zinc, TKN, ammonia, phosphorus, Total Dissolved Solids and Total Suspended Solids.

The statistical analysis summarizes the completeness, count, degrees of freedom (df), mean, sample standard deviation and sample variance for each of the eight water quality parameters in each of the five sampling environments. If one or more of the water quality parameter concentration results is less than the reporting limit or if no data is obtained for a given parameter in a given sampling environment, the estimated and/or absent concentrations are not used in the statistical comparison. These estimated or absent data values are labeled as not available (N/A) in the statistical analysis spreadsheet. Completeness indicates whether three data values were present for a particular sampling environment. If less than three data values are present, the completeness is described as being “incomplete”, whereas “OK” indicates that three values are present for the analysis. The count displays the number of data values that are present for the analysis. The degree of freedom is simply one less than the count. The mean is computed when either two or three data values are present, and the sample variance and sample standard deviation are not calculated and the statistical comparison is not performed unless all three sample values are present and the data set is complete.

The statistical comparison is performed using a parametric statistical test method known as an independent two-sample t-test. This test method employs a student's t-distribution to assess whether there is a statistically significant difference between the means of two independent sample groups. The null hypothesis (H_0) is that a statistically significant difference does not exist between the means of the two sample groups. Hence, if the comparison indicates that the difference between the means of the two sample groups is not statistically significant, then it is concluded that the null hypothesis is true and the comparison is labeled *"OK"*. Conversely, if the comparison indicates that the difference between the means of the two sample groups is indeed statistically significant, then it is concluded that the null hypothesis is false and the comparison is labeled *"Reject H_0"*. When the statistical comparison concludes that null hypothesis is true, it only indicates that there was not enough evidence to reject the null hypothesis. It is important to note that if the null hypothesis is concluded to be true, it does not imply any statistically significant similarity between the two sample groups. To the contrary, significant statistical differences may or may not exist when the null hypothesis is concluded to be true, and additional evidence, robust test methods, and analyses are required to reach a statistically based conclusion. Essentially, the statistical comparison used in this report is only informative for cases when the null hypothesis is rejected. This is because a rejection of the null hypothesis indicates that there is convincing evidence that a statistically significant difference exists between the means of the two sample groups. Consequently, inferences concerning the results of the statistical comparison were only conducted for cases in which the null hypothesis was rejected.

4.4 Results of Statistical Analysis

One of the primary goals of the statistical analysis program is to provide an indication of whether the Chicago CDF is affecting the water quality in the Calumet River or Harbor. Such an impact may be indicated, for example, if there was a statistically significant difference between the means of the contaminant concentrations in the near-dike samples (ND-Comp-XXX) and background water samples (BACK-XXX). Moreover, if the mean of the near-dike samples was greater than the mean of the background samples, this might suggest that the water outside the CDF dike wall might be affected by the seepage of contaminants from the CDF pond, causing higher concentrations in the near-dike environment relative to the background environment.

For the current monitoring period, which includes the sampling events of May, August, and September of 2003, the statistical comparisons for the five sampling environments and eight parameters are summarized in Table 5. This table only provides information regarding the statistical comparisons that were complete and had all three data values present for each of the compared sampling environments. In addition, the table only provides information for cases in which the null hypothesis was rejected, indicating that a significant difference existed between the means of the two sample groups. For cases where the null hypothesis was rejected, the mean values were then compared to determine which of the sampling environments had the higher mean value.

Table 5: Chicago Area CDF Year 2003 Routine Water Quality Parameter Statistical Comparison Summary

Water Quality Parameter	May 2003		August 2003		September 2003	
	Sampling Environment With Higher Mean Value	Sampling Environment With Lower Mean Value	Sampling Environment With Higher Mean Value	Sampling Environment With Lower Mean Value	Sampling Environment With Higher Mean Value	Sampling Environment With Lower Mean Value
Chromium						
Manganese	CDF	RIV			CH	RIV
					CH	NDC
					CH	BACK
					CDF	RIV
					CDF	NDC
					CDF	BACK
Zinc					CH	RIV
					CDF	RIV
					NDC	RIV
TKN	CDF	RIV				
	CDF	BACK				
NH_3			CDF	NDC		
			CDF	BACK		
Phosphorus					CDF	CH
					CDF	NDC
Total Dissolved Solids	CH	RIV	CH	RIV	CH	RIV
	CH	NDC	CH	NDC	CH	NDC
	CH	BACK	CH	BACK	CH	BACK
	CDF	RIV	CDF	RIV	CDF	RIV
	CDF	NDC	CDF	NDC	CDF	NDC
	CDF	BACK	CDF	BACK	CDF	BACK
	RIV	NDC	RIV	NDC		
	RIV	BACK				
Total Suspended Solids						

Comments:
BACK = Background Samples
NDC = Near CDF Dike Composite Samples
RIV = Calumet River Samples
CDF = CDF Pond Samples
CH = Landing Well Samples
This table summarizes the two-sample t-test statistical method comparisons, which were only performed on complete data sets. This table only provides information on comparisons for which the null hypothesis was rejected, indicating a statistically significant difference between the means of the two sampling environments.

4.5 Discussion of Results

4.5.1 Metals

Due to a high number of sample results that were less than the reporting limit for all three sampling events, May, August and September 2003, a statistical comparison was not

conducted for any of the sampling environments for the chromium water quality parameter (Tables 3A, 3B, and 3C).

The statistical comparison for manganese indicated that the samples collected during the September event from the landing well and CDF pond environments had means that were significantly different and higher than the corresponding means of the samples from the Calumet River, near-dike and background environments (Table 5). Moreover, the samples collected during the May event from the CDF pond environment had a mean that was significantly different and higher than the mean of the samples from the Calumet River environment. These differences can also be observed graphically in Figure 3B.

As seen in Table 5, the statistical comparison for zinc shows that the samples collected during the September event from the landing well, CDF pond and near-dike environments had means that were significantly different and higher than the mean of the samples from the Calumet River environment. This was the only instance where a water quality parameter from the near-dike environment had a sample mean that was found to be statistically different and higher than another sampling environment. For the September event, the mean zinc concentration of the samples from the near-dike environment was approximately 0.015 mg/L. For comparison, this concentration was around twice as high as the mean zinc concentrations of the samples collected during September from the Calumet River and background environments, but substantially less than the mean zinc concentrations of the samples collected during September from the CDF pond or landing well environments, which were 0.021 and 0.024 mg/L, respectively.

4.5.2 Nutrients

As exhibited in Table 5, the statistical comparison for the nutrients, TKN, ammonia and phosphorus, revealed that mean of the samples collected from the CDF pond environment was significantly different and higher than adjacent environments in several instances. For the May event, the mean TKN concentration of the CDF pond samples was significantly different and higher than the mean TKN concentration of the Calumet River and background samples, for the August event, the mean ammonia concentration of the CDF pond samples was significantly different and higher than the mean ammonia concentration of the near-dike and background samples, and for the September event, the mean phosphorus concentration of the CDF pond samples was significantly different and higher than the mean phosphorus concentration of the landing well and near-dike samples.

4.5.3 Solids

For all three sampling events, May, August and September 2003, the mean Total Dissolved Solids concentration from the landing well and CDF pond environment samples was significantly different and higher than the corresponding Total Dissolved Solids concentration mean of the Calumet River, near-dike and background environment samples (Table 5). These differences can also be observed in the graphical analysis in Figure 3G. In addition, Table 5 shows that the mean Total Dissolved Solids concentration for the samples from the Calumet River environment was statistically

different and higher than the Total Dissolved Solids concentration mean for the samples collected during the May and August events from the near-dike environment and for the samples collected during the May event from the background environment.

Since a high number of sample results were less than the reporting limit for all three sampling events, May, August and September 2003, a statistical comparison was not conducted for any of the sampling environments for Total Suspended Solids (Tables 3A, 3B, and 3C)

5 Water Level Data

The water level in Calumet Harbor and in the Chicago CDF is continuously measured at two nearby gage stations. The water level monitoring station at Calumet Harbor (Station #7044) is maintained by the National Oceanographic and Atmospheric Administration (NOAA), and the water level monitoring station within the CDF pond is maintained by the U.S. Geological Survey (USGS). As observed in Figure 4, the data from these stations was used to compare the daily mean elevations in Calumet Harbor with the daily mean elevations in the CDF pond using Low Water Datum 1955 in feet. This figure shows that the water level daily mean elevations were nearly identical in Calumet Harbor and the CDF pond for the Water Year 2003. The annual average daily mean difference (CDF Pond – Calumet Harbor) was 0.11 feet. The daily mean pond surface water levels in the CDF ranged from 0.93 ft above low water datum to minus 0.66 ft below low water datum 1955. The daily mean Calumet Harbor water elevation ranged from 1.11 ft above low water datum to minus 1.19 ft below low water datum 1955. Piezometric data collected from landing wells CH-18-81 (CH 1), CH-19-81 (CH 2), and CH-20-81 (CH 3) was recorded for the three monitoring events in May, August, and September, and this data is presented in Table 6 along with the daily mean water levels for those dates for Calumet Harbor and the CDF pond.

The NOAA Calumet Harbor gage data and the Chicago Area CDF pond data in Figure 4 and Table 6 is referenced to 1955 Low Water Datum 576.8 feet above mean water level at Father Point Quebec International Great Lakes Datum, IGLD, (1955) for the purpose of this report.

Table 6: Chicago Area CDF Well, Pond, and Harbor Water Level Comparison 2003

	Elevation Expressed from Low Water Datum 1955 (feet)			Remarks
Location/Date	6 May 03	11 Aug 03	11 Sep 03	For this report
CH-18-81	2.46	1.96	2.02	(CH 1)*
CH-19-81	3.0	2.3	1.55	(CH 2)*
CH-20-81	3.87	3.87	3.59	(CH 3)*
CDF Pond	0.22	0.52	0.11	Daily Mean USGS**
Calumet Harbor	0.11		0.03	Daily Mean NOAA***

* Designation in Statistical Summary Tables in Appendices D-F
** Data taken from gage in CDF pond
*** Data taken from NOAA web site

6 Conclusion

This report presents the results of the water quality data that was collected on May 6, August 11, and September 11 of 2003 at the Chicago CDF. The purpose of this report is to analyze and summarize the water quality data to determine if the Chicago CDF had an adverse impact on the water quality of the Calumet River or Harbor during the Water Year 2003. In accordance with the IEPA permit, samples were acquired from five different sampling environments that included background samples for a baseline comparison and near-dike, river, CDF pond and landing well samples. The samples were analyzed for metals (chromium, manganese, and zinc), nutrients (Total Kjeldahl Nitrogen, ammonia nitrogen, and phosphorus), and Total Dissolved and Total Suspended Solids. Based on an analysis of the water quality data, it does not appear that the Calumet River or Harbor were adversely impacted by the Chicago CDF.

7 References

(1) Chicago Area Confined Disposal Facility: Monitoring Well Data Report, January - August 1997, prepared by USACE, Chicago District, October 1997.

(2) Final Environmental Impact Statement, Chicago Area Confined Disposal Facility and Maintenance Dredging in Cook County, Illinois, prepared by USACE, Chicago District, May 1982.

(3) Final Supplemental Environmental Impact Statement, Chicago Area Confined Disposal Facility, at Calumet Harbor, Chicago, Cook County, Illinois, prepared by USACE, Chicago District, 26 August 1998.

(4) Illinois Environmental Protection Agency, Water Pollution Control Permit Number 1997-EA-3213, Chicago Area Confined Disposal Facility, issued to USACE, Chicago District, April 30, 1997.

(5) Illinois Environmental Protection Agency, Water Pollution Control Permit Number 2001-EA-4691, Chicago District, Corps of Engineers, Chicago Area Confined Disposal Facility, December 7, 2001.

(6) Water Quality Monitoring Report for Routine Monitoring Events at Chicago Area Confined Disposal Facility (September 1997-July 1998) prepared by USACE, Chicago District, June 1999.

(7) Water Quality Monitoring Report for Routine Monitoring Events at Chicago Area Confined Disposal Facility Water Year 99 (October 1998 – September 1999) prepared by USACE, Chicago District, June 2000.

(8) Water Quality Monitoring Report for Routine Monitoring Events at Chicago Area Confined Disposal Facility Water Year 2000 (October 1999 – September 2000) prepared by USACE, Chicago District, September 2001.

(9) Water Quality Monitoring Report for Routine Monitoring Events at Chicago Area Confined Disposal Facility Water Year 2001 (October 2000 – September 2001) prepared by USACE, Chicago District, June 6, 2002.

(10) Report on Maintenance Dredging of Calumet Harbor (9/17/2001 through 12/13/2001) prepared by USACE, Chicago District, September 2002.

(11) Design Analysis – Calumet Harbor Illinois Chicago Area Confined Disposal Facility Vols. I and II prepared by USACE, Chicago District, January 1982.

(12) Water Quality Monitoring Report for Routine Monitoring Events at Chicago Area Confined Disposal Facility Water Year 2002 (October 01 – October 02) prepared by USACE, Chicago District, April 2003

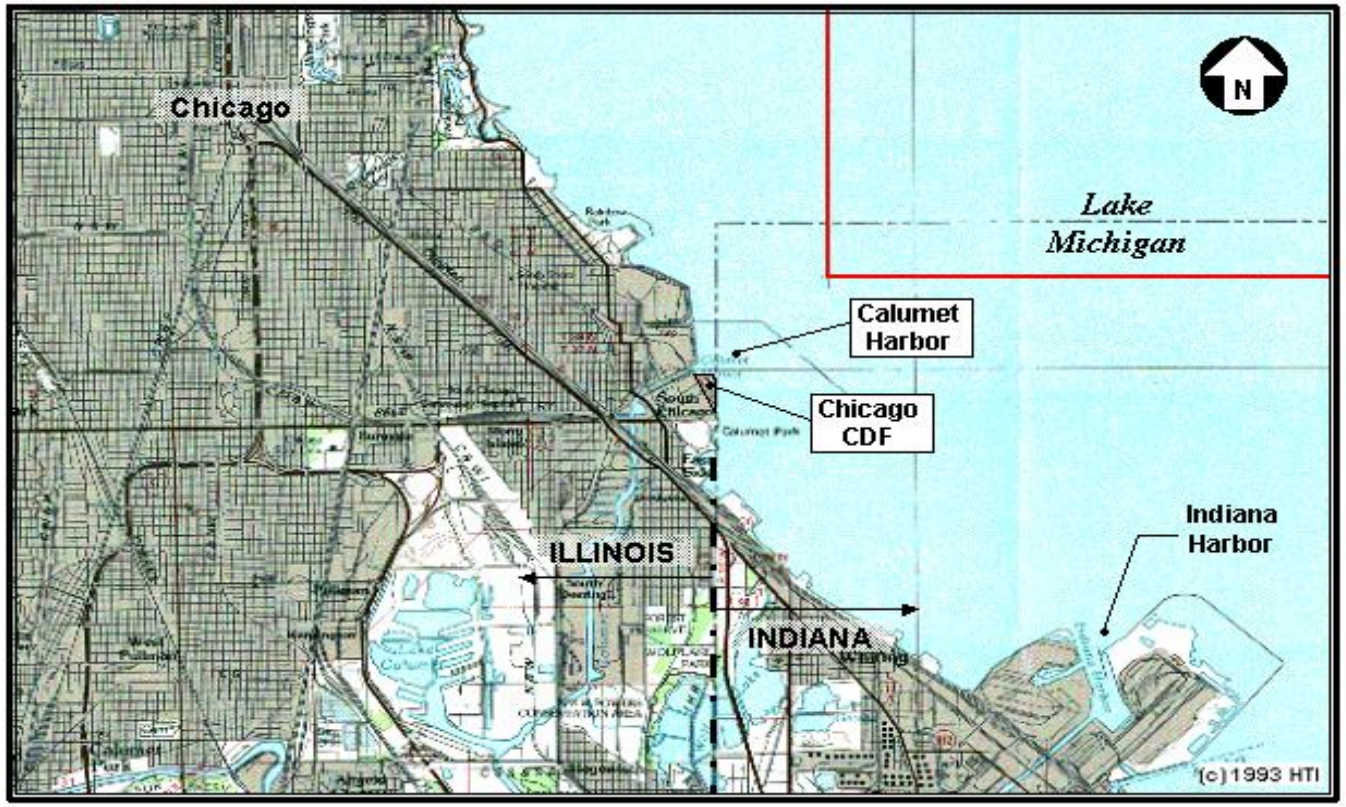

Figure 1: Location of Chicago Area CDF and Calumet Harbor

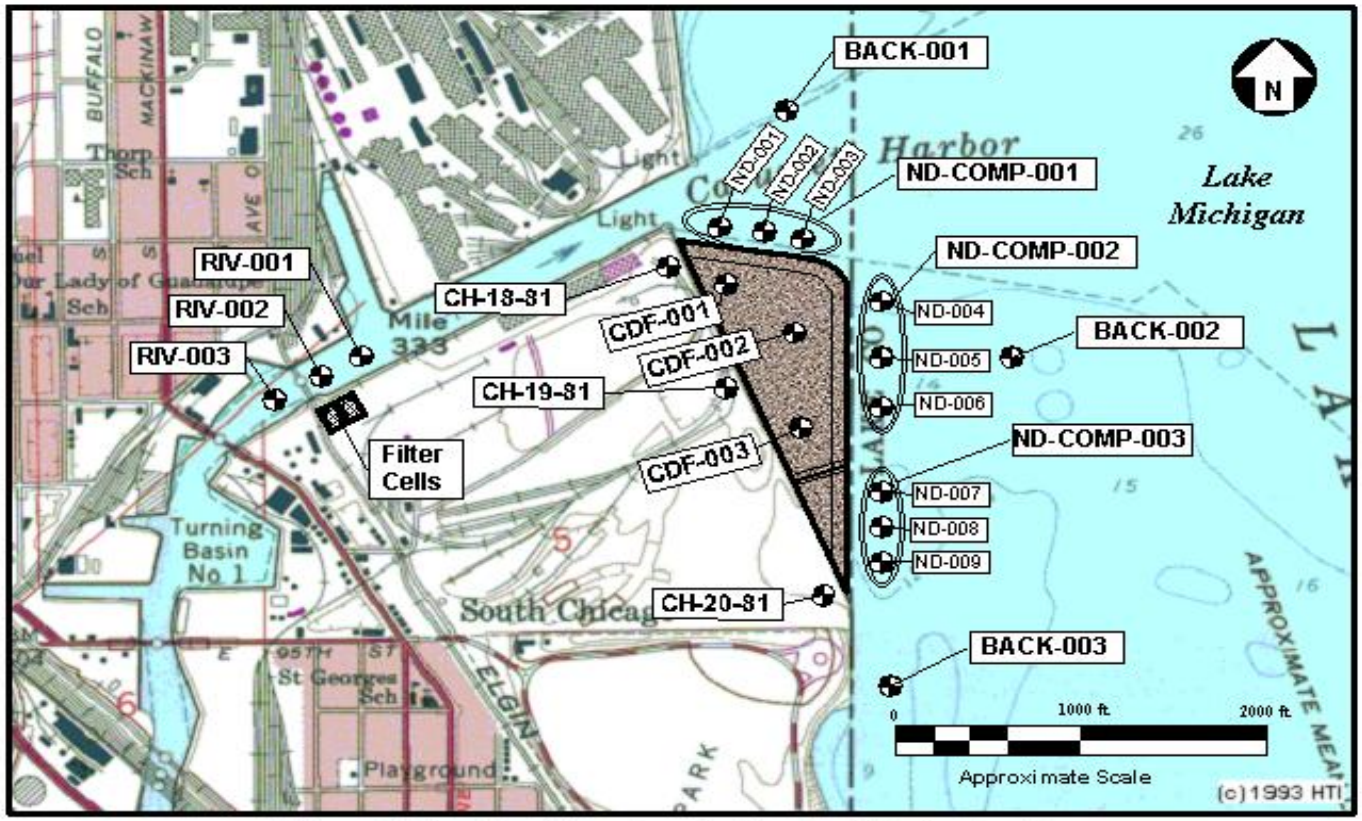

Figure 2: Sampling Locations for Routine Monitoring Events

Figure 3A Total Chromium Routine Monitoring Chicago Area CDF 2003

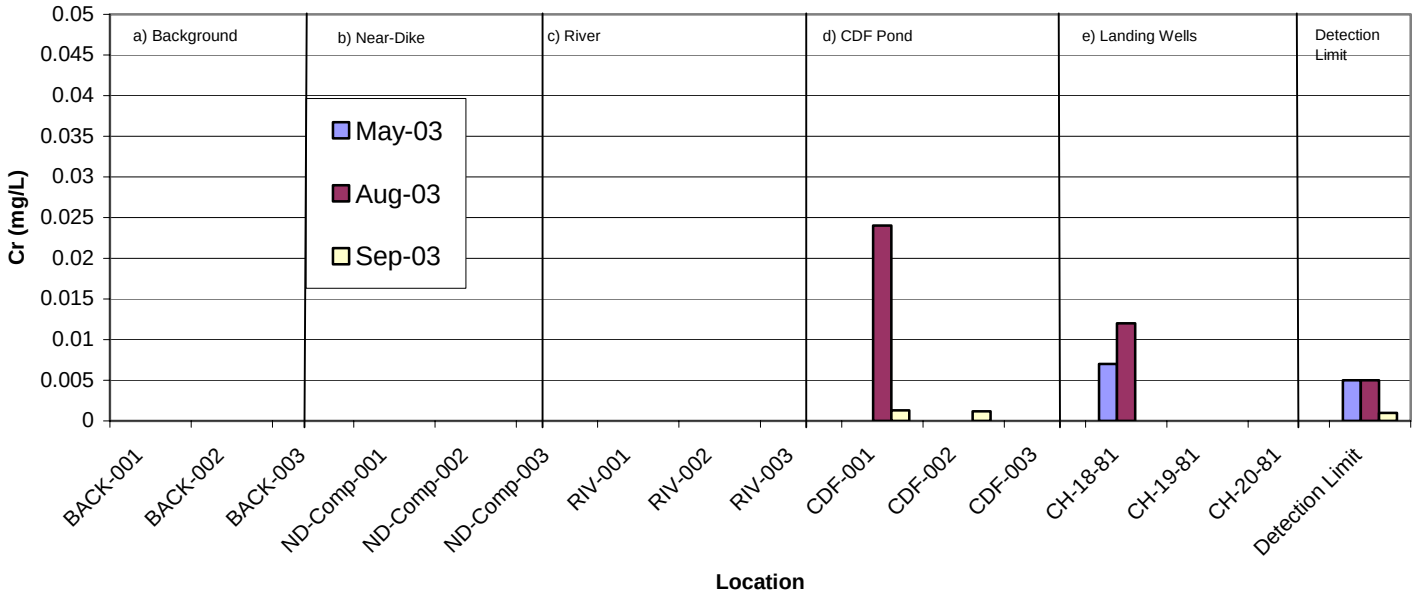

Figure 3B Total Manganese Routine Monitoring Chicago Area CDF 2003

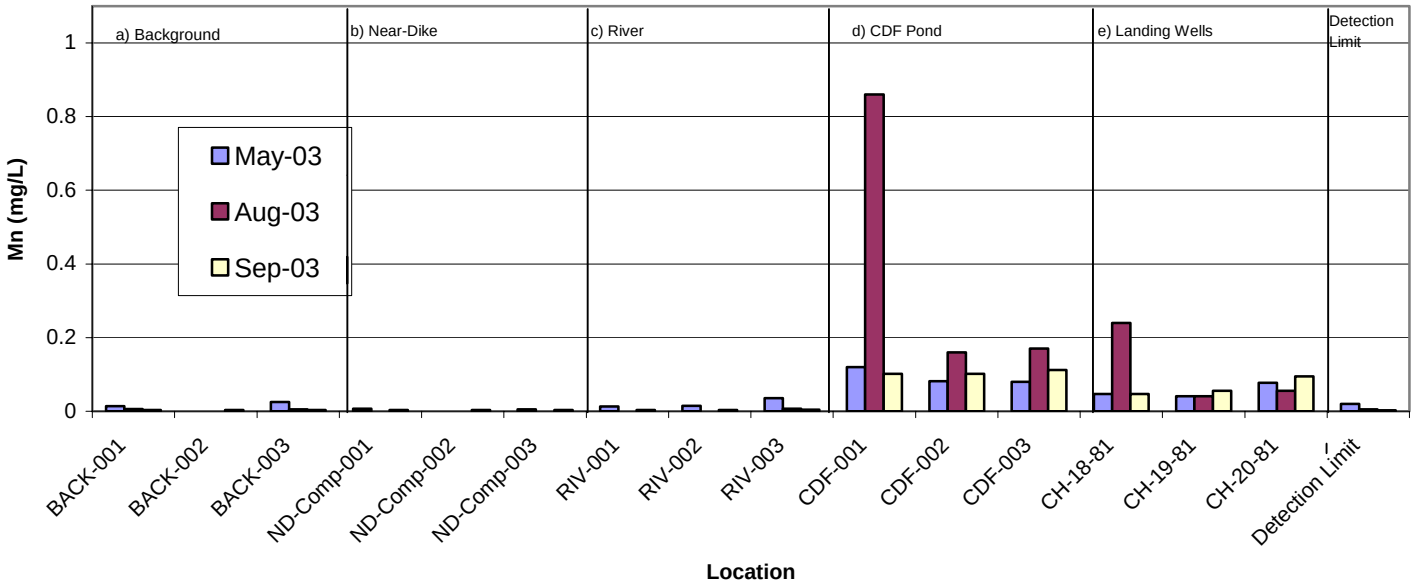

Figure 3C Total Zinc Routine Monitoring Chicago Area CDF 2003

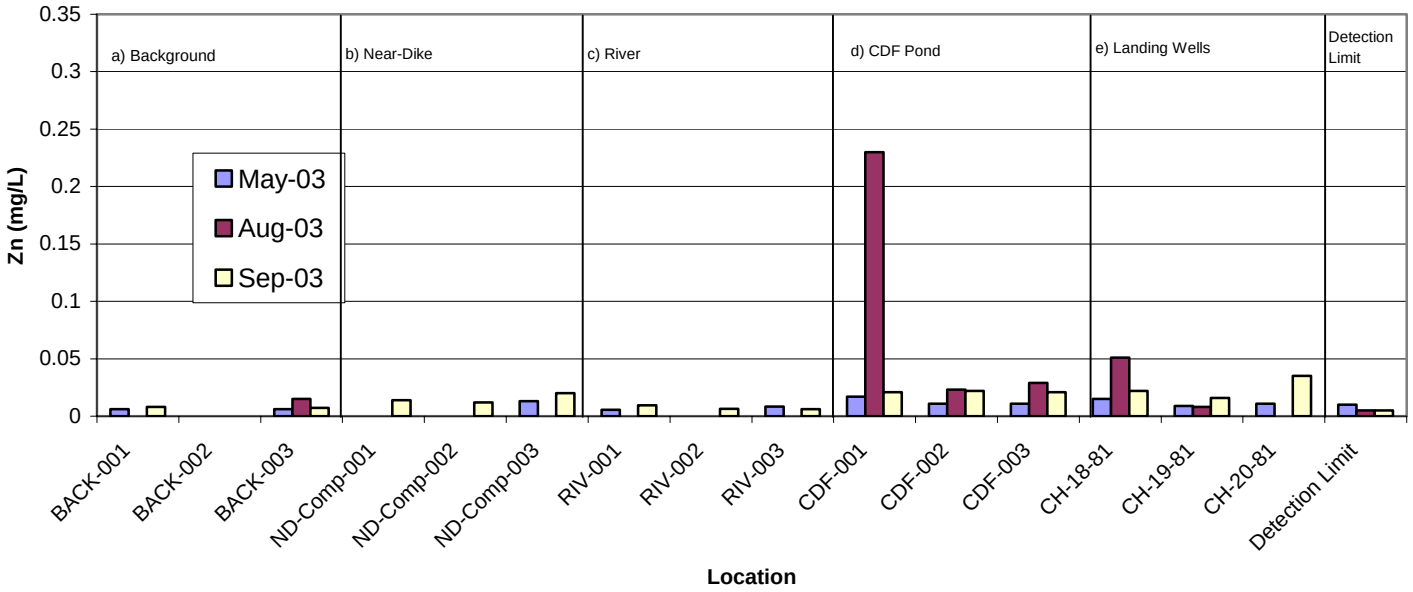

Figure 3D Total Kjedahl Nitrogen Routine Monitoring Chicago Area CDF 2003

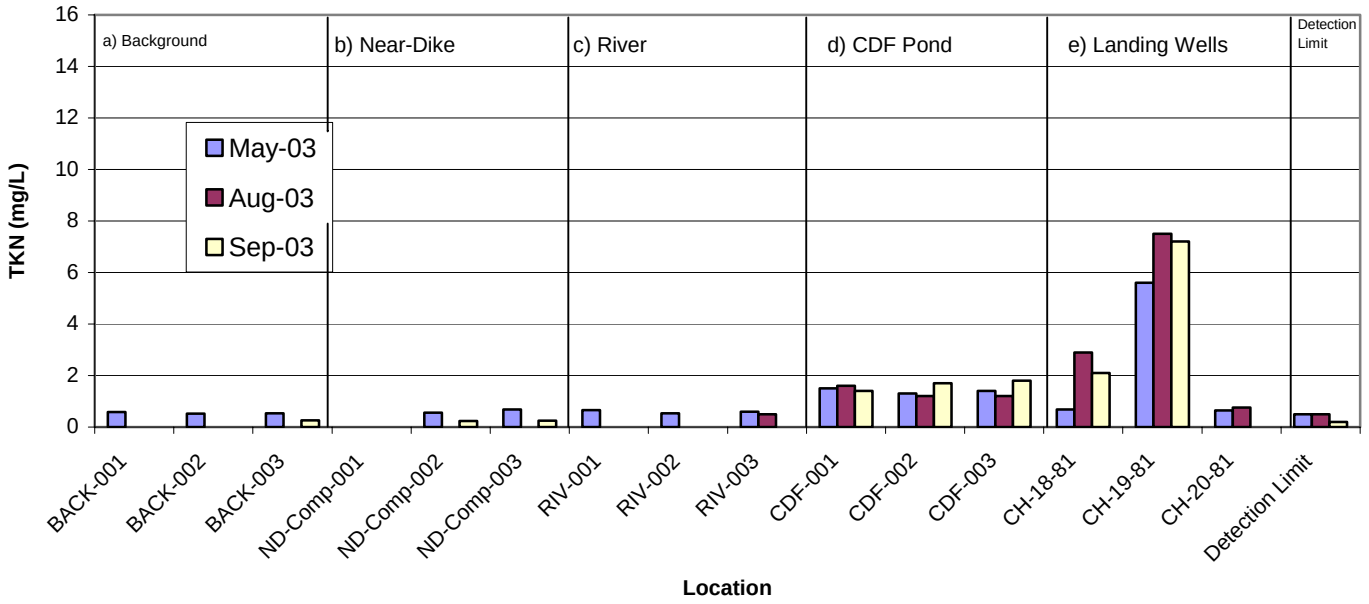

Figure 3E Total Ammonia Chicago Area CDF Routine Monitoring 2003

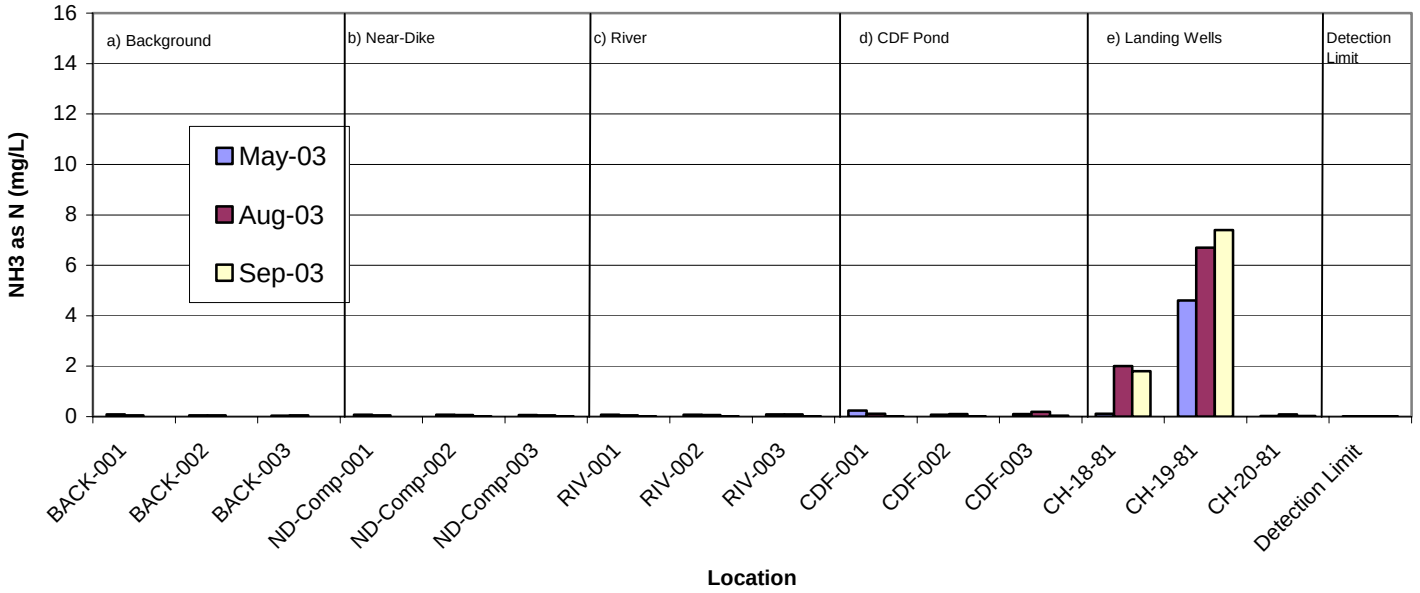

Figure 3F Total Phosphorus Routine Monitoring Chicago Area CDF 2003

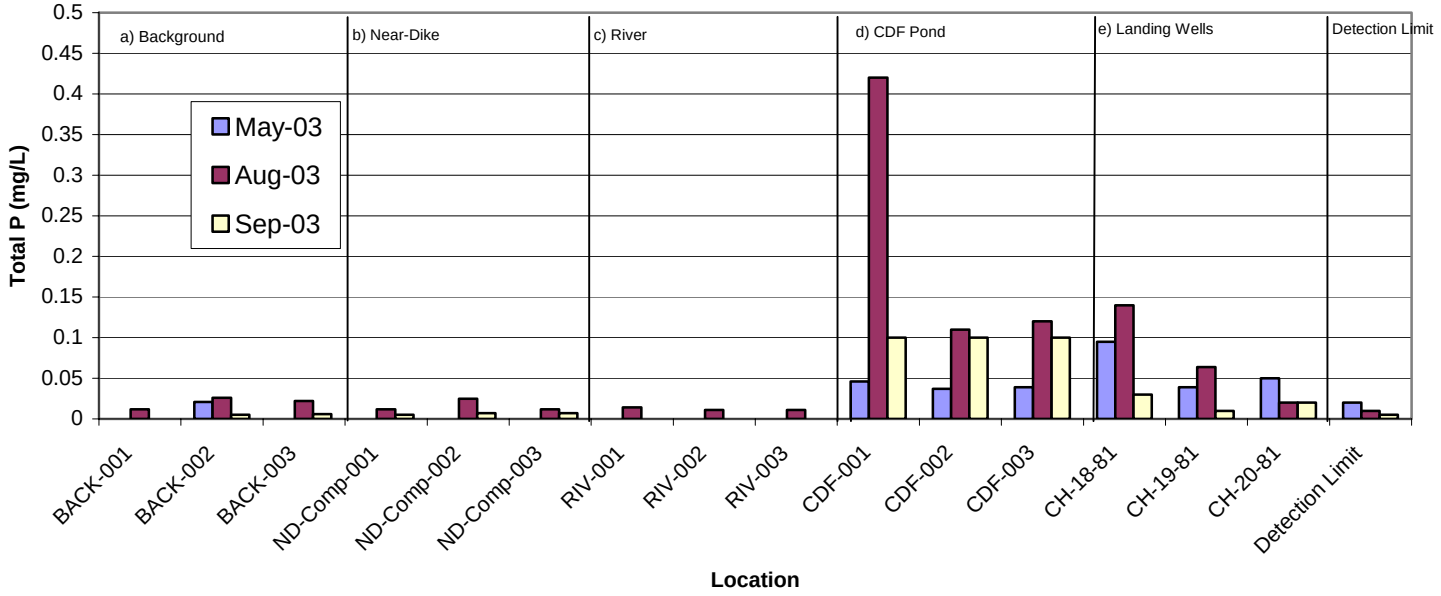

Figure 3G Total Dissolved Solids Routine Monitoring Chicago Area CDF 2003

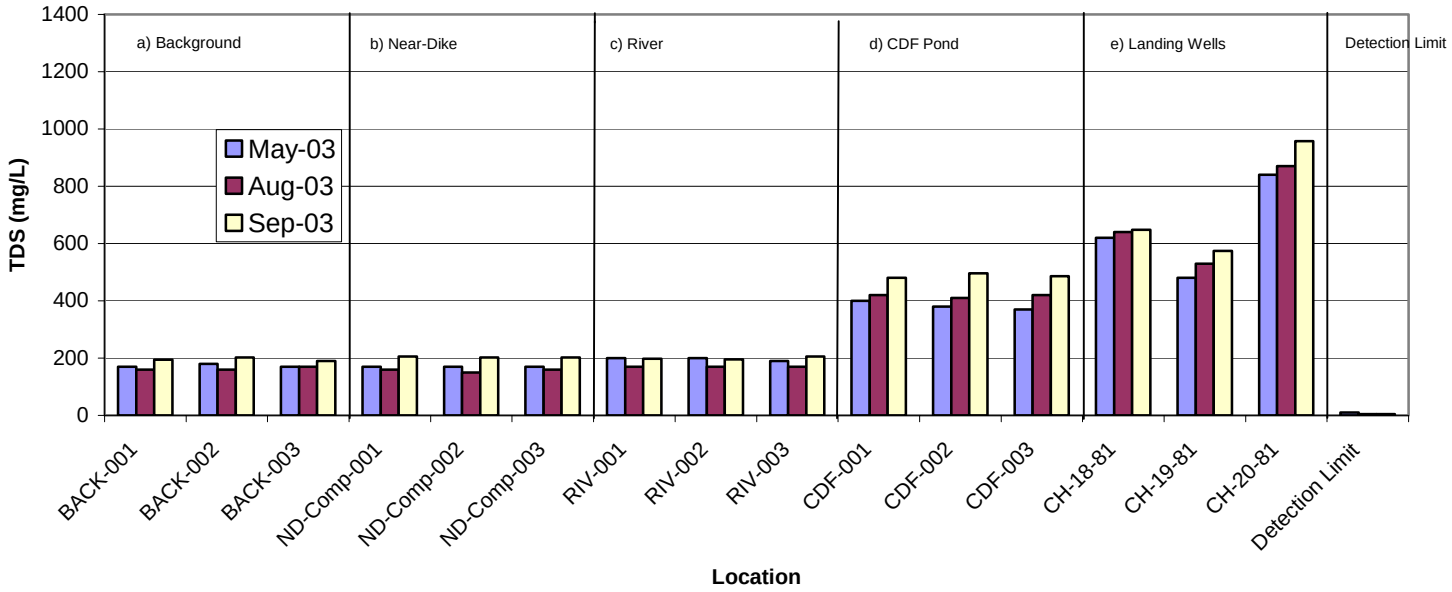

Figure 3H Total Suspended Solids Routine Monitoring Chicago Area CDF 2003

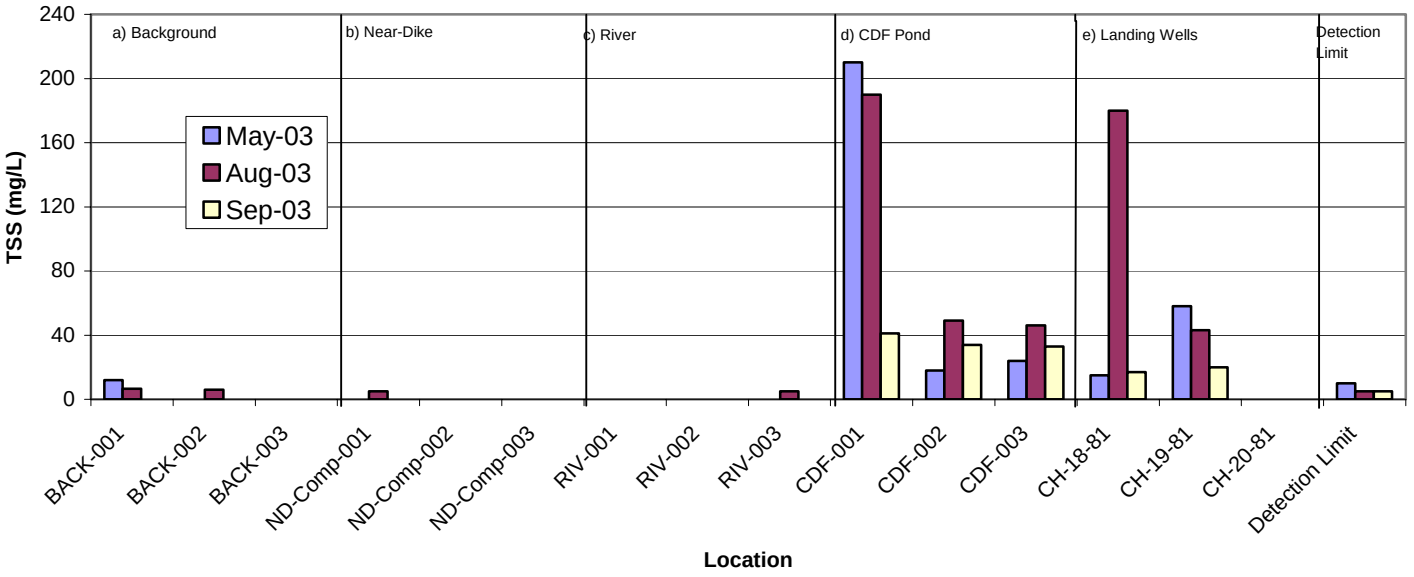

Figure 4 Comparison of Daily Mean Water Levels in Calumet Harbor and Chicago Area CDF