WATER QUALITY MONITORING REPORT
FOR
ROUTINE MONITORING EVENTS
AT
CHICAGO AREA CONFINED DISPOSAL FACILITY
WATER YEAR 2000
(OCTOBER 1999 – SEPTEMBER 2000)

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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 October 1999 to September 2000. The report includes data from routine monitoring events conducted in December 1999, April 2000, and August 2000. 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 1982-1984, 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 2000, approximately 400,000 cubic yards of mechanically dredged sediments had been placed into the facility. 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 (Reference 3 and 4).

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. As of Water Year (WY) 2000, the CDF has been used for six dredging and disposal operations since its construction. Each of these operations involved mechanical dredging. Information on these dredging events is summarized in Table 1. Separate reports cover the dredging and dredged material disposal monitoring 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

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. This most recent permit is provided for reference as part of Appendix A. This permit included significant revisions to the previous water quality monitoring plan. The permit incorporates by reference the USACE document, entitled *Water Quality Monitoring at the Chicago Area Confined Disposal Facility, Calumet Harbor, IL*, dated February 6, 1997. This document outlined the proposed modifications to the monitoring plan. It is also included in Appendix A of this report.

This is the third report for Chicago CDF water quality data collected and analyzed under the revised monitoring plan. Discussion of the old monitoring plan is provided in Appendix A of 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 also (reference 5).

3.1.1 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 set of target parameters, as outlined in Reference 5. 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 November-December. For Water Year 2000 (WY 00) covered by this report, three routine sampling events were conducted as required. Routine trimester monitoring events were conducted in December 1999, April 2000, and July 2000. The results of the three routine monitoring events are discussed in Section 4.

3.1.2 Monitoring for Dredging Events

The current overall monitoring plan also includes a separate sampling and analytical protocol for water and sediment quality monitoring before, during, and after dredging. This information is provided in separate reports of dredging and disposal monitoring. Therefore, monitoring for dredging events and dredged material disposal operations are not discussed in this report.

3.2 Sampling Locations for Routine Monitoring Events

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:

a) Background- three background samples collected from Lake Michigan about 1000 feet away from the dike (BACK-001, BACK-002, BACK-003). 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.

b) Near-Dike- three composite samples collected in Calumet Harbor near the edge of the dike (ND-COMP-001, ND-COMP-002, ND-COMP-003). 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.

c) 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). 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

d) CDF Pond- three samples within the CDF pond (CDF-001, CDF-002, CDF-003). 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.

e) 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 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. The laboratory achieved detection limits varied from sampling event to sampling event.

Table 2: Detection Limits for Routine Monitoring Parameters

Parameter	Required Detection Limit (mg/L)
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

3.4 Standard Operating Procedure for Routine Monitoring at Chicago CDF

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 is included in Appendix C.

4 ROUTINE WATER QUALITY MONITORING EVENTS, WY 2000

This section will report and discuss the results of analytical data from the three sampling events conducted at the Chicago CDF during the WY 2000 monitoring events, December 1999, April 2000, and July 2000.

4.1 Water Quality Data

The analytical data for each of the three monitoring events listed above is provided in detail in Appendix D through Appendix F. The data is also summarized in Table 3A through Table 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. All of the values are reported in milligrams per liter (mg/L).

A cross event comparison of tables 3A through 3C has been made to express general concentration ranges for the Water Year 2000. This comparison uses some location versus magnitude comparisons where possible. See paragraphs 4.1.2 through 4.1.4 of this report.

The analytical results for December 1999 through July 2000 are also shown graphically in Figure 3A through 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, (b) Near-Dike Samples, (c) River Samples, (d) CDF Pond Samples, and (e) Landing Well Samples. For each of the locations, three concentrations are given, corresponding to the three monitoring events in order from December 1999 to July 2000. The order is from left to right. This order is shown in the legend for each graph. In addition, the detection limit achieved by the laboratory is provided for comparison. Data points for detect and non-detect values are plotted on the figures. These values can be compared with the laboratory detection limits thereby showing their frequency of occurrence.

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 has tended to be poor. This year landing well pH data was not available due to a meter malfunction. Some partial grab sample pH and temperature data from some of the other stations is available in the field logs in the data Appendices D through F.

Table 3A: Analytical Data Summary for Chicago CDF Water Quality Monitoring, 2 December 1999

Sample	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	<0.002	0.004	0.038	<0.1	0.018	0.01	187	6
BACK-002	<0.002	0.003	0.012	<0.1	<0.01	0.01	174	4.0
BACK-003	<0.002	0.003	0.027	<0.1	0.058	0.01	181	4
ND-Comp-001	<0.002	0.004	0.114	<0.1	<0.01	0.01	185	8
ND-Comp-002	<0.002	0.003	0.026	<0.1	<0.01	<0.01	189	6
ND-Comp-003	<0.002	0.002	0.044	0.119	0.045	<0.01	182	4
RIV-001	<0.002	0.014	0.060	0.121	0.144	0.01	208	6
RIV-002	<0.002	0.008	0.435	<0.1	<0.01	0.01	207	7
RIV-003	<0.002	0.009	0.023	0.14	0.143	0.02	206	7
CDF-001	<0.002	0.02	0.021	0.772	0.452	0.03	286	5
CDF-002	<0.002	0.083	0.041	0.834	0.546	0.03	284	32
CDF-003	<0.002	0.023	0.024	0.759	0.36	0.03	283	11
CH-18-81	0.009	0.42	0.558	6.8	4.9	0.15	1240	860
CH-19-81	0.004	1.17	0.144	8.77	7.34	0.17	491	365
CH-20-81	<0.002	0.088	0.059	0.103	0.054	0.03	998	3
Detection limit	<0.002	<0.002	<0.005	<0.1	<0.01	<0.01	<5	<1

< detectable limit.

Table 3B: Analytical Data Summary for Chicago Area CDF Water Quality Monitoring 26 Apr 2000

Sample	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	0.125	0.78	0.092	0.03	206	17
BACK-002	<0.0025	0.0114	0.0964	0.66	0.12	0.03	174	14.0
BACK-003	<0.0025	0.0099	0.0734	0.56	0.11	0.02	173	8
ND-Comp-001	<0.0025	0.0143	0.114	0.53	0.097	0.02	192	13
ND-Comp-002	<0.0025	0.0099	0.0746	0.46	0.098	0.02	172	12
ND-Comp-003	<0.0025	0.0075	0.0434	0.42	0.079	0.01	170	10
RIV-001	<0.0025	0.0279	0.079	0.71	0.16	0.02	356	12
RIV-002	<0.0025	0.0275	0.0521	0.63	0.16	0.03	342	12
RIV-003	<0.0025	0.0308	0.0576	0.71	0.18	0.04	354	12
CDF-001	<0.0025	0.0691	0.194	1.7	0.76	0.06	269	21
CDF-002	<0.0025	0.0691	0.182	1.5	0.8	0.06	273	21
CDF-003	<0.003	0.0735	0.0647	0.9	0.73	0.07	273	21
CH-18-81	0.021	0.264	0.142	2.1	0.24	0.17	630	196
CH-19-81	<0.0025	0.0515	0.0818	5.9	4.8	0.02	609	23
CH-20-81	<0.0025	0.0168	0.206	0.25	0.096	0.03	1030	4
Detection limit	<0.0025	<0.0025	<0.0075	<0.1	<0.025	<0.01	<5	<1

< detectable limit.

Table 3C: Analytical Data Summary for Chicago Area CDF Water Quality Monitoring, 19 July 2000

Sample	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	0.0078	0.0098	0.43	0.042	0.01	158	8
BACK-002	<0.0025	0.0044	0.01	0.41	0.13	0.01	155	4.0
BACK-003	<0.0025	0.0042	0.0114	0.39	0.1	0.01	155	3
ND-Comp-001	<0.0025	0.0065	0.0083	0.30	0.11	0.01	160	5
ND-Comp-002	<0.0025	0.0061	0.0108	0.28	0.068	0.01	163	7
ND-Comp-003	<0.0025	0.0062	0.0185	0.31	0.21	0.01	166	6
RIV-001	<0.0025	0.0088	0.005	0.39	0.05	0.01	157	7
RIV-002	<0.0025	0.0145	0.0082	0.21	0.096	0.01	156	8
RIV-003	<0.0025	0.0179	0.0078	0.26	0.065	0.01	156	12
CDF-001	0.0025	0.0753	0.0364	1.1	0.34	0.05	294	26
CDF-002	<0.0025	0.0608	0.017	1.1	0.32	0.05	282	19
CDF-003	<0.0025	0.0581	0.0239	1.2	0.28	0.05	297	18
CH-18-81	<0.0025	0.0138	0.010	2.7	1.8	0.1	771	64
CH-19-81	<0.0025	0.0141	0.0124	4.3	3.8	0.01	549	5
CH-20-81	0.0051	0.14	0.0542	0.24	0.24	0.02	1220	<1.0
Detection limit	<0.0025	<0.0025	<0.005	<0.1	<0.01	<0.01	<5	<1

< detectable limit.

4.1.2 Metals Data

The monitoring results for metals, including total Chromium, Manganese, and Zinc, are shown in Tables 3A, 3B, and 3C, respectively. Chromium was detected in two samples from well CH-18-81 and one sample each from wells CH-19-81 and CH-20-81. All other Chromium samples were below detectable limits. Manganese concentrations above the detection limits were reported for 45 of the samples including the landing well samples, which had concentrations as high as 1.17 mg/L. Manganese concentrations ranged from 0.002 mg/L in the outside dike sample ND-Comp-003 to 1.17 mg/L in landing well CH-19-81. Zinc concentrations were detected in 45 of the samples from all locations. Zinc concentrations ranged from 0.0078 mg/L in station RIV-003 to 0.558 mg/L in well CH-18-81.

***4.1.3** Nutrients Data*

The monitoring results for microbiological inorganic nutrients, including Total Kjeldahl Nitrogen (TKN), Ammonia as Nitrogen, and Total Phosphorus, are shown in Tables 3A, 3B, and 3C, respectively. TKN was found above the detectable limit of 0.1 mg/L in 39 samples. TKN concentrations ranged from 0.103 mg/L in well CH-20-81 to 8.77 mg/L in well CH-19-81. The higher concentrations were found in wells CH-18-81 and CH-19-81. Ammonia Nitrogen concentrations above the detectable limit of 0.01 mg/L were found in 40 samples ranging from 0.018 mg/L in BACK-001 to 7.34 mg/L in landing well CH-19-81**.** The laboratory could not meet the required detection limit of 0.01 mg/L for Ammonia Nitrogen for the 26 April 2000 event and met a detection limit of 0.025 mg/L.

The Ammonia concentrations for the April event in Table 3B are all above this limit therefore the detection limit met is acceptable. Phosphorus concentrations were found in 26 samples ranging from 0.02 mg/L in RIV-003, to 0.17 mg/L in landing well CH-19-81. The higher concentrations were found in landing wells CH-18-81 and CH-19-81. The total phosphorus required detection limit of 0.01 mg/L is the low end of the achievable limit range for EPA method 365.1 (reference 1). This phosphorus concentration was below the limit for 17 of the background, near dike and river samples this year.

4.1.4 Solids Data

The monitoring results for Total Dissolved Solids (TDS) and Total Suspended Solids (TSS) are shown in Tables 3A through 3C respectively. Dissolved solids concentrations ranged from 155 mg/L in BACK-002 and BACK-003 to 356 mg/L in RIV-001 for the river (RIV) and harbor (BACK and ND-Comp) samples, with levels ranging from 269 mg/L to 297 mg/L for the CDF pond samples. The dissolved solids in the landing wells were significantly higher, ranging from 491 to 1240 mg/L. The landing well samples had widely varying TSS concentrations, ranging from 3 mg/L to as high as 860 mg/L. The higher concentrations were in landing wells CH-18-81 and CH-19-81.

4.2 Quality Assurance/Quality Control

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 through F. 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 exceeded and therefore acceptable.

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, (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 in each event are provided in Appendices D through F.

In each spreadsheet, the analytical values of each parameter are summarized for each of the five sampling environments. 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 are 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 curve for that parameter in a given sampling environment. Based on the probability curves 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 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 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 December 1999, April 2000, and July 2000, 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 through 5H.

4.4.1 Metals

Chromium concentrations were mostly non-detect for the three sampling events. As such, no statistical analysis could be performed and all comparisons were labeled "N/A", as shown in Table 5A. For the three sampling events (December 1999, April 2000, and July 2000) Manganese concentrations in the Calumet River were significantly higher than the background, and near-dike concentrations (Table 5B). For the April and July 2000 events, CDF pond Manganese concentrations were significantly higher than background, near dike, and Calumet River. This limited data appears to indicate that the Manganese is successfully contained within the CDF. Finally, the Zinc concentrations in the three sampling event data sets of this reporting period were not significantly different between sampling environments, except for the July 2000 event where the River Zinc concentration was significantly lower than the background concentration and the CDF concentration. Table 5C indicates that the Zinc concentrations in the CDF were not significantly above background for this annual reporting period.

4.4.2 Nutrients

Non detectable nutrient concentrations prevented most December 1999 statistical comparisons in Tables 5D and 5E. For April and July 2000 events, CDF TKN concentrations were significantly higher than background, near dike, and river TKN concentrations. TKN is reported in Table 5D. For Ammonia-Nitrogen (NH_3-N) reported in table 5E, most of the data was non-detectable in the December 1999 event. Therefore there was insufficient data to do a statistical analysis for this event. The April and July 2000 events showed the CDF Ammonia concentrations to be significantly greater than the background, near-dike, and Calumet River concentrations. Table 5E also shows that 26 April 2000 Ammonia Nitrogen in the river is greater than background and the near dike concentrations. Statistical data analysis for Phosphorus (Table 5F) suggests that the December 1999 CDF sample concentration magnitudes are significantly higher than the background, and river concentrations. The April and July 2000 CDF Phosphorus concentrations are significantly greater than the background, near dike, and river concentrations.

4.4.3 Solids

Statistical analysis showed that the Iroquois Landing wells contained significantly higher Total Dissolved Solids (TDS) than all of the other sampling environments (Table 5G) in December 1999, April 2000, and July 2000. With the exception of the April 2000 River samples, CDF TDS sample concentrations were significantly higher than the background, near dike composite, and river samples for all three sampling events. April 2000 TDS river sample concentrations were significantly higher than CDF TDS sample concentrations. With respect to Total Suspended Solids (TSS), there was sufficient data to perform the statistical analysis for all three events (Table 5H). The TSS statistical analysis for December 1999 indicated no significant differences between four sampling environments. Data from the April and July 2000 events indicated that the CDF pond TSS levels were significantly greater than the background, near dike, and river samples.

4.5 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 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 is from a statistically different population than the other locations, even though this was the case based on visual observation of the data. The TKN and ammonia concentrations in the samples from wells 18 and 19 were observed to be visually higher than the river, harbor, and CDF pond samples. Therefore in this case the visual observation of the graphed data is a better indicator for the landing wells 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. However, the Chicago District, USACE also intends to make statistical comparisons of cumulative data sets obtained from sampling events over a number of monitoring periods (years). For example, future monitoring reports may include comparisons of water quality by season, based upon sampling data collected over a number of years. This will enhance the utility of the statistical analysis, because 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. Future water quality monitoring reports are therefore expected to make fuller use of the capabilities of the statistical analysis program.

Further 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 much 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 1 to 8mg/L. The near dike TSS concentration ranges from 1 to 12 mg/L. Other parameters, however, including phosphorus and TDS, 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.

By 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 landing wells have significantly higher concentrations of metals, nutrients, and solids than the other sampling environments. The CDF pond samples contained higher levels of some parameters, such as Manganese, Ammonia, Total, and Dissolved solids, compared with the background and near-dike samples. However, none of the statistical comparisons indicated that the near-dike composite samples significantly exceeded the background concentrations for any of the parameters except TKN and TDS in July 2000. The Calumet river concentrations of TDS, and Manganese significantly exceeded the near dike composite sample concentration mean in December 1999, April 2000, and July 2000. River concentrations of Ammonia, and TKN in April 2000 significantly exceeded near dike composite concentrations. The river concentrations of TDS, Ammonia, and Manganese significantly exceeded background concentrations for December 1999 and April 2000. The river concentrations of zinc were significantly lower than background for July 2000. The dike appears to be effective in preventing the water from the CDF from affecting the water quality in Calumet Harbor.

4.6 Water Level Data

Aside from the water quality data obtained during monitoring events, 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. Water level data is collected from the gage stations and landing wells to monitor any seepage communication through the boundaries of the CDF.

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

	Elevation Expressed from Low Water Datum 1955			Remark
Location/Date	12/2/1999	4/26/2000	7/19/2000	For this report
Well CH-20-81	1.37	3.77	No Data	CH 3
Well CH-19-81	5.5	4.1	No Data	CH 2
Well CH-18-81	1.46	2.81	No Data	CH 1
CDF Pond	-0.24	0.18	0.79	Daily Mean USGS
Calumet Harbor	-0.2	0.06	0.82	Daily Mean NOAA

Piezometric data collected from wells CH-18-81 (CH 1), CH-19-81 (CH 2), and CH-20-81 (CH 3) for the December 1999, through July 2000 monitoring events is shown in Table 4. A comparison between singular well water levels and daily mean CDF pond and Calumet harbor water levels is also shown in table 4 for the dates the well levels were measured. The wells monitored are all on the Iroquois landing shore of the CDF. These well water levels are greater than the CDF pond and Harbor levels. This indicates that the landing wells water levels continue to be up-gradient of the CDF pond water level. Even though the well screens for these wells are installed at +1.0 1955 Low Water Datum (LWD), their water levels are higher than the CDF pond level when measured during monitoring events. The computed daily mean water elevations for the CDF pond and Calumet Harbor stations are shown graphically in Figure 4. For the period from October 1999 to September 2000, the mean pond surface water levels in the CDF ranged from 0.6 ft above the daily mean harbor water elevation to 0.4 ft below the daily mean harbor water elevation.

5 CONCLUSIONS

The water quality data collected at the Chicago Area Confined Disposal Facility during the WY 2000 monitoring period represented the third 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 2000 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. Future monitoring reports will compile data from multiple monitoring periods to assess the long term impact of the Chicago CDF on the surrounding waters of Calumet Harbor and Calumet River.

6 REFERENCES

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