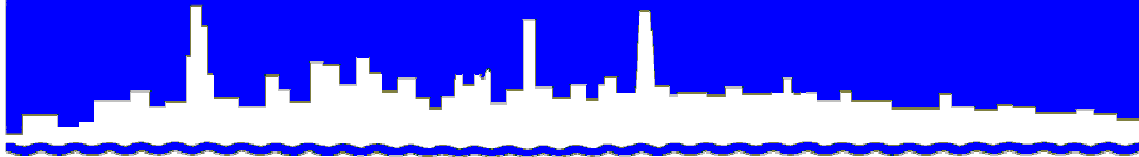


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***RESEARCH AND DEVELOPMENT
DEPARTMENT***

REPORT NO. 06-23

BIOMONITORING REPORT 2002-2004: CHRONIC WHOLE EFFLUENT TOXICITY (WET) ASSESSMENT OF EFFLUENTS FROM THE STICKNEY, NORTH SIDE, AND CALUMET WATER RECLAMATION PLANTS, 2002-2004, CONDUCTED BY THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO (DISTRICT), THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA), REGION V, AND THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA)

DECEMBER 2005

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May 2, 2006

Ms. Jo Lynn Traub
Director, Water Division
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Toby Frevert
Manager, Water Pollution Control
Bureau of Water
Illinois Environmental Protection Agency
1021 N. Grand Avenue East
Springfield, Illinois 62707

Dear Ms. Traub and Mr. Frevert:

Subject: Final Biomonitoring Report 2002-2004: Chronic Whole Effluent Toxicity (WET) Assessment of Effluents from the Stickney, North Side, and Calumet Water Reclamation Plants, 2002-2004, Conducted by the Metropolitan Water Reclamation District of Greater Chicago (District), the United States Environmental Protection Agency (USEPA), Region 5, and the Illinois Environmental Protection Agency (IEPA)

The final copy of the subject report, without the appendices, is attached. Copies of letters received from your agencies dated April 17, 2006, and February 8, 2006, respectively, indicating that your agencies had no comments regarding the draft of the subject final report, are also attached. The final report remains unchanged from the draft report except that a final report cover page has replaced the draft final report cover page.

As indicated in my letter of February 24, 2006, addressed to Ms. Rebecca L. Harvey and Mr. Toby Frevert (copy attached), the text of the final report will be posted on the District's web site with a notation that the appendices may be viewed in the offices of the District's Environmental Monitoring and Research Division at the Cecil Lue-Hing R&D Complex by appointment.

Ms. Jo Lynn Traub
Mr. Toby Frevert

2

May 2, 2006

Subject: Final Biomonitoring Report 2002-2004: Chronic Whole Effluent Toxicity (WET) Assessment of Effluents from the Stickney, North Side, and Calumet Water Reclamation Plants, 2002-2004, Conducted by the Metropolitan Water Reclamation District of Greater Chicago (District), the United States Environmental Protection Agency (USEPA), Region 5, and the Illinois Environmental Protection Agency (IEPA)

The District greatly appreciates your cooperation during this entire study. We also hope that our partnerships will continue in future projects as expressed by Ms. Traub in her letter dated April 17, 2006. Should you have any questions, please do not hesitate to call Dr. Thomas Granato, Assistant Director of Research and Development, Environmental Monitoring and Research Division, at (708) 588-4059.

Very truly yours,

Richard Lanyon
Director
Research and Development

RL:JTZ:rg
Attachments

Metropolitan Water Reclamation District of Greater Chicago

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BIOMONITORING REPORT
2002-2004

CHRONIC WHOLE EFFLUENT TOXICITY (WET) ASSESSMENT OF
EFFLUENTS FROM THE STICKNEY, NORTH SIDE, AND CALUMET WATER
RECLAMATION PLANTS, 2002-2004, CONDUCTED BY THE METROPOLITAN
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ACKNOWLEDGEMENTS

Dale MacDonald obtained the plant operating data discussed in this report. Dr. Ali Oskouie made valuable suggestions related to analysis of the plant operating data. Drs. Heng Zhang and Jain Jain reviewed the discussion of North Side WRP operating data. Ms. Rhonda Griffith typed this report. Dr. Thomas Granato reviewed this report.

The summary data contained in this report were presented at the Illinois Water Environment Association Conference in Rockford, Illinois, March 2005.

DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

SUMMARY AND CONCLUSIONS

In the summer of 2002, the Metropolitan Water Reclamation District of Greater Chicago (District) entered into a cooperative agreement (Agreement) with Region V of the United States Environmental Protection Agency (USEPA) and the Illinois Environmental Protection Agency (IEPA) to conduct a two-year chronic whole effluent toxicity (WET) assessment (Assessment) of the District's North Side, Stickney, and Calumet WRPs. The objective of this Assessment was to determine whether any chronic toxicity is associated with the effluents from these WRPs. The effluents from these WRPs are the dominant source of flow during low-flow periods in the deep-draft portions of the Calumet and Chicago River Systems and in the Lower Des Plaines River from Lockport to the confluence with the Kankakee River. Maintenance of a diverse aquatic community is the most sensitive environmental use within the General Use Waters of the Illinois Waterway starting at the I-55 Bridge southwest of Joliet. Chronic effluent toxicity or a lack thereof in the effluents from the North Side, Stickney, and Calumet WRPs is a vital issue for the USEPA, the IEPA, and the District.

As part of the Agreement the District and the USEPA Central Regional Laboratory (CRL) performed chronic WET tests consistent with sample collection and analytical laboratory procedures agreed to by a technical coordination group (TCG) composed of representatives of each of the three parties. The District conducted ten chronic WET tests using *Pimephales promelas* and *Ceriodaphnia dubia* on 24-hour composite effluent samples from each of these WRPs (a total of 30 pairs of WET tests), and the CRL conducted three chronic WET tests on split samples of these effluent samples using both of these organisms (a total of nine pairs of tests). These tests were conducted between October 2002 and November 2004.

No toxic effect on *Pimephales promelas* larval survival or growth due to Stickney, Calumet, or North Side WRP effluent was observed in any of the tests conducted in the District's WET Laboratory or the CRL. No toxic effect on *Ceriodaphnia dubia* survival or reproduction due to Stickney or Calumet WRP effluent was observed in any of the tests conducted in the District's Laboratory or the CRL. No toxic effect on *Ceriodaphnia dubia* survival or reproduction due to North Side WRP effluent was observed in any of the tests conducted in the CRL.

In the District Laboratory no observed effect concentration (NOEC) values of 75 percent effluent were observed for both *Ceriodaphnia* survival and *Ceriodaphnia* reproduction for the North Side WRP effluent samples collected during the week of July 21-26, 2003. In the District Laboratory an NOEC value of 75 percent effluent was also observed for *Ceriodaphnia dubia* survival for the North Side WRP effluent samples collected during the week of March 8-13, 2004. Other than the tests conducted on samples collected during the weeks of July 21-26, 2003, and on March 8-13, 2004, no toxic effect on *Ceriodaphnia dubia* survival or reproduction due to North Side WRP effluent was observed in any of the other North Side WRP tests.

Results of organic priority pollutant analysis suggested that a slug of methylene chloride may have entered the North Side WRP during a high flow event the week of July 21-26, 2003. Analysis of North Side WRP operating data also indicated that flows as high as 487 MGD occurred during the week prior to the March 8-13, 2004 WET test which may have caused operating parameters and effluent chemical composition to be different during that week than during the eight weeks where no observable toxicity was found. The District is addressing the current and future needs of the Stickney, Calumet, and North Side WRPs for handling wet weather flow.

In summation, the District and the CRL dedicated considerable resources to assess the final effluents from the Stickney, North Side, and Calumet WRPs for chronic toxicity during the period October 2002 through November 2004. Thirty chronic WET tests with *Pimephales promelas* and 30 chronic WET tests with *Ceriodaphnia dubia* were conducted in the District's WET Laboratory, and nine chronic WET tests with *Pimephales promelas* and 9 chronic WET tests with *Ceriodaphnia dubia* were conducted in CRL. The results of this study support the following conclusions:

- 1) Chronic toxicity is not associated with the effluents from the Stickney, Calumet, and North Side WRPs.
- 2) Effluents from the Stickney, Calumet, and North Side WRPs would not cause chronic toxicity problems in their receiving streams.
- 3) The District's Stickney, Calumet, and North Side WRPs provide exceptional quality wastewater treatment and will continue to do so.

The successful completion of this Assessment demonstrated how cooperation between different governmental agencies can resolve issues vital for all parties such as chronic effluent toxicity or a lack thereof associated with District WRPs.

INTRODUCTION

The District's Stickney, Calumet, and North Side WRPs serve a combined area of over 701 square miles with a service population of four and one-half million people. These WRPs treat an average of over 1,450 million gallons of sewage per day. The descriptive statistics for these three WRPs, taken from the District's M&O Facility Handbook (MWRD 2002c), are shown in Tables 1 through 3. The location of the Stickney, Calumet, and North Side facilities is shown in Figure 1.

An average annual flow of over 2,000 cubic feet of final effluent from these three WRPs per second enters the Chicago Waterway System (CWS) (Figure 1). Over seventy percent of the flow in the CWS is from these municipal WRPs. All flow from the CWS 740 square mile watershed discharges from the Chicago Sanitary and Ship Canal to the Des Plaines River north of the city of Joliet.

Toxicity Issues

As part of the normal regulatory process, in 1994 the IEPA issued draft National Pollutant Discharge Elimination System (NPDES) Permits for the District's Stickney, Calumet, and North Side WRPs after the existing NPDES Permits for these WRPs expired. The USEPA Region V Office reviewed these draft permits and identified a number of issues which had to be resolved before the draft permits could be approved. One of the most important issues to be resolved was whether the effluents from these WRPs contained toxic components. The Clean Water Act explicitly states that it is the national policy that the discharge of toxic substances in toxic amounts to the Nation's waters is prohibited. Various environmental groups and individual citizens had also expressed the concern that the effluents from these WRPs had to be monitored for chronic toxicity to aquatic life.

TABLE 1: STICKNEY WRP GENERAL DATA

Address	6001 W. Pershing Road, Cicero, IL
Service Area	259.8 square miles
Service Population	2,181,063 (1990)
Plant Area	570 acres
Type	Conventional Activated Sludge
Incoming Receptors	Salt Creek; West Side; Southwest #1; Southwest #2
Design Average Flow	1200 mgd
Design Maximum Flow	1440 mgd
Receiving Stream	Chicago Sanitary and Ship Canal
NPDES Permit Number	IL0028053
NPDES Permit Limitations	
BOD ₅	Maximum monthly average = 10 mg/L
SS	Maximum monthly average = 12 mg/L
NH ₃ -N	Maximum monthly average = 2.5 mg/L (April-Oct)
	Maximum monthly average = 5.0 mg/L (Nov-March)
Start-up Date	June 2, 1930 (West Side); May 23, 1939 (Southwest)

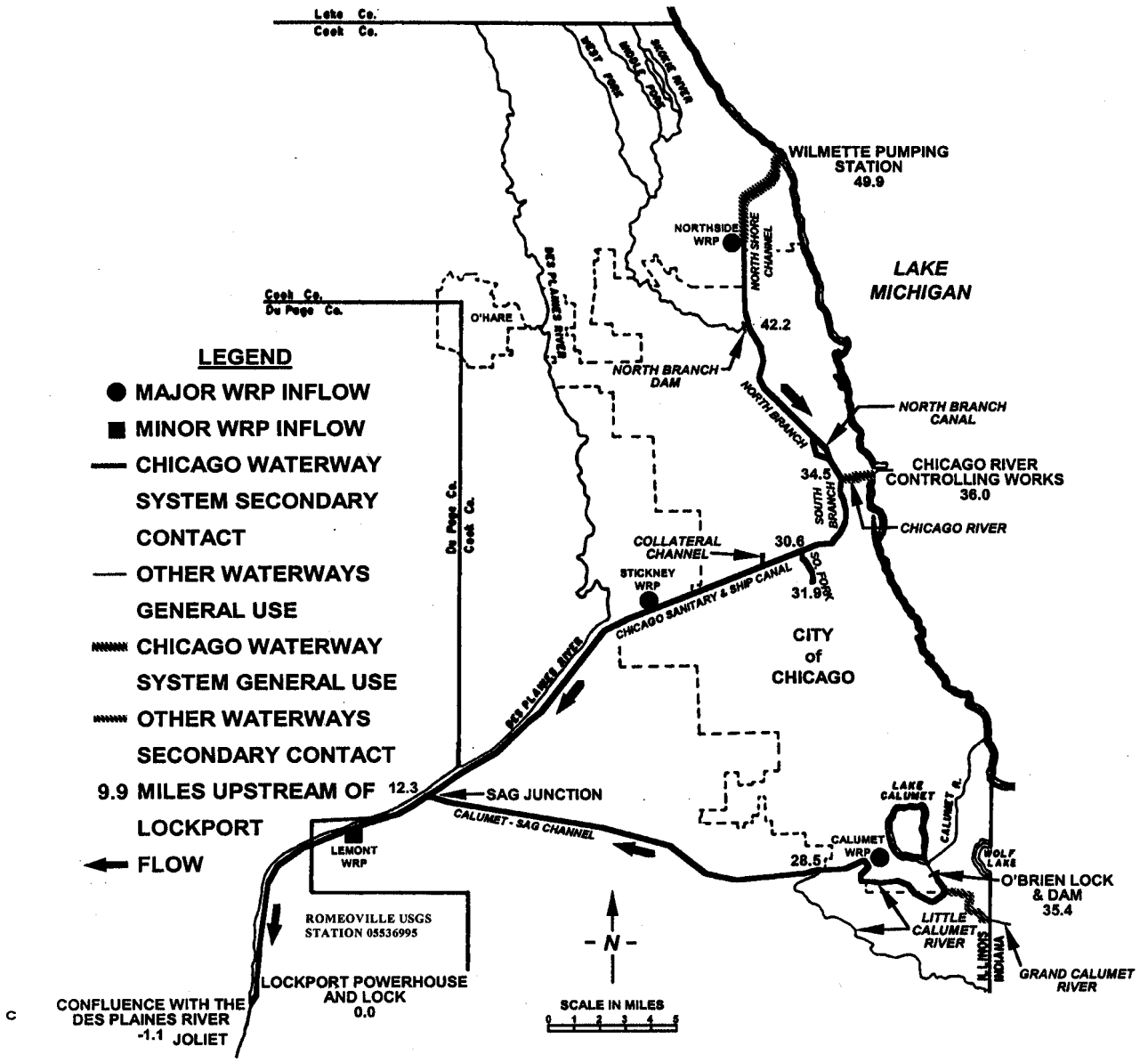
TABLE 2: NORTH SIDE WRP GENERAL DATA

Address	3500 W. Howard Street, Skokie, IL 60076
Service Area	142.4 square miles
Service Population	1,257,460 (1990)
Plant Area	97 acres
Type	Conventional Activated Sludge
Incoming Receptors	North Side #1; North Side #3; Howard Street #1
Design Average Flow	333 mgd
Design Maximum Flow	450 mgd
Receiving Stream	North Shore Channel
NPDES Permit Number	IL0028088
NPDES Permit Limitations	
BOD ₅	Maximum monthly average = 10 mg/L
SS	Maximum monthly average = 12 mg/L
NH ₃ -N	Maximum monthly average = 2.5 mg/L (April-Oct)
	Maximum monthly average = 5.0 mg/L (Nov-March)
Start-up Date	October 3, 1928

TABLE 3: CALUMET WRP GENERAL DATA

Address	400 E. 130 th Street, Chicago, IL 60628
Service Area	299.4 square miles
Service Population	1,025,733 (1990)
Plant Area	470 acres
Type	Conventional Activated Sludge
Incoming Receptors	Main level: Blue Island, Harvey, South Park Lower level: Calumet City; TARP
Design Average Flow	354 mgd
Design Maximum Flow	430 mgd
Receiving Stream	Little Calumet River
NPDES Permit Number	IL0028061
NPDES Permit Limitations	
BOD ₅	Maximum monthly average = 10 mg/L
SS	Maximum monthly average =15 mg/L
NH ₃ -N	Maximum monthly average = 2.5 mg/L (April-Oct) Maximum monthly average = 5.0 mg/L (Nov-March)
Start-up Date	September 11, 1922

FIGURE 1: CHICAGO WATERWAY SYSTEM



The effluents from the North Side, Stickney, and Calumet WRPs are the dominant source of flow during low-flow periods in the deep-draft portions of the Calumet and Chicago River Systems and in the Lower Des Plaines River from Lockport to the confluence with the Kankakee River. Therefore, chronic effluent toxicity, or a lack thereof, in the effluents from these WRPs is a vital issue for the USEPA, the IEPA, and the District. The District had conducted extensive whole effluent toxicity (WET) monitoring of the effluents from these WRPs since 1989, including cooperative studies with the IEPA in 1993 and the USEPA in 1995, and found no evidence of toxicity (Bertucci et al., 1991; Yamanaka et al., 1991 and 1992; Lue-Hing, 1994; MWRD, 1990, 1991a, 1991b, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2002a, 2002b, and 2003a).

Chronic WET Agreement

In order to address the concerns raised by the USEPA and others, representatives of the District, the USEPA, Region V, and the IEPA discussed the potential for chronic toxicity in effluents from District WRPs. Mr. Richard Lanyon, Director of Research and Development at the District, coordinated these discussions. These discussions took on added importance in the context of a Use Attainability Analysis (UAA) for the Chicago Area Waterways (CAWs) which the IEPA began in 2002 and hopes to complete in 2005. In particular, although the preliminary findings of the UAA indicated that the water quality in the CAWs is good, some deficiencies were identified (Lanyon, 2004).

After extensive negotiations representatives of the three agencies reached an agreement to investigate chronic whole effluent toxicity at the Calumet, North Side, and Stickney WRPs (Agreement). In June 2002 the Agreement was signed by Ms. Jo-Lynn Traub, Director, Water

Division, USEPA Region V, Mr. Toby Frevert, Manager, Division of Water Pollution Control, IEPA, and Mr. Lanyon. Ms. Traub acknowledged the MWRDs efforts in developing the Agreement in a letter to Mr. Lanyon dated July 10, 2002. A copy of Ms. Traub's letter and a copy of the signed Agreement are shown in Appendix AI.

The Agreement to conduct a chronic WET assessment (Assessment) of the effluents from the Stickney, Calumet, and North Side WRPs contains the following sections:

1. Parties to the Agreement

The parties of this Agreement, the District, the IEPA, and USEPA Region V, shall work cooperatively toward the successful completion of the objectives of the Agreement.

2. Objective

The objective of a WET assessment of the District's Calumet, North Side, and Stickney WRP effluents is to determine whether they exhibit any chronic effluent toxicity.

3. Administration

This Agreement shall be administered by the following representatives of each party: James Filippini, Deputy Branch Chief, Water Division, NPDES, USEPA Region V; Toby Frevert, Manager, Division of Water Pollution Control, IEPA; Richard Lanyon, Director of Research and Development, District.

4. Technical Coordination

Members of the Technical Coordination Group (TCG) are designated by each party as follows: Charles Steiner, Aquatic Biologist, USEPA; Robert Mosher, Manager, Water Quality Standards Section, IEPA; James Zmuda, Microbiologist IV, District.

5. Work to be Performed

The District and USEPA will conduct chronic WET tests with *Ceriodaphnia dubia* and *Pimephales promelas* on effluent samples from the Stickney, Calumet, and North Side WRPs consistent with sample collection and analytical procedures agreed to by the TCG and as shown in the (preliminary) Biomonitoring Plan.

6. Conditions

Failure of the TCG to agree at any phase in the chronic WET assessment or interpretation of final results is the basis for cancellation of this Agreement.

7. Conclusion

The need for follow-up investigations including the identification of toxic agents causing effluent toxicity, identification of the source(s) of the toxic agents, and additional biological and or chemical monitoring shall be determined through consultation and agreement among the parties.

8. Preliminary Biomonitoring Plan

This included a tentative schedule for conducting the WET Tests.

After the Agreement was signed by all three parties, the TCG began its work in July 2002. Members of the TCG discussed the technical aspects of the work to be performed under the Agreement. Specifically, members of the TCG discussed field sample and collection methodology, culturing of test organisms, laboratory toxicity testing procedures, interpretation of chronic WET test results, deliverables, visits to the CRL and the District's WET Laboratory, and other issues. Details agreed upon by the members of the TCG are explained in Dr. Prakasam Tata's memo to Mr. Lanyon dated October 15, 2002 (Appendix AII). CRL personnel and District WET Laboratory personnel exchanged SOPs for culturing test organisms and conducting chronic WET tests with *Pimephales promelas* and *Ceriodaphnia dubia*. The TCG found the District SOPs and the CRL SOPs to be acceptable. The TCG visited the CRL and the District WET Laboratory and found both facilities to be acceptable for conducting the Assessment.

Experimental work began in October 2002. In October 2003, representatives of all three parties to the Agreement discussed the data collected at that time, and no corrective actions were necessary as everything was proceeding according to the biomonitoring plan in the Agreement.

Experimental work was completed in November 2004. When all of the tests were completed the District submitted a complete report to Mr. Charles Steiner and to Mr. Mosher. The report included the following: chain-of-custody forms, CETIS™ reports (which show all data and calculated endpoints), culture logs, bench sheets, control charts, calculations, and a certification of accuracy of the information submitted, which was signed by Mr. Lanyon. When all the tests were completed the CRL submitted a similar report to Mr. Mosher and Dr. Zmuda. The TCG used the District's and USEPA CRL's complete reports to prepare this final report.

MATERIALS AND METHODS

Sampling Plan

Three 24-hour composite samples of WRP effluent were used for each chronic WET test. Samples were collected on the dates shown in Table 4. Grab samples (2.5 gallon volume) were collected every six hours in 2.5-gallon Cubitainers™. All grab samples were collected by District Maintenance and Operations (M&O) personnel as outlined in the MWRD Sampling Manuals (MWRD, 2003b, c, d). A total of five grab samples were collected at 0600, 1200, 1800, 2400, and 0600 the following day, over a 24-hour period. Grab samples used to make a 24-hour composite sample were collected according to the following schedule.

FIRST 24-HOUR COMPOSITE SAMPLE

Grab samples were collected at 0600, 1200, 1800, and 2400 on Mondays and 0600 on Tuesdays.

SECOND 24-HOUR COMPOSITE SAMPLE

Grab samples were collected at 0600, 1200, 1800, and 2400 on Wednesdays and 0600 on Thursdays.

THIRD 24-HOUR COMPOSITE SAMPLE

Grab samples were collected at 0600, 1200, 1800, and 2400 on Fridays and 0600 on Saturdays.

Sample Handling

Immediately after being collected, individual grab samples were held at 0.1 to 6°C in a cold room. After the last grab sample was collected for each 24-hour composite sample to be made,

TABLE 4: BIOMONITORING TEST SCHEDULE FOR THE CHRONIC WHOLE EFFLUENT TOXICITY (WET) ASSESSMENT OF THE STICKNEY, NORTH SIDE, AND CALUMET WRPs, 2002 THROUGH 2004

WRP	Dates Samples Collected	Laboratories ¹
Stickney	October 7-12, 2002	D and EPA
North Side	October 21-26, 2002	D and EPA
Calumet	November 18-23, 2002	D and EPA
Stickney	December 2-7, 2002	D
North Side	January 6-11, 2003	D
Calumet	January 27-February 1, 2003	D
Stickney	February 24-March 1, 2003	D and EPA
North Side	March 10-15, 2003	D
Stickney	March 24-29, 2003	D
Calumet	April 7-12, 2003	D and EPA
North Side	April 21-26, 2003	D
Stickney	May 12-17, 2003	D
Calumet	June 16-21, 2003	D
North Side	July 21-26, 2003	D
Stickney	August 18-23, 2003	D
Calumet	September 1-6, 2003	D
North Side	September 15-20, 2003	D and EPA
Calumet	September 29-October 4, 2003	D
Stickney	January 19-24, 2004	D
Calumet	February 23-28, 2004	D
North Side	March 8-13, 2004	D
Calumet	March 22-27, 2004	D
North Side	April 5-10, 2004	D
Stickney	April 19-24, 2004	D
North Side	May 3-8, 2004	D
Stickney	July 5-10, 2004	D and EPA
Calumet	July 19-24, 2004	D
North Side	August 16-21, 2004	D and EPA
Stickney	September 13-18, 2004	D
Calumet	November 1-6, 2004	D and EPA

¹ D=District; EPA=USEPA Region V, Central Regional Laboratory.

the five grab samples were transported on ice to the WET Laboratory at the Stickney WRP. A chain-of-custody sheet accompanied each set of five grab samples.

The individual grab samples were poured through a plankton net (60 μm mesh) (Aquatic Eco-Systems Inc., Apopka, FL) and combined in a 15-gallon Nalgene cylindrical container. The composite samples were mixed for 15 minutes with a magnetic stirring bar. The 24-hour composite samples were stored in 2.5-gallon Cubitainers at $4^{\circ}\text{C} \pm 1^{\circ}\text{C}$ in a locked REVCO laboratory refrigerator in the WET Laboratory at the Stickney WRP. (This refrigerator is dedicated to the storage of effluent samples only). When the USEPA CRL was conducting WET tests on split samples, a 2.5-gallon aliquot of each 24-hour composite sample was reserved for the USEPA CRL. When the USEPA CRL was conducting WET tests on split samples, an individual from the USEPA CRL picked up the reserved aliquot of the 24-hour composite sample at the MWRDGC WET Laboratory after 1200 and before 1600 on the day the composite sample was prepared, that is, on Tuesdays, Thursdays, and Saturdays.

Chemical Analyses

A residual chlorine analysis was conducted on each new sample by the District's WET Laboratory personnel using a Hach amperometric titrator. An ammonia analysis was conducted on each new sample by the District's Analytical Laboratories Division (ALD). At the beginning and end of each 24-hour exposure period DO, pH, and temperature were measured in at least one test chamber at each test concentration and in the controls. This was done in both the CRL and the District's WET Laboratory. Organic priority pollutant analysis was conducted by the District's ALD on composite samples collected during the weeks of July 21-26, 2003, and March 8-13, 2004. Organic priority pollutant analyses were performed using capillary columns following EPA Methods 608 for Pesticides/PCBs, 624 for VOCs, 625 for BNAs, and Standard Method 6640B for Herbicides. The following chemical analyses were conducted on each new

sample and on the control water by the District's WET Laboratory: pH, conductivity, hardness, and alkalinity. Results of the following analyses conducted on WRP effluent were taken from plant operating data: DO, pH, BOD₅, CBOD₅, SS, TKN, NH₃-N, NO₂-N, NO₃-N, P-TOT, P-SOL, Cl, F, FOG, Phenol, SO₄, CN (COMP), CN (WAD), As, Ba, Cd, Cr_Tot, Cu, Fe_Tot, Fe_Sol, Pb, Mn, Hg, Ni, Se, Ag, Zn, Sb, Be, Tl, Cr⁶⁺, Ca, Mg, hardness, As_Sol, Ba_Sol, Cd_Sol, Fe_Sol, Pb_Sol, Mn_Sol, Hg_Sol, Ni_Sol, Se_Sol, Ag_Sol, Zn_Sol, Sb_Sol, Be_Sol, Tl_Sol, Ca_Sol, Mg_Sol, and TOC. Flow data, sludge residence times (SRT), results of analyses for mixed liquor suspended solids (MLSS), and results of analyses for mixed liquor volatile suspended solids (MLVSS) were also taken from plant operating data.

Culturing Test Organisms

The USEPA CRL and the District's WET Laboratory cultured test organisms, *Pimephales promelas* and *Ceriodaphnia dubia*, as outlined by the USEPA (2002a and b, respectively) and as specified in their respective standard operating procedures (SOPs). The CRL SOPs are shown in Appendix AIII. The District's SOPs are shown in Appendix AIV. Members of the TCG reviewed the CRL's and District's SOPs and agreed that they were acceptable. The District's SOPs for culturing test organisms are embedded in the District's SOPs for conducting chronic WET tests. The CRL and the District cultured *Ceriodaphnia dubia* in house. The District's WET Laboratory purchased *Pimephales promelas* eggs from Environmental Consulting and Testing (Superior, WI) for each test. The CRL was supplied with *Pimephales promelas* eggs or larvae by the USEPA Laboratory in Cincinnati for each test.

Laboratory Toxicity Testing Procedures

The Fathead Minnow, *Pimephales promelas*, Larval Survival and Growth Test Method 1000.0 (USEPA, 2002a), and the Daphnid, *Ceriodaphnia dubia* Survival and Reproduction Test Method 1002.0 (USEPA, 2002b) were conducted by the CRL and the District WET Laboratory.

The CRL and the District's WET Laboratory implemented these tests following their respective SOPs (Appendices AIII and AIV, respectively). Fathead minnows less than 48 hours old were used for all fish tests. *Ceriodaphnia dubia* less than 24 hours old and all released within an 8-hour period were used for all daphnid tests.

The CRL used 40 percent dilute mineral water (DMW) as dilution and control water. The hardness of the DMW was 160 to 180 mg CaCO₃/L. The CRL diluted the commercially available mineral water PERRIER™ with Milli-Q purified water to make DMW as outlined by the USEPA (2002c). The District's WET Laboratory used hard synthetic water (HSW) with 2 µg of Se/L as dilution and control water. The District prepared HSW using Milli-Q purified water and reagent grade chemicals as outlined by the USEPA (2002c). The hardness of the District's HSW was 160 to 180 mg CaCO₃/L. The CRL and the District's WET Laboratory both used the following percent concentrations of effluent for each test: 100, 75, 50, 25, and 12.5.

In both the District's WET Laboratory and the CRL, the first 24-hour composite sample was used to set up the tests at approximately 11 a.m. on Wednesdays and for renewals on Thursdays. The second 24-hour composite sample was used for renewals of test solutions on Fridays and Saturdays. The third 24-hour composite sample was used for renewals of test solutions on Sundays, Mondays, and Tuesdays. The District's WET Laboratory conducted concurrent reference toxicant tests using the toxicant NaCl.

All WET test data collected in the District's WET Laboratory were reviewed for any deviations from the USEPA test methods employed in this study using a WET test data checklist developed by the District (Appendix AV). Test data qualifier flags are described in Table 5. Flags A₁, A₂, A₃, and A₄ were used to indicate a failure to meet test acceptability criteria. Tests, which failed to meet test acceptability criteria, were considered invalid tests. Other flags were used to indicate a deviation from optimal conditions for tests considered to be valid.

Calculations

The District's WET Laboratory used the CETIS™ software program versions 1.020, 1.022, and 1.025B (Tidepool Scientific Software, McKinleyville, CA) to calculate no observed effect concentration (NOEC) and lowest observed effect concentration (LOEC) endpoints for survival (fathead minnow and *Ceriodaphnia* tests), growth (fathead minnow tests), and reproduction (*Ceriodaphnia* tests). The CETIS™ software program was also used to calculate 25 percent inhibition concentration (IC₂₅) values for fathead minnow growth (original number) and *Ceriodaphnia dubia* reproduction. Calculations made with the CETIS™ program were verified using the USEPA program for the Dunnett's procedure, version 1.5, obtained from the USEPA, Cincinnati, OH. In the District percent minimum significant differences (MSDp) for each of these endpoints were also calculated with the CETIS™ program. (The MSDp is defined as the smallest difference between the control and another treatment that can be determined statistically in a given test. The use of MSDp values along with other statistical tools greatly increases the confidence that can be put in the results of a WET test when all test acceptability criteria have been met.) The CRL used Toxstat 3.5 software (West, Inc., Cheyenne, WY) to statistically evaluate WET test results for NOEC and LOEC endpoints.

Analysts

The following personnel conducted WET tests in the District's WET Laboratory: Jon Yamanaka (Biologist I), George Billett (Laboratory Technician II), Hema Shukla (Laboratory Technician II), Mina Patel (Laboratory Technician II). The following personnel conducted the WET tests in the CRL: Charles Steiner, Peggy Donnelly, Mari Nord, and Jennifer Smith.

TABLE 5: WHOLE EFFLUENT TOXICITY (WET) TEST DATA QUALIFIER FLAGS¹

Flag Code	Flag Description
A	Test Acceptability
A ₁	Survival of control organisms failed to meet the minimum test acceptability criteria for the method. 90% or greater survival in controls for Acute toxicity tests. 80% or greater survival in controls for Chronic toxicity tests.
A ₂	Growth of control organisms (measured as the mean weight of control organisms) failed to meet the minimum test acceptability criteria for the method. (The average dry weight per control larvae at the end of the test = ≥ 0.25 mg.)
A ₃	Reproduction of control organisms in the <i>Ceriodaphnia</i> chronic test failed to meet the minimum test acceptability criteria requiring that 60% surviving control organisms have 3 broods prior to test termination at 7-8 days.
A ₄	Mean Reproduction of control organisms in the <i>Ceriodaphnia</i> chronic test failed to meet the minimum test acceptability criteria of 15 neonates.
B	Sample Receipt
B ₁	Sample temperature was $> 10^{\circ}\text{C}$ upon arrival at the laboratory.
B ₂	Sample was > 48 hour old at the time of test initiation.
B ₃	Sample was not delivered directly to WET Laboratory. The sample was located and tests were initiated on time.
B ₄	Sample Chain-of-Custody form contained minor errors, which required corrective action.
B ₅	Sample was not stored at $0-6^{\circ}\text{C}$.
B ₆	Sample initial pH was outside the 6.0-9.0 range.
B ₇	Sample was received without Chain-of-Custody. The sample transporter was informed and the COC was received next day.
B ₈	Sample was not filtered.
B ₉	Sample was not warmed to prescribed test temperature ($25 \pm 1^{\circ}\text{C}$).
B ₁₀	Sample was not aerated due to oversaturation of dissolved oxygen.
C	Dilution Water
C ₁	Dilution water used for the test was different from that required in the study.
C ₂	Alkalinity of dilution water was 10% outside of recommended ranges for test dilution water (Moderately Hard Synthetic Water with Selenium = 60-70 mg CaCO ₃ /L; Hard Synthetic Water with Selenium = 110-120 mg CaCO ₃ /L).

TABLE 5 (Continued): WHOLE EFFLUENT TOXICITY (WET) TEST DATA QUALIFIER FLAGS¹

Flag Code	Flag Description
C ₃	Hardness of dilution water was 10% outside of recommended ranges for test dilution water (Moderately Hard Synthetic Water with Selenium = 80-100 mg CaCO ₃ /L; Hard Synthetic Water with Selenium = 160-180 mg CaCO ₃ /L).
C ₄	pH of dilution water was 10% outside of recommended ranges for test dilution water (Moderately Hard Synthetic Water with Selenium = 7.4-7.8; Hard Synthetic Water with Selenium = 7.6-8.0).
D	Water Quality
D ₁	Temperature of one or more test concentrations was outside of range required in the test (25±1°C).
D ₂	Dissolved Oxygen (DO) was less than 4 mg/L in one or more test concentrations.
D ₃	Aeration was not provided in all test chambers when DO was < 4.0 mg/L.
D ₄	pH was <6 or >9 in one or more test concentrations.
D ₅	Total ammonia >5.0 mg/L in one or more test concentrations.
E	Test Conditions
E ₁	Number of organisms per test container differed from the required number of organisms (1 neonate per chamber or 10 minnows per chamber) due to accidental loss of one or more test organisms.
E ₂	Test chamber size was different from that required in the study. <u>Tests</u> Chronic Fathead minnow 16 oz. (500 mL) Chronic <i>C. dubia</i> (30 mL) <u>Organisms</u> Disposable polystyrene cups Disposable polystyrene cups <u>Test Chamber Size</u> Disposable polystyrene cups Disposable polystyrene cups
E ₃	Test solution volume in test containers was outside of the range required in the study. Chronic Fathead minnow = 250 mL; Chronic <i>C. dubia</i> = 15 mL
E ₄	Test renewals were conducted more than 2 hours outside of the required time for test renewal.
E ₅	Test cups were covered with safety plastic sheet to avoid potential contamination from the air and excessive evaporation of test solutions during the test.
E ₆	Feeding schedule used during the test differed from feeding schedule recommended in the method manuals. (Feed test organisms 1 - 2 hours prior to test set-up. This applies to both Fathead minnows and <i>Ceriodaphnia</i>)
E ₇	Test termination was conducted more than 2 hours prior to proper test termination time.
E ₈	Lighting Cycle was interrupted for 2 hours during the test duration.
E ₉	Light intensity readings were not within the 50-100 foot-candles range.

TABLE 5 (Continued): WHOLE EFFLUENT TOXICITY (WET) TEST DATA QUALIFIER FLAGS¹

Flag Code	Flag Description
F	Test Organisms
F ₁	Age of organism was outside of range required in the study. - Chronic Fathead minnow toxicity tests: ≤24 h (in-house); ≤48 h (shipped) - Chronic, <i>Ceriodaphnia</i> test: <24 h old neonates born within the same 8-h period (8-16 hours old, 16-24 hours old)
F ₂	Organism culture contaminated with rotifers.
F ₃	Organism culture crashed just prior to testing.
F ₄	Males were identified in the test.
F ₅	Organisms were not cultured at the same temperature as of test temperature (25±1°C).
G	Quality Control
G ₁	Reference Toxicant Test (RTT) conducted concurrently with the Acute or Chronic tests were outside of the 2 standard deviation control chart limits or the test was not conducted.
G ₂	Percent Minimum significant difference (MSDp) was greater than the recommended criteria for test methods. MSDp Fathead minnow Growth-Survival/Mean Dry Weight-mg = 12-30% MSDp <i>C. dubia</i> Reproduction-Survival/Reproduction = 13-47%
G ₃	Interrupted concentration-response relationship was observed (i.e., a test concentration was determined to be significantly different from the control, while one or more higher test concentrations were not significantly different from the control).
G ₄	One or more multiple test replicates were lost due to laboratory error.
G ₅	Test was repeated due to laboratory error. Initial test was incorrectly terminated at 48 hours.
G ₆	Test was repeated due to laboratory error. Initial test was incorrectly renewed with the wrong sample.
G ₇	Two sets of controls were conducted for this test, and one did not meet test acceptability criteria for survival, reproduction, or growth.

¹Test data qualifier flags adapted from Table 8.3 in EPA/821-R-00-028A.

RESULTS AND DISCUSSION

Tabulated summaries, raw data, chain-of-custody documentation, CETIS™ reports, and quality assurance data for the WET tests conducted on Stickney, North Side, and Calumet WRP effluents in the District are shown in Appendices BI-BX, CI-CX, and DI-DX, respectively. Raw data and Toxstat reports for the WET tests conducted on Stickney, North Side, and Calumet WRP effluents in the CRL are shown in Appendices EI-EIII, FI-FIII, and GI-GIII, respectively. Plant operating data for the dates on which samples were collected for this study are shown in Appendices HI (Stickney WRP), HII (North Side WRP), and HIII (Calumet WRP). The results of organic priority pollutant analysis performed on North Side WRP effluent samples collected during the weeks of July 21-26, 2003, and March 8-13, 2004, are shown in Appendices I.

The measured alkalinity, hardness, conductivity, pH, temperature, total residual chlorine, dissolved oxygen, and total ammonia values of Stickney, North Side, and Calumet WRP composite final effluent samples are shown in Tables 6, 7, and 8, respectively. Alkalinity values for the Stickney, North Side, and Calumet WRP effluent samples ranged from 78 to 156, 106 to 196, and 90 to 186 mg/L as CaCO₃, respectively. Hardness values for the Stickney, North Side, and Calumet WRP effluent samples ranged from 176 to 296, 152 to 344, and 176 to 392 mg/L as CaCO₃, respectively. There was good general agreement between the alkalinity, hardness, pH, and total ammonia values measured in the composite WET samples (Tables 6, 7, and 8) and the values for these parameters measured in the final effluent plant operating data (Appendices HI, HII, and HIII).

Summaries of the control data and qualifiers for the *Pimephales promelas* survival and growth tests conducted in the District on Stickney, North Side, and Calumet WRP effluent are shown in Tables 9, 10, and 11, respectively. Summaries of the control data and qualifiers for the

TABLE 6: WATER CHEMISTRY OF STICKNEY COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH SEPTEMBER 2004

Parameter	Dates of Sample Collection						
	10/7-8/2002	10/9-10/2002	10/11-12/2002	12/2-3/2002	12/4-5/2002	12/6-7/2002	
Alkalinity (mg/L as CaCO ₃)	102	108	132	108	106	124	
Hardness (mg/L as CaCO ₃)	176	188	200	196	220	196	
Conductivity (micromhos/cm)	0.733	0.790	0.827	0.875	2.160	1.210	
pH	7.33	7.21	7.20	7.68	7.48	7.55	
Temperature (°C)	24.5	25.0	25.3	24.6	25.0	24.1	
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	
Dissolved Oxygen (mg/L)	7.83	6.41	7.64	8.10	8.01	7.45	
Total Ammonia (mg/L)	0.04	0.17	0.63	0.04	0.02	0.03	

TABLE 6 (Continued): WATER CHEMISTRY OF STICKNEY COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH SEPTEMBER 2004

Parameter	Dates of Samples Collection					
	2/24-25/03	2/26-27/03	2/28-3/1/03	3/24-25/03	3/26-27/03	3/28-29/03
Alkalinity (mg/L as CaCO ₃)	78	92	88	106	136	138
Hardness (mg/L as CaCO ₃)	204	204	200	236	240	216
Conductivity (micromhos/cm)	1.005	1.176	0.975	1.120	1.233	1.143
pH	7.76	7.74	7.63	7.78	8.12	7.66
Temperature (°C)	24.0	25.2	25.4	24.4	25.6	25.3
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	8.03	7.96	7.92	7.86	7.82	7.57
Total Ammonia (mg/L)	0.21	0.23	0.48	0.58	0.57	3.92

TABLE 6 (Continued): WATER CHEMISTRY OF STICKNEY COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH SEPTEMBER 2004

Parameter	Dates of Samples Collection					
	5/12-13/03	5/14-15/03	5/16-17/03	8/18-19/03	8/20-21/03	8/22-23/03
Alkalinity (mg/L as CaCO ₃)	156	140	146	108	126	124
Hardness (mg/L as CaCO ₃)	296	256	260	208	216	216
Conductivity (micromhos/cm)	1.127	1.028	1.019	0.774	0.848	0.846
pH	8.17	7.67	7.79	7.99	7.99	7.76
Temperature (°C)	24.2	25.3	25.4	24.2	25.4	25.4
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	7.79	8.01	7.50	7.95	7.82	7.67
Total Ammonia (mg/L)	0.08	0.24	0.22	0.09	1.17	0.80

TABLE 6 (Continued): WATER CHEMISTRY OF STICKNEY COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH SEPTEMBER 2004

Parameter	Dates of Samples Collection					
	1/19-20/04	1/21-22/04	1/23-24/04	4/19-20/04	4/21-22/04	4/23-24/04
Alkalinity (mg/L as CaCO ₃)	130	112	104	114	102	130
Hardness (mg/L as CaCO ₃)	244	236	240	236	184	240
Conductivity (micromhos/cm)	1.762	1.063	0.978	1.018	0.870	1.116
pH	8.06	7.84	7.67	8.05	7.97	7.93
Temperature (°C)	24.2	24.6	24.8	24.2	25.6	25.8
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	7.80	7.81	7.86	7.16	7.92	7.63
Total Ammonia (mg/L)	0.08	0.51	1.05	0.16	0.37	0.14

TABLE 6 (Continued): WATER CHEMISTRY OF STICKNEY COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH SEPTEMBER 2004

Parameter	Dates of Samples Collection					
	7/5-6/04	7/7-8/04	7/9-10/04	9/13-14/04	9/15-16/04	9/17-18/04
Alkalinity (mg/L as CaCO ₃)	106	102	114	116	128	110
Hardness (mg/L as CaCO ₃)	180	176	188	208	204	196
pH	8.09	7.91	7.89	7.98	7.93	7.77
Temperature (°C)	24.3	25.3	25.2	24.4	25.0	25.0
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	7.63	7.69	7.91	8.15	7.96	8.09
Total Ammonia (mg/L)	0.26	0.59	0.93	0.16	0.93	0.20

TABLE 7: WATER CHEMISTRY OF NORTH SIDE COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH AUGUST 2004

Parameter	Dates of Sample Collection					
	10/21-22/02	10/23-24/02	10/25-26/02	1/6-7/03	1/8-9/03	1/10-11/03
Alkalinity (mg/L as CaCO ₃)	130	126	112	118	124	126
Hardness (mg/L as CaCO ₃)	188	180	168	200	200	196
Conductivity (micromhos/cm)	0.622	0.657	0.593	1.075	0.798	0.748
pH	7.52	7.21	7.13	7.85	7.61	7.43
Temperature (°C)	25.0	25.2	25.0	25.0	25.2	24.8
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	7.89	8.08	7.76	6.62	7.77	6.67
Total Ammonia (mg/L)	1.04	0.50	0.87	0.88	0.84	1.5

TABLE 7 (Continued): WATER CHEMISTRY OF NORTH SIDE COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH AUGUST 2004

Parameter	Dates of Samples Collection					
	3/10-11/03	3/12-13/03	3/14-15/03	4/21-22/03	4/23-24/03	4/25-26/03
Alkalinity (mg/L as CaCO ₃)	128	126	138	144	158	136
Hardness (mg/L as CaCO ₃)	208	204	232	228	236	236
Conductivity (micromhos/cm)	1.160	1.235	1.359	0.904	0.889	0.881
pH	7.86	8.00	7.91	7.97	7.93	7.85
Temperature (°C)	24.3	25.2	25.2	24.2	25.2	24.6
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	7.82	7.95	7.21	8.04	8.09	7.73
Total Ammonia (mg/L)	1.79	2.15	2.48	1.18	1.56	1.08

TABLE 7 (Continued): WATER CHEMISTRY OF NORTH SIDE COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH AUGUST 2004

Parameter	Dates of Samples Collection					
	7/21-22/03	7/23-24/03	7/25-26/03	9/15-16/03	9/17-18/03	9/19-20/03
Alkalinity (mg/L as CaCO ₃)	116	136	130	114	120	122
Hardness (mg/L as CaCO ₃)	188	232	216	196	204	204
Conductivity (micromhos/cm)	0.632	0.808	0.765	0.640	0.682	0.686
pH	8.00	8.01	7.98	7.97	7.91	7.86
Temperature (°C)	24.2	25.4	25.6	24.6	25.4	25.2
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	7.93	8.23	8.22	7.95	8.03	7.63
Total Ammonia (mg/L)	0.47	0.54	0.53	0.32	0.32	0.53

TABLE 7 (Continued): WATER CHEMISTRY OF NORTH SIDE COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH AUGUST 2004

Parameter	Dates of Samples Collection					
	3/8-9/04	3/10-11/04	3/12-13/04	4/5-6/04	4/7-8/04	4/9-10/04
Alkalinity (mg/L as CaCO ₃)	196	188	180	162	154	150
Hardness (mg/L as CaCO ₃)	344	328	324	260	260	256
Conductivity (micromhos/cm)	1.249	1.115	1.103	1.042	1.052	1.015
pH	8.12	8.05	8.00	8.17	7.98	8.06
Temperature (°C)	24.8	25.2	25.1	24.2	25.1	24.8
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	7.48	7.91	7.88	7.26	7.94	7.41
Total Ammonia (mg/L)	2.67	4.63	4.27	0.98	1.25	1.18

TABLE 7 (Continued): WATER CHEMISTRY OF NORTH SIDE COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
OCTOBER 2002 THROUGH AUGUST 2004

Parameter	Dates of Samples Collection						
	5/3-4/04	5/5-6/04	5/7-8/04	8/16-17/04	8/18-19/04	8/20-21/04	
Alkalinity (mg/L as CaCO ₃)	138	142	138	128	106	122	
Hardness (mg/L as CaCO ₃)	244	228	224	196	152	196	
Conductivity (micromhos/cm)	0.912	0.930	0.904	0.772	0.604	0.750	
pH	8.18	8.11	7.84	7.94	7.88	7.84	
Temperature (°C)	24.4	25.2	25.5	24.5	24.2	25.4	
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	
Dissolved Oxygen (mg/L)	7.46	7.97	7.63	7.08	8.00	8.13	
Total Ammonia (mg/L)	1.49	1.27	1.73	1.07	0.65	0.99	

TABLE 8: WATER CHEMISTRY OF CALUMET COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
NOVEMBER 2002 THROUGH NOVEMBER 2004

Parameter	Dates of Sample Collection					
	11/18-19/02	11/20-21/02	11/22-23/02	1/27-28/03	1/29-30/03	1/31-2/1/03
Alkalinity (mg/L as CaCO ₃)	140	136	130	148	162	142
Hardness (mg/L as CaCO ₃)	232	232	220	224	232	244
Conductivity (micromhos/cm)	1.056	0.916	0.906	1.012	1.246	1.494
pH	7.25	7.41	7.20	7.89	7.96	7.51
Temperature (°C)	24.2	24.1	24.4	24.2	25.0	25.2
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	8.13	8.42	7.89	8.27	8.58	8.17
Total Ammonia (mg/L)	0.13	0.18	0.10	0.12	2.39	2.65

TABLE 8 (Continued): WATER CHEMISTRY OF CALUMET COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
NOVEMBER 2002 THROUGH NOVEMBER 2004

Parameter	Dates of Samples Collection					
	4/7-8/03	4/9-10/03	4/11-12/03	6/16-17/03	6/18-19/03	6/20-21/03
Alkalinity (mg/L as CaCO ₃)	156	170	172	166	154	158
Hardness (mg/L as CaCO ₃)	280	316	336	292	284	284
Conductivity (micromhos/cm)	1.606	1.431	1.462	1.062	1.079	1.049
pH	8.14	8.04	7.86	8.09	8.02	7.80
Temperature (°C)	24.2	25.5	25.4	24.8	25.8	25.9
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	8.27	8.06	7.95	7.80	7.95	7.79
Total Ammonia (mg/L)	0.32	0.42	0.32	0.15	0.22	0.10

TABLE 8 (Continued): WATER CHEMISTRY OF CALUMET COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
NOVEMBER 2002 THROUGH NOVEMBER 2004

Parameter	Dates of Samples Collection						
	9/1-2/03	9/3-4/03	9/5-6/03	9/29-30/03	10/1-2/03	10/3-4/03	
Alkalinity (mg/L as CaCO ₃)	90	182	180	164	152	158	
Hardness (mg/L as CaCO ₃)	176	308	292	272	272	264	
Conductivity (micromhos/cm)	0.652	1.001	1.097	0.983	1.071	1.039	
pH	7.81	8.13	7.91	8.11	8.06	7.66	
Temperature (°C)	24.2	25.0	25.2	24.6	25.3	25.3	
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	
Dissolved Oxygen (mg/L)	8.02	7.96	7.54	8.08	8.14	7.92	
Total Ammonia (mg/L)	0.09	0.08	0.03	0.00	0.14	0.09	

TABLE 8 (Continued): WATER CHEMISTRY OF CALUMET COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
NOVEMBER 2002 THROUGH NOVEMBER 2004

Parameter	Dates of Samples Collection					
	2/23-24/04	2/25-26/04	2/27-28/04	3/22-23/04	3/24-25/04	3/26-27/04
Alkalinity (mg/L as CaCO ₃)	176	182	176	186	154	158
Hardness (mg/L as CaCO ₃)	364	388	384	392	344	324
Conductivity (micromhos/cm)	1.723	1.658	1.562	1.275	1.324	1.288
pH	8.17	8.20	7.94	8.27	8.12	8.04
Temperature (°C)	24.2	24.8	25.4	24.4	25.6	25.6
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	8.28	8.66	7.75	7.82	7.87	7.67
Total Ammonia (mg/L)	0.45	0.47	0.27	0.13	0.72	0.11

TABLE 8 (Continued): WATER CHEMISTRY OF CALUMET COMPOSITE FINAL EFFLUENT SAMPLES COLLECTED
NOVEMBER 2002 THROUGH NOVEMBER 2004

Parameter	Dates of Samples Collection					
	7/19-20/04	7/21-22/04	7/23-24/04	11/1-2/04	11/3-4/04	11/5-6/04
Alkalinity (mg/L as CaCO ₃)	172	138	144	120	164	158
Hardness (mg/L as CaCO ₃)	264	232	228	204	244	240
Conductivity (micromhos/cm)	1.071	0.978	0.946	0.819	0.956	0.912
pH	7.96	7.93	7.93	8.00	8.06	7.98
Temperature (°C)	24.6	25.6	25.1	24.2	24.8	24.6
Total Residual Chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0
Dissolved Oxygen (mg/L)	6.61	7.97	8.07	7.99	7.90	8.08
Total Ammonia (mg/L)	0.17	0.09	0.35	0.28	0.21	0.03

TABLE 9: SUMMARY OF CONTROL DATA AND QUALIFIERS FOR THE *PIMEPHALES PROMELAS* LARVAL SURVIVAL AND GROWTH TESTS CONDUCTED ON THE STICKNEY WRP EFFLUENT SAMPLES IN THE DISTRICT LABORATORY

Dates Collected	Survival Control		Growth Control		Data Qualifier		Valid Test
	Mean %	CV %	Mean Wt (mg)	CV %	MSDp %	Flags ¹	
October 7-12, 2002	100	0	0.9275	13.10	27	None	Yes ²
December 2-7, 2002	97.5	5.13	0.7807	21.56	23	None	Yes
February 24-March 1, 2003	100	0	1.1120	2.7	19	B ₄	Yes
March 24-29, 2003	100	0	0.8737	9.16	15	None	Yes
May 12-17, 2003	97.5	5.13	0.6299	4.03	20	None	Yes
August 18-23, 2003	100	0	0.8152	3.77	9	G ₂	Yes
January 19-24, 2004	95	10.53	0.7227	20.14	30	None	Yes
April 19-24, 2004	97.5	5.13	0.5670	9.04	22	None	Yes
July 5-10, 2004	100	0	0.7597	8.29	20	None	Yes
September 13-18, 2004	100	0	0.9900	10.23	13	None	Yes

¹Test data qualifier flags are described in Table 5.

²Indicates that all test acceptability criteria (TAC) were acceptable.

TABLE 10: SUMMARY OF CONTROL DATA AND QUALIFIERS FOR THE *PIMEPHALES PROMELAS* LARVAL SURVIVAL AND GROWTH TESTS CONDUCTED ON THE NORTH SIDE WRP EFFLUENT SAMPLES IN THE DISTRICT LABORATORY

Dates Collected	Survival Control		Mean	Growth Control		MSDp	Data Qualifier Flags ¹	Valid Test
	Mean	CV		CV	CV			
	%	%	Wt (mg)	%	%			
October 21-26, 2002	100	0	0.9897	2.67	14	B ₃	Yes ²	
January 6-11, 2003	97.5	5.13	0.7717	14.91	21	B ₄	Yes	
March 10-15, 2003	97.5	5.13	0.9590	8.94	19	None	Yes	
April 21-26, 2003	97.5	5.13	0.8930	9.42	16	None	Yes	
July 21-26, 2003	97.5	5.13	1.0775	7.96	12	None	Yes	
September 15-20, 2003	95	6.08	0.9915	11.69	14	B ₄	Yes	
March 8-13, 2004	97.5	5.13	0.7727	7.87	15	None	Yes	
April 5-10, 2004	92.5	10.35	0.8467	8.00	17	None	Yes	
May 3-8, 2004	100	0	1.1322	4.22	13	None	Yes	
August 16-21, 2004	100	0	0.9130	9.71	14	B ₄	Yes	

¹Test data qualifier flags are described in Table 5.

²Indicates that all test acceptability criteria (TAC) were acceptable.

TABLE 11: SUMMARY OF CONTROL DATA AND QUALIFIERS FOR THE *PIMEPHALES PROMELAS* LARVAL SURVIVAL AND GROWTH TESTS CONDUCTED ON THE CALUMET WRP EFFLUENT SAMPLES IN THE DISTRICT LABORATORY

Dates Collected	Survival Control		Growth Control		MSDp %	Data Qualifier Flags ¹	Valid Test
	Mean %	CV %	Mean Wt (mg)	CV %			
November 18-23, 2002	100	0	0.6760	4.66	26	B _{4,7}	Yes ²
January 27-Feb. 1, 2003	92.5	10.35	0.9220	15.54	22	None	Yes
April 7-12, 2003	95	6.08	0.8195	6.26	21	B ₄	Yes
June 16-21, 2003	100	0	0.7735	10.08	19	None	Yes
September 1-6, 2003	97.5	5.13	0.9057	10.66	23	None	Yes
September 29-Oct. 4, 2003	95	10.53	0.8717	3.71	17	None	Yes
February 23-28, 2004	97.5	5.13	0.9092	11.15	20	None	Yes
March 22-27, 2004	100	0	0.8757	11.01	18	None	Yes
July 19-24, 2004	97.5	5.13	0.9435	5.90	12	None	Yes
November 1-6, 2004	97.5	5.13	0.9872	6.47	9.2	G ₂	Yes

¹ Test data qualifier flags are described in Table 5.

² Indicates that all test acceptability criteria (TAC) were acceptable.

Ceriodaphnia dubia survival and reproduction tests conducted in the District on Stickney, North Side, and Calumet WRP effluent are shown in Tables 12, 13, and 14, respectively. All of the WET tests conducted in the District's Laboratory were valid. All of the concurrent reference toxicant tests conducted in the District's WET Laboratory were also valid and in control. Control charts for concurrent reference toxicant tests conducted with NaCl using *Pimephales promelas* and *Ceriodaphnia dubia* are shown in Figures 2 and 3, respectively.

Results of the *Pimephales promelas* survival and growth tests and the *Ceriodaphnia dubia* survival and reproduction tests conducted in the District's Laboratory on Stickney, North Side, and Calumet WRP effluents are shown in Tables 15, 16, and 17, respectively. The MSDp values for the *Pimephales promelas* survival and growth tests and the *Ceriodaphnia dubia* survival and reproduction tests conducted in the District's Laboratory on Stickney, North Side, and Calumet WRP effluents are shown in Figures 4 and 5, respectively. The average MSDp value for *Pimephales promelas* growth was 18.2, and 28 of the 30 MSDp values obtained fell within the upper and lower bounds of 12 and 30 percent, respectively, recommended by the USEPA (2000). The average MSDp value for *Ceriodaphnia dubia* reproduction was 25.4, and 28 of the 30 MSDp values obtained fell within the upper and lower bounds of 13 and 47 percent, respectively, recommended by the USEPA (2000). The failure of two MSDp values for *Pimephales promelas* growth and two MSDp values for *Ceriodaphnia dubia* reproduction to fall within the upper and lower bounds recommended by the USEPA had no effect upon the results of this study because no toxicity was observed with any of these four tests.

Results of the *Pimephales promelas* survival and growth tests and the *Ceriodaphnia dubia* survival and reproduction tests conducted in the CRL on Stickney, North Side, and Calumet WRP effluents are shown in Tables 18, 19, and 20, respectively. Except for the *Ceriodaphnia*

TABLE 12: SUMMARY OF CONTROL DATA AND QUALIFIERS FOR THE CLADOCERAN, *CERIODAPHNIA DUBIA*, SURVIVAL AND REPRODUCTION TESTS CONDUCTED ON THE STICKNEY WRP EFFLUENT SAMPLES IN THE DISTRICT LABORATORY

Dates Collected	Survival Control		Reproduction Control		Data Qualifier Flags ¹	Valid Test	
	Mean %	CV %	Mean neonates	CV %			MSDp %
October 7-12, 2002	90	35	33	12.8	29	None	Yes ²
December 2-7, 2002	90	35	26	33.1	27	None	Yes
February 24-March 1, 2003	90	35	43	33.2	22	B ₄	Yes
March 24-29, 2003	100	0	32	22.1	28	None	Yes
May 12-17, 2003	90	35	27	12.3	15	None	Yes
August 18-23, 2003	80	52.7	15	80.7	98	G ₂	Yes
January 19-24, 2004	100	0	22	5.6	26	None	Yes
April 19-24, 2004	100	0	37	30.2	20	None	Yes
July 5-10, 2004	100	0	33	6.4	20	None	Yes
September 13-18, 2004	90	35	26	40.6	24	None	Yes

¹Test data qualifier flags are described in Table 5.

²Indicates that all test acceptability criteria (TAC) were acceptable.

TABLE 13: SUMMARY OF CONTROL DATA AND QUALIFIERS FOR THE CLADOCERAN, *CERIODAPHNIA DUBIA*, SURVIVAL AND REPRODUCTION TESTS CONDUCTED ON THE NORTH SIDE WRP EFFLUENT SAMPLES IN THE DISTRICT LABORATORY

Dates Collected	Survival Control		Reproduction Control		MSDp %	Data Qualifier Flags ¹	Valid Test
	Mean %	CV %	Mean neonates	CV %			
October 21-26, 2002	100	0	32	18.3	18	B ₃	Yes ²
January 6-11, 2003	100	0	30	5.19	17	B ₄	Yes
March 10-15, 2003	100	0	46	15.7	14	None	Yes
April 21-26, 2003	100	0	24	8.59	25	None	Yes
July 21-26, 2003	100	0	32	4.58	22	None	Yes
September 15-20, 2003	90	35	33	39.5	39	B ₄	Yes
March 8-13, 2004	100	0	27	10.9	31	None	Yes
April 5-10, 2004	100	0	38	10.9	10	G ₂	Yes
May 3-8, 2004	100	0	36	21.5	24	None	Yes
August 16-21, 2004	100	0	34	12.4	13	B ₄	Yes

¹Test data qualifier flags are described in [Table 5](#).

²Indicates that all test acceptability criteria (TAC) were acceptable.

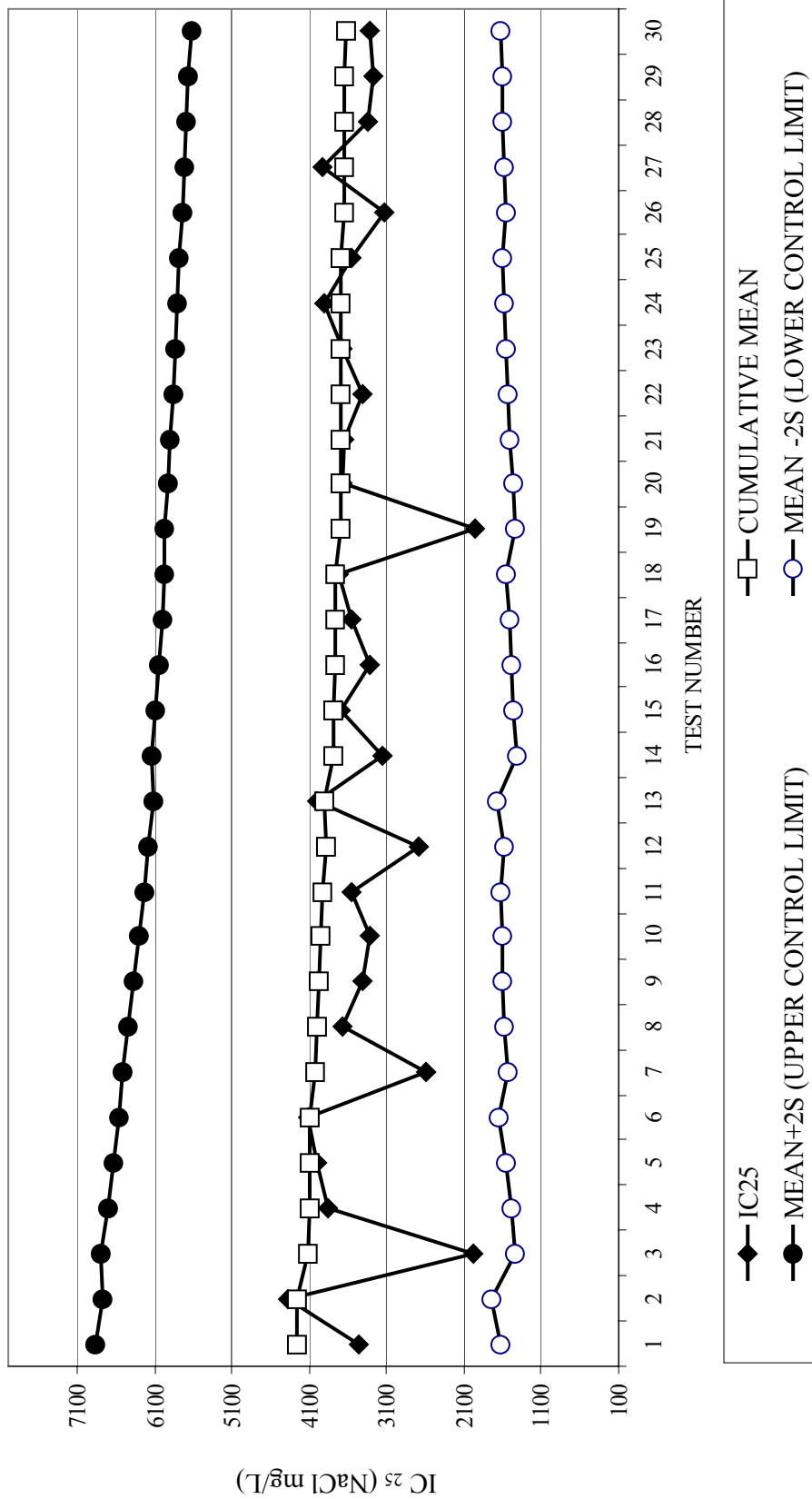
TABLE 14: SUMMARY OF CONTROL DATA AND QUALIFIERS FOR THE CLADOCERAN, *CERIODAPHNIA DUBIA*, SURVIVAL AND REPRODUCTION TESTS CONDUCTED ON THE CALUMET WRP EFFLUENT SAMPLES IN THE DISTRICT LABORATORY

Dates Collected	Survival Control		Reproduction Control		MSDp %	Data Qualifier Flags ¹	Valid Test
	Mean %	CV %	Mean neonates	CV %			
November 18-23, 2002	90	35	36	21.5	32	B _{4,7}	Yes ²
January 27-Feb. 1, 2003	100	0	33	15.9	19	None	Yes
April 7-12, 2003	100	0	35	20.4	24	B ₄	Yes
June 16-21, 2003	100	0	32	7.8	20	None	Yes
September 1-6, 2003	100	0	39	22.6	25	None	Yes
September 29-Oct. 4, 2003	100	0	29	10.3	25	None	Yes
February 23-28, 2004	90	35	27	36.2	31	None	Yes
March 22-27, 2004	100	0	36	28.2	26	None	Yes
July 19-24, 2004	100	0	40	19.2	18	None	Yes
November 1-6, 2004	100	0	29	7.0	18	None	Yes

¹Test data qualifier flags are described in Table 5.

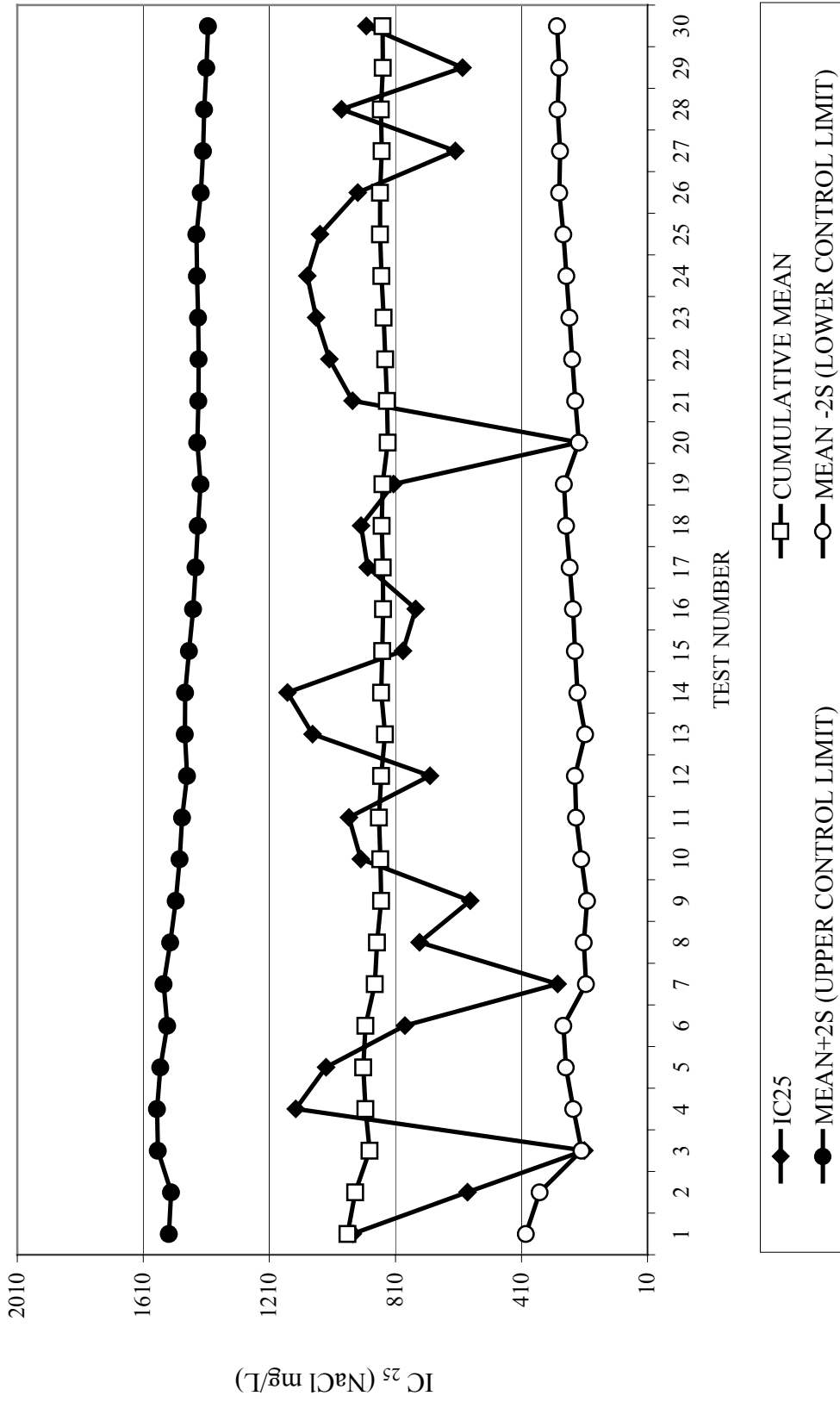
²Indicates that all test acceptability criteria (TAC) were acceptable.

FIGURE 2: CONTROL CHART FOR CHRONIC REFERENCE TOXICITY TESTS *PIMEPHALES PROMELAS*
 (GROWTH-ORIGINAL NUMBER): IC₂₅ REFERENCE TOXICANT (NaCl)



Note: Test numbers 1-30 were conducted concurrently with the chronic tests on Calumet, Stickney, and North Side WRPs final effluent samples collected October 2002 through November 2004.

FIGURE 3: CONTROL CHART FOR CHRONIC REFERENCE TOXICITY TESTS *CERIODAPHNIA DUBIA*
 (REPRODUCTION): IC₂₅ REFERENCE TOXICANT (NaCl)



Note: Test numbers 1-30 were conducted concurrently with the chronic tests on Calumet, Stickney, and North Side WRPs final effluent samples collected October 2002 through November 2004.

TABLE 15: RESULTS OF CHRONIC WHOLE EFFLUENT TOXICITY TESTS¹ CONDUCTED ON STICKNEY WATER RECLAMATION PLANT EFFLUENT IN THE DISTRICT'S WET LABORATORY: 2002-2004

Dates Collected	Chronic <i>P.promelas</i>		Chronic <i>C.dubia</i>	
	NOEC ² Survival	NOEC Growth	NOEC Survival	NOEC <u>Reproduction</u>
Oct 7-12, 2002	100	100	100	100
Dec 2-7, 2002	100	100	100	100
Feb 24-Mar 1, 2003	100	100	100	100
Mar 24-29, 2003	100	100	100	100
May 12-17, 2003	100	100	100	100
Aug 18-23, 2003	100	100	100	100
Jan 19-24, 2004	100	100	100	100
Apr 19-24, 2004	100	100	100	100
July 5-10, 2004	100	100	100	100
Sep 13-18, 2004	100	100	100	100

¹WET tests: Chronic *Pimephales promelas* (Survival, Growth) and Chronic *Ceriodaphnia dubia* (Survival, Reproduction), EPA-821-R-02-013, (Fourth Edition), 2002.

²NOEC = no observable effect concentration; an NOEC of 100 indicates no significant toxicity.

TABLE 16: RESULTS OF CHRONIC WHOLE EFFLUENT TOXICITY TESTS¹ CONDUCTED ON NORTH SIDE WATER RECLAMATION PLANT EFFLUENT IN THE DISTRICT'S WET LABORATORY: 2002-2004

Dates Collected	Chronic <i>P.promelas</i>		Chronic <i>C.dubia</i>	
	NOEC ² <u>Survival</u>	NOEC Growth	NOEC Survival	NOEC Reproduction
Oct 21-26, 2002	100	100	100	100
Jan 6-11, 2003	100	100	100	100
Mar 10-15, 2003	100	100	100	100
Apr 21-26, 2003	100	100	100	100
Jul 21-26, 2003	100	100	75	75
Sep 15-20, 2003	100	100	100	100
Mar 8-13, 2004	100	100	75	100
Apr 5-10, 2004	100	100	100	100
May 3-8, 2004	100	100	100	100
Aug 16-21, 2004	100	100	100	100

¹WET tests: Chronic *Pimephales promelas* (Survival, Growth) and Chronic *Ceriodaphnia dubia* (Survival, Reproduction), EPA-821-R-02-013, (Fourth Edition), 2002.

²NOEC = no observable effect concentration; an NOEC of 100 indicates no significant toxicity.

TABLE 17: RESULTS OF CHRONIC WHOLE EFFLUENT TOXICITY TESTS¹ CONDUCTED ON CALUMET WATER RECLAMATION PLANT EFFLUENT IN THE DISTRICT'S WET LABORATORY: 2002-2004

Dates Collected	Chronic <i>P.promelas</i>		Chronic <i>C.dubia</i>	
	NOEC ² Survival	NOEC Growth	NOEC Survival	NOEC Reproduction
Nov 18-23, 2002	100	100	100	100
Jan 27-Feb 1, 2003	100	100	100	100
Apr 7-12, 2003	100	100	100	100
Jun 16-21, 2003	100	100	100	100
Sep 1-6, 2003	100	100	100	100
Sep 29-Oct 4, 2003	100	100	100	100
Feb 23-28, 2004	100	100	100	100
Mar 22-27, 2004	100	100	100	100
July 19-24, 2004	100	100	100	100
Nov 1-6, 2004	100	100	100	100

¹WET tests: Chronic *Pimephales promelas* (Survival, Growth) and Chronic *Ceriodaphnia dubia* (Survival, Reproduction), EPA-821-R-02-013, (Fourth Edition), 2002.

²NOEC = no observable effect concentration; an NOEC of 100 indicates no significant toxicity.

FIGURE 4: MSDp VALUES FOR *PIMEPHALES PROMELAS* GROWTH

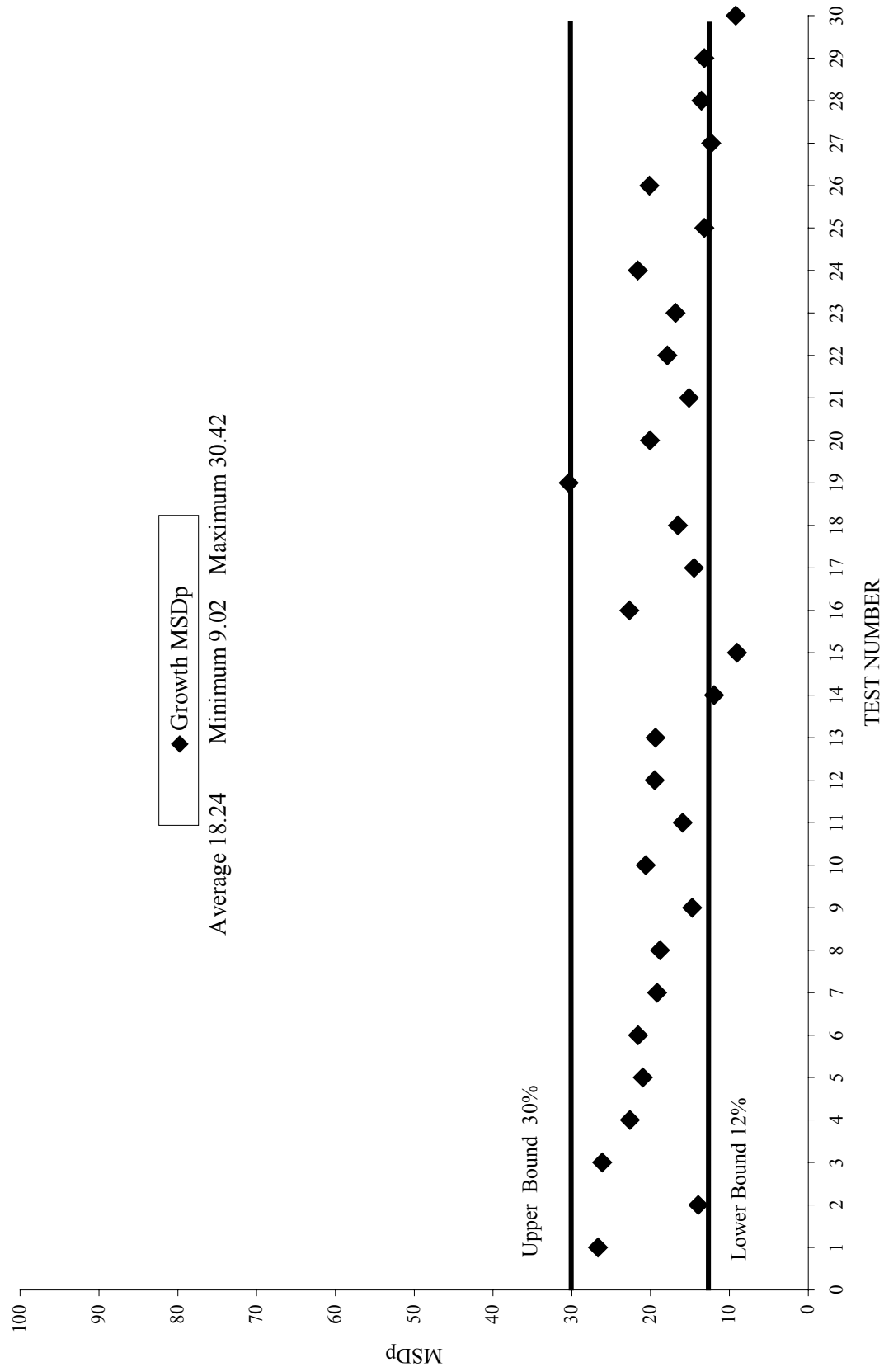


FIGURE 5: MSDp VALUES FOR *CERIODAPHNIA DUBIA* REPRODUCTION

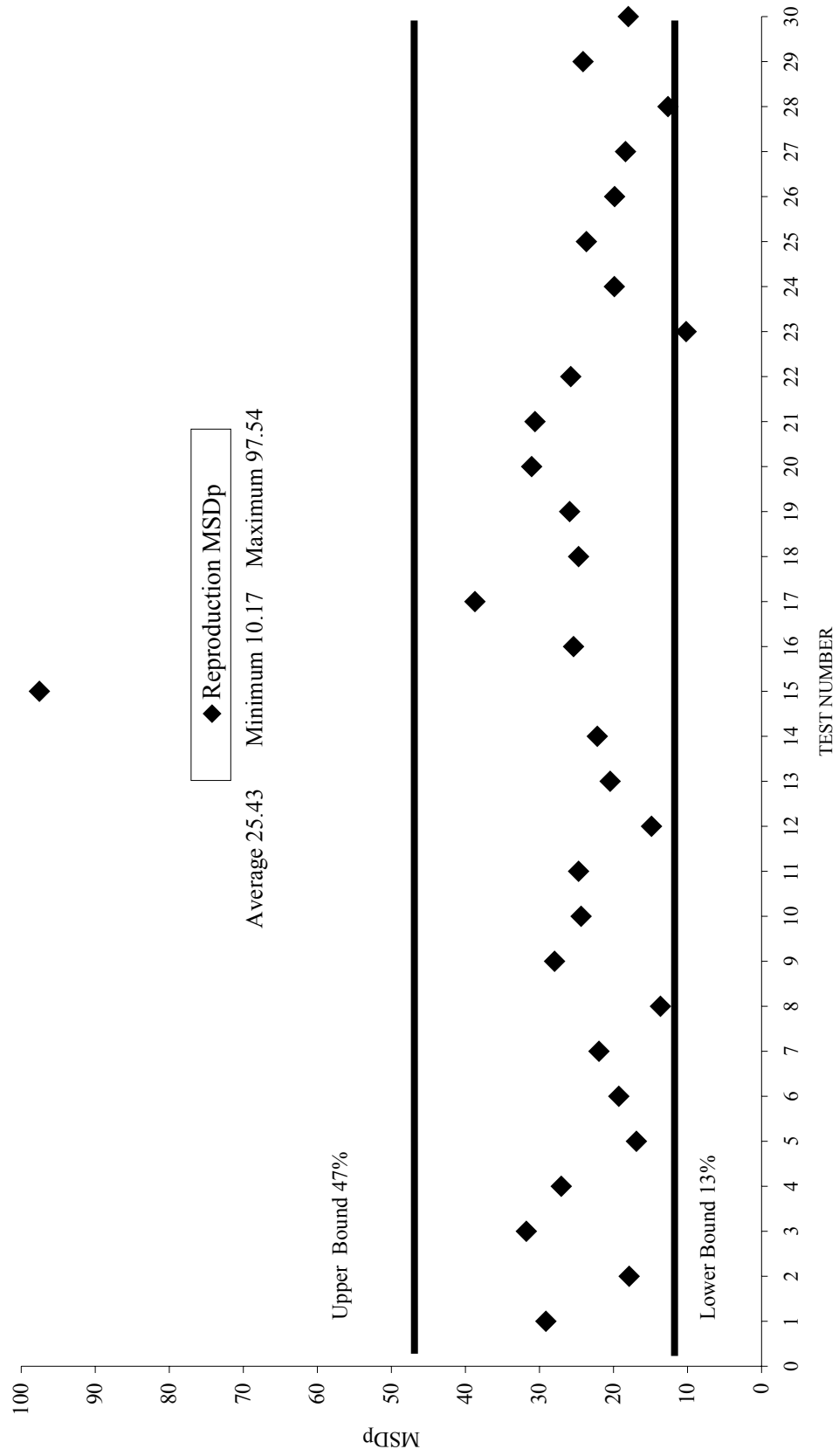


TABLE 18: RESULTS OF CHRONIC WHOLE EFFLUENT TOXICITY (WET) TESTS¹ CONDUCTED ON STICKNEY WATER RECLAMATION PLANT EFFLUENT IN THE CRL: 2002 - 2004

Dates Collected	Chronic <i>P. promelas</i>		Chronic <i>C. dubia</i>	
	NOEC ² Survival	NOEC Growth	NOEC Survival	NOEC Reproduction
Oct 7-12, 2002	100	100	IT ³	IT
Feb 24-Mar 1, 2003	100	100	100	100
Apr 19-24, 2004	100	100	100	100

¹WET tests: Chronic *Pimephales promelas* (Survival, Growth) and Chronic *Ceriodaphnia dubia* (Survival, Reproduction), EPA-821-R-02-013, (Fourth Edition), 2002.

²NOEC = No Observable Effect Concentration; an NOEC of 100 indicates no significant toxicity.

³Invalid Test.

TABLE 19: RESULTS OF CHRONIC WHOLE EFFLUENT TOXICITY (WET) TESTS¹ CONDUCTED ON NORTH SIDE WATER RECLAMATION PLANT EFFLUENT IN THE CRL: 2002 - 2004

Dates Collected	Chronic <i>P. promelas</i>		Chronic <i>C. dubia</i>	
	NOEC ² Survival	NOEC Growth	NOEC Survival	NOEC Reproduction
Oct 21-26, 2002	100	100 ^a	100	100
Sep 15-20, 2003	100	100	100	100
Aug 16-21, 2004	100	100	100	100

¹WET tests: Chronic *Pimephales promelas* (Survival, Growth) and Chronic *Ceriodaphnia dubia* (Survival, Reproduction), EPA-821-R-02-013, (Fourth Edition), 2002.

²NOEC = No Observable Effect Concentration; an NOEC of 100 indicates no significant toxicity.

³Anomalous Result; toxicity observed only at the 50 percent concentration (not at the 75 percent or 100 percent concentration).

TABLE 20: RESULTS OF CHRONIC WHOLE EFFLUENT TOXICITY (WET) TESTS¹ CONDUCTED ON CALUMET WATER RECLAMATION PLANT EFFLUENT IN THE CRL: 2002 - 2004

Dates Collected	Chronic <i>P. promelas</i>		Chronic <i>C. dubia</i>	
	NOEC ² Survival	NOEC Growth	NOEC Survival	NOEC Reproduction
Nov 18-23, 2002	100	100	100	100
<u>Apr 7-12, 2003</u>	100	100	100	100
Nov 1-6, 2004	100	100	100	100

¹WET tests: Chronic *Pimephales promelas* (Survival, Growth) and Chronic *Ceriodaphnia dubia* (Survival, Reproduction), EPA-821-R-02-013, (Fourth Edition), 2002.

²NOEC = No Observable Effect Concentration; an NOEC of 100 indicates no significant toxicity

dubia survival and reproduction test conducted on Stickney WRP effluent samples collected October 7-12, 2002, all tests met test acceptability criteria.

No toxic effect on *Pimephales promelas* larval survival or growth due to Stickney, Calumet, or North Side WRP effluent was observed in any of the WET tests conducted in the District's Laboratory or the CRL. No toxic effect on *Ceriodaphnia dubia* survival or reproduction due to Stickney or Calumet WRP effluent was observed in any of the WET tests conducted in the District's Laboratory or the CRL. No toxic effect on *Ceriodaphnia dubia* survival or reproduction due to North Side WRP effluent was observed in any of the WET tests conducted in the CRL.

In the District's Laboratory NOEC values of 75 percent effluent were observed for both *Ceriodaphnia dubia* survival and reproduction for the North Side WRP effluent samples collected during the week of July 21-26, 2003. In the District's Laboratory an NOEC value of 75 percent effluent was also observed for *Ceriodaphnia dubia* survival for the North Side WRP effluent samples collected during the week of March 8-13, 2004. Other than the tests conducted on samples collected during the weeks of July 21-26, 2003, and on March 8-13, 2004, no toxic effect on *Ceriodaphnia dubia* survival or reproduction due to North Side WRP effluent was observed in any of the other North Side WRP tests. The WET results obtained on the North Side WRP samples collected during the weeks of July 21-26, 2003, and March 8-13, 2004, are discussed further below.

A review of the North Side WRP operating data ([Appendix HII](#)) for the weeks of July 21-26, 2003, and March 8-13, 2004, revealed that the flows at the North Side WRP were greater for these two weeks (NOEC75 weeks) than for any of the other eight weeks (NOEC100 weeks) samples were collected from the North Side WRP for the study ([Table 21](#)). Average flows

TABLE 21: COMPARISON OF FLOW, BOD₅, CBOD₅, SS, TKN, AND NH₃-N DATA COLLECTED ON NORTH SIDE WRP
FINAL EFFLUENT SAMPLES

Dates	Range (Mean) Flow MGD	Range (Mean) BOD ₅ mg/L	Range (Mean) CBOD ₅ mg/L	Range (Mean) SS mg/L	Range (Mean) TKN mg/L	Range (Mean) NH ₃ -N mg/L
<u>Oct 21-26, 2002</u>	182-282 (216)	8-12 (9.2)	<2-2 (2.0)	4-8 (6.2)	1.8-2.7 (2.2)	0.3-0.8 (0.6)
Jan 6-11, 2003	185-209 (198.8)	9-11 (9.7)	<2-3 (2.8)	6-7 (6.3)	1.9-2.5 (2.2)	0.5-1.2 (0.9)
Mar 10-15, 2003	206-244 (229.3)	10-16 (13.8)	3-5 (3.8)	7-11 (9.0)	2.8-4.4 (3.8)	1.1-2.3 (1.7)
Apr 21-26, 2003	197-214 (205.7)	9-12 (10.3)	<2-4 (3.4)	6-9 (7.5)	2.0-3.0 (2.5)	0.8-1.1 (0.9)
Jul 21-26, 2003	212-371 (247.5)	4-7 (4.7)	<2-4 (3.0)	3-7 (4.2)	1.1-1.8 (1.5)	0.2-0.6 (0.4)
Sep 15-20, 2003	203-218 (211.2)	3-6 (4.3)	<2-2 (2.0)	2-3 (2.7)	1.2-1.8 (1.5)	0.2-0.5 (0.3)
Mar 8-13, 2004	231-279 (245.5)	22-30 (26.3)	4-6 (5.0)	9-12 (10.5)	3.5-5.3 (4.3)	2.3-4.2 (3.1)
Apr 5-10, 2004	215-240 (222.7)	10-22 (12.7)	3-7 (4.0)	5-9 (6.3)	2.0-2.8 (2.3)	0.63-1.25 (0.8)

TABLE 21 (Continued): COMPARISON OF FLOW, BOD₅, CBOD₅, SS, TKN, AND NH₃-N DATA COLLECTED ON NORTH SIDE WRP FINAL EFFLUENT SAMPLES

Dates	Range (Mean) Flow MGD	Range (Mean) BOD ₅ mg/L	Range (Mean) CBOD ₅ mg/L	Range (Mean) SS mg/L	Range (Mean) TKN mg/L	Range (Mean) NH ₃ -N mg/L
May 3-8	197-219 (207.2)	9-16 (11.0)	2-4 (2.7)	3-4 (3.7)	2.1-2.9 (2.4)	0.96-1.41 (1.2)
Aug 16-21, 2004	194-304 (232.8)	5-12 (7.3)	<2.3 (3.0)	3-7 (5.2)	1.6-3.7 (2.3)	0.45-1.9 (1.0)

ranged from 198.8 MGD to 232.8 MGD for the NOEC100 weeks during which North Side WRP effluent samples were collected for the study. The flows during the week of July 21-26, 2003 ranged from 212 to 371 million gallons per day (MGD) with an average flow of 247.5 MGD during that week. The high end of this range is greater than the design flow of the North Side WRP (333 MGD) but well within the maximum flow (450 MGD). The flows during the week of March 8-13, 2004, ranged from 231 to 279 MGD with an average flow of 245.5 MGD during that week. This range of flow is far below the design flow. However, during the time period March 1-7, 2004, the flows ranged from 231 to 487 MGD with an average flow of 328 MGD. It is not known whether the extremely high flows that occurred during the week preceding the March 8-13, 2004 WET test had any impact on its outcome.

Values for all of the parameters measured in the North Side WRP final effluent during the week of July 21-26, 2003, (operating data, [Appendix HII](#)) appear to be in the normally observed ranges. However, the results of organic priority pollutant analysis performed on the composite final effluent samples used for the WET tests that week revealed the presence of methylene chloride in the first composite sample ([Appendix I-1](#)). The highest observed flow during that week (371 MGD) was on July 21, that is, on the day that the first samples were collected for the WET test. The flow value of 371 MGD on July 21 and the presence of methylene chloride (4 µg/L) in the first composite sample, suggest that a slug of methylene chloride may have entered the North Side WRP on July 21 and or July 22, 2003, during this high flow event. However, it is not known whether methylene chloride was present in any of the composite samples of North Side WRP effluent from NOEC100 weeks or whether 4 µg/L methylene chloride is a high enough concentration to effect *Ceriodaphnia dubia* survival and reproduction.

Values for most of the parameters measured in North Side WRP final effluent (operating data, Appendix HII) during the week of March 8-13, 2004, appeared to be similar to observed ranges for NOEC100 weeks except for BOD₅, CBOD₅, SS, TKN, and NH₃- N (Table 21). The ranges of these parameters are all within NPDES limits for the North Side WRP but appear to be higher during the week of March 8-13, 2004, than during NOEC100 weeks. No toxic organic pollutants or elevated trace metal concentrations were observed in the effluent samples used for this test. It is not known whether elevated levels of parameters in Table 21 during the week of March 8-13, 2004, can explain why an NOEC survival value of 75 percent effluent was observed with the WET test that week.

The SRT in the four batteries at the North Side WRP for the dates on which WET samples were collected plus the day before sample collection began are summarized in Table 22. The mean SRT and range of values for each of the four batteries for the weeks of July 20-26, 2003, and March 7-13, 2004, were similar to the range for NOEC100 weeks and do not reveal any operational problems. The results of analyses of MLSS and MLVSS on the same dates, July 20-26, 2003, and March 7-13, 2004, are summarized in Tables 23 and 24, respectively. The mean MLSS (values in mg/L) and the mean MLVSS (values in mg/L) for Batteries A, B, C, and D for March 7-13, 2004, all appear to be similar to the range for NOEC100 weeks. However, the mean MLSS and the mean MLVSS for Batteries A, B, C, and D for July 20-26, 2003, are all below the corresponding mean values for NOEC100 weeks.

The WRP operating data discussed in the previous paragraphs indicate that some WRP operating parameters and effluent chemical compositions were different at the North Side WRP during the weeks of July 21-26, 2003, and March 8-13, 2004 than during the NOEC100 weeks

TABLE 22: MEAN (RANGE) SLUDGE RESIDENCE TIME (DAYS) NORTH SIDE WRP ON THE DATES WET SAMPLES WERE COLLECTED

DATES	BATTERY			
	A	B	C	D
July 20-26, 2003 ^a	8.4 (7.2-9.7)	9.6 (6.7-12.3)	9.6 (6.2-12.9)	11.2 (8.0-14.3)
March 7-13, 2004 ^a	7.6 (6.1-8.9)	6.9 (6.3-7.9)	10.1 (9.1-11.7)	10.1 (9.1-11.7)
All Dates of Other 8 Tests	8.9 (7.5-10.9)	9.8 (7.7-13.8)	11.6 (8.8-20.0)	9.1 (6.7-12.7)

^aDates on which WET samples were collected plus the day before sample collection began.

TABLE 23: MEAN (RANGE) MIXED LIQUOR SUSPENDED SOLIDS (mg/L) NORTH SIDE WRP ON THE DATES WET SAMPLES WERE COLLECTED

DATES	BATTERY			
	A	B	C	D
July 20-26, 2003 ^a	1860 (1708 ^b -1936)	1792 (1544 ^b -1900)	1772 (1616 ^b -1896)	2214 (2016 ^b -2320)
March 7-13, 2004 ^a	2052 (1892-2236)	2125 (1936-2380)	2144 (1880-2356)	2689 (2240-2976)
All Dates for Other 8 Tests	1981 (1644-2444)	2010 (1552-2588)	1960 (1644-2344)	2325 (1896-2820)

^aDates on which WET samples were collected plus the day before sample collection began.

^bSample collected on July 21, 2003.

TABLE 24: MEAN (RANGE) MIXED LIQUOR VOLATILE SUSPENDED SOLIDS (mg/L) NORTH SIDE WRP ON THE DATES WET SAMPLES WERE COLLECTED

<u>DATES</u>	<u>BATTERY</u>			
	A	B	C	D
July 20-26, 2003 ^a	1351 (1236 ^b -1404)	1301 (1112 ^b -1400)	1289 (1176 ^b -1360)	1580 (1436 ^b -1668)
March 7-13, 2004 ^a	1507 (1416-1596)	1566 (1460-1716)	1582 (1420-1744)	1985 (1644-2356)
All Dates for Other 8 Tests	1527 (1364-1850)	1555 (1385-1893)	1518 (1384-1841)	1792 (1607-2046)

^aDates on which WET samples were collected plus the day before sample collection began.

^bSample collected on July 21, 2003.

The actual effect of these differences on the outcome of the WET tests that were conducted on *Ceriodaphnia dubia* is not known at this time. With respect to the observation that high flow conditions existed at the North Side WRP during the week of July 21-26, 2003 and immediately prior to the week of March 8-13, 2004, the District's Engineering Department, in cooperation with Maintenance and Operations and the Research and Development Departments, is involved in a long-range planning study to address current and future plant needs at the North Side, Stickney, and Calumet WRPs. The consultant firms of Consoer Townsend Envirodyne Engineers, Inc. (CTE), Black and Veatch Corp., Greeley Hansen LLC (BV&GH), and Metcalf and Eddy were selected by the District to evaluate the current conditions at the North Side WRP, Stickney, and Calumet WRPs, respectively, and develop detailed master plans of improvements to be implemented at these WRPs over the next 20 years, to ensure that these WRPs continue to provide exceptional quality wastewater treatment into the next half-century.

In summation, the District and the CRL dedicated considerable resources to assess the final effluents from the Stickney, North Side, and Calumet WRPs for chronic toxicity during the period October 2002 through November 2004. Thirty chronic WET tests with *Pimephales promelas* and 30 chronic WET tests with *Ceriodaphnia dubia* were conducted in the District's WET Laboratory, and nine chronic WET tests with *Pimephales promelas* and 9 chronic WET tests with *Ceriodaphnia dubia* were conducted in CRL. The results of the WET tests conducted and the results of chemical specific data collected for this study were in good general agreement, that is, calculable NOEC values were observed only for the North Side WRP during weeks when the operating data indicated that there was high flow and/or presence of methylene chloride in the effluent. While the exact causes of the calculable NOEC values observed for the North Side WRP in this study have not been determined, these results indicate that the WET tests deployed

here have adequate sensitivity to respond to changes in effluent quality which may be caused by high flow (greater than design flow) or presence of toxic chemicals.

Regarding optimal treatment of wet weather flow, the District is addressing current and long-range needs of the North Side, Stickney, and Calumet WRPs. The results of this study support the following conclusions:

- 1) Chronic toxicity is not associated with the effluents from the Stickney, Calumet, and North Side WRPs.
- 2) Final effluents from the Stickney, Calumet, and North Side WRPs would not cause chronic toxicity problems in their receiving streams.
- 3) The District's Stickney, Calumet, and North Side WRPs provide exceptional quality wastewater treatment and will continue to do so.

The successful completion of this Assessment demonstrated how cooperation between different governmental agencies can address issues vital for all parties such as evaluating chronic effluent toxicity associated with District WRPs in a manner that will promote public confidence.

CERTIFICATION OF ACCURACY

I certify under penalty of law that this document and all appendices were prepared under my supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations 40 C.F.R. 122.22 (d).

Date

Richard Lanyon
Director
Research and Development

If you have any questions concerning this report, telephone Dr. James T. Zmuda, Microbiologist IV, at 708-588-4224.

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