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WATER QUALITY MONITORING REPORT
FOR
ROUTINE MONITORING EVENTS
AT
CHICAGO AREA CONFINED DISPOSAL FACILITY
WATER YEAR 2001
(OCT 00 - SEP 01)

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1 PURPOSE

The purpose of this report is to summarize and discuss water quality data collected at the Chicago Area Confined Disposal Facility (Chicago CDF), Calumet River, and Calumet Harbor by the U.S. Army Corps of Engineers (USACE), Chicago District, during the monitoring period from Oct 2000 to Sep 2001. The report includes data from routine monitoring events conducted in October 2000, April 2001, and August 2001. Finally, a discussion of the sampling procedures, laboratory testing, and data quality for these events is also provided. The main purpose of the trimester routine monitoring events is to determine if the Chicago Area CDF appears to have had any adverse effect on the water of Calumet Harbor or Calumet River.

2 BACKGROUND

The Chicago CDF is a diked facility for the disposal and containment of contaminated dredged materials from deep-draft federal navigation projects in Chicago, Illinois. The CDF was constructed between 1982-84, and is located at the mouth of Calumet River in Calumet Harbor, Illinois, as shown in Figure 1. This facility has been constructed, operated, and maintained by USACE, Chicago District, under authority of Public Law 91-611, Section 123. Adjoining interests for this project are the Chicago Regional Port District and the Chicago Park District. The facility is roughly triangular in shape, and has a surface area of roughly 43 acres. The CDF has a capacity of about 1.3 million cubic yards of dredged material. As of the end of the year 2001, the total dredged sediments placed into the facility since its first use increased to 902,000 cubic yards. More detailed information on the design and operation of the CDF may be found in the Environmental Impact Statement (EIS) and Supplemental EIS for the Chicago CDF, as referenced at the end of this report.

The Chicago CDF dike consists of a prepared limestone core, a synthetic liner placed over the core on the inside face of the dike, and larger stone on both sides of the dike to protect against wave action. A blanket of fine-grained sand was installed along the inside face of the dike to promote clogging of the core stone around perforations in the synthetic liner and provide an additional positive cutoff. The CDF has been used for eight dredging and disposal operations since its construction. Each of these operations involved mechanical dredging. Information on these dredging events is summarized in Table 1. Calumet River and Harbor Breakwater dredged material placed in the CDF in the year 2000 was 206,000 cubic yards. Calumet Harbor dredged material placed in the CDF in the year 2001 was 291,000 cubic yards. Separate reports will cover these dredging events.

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

3 SAMPLING AND ANALYTICAL PROCEDURES

3.1 Water Quality Monitoring Plan

USACE obtained its most recent Section 401 water quality certification from the Illinois EPA under Permit # 1997-EA-3213, which was issued April 30, 1997, and is valid until April 1, 2002. The current permit is provided for reference in Appendix A. This permit included significant revisions to the previous water quality monitoring plan. The USACE document, entitled *Water Quality Monitoring at the Chicago Area Confined Disposal Facility, Calumet Harbor, IL*, dated February 6, 1997 (Reference 4), which outlined the proposed modifications to the monitoring plan and was accepted by Illinois EPA, is also included in Appendix A. This is the fourth report for Chicago CDF water quality data collected and analyzed under the revised monitoring plan. Some discussion is provided here of the current monitoring plan. Discussion of the old monitoring plan is provided in the June 1999 report. A map of the monitoring locations and the target parameter schedules under the old plan for both routine monitoring events and for dredging and disposal events is included in Reference 6.

3.1.1 Current Routine Monitoring

The current monitoring plan has two distinct monitoring schedules, one for routine monitoring events, and one for dredging and disposal events. Routine monitoring events are conducted three times a year at fifteen separate locations and for a revised set of target parameters, as outlined in Reference 6. The sampling locations and target analytes for routine monitoring events are discussed in Section 3.2 and Section 3.3 respectively. Approximate dates of routine monitoring events are March-April, July-August, and October-December. For water year 2001 (WY 01) covered by this report, three routine sampling events were conducted as required. Routine trimester monitoring events were conducted in October 2000, April 2001, and August 2001. The results of the three routine monitoring events are discussed in Section 4.

3.1.2 Monitoring for Dredging Events

The current monitoring plan also includes a separate sampling and analytical protocol for water quality monitoring before, during, and after dredging. As such, the sampling and analytical procedures will not be discussed here. However, detailed explanations of

sampling locations, sampling frequency, and target parameters for monitoring events during dredging and disposal events are provided in Reference 6.

3.2 Sampling Locations for Routine Monitoring Events

(a) The sampling locations for routine monitoring events at the Chicago CDF are shown in Figure 2. Each monitoring event includes a total of fifteen sampling stations. Samples are collected from five distinct sampling environments, as follows:

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

The background samples are collected far enough from the CDF that the concentrations detected at these locations should provide an indication of baseline contaminant levels in Calumet Harbor. The CDF pond samples provide an indication of the quality of the water in direct contact with the contaminated sediments in the CDF. Depending on the parameter, the CDF pond samples may be expected to have slightly higher contaminant concentrations compared with background levels. The composite samples collected in the harbor near the edge of the CDF dike wall are intended to provide a direct comparison with the CDF pond water samples. If the near-dike composite samples are significantly higher than the background concentrations, then the CDF may be having an impact on the water quality in Calumet Harbor. During dredging and disposal events, excess water from the CDF is discharged into the Calumet River through one of two filters. The river samples are collected upstream, adjacent to, and downstream of the filter cell discharge point in order to determine the impact of the CDF effluent discharge on the water quality in the river. The landing well data is difficult to interpret because the shallow depth groundwater gradient from Iroquois Landing is toward, and thus may influence, the water quality within the CDF. As such, the landing well data mainly provides an indication of groundwater quality directly upgradient of the CDF.

3.3 Target Analytes for Water Quality Samples

The target parameters for routine monitoring events include metals (Chromium, Manganese, Zinc), nutrients (Total Phosphorus, Ammonia as Nitrogen, Total Kjeldahl Nitrogen - TKN), pH, Total Suspended Solids (TSS), and Total Dissolved Solids (TDS). The detection limits required in the monitoring plan for these parameters are in Table 2. The laboratory analyses for the three events were subcontracted by MAXIM Technologies Inc. of St. Louis, Missouri to Accutest, Houston, Texas. The analytical scope of work for these events is included in Appendix B.

Table 2: Detection Limits for Routine Monitoring Parameters

Parameter	Required Detection Limit
Chromium (total)	0.005
Manganese (total)	0.005
Zinc (total)	0.005
Total Phosphorus	0.01
Ammonia as Nitrogen	0.01
Total Kjeldahl Nitrogen	0.1
Total Suspended Solids	5.0
Total Dissolved Solids	5.0
pH	1.0 - 14.0

3.4 Standard Operating Procedure for Routine Monitoring at Chicago CDF

A copy of the supply list is included as part of the scope of work in Appendix B. Based on the experiences of the monitoring event conducted in September 1997, a new Standard Operating Procedure (SOP) was developed for routine water quality monitoring events at the Chicago CDF. A copy of the SOP checklist is included in Appendix C.

4 ROUTINE WATER QUALITY MONITORING EVENTS, WY 2001

This section will report and discuss the results of analytical data from the three sampling events conducted at the Chicago CDF during the WY 01 monitoring events, October 2000, April 2001, and August 2001.

4.1 Water Quality Data

The analytical data for each of the three monitoring events listed above is provided in detail in Appendices D-F. The data is also summarized in Tables 3A-3C. Concentrations for each of the target parameters are given for each of the fifteen monitoring sample locations, as well as the detection limits achieved by the laboratory for each of those parameters. A non-detect value is listed as "<" in the tables. ND is defined as no data. N/A is defined as insufficient data to perform calculation. All of the values are reported in milligrams per liter (mg/L). Due to problems with a dedicated bailer lodged in well CH-18-81, only limited data was available from this landing station in water year 2001.

The analytical results are also shown graphically in Figure 3A-3H. Each figure shows a bar graph of the concentrations of a given target parameter for all of the sampling points. The sampling locations 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, 19-81, 20-81). For each of the locations, three concentrations are given, corresponding to the three monitoring events. In addition, the detection limit achieved by the laboratory is provided for comparison. Data points for non-detect values are plotted on the figures. These non-detect values can be compared with the detection limits thereby showing their frequency of occurrence.

Table 3A: Analytical Data Summary for Chicago CDF Water Quality Monitoring, 25 October 2000

	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	0.0038	0.0105	0.097	0.31	0.1	0.01	171	6
BACK-002	0.0065	0.0203	0.065	0.41	0.34	0.02	168	8.0
BACK-003	0.0164	0.0075	0.124	0.5	0.13	0.01	166	2
ND-Comp-001	0.0154	0.0125	0.0686	0.51	0.12	0.02	184	7
ND-Comp-002	0.0186	0.0188	0.115	0.44	0.12	0.03	176	9
ND-Comp-003	0.0142	0.0161	0.0911	0.47	0.13	0.07	173	7
RIV-001	0.0081	0.0542	0.080	0.37	0.29	0.03	182	33
RIV-002	0.0071	0.18	0.125	0.47	0.42	<0.010	181	90
RIV-003	0.0207	0.0686	0.0529	0.4	0.32	0.05	186	44
CDF-001	0.0117	0.0677	0.14	2	0.93	0.05	340	9
CDF-002	0.0048	0.0472	0.063	1.8	1	0.06	610	9
CDF-003	0.0199	0.042	0.0613	1.6	0.83	0.03	337	8
CH-18-81	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*
CH-19-81	0.0124	0.104	0.603	5.9	6.1	0.05	517	49
CH-20-81	0.0028	0.022	0.0838	0.29	0.17	0.05	1250	13
Detection limit	<0.0025	<0.0015	<0.0025	<0.01	<0.01	<0.01	<5	<1

* ND = No Data

Table 3B: Analytical Data Summary for Chicago Area CDF Water Quality Monitoring, 26 April 2001

	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	<0.0025	0.019	0.026	0.4	0.14	0.02	233	16
BACK-002	<0.0025	0.0065	0.016	0.28	0.091	0.02	176	6.0
BACK-003	<0.0025	0.006	0.023	0.33	0.067	0.02	193	5
ND-Comp-001	<0.0025	0.0112	0.0265	0.45	0.22	0.02	180	10
ND-Comp-002	<0.0025	0.0082	0.0287	0.23	0.07	0.02	177	7
ND-Comp-003	<0.0025	0.0101	0.062	0.37	0.083	0.02	181	7
RIV-001	<0.0025	0.0304	0.030	0.69	0.31	0.03	371	13
RIV-002	<0.0025	0.0337	0.0224	0.65	0.25	0.03	389	21
RIV-003	<0.0025	0.0344	0.0255	0.85	0.4	0.03	389	16
CDF-001	<0.0025	0.0409	0.031	3	1.7	0.07	360	12
CDF-002	0.0458	0.775	0.615	3.1	0.055	0.07	347	9
CDF-003	<0.0025	0.0372	0.0247	2.8	1.8	0.08	364	9
CH-18-81	<0.0025	0.0256	0.026	0.95	0.73	0.03	457	8
CH-19-81	<0.0025	0.0155	0.0304	5.9	4.9	0.02	540	1
CH-20-81	<0.0025	0.0047	0.0333	0.14	0.03	0.03	ND*	ND*
Detection limit	<0.0025	<0.0025	<0.0075**	<0.1	<0.01	<0.01	<5	<1

* ND = No Data

** Scope reporting limit was exceeded.

Table 3C: Analytical Data Summary for Chicago Area CDF Water Quality Monitoring, 15 August 2001

	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	<0.0025	0.0097	0.0207	0.43	0.42	0.020	159	6.0
BACK-002	<0.0025	0.0078	0.0264	0.57	0.16	0.030	162	3.0
BACK-003	<0.0025	0.0048	0.0348	0.43	0.15	0.030	166	2.0
ND-Comp-001	<0.0025	0.0105	0.0389	0.96	0.37	0.030	163	5.0
ND-Comp-002	<0.0025	0.0087	0.0280	0.54	0.27	0.020	162	4.0
ND-Comp-003	<0.0025	0.0053	0.0122	0.14	0.33	0.020	170	2.0
RIV-001	<0.0025	0.0114	0.0262	0.10	0.55	0.020	169	5
RIV-002	<0.0025	0.0075	0.031	0.70	0.19	0.030	169	3.0
RIV-003	<0.0025	0.0086	0.0286	0.74	0.11	0.030	164	4.0
CDF-001	0.0025	0.132	0.0412	1.1	0.43	0.11	355	25
CDF-002	0.0027	0.121	0.0400	1.9	0.38	0.10	350	23
CDF-003	0.003	0.116	0.0570	1.4	0.50	0.090	362	25
CH-18-81	0.0072	0.163	0.0650	3.0	2.6	0.050	536	93
CH-19-81	0.0029	0.0354	0.0311	7.3	6.4	0.040	556	24
CH-20-81	0.0032	0.0788	0.0279	0.41	0.10	0.040	1130	13
Detection limit	<0.0025	<0.0025	<0.0075*	<0.1	<0.01	<0.01	<5	<1

*Scope reporting limit was exceeded.

4.1.1 pH Data

In general, past samples collected from the Iroquois Landing wells tended to have higher pH readings for most of the target parameters compared to the pond, river, and harbor samples. This is not surprising, because the landing wells represent a significantly different environment than the other sampling locations. In the past, water quality in the Iroquois Landing monitoring wells tended to be poor. Historical data from 1983 to 1996 indicates that the groundwater in the landing area tends to have a high alkalinity and a high pH, which may be the result of alkaline steel mill waste used as fill material for the construction of the landing. Site water pH and site water temperatures were available only in the August field log. In the August field log, pH ranged from 7.4 in the landing wells to 9.08 in the CDF pond. Temperature ranged from 14.3 °C in the landing wells to 27 °C in the CDF pond.

4.1.2 Metals Data

The monitoring results for metals, including total chromium, manganese, and zinc, are shown in Figures 3A, 3B, and 3C, respectively. Chromium was detected in 14 samples from the 25 October 2000 monitoring event. However no Chromium sample was available on that date from well CH-18-81. Chromium was detected in the 26 April 2001 sample from surface water station CDF-002 at 0.0458 mg/L. All other chromium samples from that event were below detectable limits. The five August 15, 2001 chromium samples from the CDF stations and landing wells ranged from 0.0027 mg/L at CDF-002 to 0.0072 in well CH-18-81. The other nine chromium samples from the August sampling event were non-detects. Manganese concentrations above the detection limits were reported for 44 of the samples from the three events including the landing well samples, which had concentrations as high as 0.163 mg/L and the CDF samples with

concentrations ranging from 0.042 mg/L to 0.775 mg/L. Zinc concentrations above a detection limit of 0.005 mg/L were detected in 44 of the samples from all locations. Zinc concentrations ranged from 0.0122 mg/L in near dike composite sample 003 to 0.615 mg/L in CDF pond sample 002.

4.1.3 *Nutrients Data*

The monitoring results for microbiological nutrients, including Total Kjeldahl Nitrogen (TKN), Ammonia as Nitrogen, and Total Phosphorus, are shown in Figures 3D, 3E, and 3F, respectively. TKN was found above the detectable limit of 0.1 mg/L in 44 samples. TKN concentrations ranged from 0.10 mg/L to 7.3 mg/L. The higher concentration was in well CH-19-81. Ammonia Nitrogen concentrations above the detectable limit of 0.01 mg/L were found in 44 samples ranging from 0.10 mg/L to 6.4 mg/L**.** The higher ammonia as nitrogen concentrations were found at the CDF stations and in the landing wells. Phosphorus concentrations were found in 43 samples ranging from 0.01 mg/L, to 0.11 mg/L. The higher concentrations were at the CDF stations and in the landing wells.

4.1.4 Solids Data

The monitoring results for Total Dissolved Solids and Total Suspended Solids are shown in Figures 3G and 3H, respectively. Dissolved solids concentrations ranged from around 159 to 389 mg/L for the river and harbor samples, with levels in the high range for the CDF pond samples. The dissolved solids in the landing wells were significantly higher, ranging from 457 to 1250 mg/L. TSS levels in the river, harbor, and CDF pond samples were all below 90 mg/L. The landing well samples had widely varying TSS concentrations, ranging from 1 mg/L to as high as 93 mg/L.

4.2 Quality Assurance/Quality Control

The purpose of the data collection and analyses is to determine if there is reason to believe that the CDF is operating effectively by preventing the monitored pollutants from entering Calumet Harbor and Calumet River. 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-G. 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 otherwise acceptable. Positive exceptions were noted. Any negative exceptions were noted in the assessments in the appendices. The data is acceptable and 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, (2) near-dike harbor composites, (3) river, (4) CDF pond, and (5) landing wells. For the current monitoring plan, a Microsoft Excel spreadsheet program is used in the

statistical analysis of the contaminant concentrations in each of the sampling environments. The printouts for each parameter and station in each event are provided in Appendices D-G.

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. There are three stations per designation type. The program then summarizes the completeness, count, mean, and variance for that particular 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 no statistical analysis can be performed for that sampling environment. 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 value, 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"*.

4.3 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 Calumet 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 would suggest that the water outside the CDF dike wall might be affected by seepage of contaminants from the CDF pond, causing higher concentrations relative to background. For the current monitoring period, which includes the sampling events of October 2000, April 2001, and August 2001, the results of 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.

4.3.1 Metals

The chromium concentrations were non-detectable for the April and August sampling events. As such, statistical analysis could be performed and comparisons are discussed only for the October sampling event as shown in Table 5A. October chromium concentrations were not significantly different for the four sampling environments for which a comparison could be made. There was not enough data to make a comparison for chromium in the landing wells in October. April 2001 chromium concentrations were all non-detect except for one CDF sample. Therefore chromium statistical comparisons for April are not applicable.

For two sampling events (October 2000, and August 2001) manganese concentrations in the Chicago CDF were higher than the background, and near-dike concentrations (Table 5B). In the August 2001 sample event, CDF sample manganese concentrations were also significantly higher than the river concentrations. For the April 2001 event, Calumet River manganese concentrations were higher than background and near dike location concentrations. Also, landing (CH) manganese concentrations were lower than Calumet River sample concentrations from the April 2001 event. Finally, the zinc concentrations in the three sampling event data sets of this reporting period were not significantly different between sampling environments, except the August 2001 event where the river zinc concentration was lower than the CDF concentration.

4.3.2 Nutrients

Detectable nutrient concentrations allowed all water year 2001 statistical comparisons in tables 5D, 5E, and 5F to be made. For October 2000 and April and August 2001 events, CDF TKN concentrations were significantly higher than background, near dike, and river TKN concentrations except for August 2001. The August 2001 CDF TKN concentration sample population was not considered statistically different from the near dike sample population. April 2001 event river TKN concentrations were considered significantly higher than background and near dike concentrations. TKN is reported in table 5D. For Ammonia-Nitrogen (NH_3-N) reported in table 5E, all the data was available except October 2000 landing sample 1. Therefore there was insufficient data to do a statistical comparison for ammonia for this event's landing data. The two other event landing (CH) ammonia data comparisons showed no significant differences for the four environments. October 2000 Calumet River ammonia concentrations were statistically higher than the near dike composite concentrations. April 2001 Calumet River ammonia concentrations were statistically higher than the background and near dike concentrations. October 2000 CDF ammonia concentrations were significantly higher than the background, near-dike, and Calumet River concentrations. Statistical data analysis for Phosphorus (Table 5F) suggests that the April 2001 and August 2001 CDF sample concentration magnitudes are significantly higher than the near dike, background, and river concentrations and higher than the October 2000 background concentrations. The April 2001 river phosphorus sample concentrations are higher than the background and near dike concentrations. The August 2001 landing (CH) phosphorus concentrations are significantly higher than the background, near dike, river, and CDF pond concentrations.

4.3.3 Solids

Magnitude comparison of averages showed that the Iroquois Landing wells contained more Total Dissolved Solids (TDS) than all of the other sampling environments (Table 5G) in October 2000, April 2001, and August 2001. During water year 2001 there may have been less routine data to confirm the significance of the previous statement. A large amount of dredged material from the river and harbor was placed in the CDF during the year. Some of it could have been placed the day before, during, or after the days when routine monitoring events occurred. With the exception of the August 2001 landing samples, separate statistical analysis of the landing samples could not be performed because there were only two TDS samples each for the other two routine events. The CDF pond TDS sample concentrations were significantly higher than the background, and near dike composite samples for the April and August 2001 sampling events. The

CDF pond TDS sample concentrations were lower than the Calumet River TDS sample concentrations from April and higher than the TDS river sample concentrations from August. The October 2000 CDF TDS sample concentrations were also significantly higher than the October background samples. October 2000 TDS Calumet River sample concentrations were also higher than background sample concentrations.

With respect to Total Suspended Solids (TSS), there was not sufficient data to perform the statistical analysis for the October 2000 and April 2001 landing events (Table 5H). The TSS statistical analysis for the August 2001 event indicated no significant differences between the landing and the other four sampling locations. Data from the August 2001 event indicated that the CDF pond TSS concentration levels were higher than the background, near dike, and river samples. The October 2000 data indicates that the TSS Calumet River concentrations were higher than the background concentrations. The April 2001 data indicates that the Calumet River TSS concentrations were higher than the near dike TSS concentrations for that event.

4.4 Discussion of Results

Many of the results of the statistical analysis were inconclusive due to the fact that there was limited data. For example, if the data set for a given sampling environment contains less than three detectable concentrations, it is not possible to perform the statistical analysis (i.e. no mean or variance is calculated for fewer than three data points). As a result, some of the statistical comparisons were designated as (N/A), indicating that there was insufficient data to perform the statistical analysis.

A similar situation may also occur when the calculated variance is too high to indicate a statistically significant difference between two different sampling location environments. The TSS data was like this for some location environments. For example this high variance is found in the case of the August 2001 TSS landing well data (Table 5H column CH) versus the CDF pond data. Calculated variance can be too high to indicate a statistically significant difference between two different sampling environments. It is important to consider all the reasons for high variance in a population group. For example ammonia and TKN concentrations in the landing well samples appear to be higher than the other sampling locations based on visual inspection of the data in Figures 3D and 3E. However, for both of these parameters, the statistical analysis yielded a comparison of "OK". This simply means that the null hypothesis (H_0) is not rejected, and there was insufficient information from the statistical procedure to conclude that the two data sets were from statistically different populations. This apparent contradiction resulted because the variance of the landing well samples for these parameters was much greater than for the other sampling environments. The high variance was due to the fact that there were limited data points (in this case, three data points) to calculate the variance. As a result using statistical procedures only, it was not possible to positively conclude that the ammonia and TKN levels in the wells are from a statistically different population than the other locations. The TKN and ammonia concentrations in the samples from well CH-19-81 were observed to be visually higher than the river, harbor, and CDF pond samples. Therefore in the case of well CH-19-81 the visual observation of the graphed data is a better indicator for this well than the statistical procedure.

As such, visual inspection of the data may be necessary to aid in identification of potential differences in the data sets when the data is limited. With a greater number of data points in each data set, the likelihood of having too few sample points to perform the statistical analysis would be significantly reduced. Also, with a greater number of data points, the variance for widely varying parameters (such as ammonia for the landing well samples) may not be as great.

One of the data points (from well CH-20-81, row 3) may be in a significantly different sampling environment than the other two well points thus contributing to the high variance. Monitoring well station CH-20-81 is represented by row number 3 in column CH in table 5H. The station may be located in a different environment than wells CH-19-81 and CH-18-81. It is upgradient of the CDF pond and its cap is at a higher elevation than the other landing wells. Although the well intake screen is placed at the same level as the other two landing wells, the measured water level is generally higher than the measured water level in the other two wells. The well is placed in a rise near a fence separating Calumet Park from the vacant part of Iroquois landing. The soil at this well may be different than that at the other wells. The lower TSS concentrations at this well may be due to sandy soil or the influence of cleaner water from Calumet Park. TSS results from well CH-20-81 appear to be lower than those found at the other two landing wells. This was the case even in the previous monitoring program of the 1980s. The background TSS concentration ranges from 2 to 16 mg/L. The near dike TSS concentration ranges from 2 to 10 mg/L. Other parameters from well CH-20-81, however, including chromium, manganese, and phosphorus do not appear to show an excessive variance. Keeping this in mind, Chicago District USACE will continue to consider all three well data points as one sampling environment.

Combining the results of the statistical analysis with the visual inspection of water quality data, it is possible to draw some preliminary conclusions about the water quality in and around the Chicago CDF. Based on visual inspection of the data, it appears that the CDF pond samples have higher concentrations of metals, TKN, and ammonia than the other sampling environments except the landing wells (for some samples). However, none of the statistical comparisons indicated that the near-dike composite samples significantly exceeded the background concentrations for any of the parameters in WY 2001. As such, the dike appears to be effective in preventing the water from the CDF from affecting the water quality in Calumet Harbor.

4.4 Water Level Data

Water level is continuously measured at two nearby gage stations. The National Oceanographic and Atmospheric Administration (NOAA) maintains a continuous water level monitoring station at Calumet Harbor (Station #7044). In addition, the U.S. Geological Survey (USGS) maintains a continuous water level monitoring station within the CDF pond. Hourly data from these stations is used to compute and then compare the daily mean elevations in Calumet Harbor with the daily mean elevations in the CDF pond.

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

	Elevation Expressed from Low Water Datum 1955			Remark
Location/Date	10/25/2000	4/26/2001	8/15/2001	For this report
CDF Pond 1955	0.24	-0.23	0.28	Daily Mean USGS
Calumet Harbor 1955	0.02	-0.39	0.09	Daily Mean NOAA

Piezometric data collected from wells CH-18-81 (CH 1), CH-19-81 (CH 2), and CH-20-81 (CH 3) only available for the August 2001 monitoring event is given in the Appendix F field log. A comparison between daily mean CDF pond and Calumet harbor water levels is shown in table 4. The water elevations for the CDF pond and Calumet Harbor stations are shown graphically in Figure 4. For the period from October 2000 to September 2001, the mean pond surface water levels in the CDF ranged from 0.77 ft above 1955 low water datum to 1.06 ft below 1955 low water datum. The daily mean Calumet harbor water elevation ranged from 1.31 ft above 1955 low water datum to 1.11 ft below 1955 low water datum.

5 CONCLUSIONS

The water quality data collected at the Chicago Area Confined Disposal Facility during the WY 2001 monitoring period represented the fourth set of monitoring data obtained under the Illinois EPA 1997 water quality permit. As part of this new permit, USACE initiated a revised water quality monitoring plan which is intended to provide more useful data than in the previous plan, while at the same time reducing the frequency of sampling, number of target parameters, and the overall monitoring cost. The new monitoring plan provides data to perform statistical comparisons of water quality in different sampling environments in and around Chicago CDF. Based on the water quality data and the statistical analysis for the three WY 2001 sampling events, it does not appear that the waters of Calumet Harbor or Calumet River are being adversely impacted by water from 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) Water Quality Monitoring at the Chicago Area Confined Disposal Facility, Calumet Harbor, IL, revised monitoring plan prepared by USACE, Chicago District, 2/6/97.

(5) 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.

(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 (OCT 98 - SEP 99) 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 (OCT 1999-SEP 2000) prepared by USACE, Chicago District, September 2001.

APPENDIX A

IEPA Water Quality Permit Application And Approved Permit

APPENDIX B

Analytical Scope of Work

APPENDIX C

Standard Operating Procedure
For
Routine Monitoring Events at Chicago CDF

APPENDIX D

October 2000 Sampling Event

APPENDIX E

April 2001 Sampling Event

APPENDIX F

August 2001 Sampling Event

Field Log
October 2000

Analytical Data Summary
and
Statistical Analysis
October 2000

Data Quality Assessment
October 2000

Final Laboratory Data Package
October 2000

Field Log
April 2001

Analytical Data Summary
and
Statistical Analysis
April 2001

Data Quality Assessment
April 2001

Final Laboratory Data Package
April 2001

Field Log
August 2001

Analytical Data Summary
and
Statistical Analysis
August 2001

Data Quality Assessment
August 2001

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