WATER QUALITY MONITORING REPORT
FOR
ROUTINE MONITORING EVENTS
AT
CHICAGO AREA CONFINED DISPOSAL FACILITY
WATER YEAR 2002
(OCTOBER 01 - OCTOBER 02)

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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 2002 (monitoring period from October 2001 to October 2002). The report includes data from routine monitoring events that were conducted on April 23, July 17 and October 17 of 2002, 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 902,100 cubic yards. This table also shows that the Chicago CDF has been used for eight different dredging and disposal events, each of which used mechanical dredging operations. Separate reports have been prepared for all eight dredging events, and these reports should be consulted for details on the sampling and analyses performed for the dredging operations.

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
Total		902,100 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–April, July–August and November–December. For Water Year 2002, the three routine monitoring events were conducted on April 23, July 17, and October 17, 2002. It should be noted that Calumet Harbor was dredged in October and November of 2001, and the sediment from this dredging event was placed in the Chicago CDF. Since more rigorous water quality and sediment monitoring was conducted for this dredging event, a routine monitoring event was not performed during this time period. For information on the October and November 2001 dredging event, consult the separate report on maintenance dredging of Calumet Harbor (9/17/2001 through 12/13/2001) (Reference 10).

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) (It is important to note that the CH-19-81 landing well was obstructed for the October 17 monitoring event so a sample was not collected.)

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 three 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 April event, Maxim Technologies subcontracted the laboratory analyses to Accutest, Gulf Coast Inc. For the July and October events, Montgomery Watson Harza subcontracted the laboratory analyses to Trace Analytical Laboratories Inc. The scope of work for the analytical testing is located in Appendix B along with a copy of the supply list. 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	0.1 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 2002

4.1 Water Quality Data

The analytical data for the April 23, July 17 and October 17, 2002 monitoring events is provided in Appendices D, E and F, respectively, and this data is summarized in Tables 3A-3C. These tables provide the concentrations in mg/L for each of the target parameters at the fifteen sampling stations as well as the detection limits achieved by the laboratory for each of the parameters. 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 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 detection limit achieved by the laboratory is provided. If the laboratory reported data points that were less than the detection limit, these values were reported in Tables 3A-3C and were plotted on Figures 3A-3H. As seen in Tables 3B and 3C, numerical estimated values and non-detect values were not provided for the July and October 2002 data.

Table 3A: Analytical Data Summary for Chicago CDF Water Quality Monitoring, 23 April 2002

	Chromium (mg/L)	Manganese (mg/L)	Zinc (mg/L)	TKN (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	TDS (mg/L)	TSS (mg/L)
BACK-001	0.0033	0.0125	0.0217	0.34	0.070	0.020	189	4.0
BACK-002	0.0129	0.0081	0.0248	0.10	0.030	0.010	186	9.0
BACK-003	0.0046	0.0064	0.0548	0.28	0.040	0.030	186	8.0
ND-Comp-001	0.0133	0.0114	0.0395	0.10	0.050	0.010	197	12.0
ND-Comp-002	0.0043	0.0062	0.0369	0.10	0.050	0.020	181	8.0
ND-Comp-003	0.0066	0.0059	0.154	0.11	0.030	0.010	176	1.0
RIV-001	0.0025	0.0153	0.0402	0.41	0.11	0.020	287	5.0
RIV-002	0.0115	0.0174	0.0424	0.40	0.025	0.020	308	10.0
RIV-003	0.0029	0.0171	0.0335	0.34	0.14	0.010	308	9.0
CDF-001	0.0062	0.0876	0.0418	2.6	1.4	0.050	388	20.0
CDF-002	0.0072	0.0636	0.0189	2.5	1.4	0.060	389	16.0
CDF-003	0.0062	0.0647	0.0197	2.7	1.3	0.070	389	18.0
CH-18-81	0.0100	0.0295	0.0634	0.10	0.48	0.050	508	9.0
CH-19-81	0.0024	0.0071	0.0398	3.6	4.0	0.010	548	4.0
CH-20-81	0.0041	0.0329	0.252	0.87	0.040	0.030	1050	4.0
Detection limit	0.0025	0.0025	0.0075	0.1	0.01	0.01	5	1

ND = No Data

Table 3B: Analytical Data Summary for Chicago Area CDF Water Quality Monitoring, 17 July 2002

	Chromium (mg/L)	Manganese (mg/L)	Zinc (mg/L)	TKN (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	TDS (mg/L)	TSS (mg/L)
BACK-001	0.0050	0.0067	J	0.50	0.10	0.02	170	10
BACK-002	0.0050	0.0050	J	0.50	0.10	0.02	210	10
BACK-003	0.0050	0.0050	J	0.50	0.10	0.02	220	10
ND-Comp-001	0.0050	0.0050	J	0.50	0.10	0.02	200	10
ND-Comp-002	0.0050	0.0050	J	0.54	0.10	0.02	210	10
ND-Comp-003	0.0050	0.0050	J	0.76	0.10	0.02	210	10
RIV-001	0.0050	0.0110	J	0.50	0.05	0.02	210	10
RIV-002	0.0050	0.0100	J	0.50	0.10	0.02	210	10
RIV-003	0.0050	0.0083	J	0.50	0.05	0.02	210	10
CDF-001	0.0190	0.5400	0.1200	1.00	0.10	0.07	490	54
CDF-002	0.0050	0.1100	J	1.10	0.07	0.07	430	16
CDF-003	0.0050	0.1000	J	1.10	0.16	0.07	480	27
CH-18-81	0.0100	0.1700	0.0500	3.50	2.20	0.21	680	150
CH-19-81	0.0050	0.0580	J	6.60		0.07	550	23
CH-20-81	0.0050	0.0250	J	0.50	0.10	0.06	1100	10
Detection limit	0.005	0.005	0.005	0.50	0.050	0.02	10	10

ND = No Data

J=Zinc values were considered to be estimated.

Table 3C: Analytical Data Summary for Chicago Area CDF Water Quality Monitoring, 17 October 2002

	Chromium (mg/L)	Manganese (mg/L)	Zinc (mg/L)	TKN (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	TDS (mg/L)	TSS (mg/L)
BACK-001	U	U	U	U	0.060	0.020	120	U
BACK-002	U	U	U	U	0.069	U	160	U
BACK-003	U	0.038	U	U	0.061	U	160	U
ND-Comp-001	U	U	U	0.72	0.062	0.026	160	U
ND-Comp-002	U	U	U	U	0.067	U	160	U
ND-Comp-003	U	U	U	U	0.064	U	160	U
RIV-001	U	U	U	U	0.068	0.021	160	U
RIV-002	U	U	U	U	0.076	U	160	U
RIV-003	U	U	U	U	0.064	U	160	U
CDF-001	U	0.057	0.038	1.6	0.095	0.12	380	29
CDF-002	U	0.055	0.014	1.6	0.086	0.12	370	25
CDF-003	U	0.050	0.021	1.5	0.093	0.11	370	24
CH-18-81	U	0.048	0.014	3.8	3.2	0.11	600	37
CH-19-81	ND	ND	ND	ND	ND	ND	ND	ND
CH-20-81	U	0.160	U	0.061	0.20	0.069	920	U
Detection limit	0.005	0.020	0.010	0.50	0.010	0.020	10	10

ND = No Data
U = Compound not detected.

3.1.1 4.1.1 pH and Temperature

The field logs with pH and temperature data are provided in Appendices D, E and F for the April 23, July 17 and October 17, 2002 events, respectively. This data has also been summarized in Table 4A. The samples collected from the different stations generally had pH readings that ranged from about 6.5 to 9.0. The only exception was for landing well CH-19-81, which had a pH of greater than 12 for both the April and July events. Historically, the pH values have been high for this landing well (CH-19-81), and this may be caused by the presence of waste or slag material in the soil adjacent to this well. The samples collected from the different stations had water temperatures that ranged from a low of 9.3°C in the CDF pond for the October event to a high of 33.1°C in the CDF pond for the July event.

Table 4A Field pH and Temperature Summary Water Stations Year 2002

Location Group	Parameter	Event	Minimum	Event	Maximum	Median
Background	pH	Apr	8.25	Jul	8.61	8.42
Near Dike	pH	Apr	8.29	Jul	8.54	8.45
River	pH	Apr	6.92	Oct	8.42	8.38
CDF	pH	Jul	6.9	Apr	8.95	8.76
Landing wells	pH	Apr	6.56	Jul	12.68	7.76
Background	°C	Apr	10.1	Jul	28.2	14.7
Near Dike	°C	Apr	9.9	Jul	29	14.3
River	°C	Apr	10.6	Jul	25.5	13.2
CDF	°C	Oct	9.3	Jul	33.1	12.3
Landing wells	°C	Apr	11.8	Jul	24.4	17.05

See the field logs in the appendices for variation within groups.

3.1.2 4.1.2 Metals

The monitoring results for total chromium, total manganese and zinc are shown in Figures 3A, 3B and 3C, respectively. As observed in Figure 3A, the highest total chromium concentration (0.019 mg/L) was detected in sample CDF-001, which was acquired from the CDF pond for the July event. The next highest total chromium concentration (0.013 mg/L) was detected in sample ND-Comp-001, which was acquired from the near-dike sampling environment during the April event. For comparison, the highest concentration of chromium in a background sample was about 0.013 mg/L, which was taken for the April event.

Figure 3B shows that the highest manganese concentration (0.54 mg/L) was detected in sample CDF-001, which was acquired from the CDF pond for the July event. The next highest manganese concentration (0.17 mg/L) was detected in land well CH-18-81 for the July event. The river and near-dike samples all had manganese concentrations that were considerably lower (less than 0.02 mg/L). The manganese concentrations in the river and near-dike samples were lower than the highest concentration of manganese in a background sample, which was about 0.04 mg/L and was taken for the October event.

As seen in Figure 3C, the highest zinc concentration (0.252 mg/L) was detected in landing well sample CH-20-81 for the April event. The next highest zinc concentration (0.15 mg/L) was detected in a near-dike sample for the April event. For the July and October events, the majority of the samples had zinc concentrations that were considered

to be estimated or non-detectable. The highest concentration of zinc in a background sample was about 0.06 mg/L, which was taken for the April event.

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 (6.6 mg/L) was detected in landing well sample CH-19-81 for the July event. In addition, Figure 3D shows that the TKN concentrations in the samples from the CDF pond ranged from about 1 to 2.7 mg/L, whereas substantially lower concentrations (less than 1 mg/L) were detected in the river, near-dike and background samples. The background samples with the highest TKN concentration (0.5 mg/L) were the three samples collected for the July event, and this concentration was the detection limit.

Figure 3E shows that the highest ammonia nitrogen concentration (4.0 mg/L) was detected in landing well sample CH-19-81 for the April event. The CDF pond samples taken for the April event also had relatively high ammonia nitrogen concentrations (1.3 – 1.4 mg/L) compared to the river, near-dike and background samples, which had concentrations less than 0.14 mg/L. The background samples with the highest ammonia nitrogen concentration (0.1 mg/L) were the three samples collected during the July event.

As observed in Figure 3F, the highest phosphorus concentration (0.21 mg/L) was detected in landing well sample CH-18-81 for the July event. The CDF pond samples had concentrations that ranged from about 0.05 to 0.12 mg/L. All the river and near-dike samples had phosphorous concentrations that were significantly less than 0.05 mg/L. The highest phosphorous concentration detected in a background sample was 0.03 mg/L, and this sample was collected during the April 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 Figure 3G, the Total Dissolved Solids concentrations ranged from 120 to 1100 mg/L and they were significantly higher in the landing well and CDF pond samples. The highest concentration of Total Dissolved Solids in a background sample was 220 mg/L, and this sample was collected during the July event.

Figure 3H shows that the highest Total Suspended Solids concentration of 150 mg/L was detected in landing well CH-18-81 for the July event. This sample appears to be an anomaly however, because the all the other samples had significantly lower Total Suspended Solids concentrations (less than 54 mg/L). The highest Total Suspended Solids concentration for the background samples was 10 mg/L, this was detected in all the background samples for the July event, and this was the detection limit. The samples acquired from the Calumet River and Harbor had Total Suspended Solids concentrations of less than 12 mg/L, and there were 10 samples that were non-detectable for the October 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 the monitored 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. Holding time preservation requirements were met for all samples. Temperature preservation requirements were met for two of the three sampling events. The temperature requirement (4 + 2 = 6 ºC) was not met for the July event because one of the sample coolers was slightly higher (8.9 ºC) than the required temperature of 6 ºC. All reporting limits were met or were otherwise acceptable. Positive exceptions were noted, and any negative exceptions were also noted in the assessments in the appendices. The data is suitable for its intended purpose and objectives.

4.3 Statistical Analysis

One of the goals of the current monitoring plan is to generate a statistically analyzable data set for each monitoring event. As such, three samples are collected from each of five distinct sampling environments, including (1) the background water of Calumet Harbor (BACK), (2) near-dike harbor composites (ND-Comp), (3) river (Riv), (4) CDF pond (CDF), and (5) landing wells (CH). The current monitoring plan used a spreadsheet program for the statistical analysis of the contaminant concentrations in each of the sampling environments, and the printouts for each parameter and station in each event are provided in Appendices D-F.

In each spreadsheet, the analytical values of each parameter are summarized for each of the five sampling environments. The five different station designation types represent the five sampling environments, and there are three stations per designation type. The program summarizes the completeness, count, mean and variance for each parameter. Three sample results are the minimum number required to calculate a mean value and a variance for consideration in the statistical analysis. If one or more non-detect concentrations or no data is obtained for a given parameter in a given sampling environment, it is not possible to calculate a variance, and a statistical analysis cannot be performed for that sampling environment. It should be noted that due to an obstruction, a sample was not taken from landing well CH-19-81 for the October event. Consequently, a statistical analysis of the landing well data for the October event was not performed for any of the parameters.

The summary data for each parameter is used to produce a Student's ***t*** distribution calculation for that parameter in a given sampling environment. Based on the probability calculations generated by the program, the final comparison is made between each of the sampling environments at the bottom of the spreadsheet for a given parameter. If the data set is incomplete, or has one or more non-detect values, no comparison can be made, and the box is labeled "N/A". If the statistical analysis indicates that the sample concentrations from two distinct sampling environments are not statistically different,

then it is said that the "*null hypothesis" (H_0)* is confirmed and the comparison is labeled *"OK"*. If the analysis indicates that the concentrations of two sampling environments are indeed statistically different, then it is said that the null hypothesis is rejected and the comparison is labeled *"Reject H_0"*.

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 the contaminant concentrations in the near-dike samples (ND-COMP-XXX) were shown to be statistically greater than the background water samples (BACK-XXX). 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 relative to the background samples. For the current monitoring period, which includes the sampling events of April, July and October of 2002, the results of the statistical comparisons for each of the five sampling environments are presented in the following paragraphs. A summary of the statistical analysis for each parameter is shown in Tables 5A-5H.

4.4.1 Metals

Metals statistical comparisons can be found in Tables 5A-5C and in Appendices D, E and F. The chromium concentrations were at or below the detectable limits for the July event and non-detectable for the October sampling event. As such, a chromium statistical analysis could be performed and comparisons are discussed only for the April event. As shown in Table 5A, the April chromium concentrations were not significantly different for the five sampling environments for which a comparison could be made.

Table 5B shows that for the April event, the manganese concentrations were statistically higher in the CDF pond than in the river, near dike and background environments. Moreover, for two of the sampling events, April and July, the manganese concentrations in the Calumet River samples were statistically higher than the concentrations in the samples from the background and near-dike environments. Table 5B also shows that for the April event, the manganese concentrations in the landing well samples were statistically lower than in the samples from the CDF pond. The zinc concentrations were at or below the detectable limits for the July event and non-detectable for the October sampling event. Thus, a statistical analysis of the zinc concentrations could only be performed for the April event, and Table 5C shows that the zinc concentrations were not significantly different between the sampling environments.

4.4.2 Nutrients

Nutrient statistical comparisons for the April, July and October 2002 sampling events are shown in Tables 5D–5F and in Appendices D, E and F. As shown in Table 5D, the samples from the CDF pond had TKN concentrations that were statistically higher than the samples from the river, near-dike and background environments except for the October event, where there was insufficient data. This table also shows that for the April event, the river samples had TKN concentrations that were statistically higher than the concentrations in the near-dike samples.

The statistical analysis of the ammonia nitrogen (NH_3 as N) concentrations is shown in Table 5E. As observed in this table, the landing well data comparisons for the April and July events showed no statistical differences for the four sampling environments. For the April and October events, the ammonia nitrogen concentrations in the CDF pond samples were statistically higher than the concentrations in the river, near-dike and background samples, but the ammonia concentrations for the July event showed no significant differences between the five sampling environments (Table 5E).

As seen in Table 5F, the statistical analysis for the April and July events suggests that the CDF pond samples had phosphorus concentrations that were significantly higher than the samples from the river, near-dike and background environments.

4.4.3 Solids

Table 5G shows that the CDF pond samples had Total Dissolved Solids (TDS) concentrations that were statistically higher than the river, near-dike and background samples for all three sampling events, April, July and October. Furthermore, this table shows that the landing well samples were significantly higher than the near-dike and background samples for the April and July events, and they were significantly higher than the river samples for the July event.

As observed in Table 5H, for the April event, the samples taken from the CDF pond had Total Suspended Solids (TSS) concentrations that were statistically higher than the samples from the river, near-dike and background environments. In addition, the results from the April data indicate that the TSS concentrations in the landing wells were statistically lower than the samples from the CDF pond.

4.5 Discussion of Results

Combining the results of the statistical analysis with the visual inspection of water quality data, it is possible to draw some conclusions about the water quality in and around the Chicago CDF. Based on a visual inspection of the data (Figures 3A-3H), it appears that the CDF pond samples have higher concentrations of manganese, TKN and ammonia nitrogen than the river, near-dike and background sampling environments (ammonia nitrogen was only higher for the April event). None of the statistical comparisons indicated that the near-dike samples significantly exceeded the background concentrations for any of the parameters. As such, the dike appears to be effective at preventing the water and dredged material in the CDF from impacting the water quality in Calumet Harbor.

4.6 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 hourly data from these stations was used to compute and then compare the daily mean elevations in Calumet Harbor with the daily mean elevations in the CDF pond. This figure shows that the water level daily mean elevations were nearly identical in Calumet Harbor and the CDF pond for the Water Year 2002. The daily mean pond surface water levels in the CDF ranged

from 1.47 ft above low water datum to minus 0.09 ft below low water datum. The daily mean Calumet Harbor water elevation ranged from 1.64 ft above low water datum to minus 0.87 ft below low water datum. 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 April, July and October, and this data is presented in Table 4B along with the daily mean water levels for Calumet Harbor and the CDF pond.

Table 4B: Chicago Area CDF Well, Pond, and Harbor Water Level Comparison 2002

	Elevation Expressed from Low Water Datum			Remark
Location/Date	Apr 23,2002	Jul 17,2002	Oct 17,2002	For this report
CH-18-81	2.96	1.96	1.96	(CH 1)
CH-19-81	3.5	3.0	1.75	(CH 2)
CH-20-81	4.37	3.37	3.87	(CH 3)
CDF Pond	0.76	1.28	0.67	Daily Mean USGS
Calumet Harbor	0.49	1.15	0.54	Daily Mean NOAA

5 Conclusion

This report presents the results of the water quality data that was collected on April 23, July 17 and October 17 of 2002 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 2002. 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 a visual and statistical analysis of the water quality data, it does not appear that the Calumet River or Harbor were adversely impacted by the Chicago CDF.

6 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.

APPENDIX A

IEPA Water Quality Approved Permit

APPENDIX B

Analytical Scope of Work

Scope of Work for Analysis of Water Samples
April 2002 For
Chicago Area Confined Disposal Facility Monitoring

1. Overview

The U.S. Army Corps of Engineers (USACE), Chicago District, regularly collects water and groundwater samples at the Chicago Area Confined Disposal Facility (CDF) at Calumet Harbor, Illinois, as part of its tri-annual routine water Quality Monitoring Plan. This scope of work outlines the analytical testing requirements to be performed for three sampling Events to be conducted in Nov-Dec., 1998, April-May, 1999, and July-August, 1999. The scope of Work does not include sample collection.

2. Analytical Requirements

USACE will collect a total of fifteen (15) aqueous samples during each of the three sampling events. Samples will be immediately shipped to the contracting laboratory. The laboratory shall analyze the samples for the parameters listed in Table 1, following the guidelines for reporting limits, precision, and accuracy indicated in the table.

Table 1: Analytical Requirements for Chicago CDF Water Quality Samples

Parameter	Reporting Limits	Precision	Accuracy
Chromium (total)	0.005 mg/L	≤ 20%	± 15%
Manganese (total)	0.005 mg/L	≤ 20%	± 15%
Zinc (total)	0.005 mg/L	≤ 20%	± 15%
Ammonia as Nitrogen	0.01 mg/L	≤ 20%	± 15%
Total Kjeldahl Nitrogen	0.1 mg/L	Note (2)	Note (2)
Phosphorus (total)	0.01 mg/L	Note (2)	Note (2)
Total Dissolved Solids	5 mg/L	N/A	N/A
Total Suspended Solids	5 mg/L	N/A	N/A

Notes: (N/A = Not Applicable)

1.0 The laboratory defined reporting limit may be used based on a standard method of analysis provided that the reporting limits are less than or equal to the reporting limits shown in the above table.

1.0 The laboratory internally generated acceptance criteria shall be used.

1.0 The laboratory shall perform the appropriate precision and accuracy assessments as outlined in the analytical method used, and report the results of those assessments.

The laboratory shall perform all necessary quality assurance/quality control measures to achieve the precision and accuracy requirements outlined in Table 1. Precision shall be determined using matrix spike and matrix spike duplicate samples. Accuracy shall be determined using laboratory control samples. The laboratory shall also perform analyses on method blank samples. The laboratory internally generated acceptance criteria shall be reported along with the sample results and the QA/QC data.

SCOPE OF WORK FOR ANALYSIS OF WATER SAMPLES
JULY 2002-JULY 2003
FOR
CHICAGO AREA CONFINED DISPOSAL FACILITY MONITORING

7 Overview:

The U.S. Army Corps of Engineers (USACE), Chicago District, regularly collects water and groundwater samples at the Chicago Area Confined Disposal Facility (CDF) at Calumet Harbor, Illinois, as part of its tri-annual routine water quality monitoring plan. This scope of work outlines the analytical testing requirements to be performed for a four events planned for July-August 2002, October 2002, April 2003 and July 2003. The scope of work does not include sample collection.

8 QA/QC and Analytical Requirements

A pre-sampling QA/QC meeting will be held after award of the delivery order. The meeting will be attended by, members of USACE – Chicago District, Montgomery Watson Harza's (MWH) project manager and one chemist/analyst from the contractor's laboratories. The meeting will take place in the form of a conference call. The purpose of this call is to discuss specific Data Quality Objectives required for this sampling project. The list of objectives is included in Table 1 below. It is very important that MWH's laboratory meets the reporting limits and other QA/QC objectives. The meeting should not take more than one hour.

USACE will collect a total of fifteen (15) aqueous samples during each of the four events. Samples will be kept in ice and shipped to the contracting laboratory via overnight delivery. The laboratory shall analyze the samples for the parameters listed in Table 1, following the guidelines for reporting limits, precision, and accuracy indicated in the table.

Table 1: Analytical Requirements for Chicago CDF Water Quality Samples

PARAMETER	REPORTING LIMITS	PRECISION	ACCURACY
Chromium (total)	0.005 mg/L	≤ 20%	± 15%
Manganese (total)	0.005 mg/L	≤ 20%	± 15%
Zinc (total)	0.005 mg/L	≤ 20%	± 15%
Ammonia as Nitrogen	0.01 mg/L	≤ 20%	± 15%
Total Kjeldahl Nitrogen	0.1 mg/L	Note (2)	Note (2)
Phosphorus (total)	0.01 mg/L	Note (2)	Note (2)
Total Dissolved Solids	5 mg/L	N/A	N/A
Total Suspended Solids	5 mg/L	N/A	N/A

NOTES: (N/A = Not Applicable)

(1) The laboratory defined reporting limit may be used based on a standard method of analysis provided that the reporting limits are less than or equal to the reporting limits shown in the above table.

(2) The laboratory internally generated acceptance criteria shall be used.

(3) The laboratory shall perform the appropriate precision and accuracy assessments as outlined in the analytical method used, and report the result of those assessments.

The laboratory shall perform all necessary quality assurance/quality control measures to achieve the precision and accuracy requirements outlined in Table 1. Precision shall be determined using matrix spike and matrix spike duplicate samples. Accuracy shall be determined using laboratory control samples. The laboratory shall also perform analyses on method blank samples. All laboratory internally generated acceptance criteria shall be reported along with the sample results and the QA/QC data including continuing calibration verification of blanks.

9 Reporting Requirements

For the sampling event, the laboratory shall submit final analytical results, including QA/QC data, to the Chicago District office within 30 days of sample receipt. The laboratory data shall be summarized in a tabular format. The Lab shall send two copies (1 bound, 1 unbound) and one electronic copy (must be Microsoft Excel compatible) of the final Reporting Package, including the Quality Assurance/Quality Control report, summary table(s) and chain of custody forms.

10 Supplies

Two weeks prior to each of the sampling events, the laboratory shall provide the following supplies to USACE :

- Appropriate sample jars, labels, and protective packing (such as bubble wrap) for collection and analysis of all the samples;
- Appropriate sample preservatives for the aqueous samples in the form of glass ampoules, dissolvable tablets, or pre-preserved bottles;
- Sufficient coolers for shipment of all the samples back to the laboratory;
- Custody seals, which Chicago District will affix to the outside of the coolers just prior to shipping;
- A brief written description of which bottles are to be submitted for which analyses, and which preservatives are to be used (for aqueous analyses).

All correspondence and shipments should be sent to the following address:

U.S. Army Corps of Engineers, Chicago District
Attn: Dave Weir (Environmental Engineering Section)
111 N. Canal St., Suite 600
Chicago, IL 60606-7206
Phone: (312) 353-6400 ext. 3010
Fax: (312) 353-2156

APPENDIX C

Standard Operating Procedure
For
Routine Monitoring Events at Chicago CDF

APPENDIX F

October 2002 Sampling Event

APPENDIX D

April 2002 Sampling Event

APPENDIX E

July 2002 Sampling Event

Field Log
October 2002

Analytical Data Summary
and
Statistical Analysis
October 2002

Data Quality Assessment
October 2002

Final Laboratory Data Package
April 2002

Field Log
April 2002

Analytical Data Summary
and
Statistical Analysis
April 2002

Data Quality Assessment
April 2002

Final Laboratory Data Package
April 2002

Field Log
July 2002

Analytical Data Summary
and
Statistical Analysis
July 2002

Data Quality Assessment
July 2002

Final Laboratory Data Package
July 2002