WATER QUALITY MONITORING REPORT
FOR
ROUTINE MONITORING EVENTS
AT
CHICAGO AREA CONFINED DISPOSAL FACILITY
WATER YEAR 99
(OCT 98 - SEP 99)

PREPARED BY:

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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 1998 to Sep 1999. The report includes data from routine monitoring events conducted in November 1998, April 1999, and August 1999. 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 1996, 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, 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 six dredging and disposal operations since its construction. Each of these operations involved mechanical dredging. The next dredging project is scheduled to begin in spring of 2000. Information on these dredging events is summarized in Table 1.

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. 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 3), which outlined the proposed modifications to the monitoring plan and was accepted by Illinois EPA, is also included in Appendix A. This is the second 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 previous 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 3.

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 November-December. For water year 1999 (WY 99) covered by this report, three routine sampling events were conducted as required. Routine trimester monitoring events were conducted in November 1998, April 1999, and August 1999. 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. No dredging & disposal events took place during the WY 99 monitoring period. 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 3.

3.2 Sampling Locations for Routine Monitoring Events

(a) A map of 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-shore 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 conducted by MAXIM Technologies Inc. of St. Louis, Missouri. 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

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 and the Equipment & Supply Checklist is included in Appendix C.

4 ROUTINE WATER QUALITY MONITORING EVENTS, WY 99

This section will report and discuss the results of analytical data from the three sampling events conducted at the Chicago CDF during the WY 99 monitoring period, November 1998, April 1999, August 1999.

4.1 Water Quality Data

The analytical data for each of the three monitoring events listed above is provided in detail in Appendix 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. All of the values are reported in milligrams per liter (mg/L).

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, (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 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, 12 November 1998

	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	0.00588	0.032	0.51	<0.05	0.02	174	4
BACK-002	<0.002	0.00516	0.0257	0.51	<0.05	0.02	163	5.0
BACK-003	<0.002	0.00477	0.0618	0.47	<0.05	0.03	170	4.0
ND-Comp-001	<0.002	0.00522	0.0207	0.53	<0.05	0.02	162	4
ND-Comp-002	<0.002	0.006	0.0313	0.5	<0.05	0.02	162	4
ND-Comp-003	<0.002	0.00766	0.0292	0.52	<0.05	0.03	160	2
RIV-001	<0.002	0.0159	0.031	0.52	<0.05	0.02	176	10
RIV-002	<0.002	0.0134	0.028	0.51	<0.05	0.02	170	8
RIV-003	<0.002	0.0176	0.0302	0.57	<0.05	0.02	174	11
CDF-001	<0.002	0.02	0.0323	1.3	0.38	0.04	240	10
CDF-002	<0.002	0.0205	0.045	1.1	0.37	0.04	234	7
CDF-003	<0.002	0.0212	0.0387	1.2	0.37	0.05	237	10
CH-18-81	<0.002	0.831	0.211	11.8	2.57	0.21	624	848
CH-19-81	<0.002	0.83	0.0976	6.73	5.07	0.02	468	209
CH-20-81	<0.002	0.0708	0.0644	0.5	<0.05	0.04	1020	5
Detection limit	<0.002	<0.001	<0.009*	<0.03	<0.05*	<0.01	<5	<1

*Scope reporting limit was exceeded.

Table 3B: Analytical Data Summary for Chicago Area CDF Water Quality Monitoring, 20 April 1999

	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	0.00274	0.00865	0.0155	0.52	0.103	0.02	181	8
BACK-002	<0.001	0.00953	0.0171	0.464	0.085	0.02	186	7.0
BACK-003	0.00783	0.0262	0.0662	0.459	0.077	0.03	190	3.0
ND-Comp-001	<0.001	0.0119	0.0206	0.55	0.116	0.16	201	12
ND-Comp-002	<0.001	0.00729	0.0138	0.282	0.091	0.03	177	7
ND-Comp-003	<0.001	0.00315	0.0124	0.48	0.091	0.03	189	4
RIV-001	0.00507	0.0193	0.0251	0.483	0.095	0.02	238	14
RIV-002	0.0172	0.0206	0.0148	0.539	0.18	0.02	240	11
RIV-003	<0.001	0.0248	0.0195	0.576	0.106	0.03	269	17
CDF-001	0.00972	0.0447	0.0251	1.11	0.376	0.03	253	7
CDF-002	0.0013	0.0425	0.028	1.22	0.401	0.04	251	10
CDF-003	<0.001	0.0489	0.0245	0.98	0.37	0.04	251	14
CH-18-81	0.0135	0.27	0.080	2.5	0.934	0.11	576	207
CH-19-81	<0.001	0.0314	0.0292	5.21	1.86	0.02	525	8
CH-20-81	0.00454	0.00925	0.018	0.535	0.114	0.07	1090	1
Detection limit	<0.001	<0.0008	<0.006*	<0.2	<0.05*	<0.01	<5	<1

*Scope reporting limit was exceeded.

Table 3C: Analytical Data Summary for Chicago Area CDF Water Quality Monitoring, 4 August 1999

	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	0.00673	0.0999	0.164	0.085	< 0.01	179	3
BACK-002	<0.002	0.00276	0.0452	0.117	0.085	< 0.01	176	1.0
BACK-003	<0.002	0.00322	0.162	0.275	0.187	<0.01	173	1.0
ND-Comp-001	< 0.002	0.00328	0.116	0.14	0.126	<0.01	181	3
ND-Comp-002	< 0.002	0.0185	0.061	0.174	0.097	0.01	172	1
ND-Comp-003	< 0.002	0.00329	0.0308	0.175	0.095	0.01	173	1
RIV-001	< 0.002	0.00334	0.0343	0.225	0.151	<0.01	159	2
RIV-002	<0.002	0.00436	0.0308	0.131	0.102	< 0.01	164	2
RIV-003	<0.002	0.00391	0.0467	0.228	0.17	<0.01	168	2
CDF-001	0.0024	0.0732	0.0332	0.884	0.208	0.07	246	22
CDF-002	0.00358	0.0687	0.0618	1.26	0.194	0.06	244	19
CDF-003	0.00287	0.056	0.0952	0.998	0.144	0.07	284	16
CH-18-81	0.015	0.297	0.118	5.44	3.17	0.15	925	303
CH-19-81	0.0142	0.506	0.076	5.38	5.12	0.06	497	181
CH-20-81	<0.002	0.0659	0.0199	0.364	0.195	0.05	1090	2
Detection limit	0.002	0.002	0.015*	0.1	0.05*	0.01	5	1

*Scope reporting limit was exceeded.

4.1.1 pH Data

In general, the samples collected from the Iroquois Landing wells tended to have higher concentrations 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. In the three monitoring events discussed here, pH was measured but alkalinity was not measured. The pH readings are shown in the field logs for each event, which are provided in Appendices D-F. The pH data is summarized in Table 4. This data shows a fluctuation of landing well water pH from neutral to highly basic.

Table 4A: Summary of pH Data at Iroquois Landing Wells

	Nov 1998	April 1999	August 1999
CH-18-81	9.2	7.99	8.0
CH-19-81	11.0	9.24	11.4
CH-20-81	7.0	7.72	7.4

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 two of the background samples, two river samples, five CDF samples, and four well samples.

Manganese concentrations above the detection limits were reported for all of the samples including the landing well samples, which had concentrations as high as 0.83 mg/L. Zinc concentrations above a detection limit of 0.005 mg/L were detected in all of the sampling locations.

4.1.3 *Nutrients Data*

The monitoring results for nutrients, including Total Kjeldahl Nitrogen (TKN), Ammonia as Nitrogen, and Total Phosphorus, are shown in Figures 3D, 3E, and 3F, respectively. For the monitoring plan in the aggregate, TKN concentrations ranged from 0.117 mg/L to 11.8 mg/L. Taken as a whole, the monitoring plan sample ammonia concentrations ranged from 0.077 mg/L to 5.12 mg/L**.** Typically, phosphorus concentrations ranged from non-detect to 0.075 mg/L, except for four samples above 0.10 mg/L from landing well 18 and a near dike sample.

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 160 to 270 mg/L for the river and harbor samples, with slightly higher levels in the CDF pond samples. The dissolved solids in the landing wells were significantly higher, ranging from 500 to 1100 mg/L. TSS levels in the river, harbor, and CDF pond samples were all below 25 mg/L. The landing well samples had widely varying TSS concentrations, ranging from non-detect to as high as 850 mg/L.

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-G. Holding time preservation requirements were met for all samples. Temperature preservation requirements were met for the November 1998 and April 1999 sampling events. Temperature requirements were not met for about a third of the August 99 samples. The reporting limits required in the WY 99 analytical scope of work were not met for the November 1998 event for zinc, ammonia, or phosphorus. However, the zinc and phosphorus sample concentrations in November were all above the lab achieved detection limits. So, these November 1998 detection limits are acceptable. The same reasoning applies to the April 1999 event.

The ammonia reporting limit (0.05 mg/L) achieved by the laboratory for the November event is greater than the reporting limit (0.01 mg/L) required in the scope of work. The phosphorus detection limit (0.01 mg/L) achieved by the laboratory for the three events was above the standard. With the exceptions noted above or 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, (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-G.

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 November 1998, April 1999, and August 1999, 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.

4.4.1 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, manganese concentrations in the CDF pond were significantly higher than the background, near-dike, and Calumet River (Table 5B). This appears to indicate that the manganese is successfully contained within the CDF. Calumet River manganese concentrations in November 1998 and April 1999 were significantly higher than the near dike concentrations. In November 1998 Calumet River manganese concentrations were also significantly higher than the background concentrations. There was no significant difference between the river, near dike, and background manganese sample concentrations. 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 April 1999 event where the CDF zinc concentration was significantly greater than the near dike concentration.

4.4.2 Nutrients

For all three sampling events the statistical analysis showed that Total Kjehldahl Nitrogen (TKN) concentrations in the CDF samples were significantly higher than the background, near-dike, and Calumet River samples (Table 5D). For Ammonia-Nitrogen (NH_3-N), most of the data was reported as non-detectable in the November 1998 event. Therefore there was insufficient data to do a statistical analysis for this event (Table 5E). The April 1999 event showed the CDF ammonia concentrations to be significantly greater than the background, near-dike, and Calumet River concentrations. The August 1999 event CDF ammonia nitrogen concentrations were significantly higher than the near dike concentrations. Statistical data analysis for Phosphorus (Table 5F) suggests that the November 1998 CDF sample concentration magnitudes are significantly higher than the near dike, background, and river concentrations. The April 1999 phosphorus CDF concentrations are significantly greater than the background 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 November 1998 and August 1999. The April 1999 TDS sample concentrations from the landing wells, CDF pond, and Calumet River were significantly higher than the background and near dike composite samples. The Calumet River samples showed significantly lower TDS levels than the background samples and near dike in August 1999, but higher levels than the background and near dike samples in April 1999. With respect to Total Suspended Solids, there was sufficient data to perform the statistical analysis for all three events (Table 5H). The statistical analysis for the November 1998 event indicated that the CDF pond TSS levels were significantly greater than the background, and near-dike samples. November 1998 Calumet River TSS sample levels were significantly higher than the background and near dike TSS levels. The April 1999 Calumet River TSS sample concentrations were significantly greater than the Calumet Harbor background TSS concentrations. The August 1999 CDF pond TSS sample concentrations were significantly greater than background, near dike, and Calumet River TSS sample concentrations.

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, many 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 ammonia, TKN, and 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). 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) will 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 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.

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 exceeded the background concentrations for any of the parameters. As such, 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.

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

	Elevation Expressed from Low Water Datum 1955			Remark
Location/Date	11/12/98	4/20/99	8/4/99	
Well CH-20-81	3.37	4.37	3.37	
Well CH-19-81	2.5	3.4	2.2	
Well CH-18-81	2.46	2.86	2.46	
CDF Pond	1.1	1.13	1.43	Daily Mean USGS
Calumet Harbor	0.95	1.05	1.41	Daily Mean NOAA

Piezometric data collected from wells CH-18-81, CH-19-81, and CH-20-81 for the November 1998, through August 1999 monitoring events is shown in table 4B. A comparison between singular well water levels and daily mean CDF pond and Calumet harbor water levels is also shown in table 4B. The wells monitored are all on the Iroquois landing shore of the CDF. These well water levels are greater than the CDF pond and Lake Elevations. Even though the well screen for these wells is installed at +1.0 1955 LWD, their water levels are for the most part 0.5 to 3 feet 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 August 1998 to August 1999, the mean pond surface water levels in the CDF ranged from 0.78 ft above the harbor water elevation to -0.12 ft below the harbor water elevation.

5 CONCLUSIONS

The water quality data collected at the Chicago Area Confined Disposal Facility during the WY 99 monitoring period represented the second 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 sampling events WY 99, 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

(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

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

November 1998 Sampling Event

APPENDIX E

April 1999 Sampling Event

APPENDIX F

August 1999 Sampling Event

Field Log

Analytical Data Summary
and
Statistical Analysis

Data Quality Assessment

Final Laboratory Data Package