UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
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CHICAGO, IL 60604-3590

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STATE OF ILLINOIS
Pollution Control Board

REPLY TO THE ATTENTION OF:

WQ-16J

APR 2 8 2014

ORIGINAL

PC# 1404

John Therriault
Illinois Pollution Control Board, Clerk's Office
James R. Thompson Center
100 West Randolph Street, Suite 11-500
Chicago, Illinois 60601

Re: Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River, R08-009 Subdocket D

Dear Illinois Pollution Control Board:

The U.S. Environmental Protection Agency commends the Illinois Pollution Control Board (Board) for its continued work to update the water quality standards that apply to the Chicago Area Waterway System and Lower Des Plaines River (CAWS and LDPR). To assist the Board in this process, EPA is providing the enclosed comments on the following:

- Proposed revisions to 35 Ill. Admin. Code Part 302 attached to the "Illinois Environmental Protection Agency's Motion to Amend Regulatory Proposal Filed in 2007" filed with the Board on May 24, 2013;
- Proposed chloride criteria included in the pre-filed testimony of Roger Klocek filed with the Board on November 22, 2013;
- Additional chloride information filed with the Board on January 22, 2014 as Public Comment (PC) #1395; and
- Proposed revisions to mixing zone provisions in 35 Ill. Admin. Code Part 302 filed with the Board on December 13, 2013 as PC #1394.

Additionally, in a letter dated May 16, 2012, EPA disapproved in accordance with Section 303(c)(3) of the Clean Water Act a number of the revisions to Illinois' water quality standards that the Board adopted in Subdocket A. In that letter, which has been included in the docket of these proceedings as PC #1338, EPA specified the changes Illinois needed to make to meet the requirements of the Clean Water Act and 40 CFR Part 131. EPA urges the Board to make those necessary changes to Illinois' water quality standards.

EPA appreciates the opportunity to provide comments to the Board as it proceeds toward adoption of new and revised water quality standards for the CAWS and LDPR. Please contact Candice Bauer of my staff at bauer.candice@epa.gov or (312) 353-2106 if you have any questions.

Sincerely,

Tinka G. Hyde
Director, Water Division

Enclosures

cc: Marcia Willhite, Illinois Environmental Protection Agency

Enclosure 1: EPA's Specific Comments on Issues Raised in R08-009 Subdocket D

I. EPA Comments on Illinois EPA's Proposed Revisions Filed With the Board on May 24, 2013

A. Specific Criteria

EPA reviewed the criteria proposed by Illinois EPA in light of the requirements of 40 CFR 131.11 pertaining to state adoption of criteria.

40 CFR 131.11(a)(1) provides:

> States must adopt those water quality criteria that protect the designated use. Such criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive use.

40 CFR 131.11(b)(1) provides:

> (b) Form of criteria: In establishing criteria, States should:
> (1) Establish numerical values based on:
> (i) 304(a) Guidance; or
> (ii) 304(a) Guidance modified to reflect site-specific conditions; or
> (iii) Other scientifically defensible methods;

Criteria consistent with EPA's 304(a) Guidance would protect the designated uses for the CAWS and LDPR and be based on sound scientific rationale. EPA believes that the criteria included in Illinois EPA's amended proposal that was filed with the Board on May 24, 2013, appear to be consistent with EPA's 304(a) Guidance or are otherwise based on scientifically defensible methods except for: (a) the provision allowing exccedance hours for temperature, and (b) the criteria for ammonia, selenium, and copper.

If the Board wishes to adopt criteria that are not based on EPA's current 304(a) Guidance, the administrative record should demonstrate that any such criteria were derived using scientifically defensible methods. One approach that EPA believes could be scientifically defensible would be to utilize methods consistent with EPA's guidance for deriving site specific criteria as described in Chapter 3.7 of EPA's Water Quality Standards Handbook and its updated information (available at: http://water.epa.gov/scitech/swguidance/standards/handbook/chapter03.cfm#section7). Specifically, it could be scientifically defensible to derive criteria for the CAWS and LDPR based on a toxicity database that does not include species that are not actually occurring or expected to occur when it can be demonstrated that such species are not representative of other species occurring or expected to occur in these waters as described in EPA's 2013 guidance entitled "Revised Deletion Process for the Site-Specific Recalculation Procedure for Aquatic Life Criteria" (available at: http://water.epa.gov/scitech/swguidance/

standards/criteria/aqlife/ammonia/upload/Revised-Deletion-Process-for-the-Site-Specific-Recalculation-Procedure-for-Aquatic-Life-Criteria.pdf).

1. Allowance of Exceedence Hours to Maximum Temperature Criteria for Protection of Aquatic Life

Illinois EPA proposes to allow an increase of 3.6°F above the proposed standards to occur for 2% of the hours of the year. EPA questions whether adoption of this provision would be consistent with the requirements of 40 CFR 131.11(a)(1) that the criteria be based upon a sound scientific rationale because it would allow for temperatures above the upper incipient lethal temperature determined using lab studies such that mortality would be expected in fish exposed to these temperatures. One way that the Board could address this concern would be to remove 35 Ill. Admin. Code 302.408(a).

2. Ammonia, Selenium, and Copper Aquatic Life Criteria

EPA's review of Illinois EPA's proposed ammonia, selenium, and copper criteria suggests that the criteria do not appear to be consistent with the requirements of 40 CFR 131.11(b)(1) since the criteria are not consistent with or derived from EPA's most recent 304(a) criteria toxicity datasets. To be consistent with 40 CFR 131.11(b)(1), the Board could revise the ammonia, selenium, and copper criteria by adopting criteria consistent with EPA's most recent 304(a) Guidance; 304(a) Guidance modified to reflect site-specific conditions or other scientifically defensible methods based upon the toxicity datasets described in the 304(a) Guidance for ammonia (2013), selenium (1999), and copper (2007) (available at: http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm).

3. Cadmium Acute and Chronic Aquatic Life Criteria

In a letter to Illinois EPA filed with the Board on March 26, 2010 (PC #286), EPA questioned whether Illinois EPA's proposed cadmium criteria were based on sound scientific rationale. Subsequent to those comments, EPA reevaluated *Hyalella* chronic toxicity data that were used in developing EPA's 2001 304(a) Guidance for cadmium aquatic life criteria in light of new information on *Hyalella* amphipod toxicity test methods and cadmium toxicity data reported in Mebane 2010 (available at: http://pubs.usgs.gov/sir/2006/5245/). This preliminary review of available data suggests that the 10-day biomass endpoint for *Hyalella azteca* as reported in Ingersoll and Kemble 2001 (*See*: Enclosure 2) could be used for criteria derivation (IC25 value of 2.4 μg/L at a hardness of 280 mg/L). Use of this *Hyalella* data in place of the *Hyalella* Genus Mean Chronic Value in the cadmium toxicity database reported by C. A. Mebane in 2010, after removal of salmonid fish taxa that are not native to the CAWS/LDPR watershed, would result in a cadmium criterion of about 0.7ug/L. The resulting chronic criterion value is similar in magnitude to Illinois EPA's proposed chronic criterion of 0.62 μg/L at a hardness of 50 mg/L. Further review of Illinois EPA's proposed acute cadmium criterion suggests that the proposed acute criterion of 4.35 μg/L is more stringent than a recalculation of EPA's 2001 acute criterion, which removes nonnative salmonid fish taxa, and results in a site specific acute criterion of about 9 μg/L. This reanalysis appears to suggest that Illinois EPA's proposed acute and chronic cadmium criteria are consistent with 40 CFR 131.11(a)(1) and 131.11(b)(1).

EPA notes that it is working to release a new 304(a) Guidance for cadmium within the next year that will update the scientific basis for EPA's 304(a) Guidance for cadmium. EPA recommends that the Board move forward to adopt appropriate cadmium criteria without waiting for release of updated 304(a) Guidance. To the extent that EPA issues a draft of its 304(a) Guidance for cadmium prior to finalization of the Board's rulemaking for the CAWS, EPA recommends that the Board consider that draft and any scientific studies referenced therein to ensure that any criteria that the Board ultimately adopts is based on sound scientific rationale.

4. Mercury Human Health Criterion

EPA previously recommended that Illinois EPA either adopt criteria consistent with the fish-tissue based methyl-mercury criterion set forth in EPA's January 2001 guidance document entitled, "Water Quality Criterion for the Protection of Human Health: Methylmercury" (available at: http://water.epa.gov/scitech/swguidance/standards/criteria/health/upload/2009_01_15_criteria_methylmercury_mercury-criterion.pdf) and/or translate the methylmercury criterion into a water column criterion.

After considering this recommendation, the Illinois EPA retained its proposed water column criterion of 12 ng/L for total mercury. If Illinois EPA ultimately adopts and submits this criterion for EPA's approval, EPA will review its protectiveness and scientific defensibility, per 40 CFR 131.11(b)(1), in light of the scientific and programmatic information in EPA's January 2001 criterion and in EPA's April 2010 guidance document entitled "Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion" (available at: http://water.epa.gov/scitech/swguidance/standards/criteria/health/methylmercury.cfm).

Specifically, in Section 3.1.3.1 of the 2010 Guidance, EPA provides guidance for translating the fish-tissue concentration in EPA's 2001 recommended national water quality methylmercury criterion to a water column concentration. The preferred methods are to use site-specific bioaccumulation factors (BAFs) and conversion factors derived from field studies, or to use a scientifically defensible bioaccumulation model. In this respect, EPA recently assessed the availability of data for use in derivation of site-specific bioaccumulation factors BAFs for these waters. In response, Illinois EPA indicated to EPA that there are no entities that collect low-level mercury samples in ambient water from this area and so the calculation of a site-specific BAF does not appear to be possible at this time.

Section 3.1.3.1.3 of the 2010 Guidance presents another method for deriving a water column criterion from the 2001 methylmercury criterion using EPA's draft national BAFs and draft national conversion factors. EPA conducted a preliminary analysis of the protectiveness of Illinois EPA's proposed total mercury criterion in light of that method. In this analysis, EPA used the draft national BAF -- that is, the geometric mean of the trophic level 4 BAF for rivers in the scientific literature -- of 1,240,000 L/kg (Table A-8 of EPA's 2001 methylmercury criterion) and the corresponding draft national factor of 0.014 (Table A-3 for lotic or river systems of EPA's 2001 methylmercury criterion) to convert from methylmercury to total mercury in the water column. Based upon this preliminary analysis, it appears that Illinois EPA's proposed 12 ng/L mercury criterion could potentially be scientifically defensible and protective of the use.

EPA's 2010 Guidance cautions, however, that the use of the draft national BAFs and conversion factors, which are drawn from data that vary widely and were collected from various geographical areas, may result in criteria that are either underprotective or overprotective of human health uses. However, EPA is not aware of any information that would suggest that the habitats present in the CAWS and LDPR are substantially different from the rivers used to derive the default river BAF and conversion factor.

EPA also reviewed the limited available fish tissue data from the CAWS and LDPR sites provided by Illinois EPA (*See*: Enclosure 3). The current fish tissue levels are 0.21 mg/kg or less, based upon 141 samples collected in various waters to which Illinois EPA has proposed the application of this criterion since 1985, which is lower than EPA's 304(a) criterion guidance value for methylmercury fish tissue concentrations of 0.3 mg/kg. The average fish tissue concentration for the fish sampled (dominated by bass, especially the top predator in these waters -largemouth bass, carp and sunfish) is 0.07 mg/kg, with numerous non-detects of methylmercury (at the 0.05 mg/kg detection level).

EPA therefore recommends that in submitting its water column criterion to EPA, Illinois should provide additional information regarding the following topics:

- Why it is not feasible at present to derive site-specific BAFs for methylmercury, and methylmercury-to-total mercury water column conversion factors, for the CAWS and LDPR;
- Whether it is feasible to apply a bioaccumulation model;
- Whether Illinois is aware of additional information that would suggest that the habitats present in the CAWS and LDPR are inconsistent with the range of habitats in the rivers used to derive the draft national river BAF;
- Whether Illinois is aware of information to suggest that the draft national BAFs and conversion factors are underprotective in view of the uncertainty factors described in Section 3.1.3.1.3 of the Guidance; and,
- Whether the current water column concentrations of total mercury are at or below 12 ng/L (if concentrations are below 12 ng/L, this information may provide further support for setting the criterion at that value).

In future triennial reviews of the CAWS and LDPR standards, Illinois should evaluate the potential for future derivation of a site-specific water column criterion based on site-specific BAFs and conversion factors or on a bioaccumulation model, consistent with EPA's 2010 Guidance. Alternatively, Illinois could consider adoption of fish tissue methylmercury criteria in addition to any adopted water column mercury criteria in order to protect the human health use in the CAWS and LDPR.

5. Chloride Acute Aquatic Life Criterion

In its comments to Illinois EPA that were filed in these proceedings as PC #286, EPA previously recommended that Illinois EPA consider revising its chloride criteria based on existing 304(a) Guidance or utilize more recent toxicity data to derive appropriate criteria. Subsequently, EPA reviewed more recent toxicity data and believes that Illinois EPA's proposed never-to-be-exceeded criterion of 500 mg/L chloride would likely be sufficient to prevent acute toxicity to aquatic organisms present in the CAWS and LDPR such that this acute criterion would likely to be consistent with 40 CFR 131.11(b)(1).

EPA notes that it is working to release a new 304(a) Guidance for chloride that will update the scientific basis for EPA's 304(a) Guidance for chloride. EPA recommends that the Board move forward to adopt appropriate chloride criteria without waiting for release of an updated 304(a) Guidance. To the extent that EPA issues a draft of its 304(a) Guidance for chloride prior to finalization of the Board's rulemaking for the CAWS, EPA recommends that the Board consider that draft and any scientific studies referenced therein to ensure that any criteria that the Board ultimately adopts is based on sound scientific rationale.

There have been suggestions that the Board adopt procedures allowing for a multi-discharger or water body variance for chloride because some have suggested that it will not be feasible to attain Illinois EPA's proposed acute chloride criterion during winter months due to deicing activities. Variances to water quality standards are new or revised standards that require EPA approval under Section 303(c) of the Clean Water Act. EPA agrees that states can adopt time-limited water body variances where it is not feasible to immediately attain criteria necessary to protect a designated use, provided that the state can demonstrate that it is infeasible to attain the use during the duration of the variance due to one of the six reasons set forth at 40 C.F.R. § 131.10(g). EPA recommends that the Board consider the following documents, which summarize federal requirements pertinent to variances from water quality standards, as the Board evaluates the possibility of adopting a variance or variance procedures pertaining to chloride:

- Illinois EPA's "Agency Recommendation" filed on April 7, 2014, in *Sanitary District of Decatur v. IEPA*, PCB 2014-111;
- EPA's March 15, 2013, letter and enclosure to Illinois EPA filed on March 19, 2013, in *CITGO Petroleum Corporation and PDV Midwest Refining, L.L.C. v.* IEPA, PCB 2012-094;
- EPA's Questions and Answers regarding multiple discharger variances (available at: http://water.epa.gov/scitech/swguidance/standards/upload/Discharger-specific-Variances-on-a-Broader-Scale-Developing-Credible-Rationales-for-Variances-that-Apply-to-Multiple-Dischargers-Frequently-Asked-Questions.pdf); and,
- EPA's Federal Register Notice regarding proposed regulatory clarifications (available at: http://www.gpo.gov/fdsys/pkg/FR-2013-09-04/pdf/2013-21140.pdf).

EPA has been having discussions with Illinois EPA about the possibility of Illinois adopting a time-limited water body variance for chloride. Based on those discussions, EPA believes that such a variance could be a viable option to consider, although there are numerous complex technical and legal issues that should be further addressed in order to demonstrate that the variance is consistent with 40 CFR 131.10(g) before the Board adopts any chloride water body variances or other chloride variance procedures.

6. Attainability of Criteria

Several commenters have suggested that it may be appropriate to adopt a variance or variance procedures for various other water quality constituents where the proposed water quality criteria are not currently achievable. To the extent that the Board considers this request as it relates chloride or any other water quality criteria, the record before the Board should clearly demonstrate that the variance is consistent with federal requirements as described in the references listed above. In particular, the record should demonstrate that any variance is limited in its scope and duration such that the variance applies only to the times, places, and/or dischargers where attainment of the criteria cannot be achieved for one of the reasons set forth at 40 CFR 131.10(g).

B. Miscellanea

1. Minimum Sampling Provisions

Several provisions in Illinois EPA's proposal establish minimum sampling requirements for assessing attainment of criteria. *See, e.g.,* 302.405(c)(3) and 302.407(b) and (c). Including these types of assessment provisions within Illinois water quality standards themselves, rather than in a separate, unrelated section of Illinois' administrative code, is problematic because it suggests that the criteria's applicability is dependent on whether the requisite sampling requirements have been met. Clearly, there is no scientific basis to conclude that Illinois' aquatic life uses can be protected by water quality standards that render the criteria that are designed to protect those uses ineffective simply because sampling requirements deemed to be necessary for measuring the level of pollutants in the receiving stream have not been complied with. EPA, therefore, recommends that the Board remove minimum sampling requirements from Illinois' water quality standards.

2. Duration and Frequency Aspects of Water Quality Criteria

Water quality criteria consist of three components which, *when used together*, provide the most scientific assurance that the criteria are protective of the designated use: magnitude is the scientifically derived numeric expression of the amount of the pollutant (often expressed as a concentration value); duration is the period of time over which the magnitude is calculated; and, frequency is the number of times the pollutant may be present above the magnitude over the specified duration. As such, in reviewing new and revised water quality standards to ensure that criteria are "based on sound scientific rationale and contain sufficient parameters or constituents to protect the designated use," EPA considers all three components of water quality criteria.

Illinois EPA has proposed a duration for its chronic criteria in Section 302.407(b) that could be of unlimited scope, as the rule states that the duration can be "any period of *at least* four days" (emphasis added). EPA questions whether such an unbounded duration is based on sound scientific rationale. Rather than adopting such unbounded language of questionable scientific validity, EPA recommends that the Board adopt appropriate duration and frequency for its water quality criteria consistent with EPA's guidance, as described in EPA's Water Quality Standards

Handbook (http://water.epa.gov/scitech/swguidance/standards/handbook/index.cfm). The Handbook at Sections 3.1.2 and 3.1.3 says:

> EPA's [aquatic life] criteria indicate a time period over which exposure is to be averaged, as well as an upper limit on the average concentration, thereby limiting the duration of exposure to elevated concentrations. For acute criteria, EPA recommends an averaging period of 1 hour. That is, to protect against acute effects, the l-hour average exposure should not exceed the CMC. For chronic criteria, EPA recommends an averaging period of 4 days. That is, the 4-day average exposure should not exceed the CCC....To predict or ascertain the attainment of criteria, it is necessary to specify the allowable frequency for exceeding the criteria. This is because it is statistically impossible to project that criteria will never be exceeded. As ecological communities are naturally subjected to a series of stresses, the allowable frequency of pollutant stress may be set at a value that does not significantly increase the frequency or severity of all stresses combined. EPA recommends an average frequency for excursions of both acute and chronic [aquatic life] criteria not to exceed once in 3 years.
>
> Water quality criteria for human health contain only a single expression of allowable magnitude; a criterion concentration generally to protect against long-term (chronic) human health effects. Currently, national policy and prevailing opinion in the expert community establish that the duration for human health criteria for carcinogens should be derived assuming lifetime exposure, taken to be a 70-year time period. The duration of exposure assumed in deriving criteria for noncarcinogens is more complicated owing to a wide variety of endpoints: some developmental (and thus age-specific and perhaps gender- specific), some lifetime, and some, such as organoleptic effects, not duration-related at all. Thus, appropriate durations depend on the individual noncarcinogenic pollutants and the endpoints or adverse effects being considered.

3. Mixing Zones

EPA recommends that the Board ensure that mixing zones not result in lethality to organisms passing through the mixing zone or in significant human health risks considering likely pathways of exposure. One such significant human health risk could result where mixing zones for human health criteria are established for bioaccumulative pollutants. Section 5.1.4 of EPA's Water Quality Standards Handbook states that denial of a mixing zone should be considered when bioaccumulative pollutants are in the discharge. If the Board intends to allow mixing zones for human health criteria for bioaccumulative pollutants, the Board should also explain how it intends to ensure that such mixing zones will not result in significant human health risks.

One way the Board could address the comments on minimum sample size and duration would be to revise the proposed rule for chronic aquatic life criteria to say, "The chronic standard (CS) for the chemical constituents listed in subsection (e) shall not be exceeded by the arithmetic average of ~~at least four consecutive~~ all samples collected over any period of ~~at least~~ four days, except as provided in subsection (d)." One way the Board could address the comments as it relates to duration and mixing zones for human health criteria is to say, "The human health standard

(HHS) for the chemical constituents listed in subsection (f) shall not be exceeded on a 12-month rolling average, ~~based on at least eight samples,~~ collected in a manner representative of the sampling period, except as provided in subsection (d) for substances that are not bioaccumulative."

4. Standards for Upper Dresden Island Pool of LDPR

EPA recommends that the Board adopt criteria for the Upper Dresden Island Pool (UDIP) to ensure that the water has a set of criteria consistent with 40 CFR 131.11(a)(1) and 40 CFR 131.11(b)(1). One way for the Board to do this would be to adopt criteria for the UDIP to be consistent with Illinois EPA's May 24, 2013 proposal of updated standards for other AL Use A waters (*i.e.,* adding various criteria and correcting values for new background temperatures) except as further described in this document, and by adopting dissolved oxygen criteria for the UDIP that are consistent with the protections afforded to other General Use waters.

5. Standards for the South Fork of the South Branch of the Chicago River (Bubbly Creek)

The criteria set forth in 35 Ill. Admin. Code 302 Subpart D currently apply to Bubbly Creek. Illinois EPA's proposal to replace the Clean Water Act-effective criteria at Subpart D that currently apply to all CAWS and LDPR waters (including Bubbly Creek) with new and revised water quality criteria for the Aquatic Life Use A, Aquatic Life Use B, and Upper Dresden Island Pool Aquatic Life use waters effectively removes all criteria currently applicable in Bubbly Creek. The criteria are removed due to the fact that no new aquatic life use or criteria has been proposed for this water. These changes do not appear to be consistent with 40 CFR 131.5(a)(2), 131.5(a)(5), 131.6(c), and 131.11(a)(1) as the proposal removes all criteria necessary to protect the current "Indigenous Aquatic Life" designated use at 35 Ill. Adm. Code 303.204 for this water.

EPA recommends that Board ensure that its rules include appropriate criteria to protect the designated aquatic life use for Bubbly Creek. One way the Board could ensure adequate criteria are adopted is to either: (a) retain the existing criteria in 35 Ill. Admin. Code Section 302 Subpart D that currently apply to Bubbly Creek, or (b) place Bubbly Creek into one of the new aquatic life use designations until such time that site-specific uses and criteria are justified.

6. Standards for the Chicago River

35 Ill. Admin. Code 302.401 says:

> The Subpart B general use and Subpart C public water supply standards of this Part do not apply to waters described in 35 Ill. Admin. Code 303.204 and listed in 35 Ill. Adm. Code 303.220 through 303.235 as the Chicago Area Water System or Lower Des Plaines River, except that waters designated as Primary Contact Recreation Waters in 35 Ill. Adm. Code 303.220 must meet the numeric water quality standard for bacteria applicable to protected waters in 35 Ill. Adm. Code 302.209.

The Board decided in Subdocket C that the Chicago River should meet the General Use standards for aquatic life uses and thus did not list the Chicago River at 303.230 or 303.235 where applicable aquatic life uses for the CAWS and LDPR are described. However, the Chicago River is "described in 303.204" as part of the Waterway for which Subpart B standards do not apply. Further, the Chicago River is listed in part 303.220, which would be another reason why it would appear that the Subpart B standards for aquatic life and human health do not apply to the Chicago River. Since the proposed standards in Subdocket D do not include any reference to the appropriate standards for the Chicago River, no appropriate standards for the protection of uses other than recreation (including the aquatic life, wildlife, agricultural, industrial and aesthetic uses mentioned in the General Use designation) would exist in Illinois's water quality standards based upon Illinois EPA's proposal.

Therefore, EPA recommends that the Board ensure that its rules include appropriate criteria to protect other uses in addition to recreational uses for the Chicago River. One way the Board could ensure adequate criteria are adopted is to either: (a) remove the Chicago River from the definition of the Chicago Area Waterways at 35 Ill. Admin. Code 301.247 and Chicago River System at 35 Ill. Admin. Code 301.250, as well as from Part 303.220, so that it reverts to the standards applicable to General Use waters, or (b) to add in additional language that states specifically that all Subpart B standards do apply to the Chicago River at 35 Ill. Admin. Code 302.204.

7. Standards for the Protection of Human Health

Illinois EPA has proposed that 35 Ill. Admin. Code 302.410 be revised to include the protection of human health. EPA supports the inclusion of procedures to ensure protection of human health in the CAWS and LDPR. EPA recommends that the Board clarify Section 302.410 in order to ensure that the language provides for appropriate protection of human health because substances that are harmful to human health may not necessarily be toxic to aquatic life, but this provision could be interpreted as limiting the applicability of this provision only to substances that are harmful to aquatic life. One way to clarify the applicability of the procedures would be to delete the words "toxic to aquatic life," which appear to qualify the remainder of the provisions. The provision could be revised to state, "Any substance or combination of substances ~~toxic to aquatic life~~ not listed in Section 302.407 shall not be present in amounts toxic or harmful to human health, aquatic life or wildlife." Further, the words "human health" should be added at 35 Ill. Admin. Code 302.402 in describing the uses to be protected in these waters.

EPA also wants the Board to be aware that updates to EPA's 304(a) criteria for human health protection are being released in May 2014 (and upon their release will be available at: http://water.epa.gov/scitech/swguidance/standards/criteria/health/). EPA urges you to consider these pending updates in these proceedings.

II. EPA Comments on Citgo's Proposed Site Specific Winter Chloride Criteria submitted on November 22, 2013

A. EPA's 2013 site specific criteria (SSC) guidance recommends the following procedure be followed in deriving defensible water quality criteria:

1. Addition of data to the dataset that EPA has determined to be acceptable for criteria derivation.
2. Correction of any data already in the dataset that EPA has determined to be necessary.
3. (Optional) Deletion procedure applied to dataset.
4. Compile biological data collections for the site and surrounding waters.
5. Make a species list for the site and other nearby waters for fish, benthic macroinvertebrates, unionid and fingernail clams, zooplankton, and amphibian taxa.
6. Determine if the genus/family/order present in the updated toxicity dataset are present at the site currently or in the past or in nearby bodies of water.
7. Remove species in accordance with deletion procedure.
8. Determine if the remaining "acceptable" data fulfill 8 minimum data requirements.
9. Use dataset to derive SSC if sufficient data is available.

B. Citgo's Approach

Citgo's proposed winter SSC for chloride in the Chicago Sanitary and Ship Canal (CSSC) removed the *Sphaerium*, *Ceriodaphnia* and *Lampsilis* Genus Mean Acute Values (GMAVs) from the toxicity database used to derive chloride water quality in Iowa and added one new toxicity result for *Musculium* fingernail clams to calculate the new winter acute chloride SSC of 990 mg/L and then derived a new winter chronic chloride SSC of 620mg/L by using the Iowa acute to chronic ratio.

C. EPA's Preliminary Analysis

As described below, EPA questions whether the justification of the SSC provided by Citgo is scientifically defensible and therefore questions whether Citgo's proposed site specific criteria is consistent with the requirements of 40 CFR 131.11(a)(1) and 131.11(b)(1). Specifically, EPA's preliminary review suggests that the deletion of *Ceriodaphnia*, *Sphaerium*, and *Lampsilis* GMAVs is not appropriate due to the fact that these species should be considered to "occur at the site" as defined in EPA's 2013 revised deletion process guidance or because they serve as necessary surrogates for other species that occur at the site. Further, EPA questions whether all appropriate new toxicity data has been added to the toxicity database used to derive the criteria.

1. *Ceriodaphnia* Water Flea

There is information available supporting the use of the *Ceriodaphnia* GMAV in the chloride database for the purposes of deriving a winter site specific criteria for chloride because species in the genus have been recorded at the site. For instance, the record indicates that:

- *Ceriodaphnia* is repeatedly present in the CSSC at some times of the year (INHS 1978 data included in November 22, 2013 prefiled testimony of Roger Klocek; INHS data from 2010-2012 included in PC #1395);

- Density of cladoceran taxa is highest for *Bosminadae* taxa (80% of total), followed by *Daphnia*, *Sididae*, *Ceriodaphnia*, and *Chydoridae* taxa of cladocerans at Lockport Lock and Dam (4 miles downstream of outfall) based upon the INHS dataset from 2010-2012 (INHS data included in PC #1395);
- There is an absence of sufficient data from November through April to show *Ceriodaphnia* is not present (although EPA acknowledges one sample in November collected by Citgo did not record *Ceriodaphnia* as included in the November 22, 2013 pre-filed testimony of Roger Klockek);
- A literature review shows that some cladocerans do overwinter in low levels in the active stage (not egg stage) and are important to the following year's population. Further, water temperatures in this water are higher than the waters that were studied which provides further evidence that cladocerans are likely to be present in this water in the winter (*see* Enclosure 4);
- INHS reported that the populations of zooplankton in the CAWS are as high in these waters as in other waters (http://wwx.inhs.illinois.edu/fieldstations/kbs/ansi/ansi-asian-carp-research/) where we expect that the populations are undergoing reproduction, like the Illinois River (Wahl *et al.* 2008); and
- There does not appear to be evidence to show that *Ceriodaphnia* are not reproducing in these waters.

2. *Sphaerium* Fingernail Clam

There is information available supporting the use of the *Sphaerium* GMAV in chloride database for the purposes of deriving a winter site specific criteria for chloride since species in the genus have been recorded at the site. There is also evidence to suggest that *Sphaerium* should be retained and that evidence includes:

- 1992 Citgo data (*See* Enclosure 5);
- 1990's INHS data that collected *Sphaerium* clams in the CSSC (*see* Illinois Natural History Survey Technical Report 93/5 as included in PC #1395);
- MWRD has collected some individuals in the untested *Pisidium* fingernail clam genera in the CAWS between 2001 and 2004 (available at: http://www.mwrd.org/pv_obj_cache/pv_obj_id_1B98D0FAE658AA3ECD4DBC97DB4B0C0700440200/filename/2001-2004%20Benthic%20Invertebrate%20Data%20from%20Chicago%20and%20Calumet%20River%20Systems%20and%20Tributaries.xls), and
- There does not appear to be information to show that habitat (and not water quality issues) is responsible for the absence of fingernail clams at the site.

3. *Lampsilis* Mussel

There does not appear to be any justification offered by Citgo for removal of the *Lampsilis* GMAV. EPA suggests that the Board review the information presented in EPA's guidance on mussel absence determinations for ammonia (available at: http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/ammonia/upload/mussel-survey-methods.pdf) in order to evaluate if the available data (including, but not limited to, available historic data regarding the ranges of mussels in Illinois) supports Citgo's deletion of unionid mussels in the genus *Lampsilis* in this water.

4. Additional Data

Consistent with EPA guidance on site specific criteria recalculations, EPA recommends that the Board consider the addition of acute rotifer LC50 (Elphick *et al.* 2011) and *Musculium* LC50 toxicity data (Soucek *et al.* 2011) to the SSC dataset after proper normalization to the same hardness and sulfate concentrations used for the Iowa criteria derivation.

D. 304(a) Chloride Criteria Guidance Under Review by EPA

As noted above in EPA's comments on Illinois EPA's proposed chloride criterion, EPA is working to release a new 304(a) Guidance for chloride that will update the scientific basis for EPA's 304(a) Guidance for chloride. EPA recommends that the Board move forward to adopt appropriate chloride criteria without waiting for release of the updated 304(a) Guidance. To the extent that EPA issues a draft of its 304(a) Guidance for chloride prior to finalization of the Board's rulemaking for the CAWS, EPA recommends that the Board consider that draft and any scientific studies referenced therein to ensure that any criteria that the Board ultimately adopts is based on sound scientific rationale.

III. EPA Comments on Citgo's Proposed Revision to Mixing Zone Rules submitted December 13, 2013

EPA interprets the CWA as allowing states to adopt mixing zone provisions in their water quality standards if, among other things, such provisions are protective of designated uses. Mixing zones are areas where a discharge occurs, generally resulting in some degree of turbulence while the discharge is mixed with the receiving stream. A mixing zone provision that allows chronic criteria to be exceeded within a mixing zone may be protective of an aquatic life use designation to the extent that: (a) turbulent or other conditions within the mixing zone ensure that aquatic life reside within the mixing zone for a period of time shorter than the exposure period necessary to observe a chronic effect, and (b) water quality within the mixing zone is not allowed to exceed acute toxicity criteria. In these circumstances, water quality would not result in acute toxicity (via the requirement that acute toxicity criteria be met within the mixing zone) or chronic toxicity (because aquatic organisms would not reside within the mixing zone and therefore not be exposed to pollutant concentrations in excess of the chronic criteria for a sufficient duration to suffer from chronic effects). Consequently, such mixing zone provisions would be protective of the aquatic life use designation. This is why water quality standards generally do not allow mixing zones for acute criteria and require that chronic criteria be met at the edge of any mixing zones.

Citgo has proposed that the Board adopt a provision allowing for chronic criteria to be exceeded outside of the mixing zone. EPA does not believe that such a provision can be deemed to be protective of applicable aquatic life use designations.

IV. Revisions to 35 Ill. Admin. Code Sections 301 through 303 in Order to Address EPA's May 16, 2012, Disapproval

To address EPA's prior disapproval of portions of the standards applicable to the CAWS/LDPR, as further explained in PC #1338 (*See:* Summary of effective standards at http://www.epa.gov/region5/chicagoriver/pdfs/caws-summary-20120510.pdf), Illinois should revise its water quality standards. One way the Board could accomplish this for certain aspects of the disapproval would be to revise the water quality standards in the following way:

A. Delete 35 Ill. Admin. Code 303.227(b) and either designate the Lower CSSC and Brandon Pool for: (a) incidental contact use at 35 Ill. Admin. Code Section 303.225, or (b) reinstate the previous Secondary Contact recreation use at 35 IAC 303.441 as it applies to these waters and ensure that Illinois' standards include necessary references to Section 303.441.

B. Designate Upper North Shore Channel and Calumet River from Lake Michigan to O'Brien Lock and Dam for primary contact use at 35 Ill. Admin. Code Section 303.220 and delete 35 Ill. Admin. Code 303.227(a).

Finally, we note that aspects of IEPA's proposed revisions reference provisions in 35 Ill. Admin. Code Section 301-303 that were subject to EPA's May 16, 2012, disapproval action. *See, e.g.,* IEPA's proposed changes to 35 Ill. Admin. Code 302.101 and 302.401. We urge the Board to carefully consider how any regulatory changes arising out of Subdocket D interface with all aspects of provisions that EPA disapproved in its May 16, 2012, letter. In this regard, the Board may wish to consider EPA Region 5's "Summary of effective standards" at http://www.epa.gov/region5/chicagoriver/pdfs/caws-summary-20120510.pdf.

V. References

Elphick, J.R.F., Bergh, K.D. and H.C. Bailey. 2011. "Chronic toxicity of chloride to freshwater species: effects of hardness and implications for water quality guidelines" Environmental Toxicology Chemistry 30(1):239-246.

Soucek, D.J., Linton, T.K., Tarr, C.D., Dickenson, A., Wickramanayake, N., Delos, C.G., and L.A. Cruz. 2011. Influence of water hardness and sulfate on the acute toxicity of of chloride to sensitive freshwater invertebrates. Environmental Toxicology and Chemistry 30(4): 930–938.

Wahl, D.H., Goodrich, J., Nannini, M.A., Dettmers, J.M., and D.A. Soluk. Exploring riverine zooplankton in three habitats of the Illinois River ecosystem: Where do they come from? Limnology and Oceanography 53(6): 2583-2593.

Enclosure 2

United States Department of the Interior

U. S. GEOLOGICAL SURVEY

Columbia Environmental Research Center
4200 New Haven Road
Columbia, Missouri 65201

Date: January 11, 2001

To: Cindy Roberts
US Environment Protections Agency
Health and Ecological Criteria Division

From: Chris Ingersoll and Nile Kemble
US Geological Survey
Columbia Environmental Research Center

Subject: Revised description of toxicity data on cadmium: Chronic water-only exposures with the amphipod *Hyalella azteca* and the midge *Chironomus tentans*

cc: Scott Ireland, Dave Mount, Teresa Norberg-King, Paul Sibley

Attached is a revised summary of the cadmium toxicity data (chronic water-only exposures of *Hyalella azteca* and *Chironomus tentans*) for your consideration in development of aquatic life criteria. We originally sent you this summary on May 18, 2000 (a copy of the data files for these studies was also sent to you on January 4, 2001). We subsequently found a minor error in the calculation of the exposure concentrations for the *Hyalella azteca* test described in the May 18, 2000 memo. This new memo has corrected this error (changes to the May 18, 2000 memo have been highlighted using double underlining).

These data were produced for EPA under an Interagency Agreement (IAG) entitled, Methods development for long-term sediment toxicity tests with the amphipod *Hyalella azteca* and the midge *Chironomus tentans*. The studies were conducted at U.S. Geological Survey Columbia Environmental Research Center in Columbia Missouri. These data have not been published, but will be submitted to EPA in a final technical report pursuant to the IAG.

These flow-through studies were performed using conditions outlined in Table 1 and were conducted in accordance with procedures outlined in USEPA (2000) and ASTM (2000). Citations for these methods are: USEPA (2000) Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates, second edition, EPA/600/R-99/064, Washington, DC and ASTM (2000). Standard test methods for measuring the toxicity of sediment-associated contaminants with freshwater invertebrates. ASTM E1706-00. ASTM annual book of standards volume 11.05, ASTM, West Conshohocken, PA.

Results from these studies are summarized in Tables 2 to 4. All test solutions were prepared with reagent grade material cadmium chloride. Tests all met performance criteria recommending in USEPA (2000) and ASTM (2000; i.e, >80% survival of amphipods and >50% emergence of midge; dissolved oxygen was always above 2.5 mg/L). The dissolved organic carbon (DOC) was not monitored during these tests; however, DOC is typically <0.1 mg/L in our well water.

Tables 2 to 4 present NOEC, LOEC, and IC25 effect concentrations for each endpoint measured in the amphipod and midge exposures. In the amphipod exposure, the IC25 was 1.4 ug/L for reproduction and varied from 0.51 to 2.4 ug/L based on biomass. The IC25 for survival ranged from 1.9 to 2.7 ug/L and the IC25 for weight or length varied from 0.74 to >3.2 ug/L. Transfer of amphipods into clean water at Day 28 did not substantially influence survival or growth compared to continuously-exposed amphipods. The NOEC and LOEC for survival or growth were similar between transferred and continuously-exposed amphipods. However, the IC25 for reproduction was 1.4 ug/L for continuously-exposed amphipods compared to 2.7 ug/L for amphipods transferred to clean water from Day 28 to Day 42 of the test. The midge were less sensitive to the effects of cadmium exposure. Survival on Day 20, number of eggs produced, and time to death of adult midges were not affected at the highest concentration tested (16.4 ug/L). The IC25 for weight and biomass were similar (about 8 to10 ug/L). The IC25 for percent hatch of the second-generation organisms was the most sensitive endpoint measured in the midge test (4.0 ug/L).

We anticipate publishing these data with additional data currently being generated by our laboratory for DDD and for fluoranthene exposures with amphipods and midge. Please contact us if you have any questions on the enclosed information or if you need any additional information at this time.

Attachments:

Table 1. Conditions for conducting water-only exposures with *Hyalella azteca* and *Chironomus tentans* (USEPA 2000, ASTM 2000).

Table 2. Effect concentrations of cadmium (ug/L) for the amphipod *Hyalella azteca* in water-only exposure.

Table 3. Effect concentrations of cadmium (ug/L) for the amphipod *Hyalella azteca* comparing amphipods transferred to clean water at Day 28 to amphipods exposed continuously to cadmium.

Table 4. Effects concentrations of cadmium (ug/L) for the midge *Chironomus tentans* in water-only exposures.

Table 1. Conditions for conducting water-only exposures with *Hyalella azteca* and *Chironomus tentans* (USEPA 2000, ASTM 2000).

Parameter	Conditions
1. Test Type:	Water-only exposure to cadmium. Measured concentrations in the amphipod exposure (ug/L total cadmium): 0.10 (control), 0.12, 0.32, 0.51, 1.9, and 3.2 (n = 4) Measured concentrations in the amphipod exposure (ug/L total cadmium): 0.15 (control), 0.50, 1.5, 3.1, 5.8, 16.4 (n = 9)
2. Temperature:	23°C
3. Light quality:	Wide-spectrum fluorescent lights
4. Illuminance:	about 200 lux
5. Photoperiod:	16L:8D
6. Test chamber:	300-mL high-form lipless beaker
7. Substrate:	Amphipods: 3-m nylon mesh Midge: thin layer of sand (5 ml)
8. Water volume:	175 ml
9. Renewal water:	2 volume additions/d
10. Age of organisms:	Amphipods: 7- to 8-d old organisms Midge: <24-hour old larvae
11. Overlying water:	Well water (280 mg/L as $CaCO_3$ alkalinity 250 mg/L as $CaCO_3$; and pH 7.80).
12. Organisms/beaker:	Amphipods: 10 Midge: 12
13. Number replicates/treatment:	Amphipods: 4 replicates sampled on Day 10 for survival and growth, 4 replicates sampled on Day 28 for survival and growth, 8 replicates sampled for reproduction from the continuous exposure on Day 35 and 42 and 8 replicates sampled for reproduction from the organisms transferred to clean water on Day 28. Midge: 6 replicates sampled on Day 20 for survival and growth, 12 replicates for emergence and 6 replicates of auxiliary males.
14. Feeding:	Amphipods: 1.0 ml YCT/day (1800 mg/L stock) Midge: 1.5 ml Tetrafin® (6.0 mgof dry solids)
15. Aeration:	None, if DO >2.5 mg/L in overlying water.
16. Beaker cleaning:	Gently brush screens on outside of beakers as needed
17. Water quality:	Hardness, alkalinity, conductivity, pH, ammonia at start and end. Temperature daily. Dissolved oxygen (DO) and conductivity weekly.
18. Test duration:	Amphipods: 42 d

	Midge: 60 d
19. Endpoints:	Amphipods: 10-d survival and growth (length and weight); 28-d survival and growth; 35-d survival and reproduction; and 42-d survival and growth, reproduction, and the number of males and females on Day 42. Midge: 20-d survival and weight; emergence, number of egg cases oviposited, number of eggs produced, number of hatched eggs, time to death.
20. Test acceptability:	Amphipods: 80% control survival at Day 28. Midge: 50% emergence of adults. See additional performance-based criteria outlined in EPA (2000) and ASTM (2000).

Table 2. Effect concentrations of cadmium (ug/L) for the amphipod *Hyalella azteca* in a water-only exposure.

	Survival				Length			Weight			Biomass			Reproduction
	10-d	28-d	35-d	42-d	10-d	28-d	42-d	10-d	28-d	42-d	10-d	28-d	42-d	Day 28 to 42
LOEC	3.2	1.9	3.2	1.9	3.2	3.2	>3.2	>3.2	3.2	>3.2	>3.2	3.2	>3.2	3.2
NOEC	1.9	0.51	1.9	0.51	1.9	1.9	3.2	3.2	1.9	3.2	3.2	1.9	3.2	1.9
IC25	2.7	2.1	2.0	1.9	>3.2	2.6	>3.2	>3.2	0.74	2.8	2.4	0.51	1.9	1.4

Table 3. Effect concentrations of cadmium (ug/L) for the amphipod *Hyalella azteca* comparing amphipods transferred to clean water at Day 28 to amphipods exposed continuously to cadmium.

	Survival				Length		Weight		Biomass		Reproduction	
	Day 35		Day 42		Day 42		Day 42		Day 42		Day 28 to 42	
	Trans	Cont	Trans	Cont	Trans	Cont	Trans	Cont	Trans	Cont	Trans	Cont
LOEC	1.9	3.2	3.2	1.9	0.51	>3.2	>3.2	>3.2	1.9	>3.2	3.2	3.2
NOEC	0.51	1.9	1.9	0.51	0.32	3.2	3.2	3.2	0.51	3.2	1.9	1.9
IC25	2.1	2.0	2.2	1.9	>3.2	>3.2	2.1	2.8	1.9	1.9	2.7	1.4

Table 4. Effect concentrations of cadmium (ug/L) for the midge *Chironomus tentans* in water-only exposures.

	Survival	Weight	Biomass	Percent Emergence	Number of Eggs	Percent Hatch	Time to Death
LOEC	>16.4	16.4	16.4	16.4	>16.4	16.4	>16.4
NOEC	16.4	5.8	5.8	5.8	16.4	5.8	16.4
IC25	>16.4	9.9	10.3	8.1	>16.4	4.0	>16.4

Enclosure 3

Station	Date	Body Part	FishSpecies	Stream Name	# Fish	Fish lbs	Fish inches	Mercury (mg/kg)	Detection
G-01	09/02/03	Fillet	Largemouth bass	Des Plaines River	5	0.78	11.6	0.1	Detect
G-01	07/10/89	Fillet	Largemouth bass	Des Plaines River	5	1	12.2	0.05	Nondetect
G-03	08/27/08	Fillet	Black crappie	Des Plaines River	5	0.43	8.9	0.065	Detect
G-03	08/27/08	Fillet	Largemouth bass	Des Plaines River	5	0.94	11.3	0.073	Detect
G-03	08/27/08	Fillet	Sauger	Des Plaines River	5	1.41	16	0.1	Detect
G-33	08/20/03	Fillet	Largemouth bass	Des Plaines River	3	0.72	11.3	0.11	Detect
G-33	08/04/08	Fillet	Largemouth bass	Des Plaines River	5	1.2	13	0.11	Detect
G-33	08/20/03	Fillet	Sauger	Des Plaines River	5	0.83	14.2	0.2	Detect
GI-02	09/11/02	Fillet	Channel catfish	Chicago Sanitary & Ship Canal	2	2	18.2	0.05	Nondetect
GI-02	07/25/06	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	4.64	20.1	0.018	Detect
GI-02	09/11/02	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	4.1	19.4	0.05	Nondetect
GI-02	09/11/02	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	8.41	23.6	0.05	Nondetect
GI-02	07/25/06	Fillet	Freshwater drum	Chicago Sanitary & Ship Canal	3	1.1	13.7	0.046	Detect
GI-03	08/30/06	Fillet	Common carp	Chicago Sanitary & Ship Canal	3	0.89	11.8	0.008	Detect
GI-03	08/30/06	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	3.69	19.2	0.017	Detect
GI-03	05/21/99	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	2.81	17.3	0.05	Nondetect
GI-03	05/21/99	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	9.78	25.6	0.05	Nondetect
GI-03	08/28/00	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	1.92	14.67	0.05	Nondetect
GI-03	08/28/00	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	4.6	20.04	0.05	Nondetect
GI-03	08/28/00	Fillet	Largemouth bass	Chicago Sanitary & Ship Canal	4	0.57	9.82	0.12	Detect
GI-03	08/30/06	Fillet	Largemouth bass	Chicago Sanitary & Ship Canal	5	0.61	10.6	0.045	Detect
GI-03	05/21/99	Fillet	Largemouth bass	Chicago Sanitary & Ship Canal	4	0.06	5.1	0.05	Nondetect
GI-03	05/21/99	Fillet	Largemouth bass	Chicago Sanitary & Ship Canal	4	0.73	11.4	0.05	Nondetect
GI-04	05/14/99	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	0.82	14.9	0.05	Nondetect
GI-04	05/14/99	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	6.48	22.7	0.05	Nondetect
GI-04	08/04/00	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	2.53	16.62	0.05	Nondetect
GI-04	05/14/99	Fillet	Largemouth bass	Chicago Sanitary & Ship Canal	5	0.14	6.7	0.05	Nondetect
GI-05	08/01/00	Fillet	Common carp	Chicago Sanitary & Ship Canal	5	4.7	19.8	0.05	Nondetect
H-01	05/26/99	Fillet	Channel catfish	Calumet Sag Channel	3	1.28	15.9	0.05	Nondetect
H-01	08/03/00	Fillet	Channel catfish	Calumet Sag Channel	5	2.03	18.4	0.05	Nondetect
H-01	05/26/99	Fillet	Common carp	Calumet Sag Channel	4	3.7	18.7	0.05	Nondetect
H-01	05/26/99	Fillet	Common carp	Calumet Sag Channel	5	6.67	23	0.05	Nondetect
H-01	05/26/99	Fillet	Largemouth bass	Calumet Sag Channel	3	0.42	9.4	0.1	Detect

H-02	07/24/06	Fillet	Common carp	Calumet Sag Channel	5	1.07	12.4	0.01	Detect
H-02	07/24/06	Fillet	Freshwater drum	Calumet Sag Channel	3	1.1	13.7	0.12	Detect
H-02	07/24/06	Fillet	Largemouth bass	Calumet Sag Channel	3	1.3	13.2	0.14	Detect
H-03	06/16/00	Fillet	Common carp	Calumet Sag Channel	5	0.49	9.5	0.05	Nondetect
H-03	06/16/00	Fillet	Common carp	Calumet Sag Channel	5	6.33	22.86	0.05	Nondetect
H-03	06/16/00	Fillet	Largemouth bass	Calumet Sag Channel	5	0.45	9.7	0.05	Nondetect
H-03	07/12/99	Fillet	Yellow bass	Calumet Sag Channel	5	0.32	8.4	0.05	Nondetect
H-03	06/16/00	Fillet	Yellow bass	Calumet Sag Channel	6	0.16	7.14	0.05	Nondetect
H-03	06/16/00	Fillet	Yellow bass	Calumet Sag Channel	4	0.37	9.06	0.05	Nondetect
H-08	07/14/99	Fillet	Channel catfish	Calumet Sag Channel	3	0.58	12.25	0.05	Nondetect
H-08	07/14/99	Fillet	Yellow bass	Calumet Sag Channel	3	0.109	6.09	0.05	Nondetect
HA-04	06/13/00	Fillet	Bluegill	Little Calumet River	6	0.95	4.95	0.05	Nondetect
HA-04	06/15/00	Fillet	Bluegill	Little Calumet River	6	0.09	4.94	0.05	Nondetect
HA-04	07/21/06	Fillet	Common carp	Little Calumet River	4	2.03	15	0.01	Detect
HA-04	07/21/06	Fillet	Common carp	Little Calumet River	4	7.01	22.8	0.045	Detect
HA-04	06/13/00	Fillet	Common carp	Little Calumet River	5	2.8	17.38	0.05	Nondetect
HA-04	06/13/00	Fillet	Common carp	Little Calumet River	5	6.26	21.92	0.05	Nondetect
HA-04	08/27/01	Fillet	Largemouth bass	Little Calumet River	3	0.802	11.1	0.17	Detect
HA-04	07/21/06	Fillet	Largemouth bass	Little Calumet River	5	0.9	11.7	0.1	Detect
HA-04	07/21/06	Fillet	Pumpkinseed	Little Calumet River	5	0.26	6.6	0.03	Detect
HA-04	06/15/00	Fillet	Pumpkinseed	Little Calumet River	6	0.14	5.29	0.05	Nondetect
HA-04	06/15/00	Fillet	White sucker	Little Calumet River	4	1.29	14.67	0.05	Nondetect
HA-06	04/21/99	Fillet	Common carp	Little Calumet River	5	2.05	15.7	0.05	Nondetect
HA-06	04/21/99	Fillet	Common carp	Little Calumet River	5	7.33	22.8	0.05	Nondetect
HA-06	06/05/00	Fillet	Common carp	Little Calumet River	5	6.73	23.4	0.05	Nondetect
HA-06	06/05/00	Fillet	Largemouth bass	Little Calumet River	5	0.93	11.8	0.13	Detect
HA-06	04/21/99	Fillet	Largemouth bass	Little Calumet River	4	0.75	11.5	0.05	Nondetect
HA-06	04/21/99	Fillet	Largemouth bass	Little Calumet River	4	1.47	13.9	0.05	Nondetect
HA-06	06/11/99	Fillet	Smallmouth bass	Little Calumet River	3	0.67	11.3	0.05	Nondetect
HA-06	06/11/99	Fillet	Yellow bass	Little Calumet River	5	0.15	6.6	0.05	Nondetect
HAA-01	05/03/99	Fillet	Common carp	Calumet River	5	3	17.9	0.16	Detect
HAA-01	06/29/06	Fillet	Common carp	Calumet River	3	6.03	21.6	0.036	Detect
HAA-01	06/29/06	Fillet	Common carp	Calumet River	3	8.52	25.1	0.039	Detect
HAA-01	05/03/99	Fillet	Common carp	Calumet River	3	12.1	26.8	0.05	Nondetect

HAA-01	07/10/91	Fillet	Largemouth bass	Calumet River	5	1.4	13.8	0.06	Detect
HAA-01	06/29/06	Fillet	Largemouth bass	Calumet River	3	0.92	12.3	0.096	Detect
HAA-01	06/29/06	Fillet	Quillback	Calumet River	3	3.5	19	0.021	Detect
HAA-01	06/29/06	Fillet	Rock bass	Calumet River	5	0.39	7.8	0.044	Detect
HAA-01	06/29/06	Fillet	Smallmouth bass	Calumet River	2	0.88	12.5	0.076	Detect
HAA-01	06/29/06	Fillet	Yellow bass	Calumet River	3	0.93	13.5	0.075	Detect
HAA-40	06/15/99	Fillet	Bluegill	Calumet River	5	0.1	5.1	0.05	Nondetect
HAA-40	06/07/00	Fillet	Bluegill	Calumet River	5	0.12	5.35	0.05	Nondetect
HAA-40	06/07/00	Fillet	Green sunfish	Calumet River	5	0.16	5.63	0.05	Nondetect
HAA-40	06/07/00	Fillet	Largemouth bass	Calumet River	5	0.4	9.62	0.05	Nondetect
HAA-40	06/07/00	Fillet	Largemouth bass	Calumet River	5	1.89	14.97	0.05	Nondetect
HAA-40	06/15/99	Fillet	Pumpkinseed	Calumet River	5	0.13	5.5	0.05	Nondetect
HAA-40	06/07/00	Fillet	Pumpkinseed	Calumet River	5	0.13	5.54	0.05	Nondetect
HAA-40	06/15/99	Fillet	Rock bass	Calumet River	3	0.22	6.9	0.05	Nondetect
HAA-40	06/07/00	Fillet	Rock bass	Calumet River	4	0.21	6.43	0.05	Nondetect
HAA-41	07/09/99	Fillet	Largemouth bass	Calumet River	5	0.155	7	0.05	Nondetect
HAA-41	06/08/00	Fillet	Smallmouth bass	Calumet River	5	1.05	12.75	0.05	Nondetect
HCA-01	09/05/06	Fillet	Common carp	South Fork So. Br. Chicago R.	3	0.74	11.2	0.013	Detect
HCA-01	09/05/06	Fillet	Largemouth bass	South Fork So. Br. Chicago R.	3	0.68	11.3	0.12	Detect
HCB-01	08/09/99	Fillet	Bluegill	Chicago River	5	0.23	6.74	0.05	Nondetect
HCB-01	08/10/00	Fillet	Common carp	Chicago River	5	2.85	17.06	0.05	Nondetect
HCB-01	08/29/00	Fillet	Common carp	Chicago River	5	5.31	20.94	0.05	Nondetect
HCB-01	08/10/00	Fillet	Largemouth bass	Chicago River	4	0.76	11.22	0.17	Detect
HCB-02	07/26/06	Fillet	Common carp	Chicago River	3	5.01	21.4	0.027	Detect
HCB-02	07/22/99	Fillet	Common carp	Chicago River	5	4.58	20.6	0.05	Nondetect
HCB-02	07/22/99	Fillet	Common carp	Chicago River	5	9.59	27.7	0.05	Nondetect
HCB-02	07/22/99	Fillet	Largemouth bass	Chicago River	4	0.58	8.15	0.15	Detect
HCB-02	07/22/99	Fillet	Largemouth bass	Chicago River	4	1.28	13.8	0.2	Detect
HCB-02	07/26/06	Fillet	Largemouth bass	Chicago River	3	1.51	14.2	0.16	Detect
HCB-02	08/11/00	Fillet	Largemouth bass	Chicago River	5	0.37	8.87	0.05	Nondetect
HCB-02	07/22/99	Fillet	Rock bass	Chicago River	4	0.39	8.09	0.05	Nondetect
HCB-02	07/22/99	Fillet	Rock bass	Chicago River	4	0.16	6.11	0.05	Nondetect
HCC-02	08/13/99	Fillet	Bluegill	North Branch Chicago River	6	0.12	5.33	0.05	Nondetect
HCC-02	08/13/99	Fillet	Bluegill	North Branch Chicago River	6	0.2	6.23	0.05	Nondetect

HCC-02	09/01/00	Fillet	Bluegill	North Branch Chicago River	5	0.13	5.67	0.05	Nondetect
HCC-02	09/01/00	Fillet	Bluegill	North Branch Chicago River	5	0.23	6.54	0.05	Nondetect
HCC-02	08/13/99	Fillet	Green sunfish	North Branch Chicago River	6	0.05	4.1	0.05	Nondetect
HCC-02	08/13/99	Fillet	Green sunfish	North Branch Chicago River	6	0.1	5	0.05	Nondetect
HCC-02	09/01/00	Fillet	Green sunfish	North Branch Chicago River	5	0.06	4.33	0.05	Nondetect
HCC-02	09/01/00	Fillet	Green sunfish	North Branch Chicago River	5	0.13	5.6	0.05	Nondetect
HCC-02	08/13/99	Fillet	Largemouth bass	North Branch Chicago River	6	0.93	11.85	0.14	Detect
HCC-02	08/13/99	Fillet	Largemouth bass	North Branch Chicago River	6	0.12	6.41	0.05	Nondetect
HCC-02	09/01/00	Fillet	Largemouth bass	North Branch Chicago River	5	0.42	9.19	0.05	Nondetect
HCC-02	07/31/01	Fillet	Largemouth bass	North Branch Chicago River	6	0.722	10.7	0.05	Nondetect
HCC-05	08/06/99	Fillet	Common carp	North Branch Chicago River	5	1.39	12.98	0.05	Nondetect
HCC-05	08/06/99	Fillet	Common carp	North Branch Chicago River	3	5.57	21.5	0.05	Nondetect
HCC-05	08/29/00	Fillet	Common carp	North Branch Chicago River	4	2.37	16.47	0.05	Nondetect
HCC-05	08/29/00	Fillet	Common carp	North Branch Chicago River	4	4.78	20.03	0.05	Nondetect
HCC-08	07/18/05	Fillet	Largemouth bass	North Branch Chicago River	3	1.28	13.4	0.17	Detect
HCCA-01	09/01/99	Fillet	Black crappie	North Shore Channel	6	0.14	6.47	0.05	Nondetect
HCCA-01	09/28/00	Fillet	Bluegill	North Shore Channel	5	0.19	6.36	0.05	Nondetect
HCCA-01	07/20/05	Fillet	Largemouth bass	North Shore Channel	3	1.65	14.2	0.21	Detect
HCCA-02	07/20/05	Fillet	Largemouth bass	North Shore Channel	3	1.65	14.2	0.059	Detect
HCCA-02	07/25/06	Fillet	Largemouth bass	North Shore Channel	3	1.75	14.3	0.17	Detect
HCCA-03	09/07/00	Fillet	Bluegill	North Shore Channel	4	0.15	5.92	0.05	Nondetect
HCCA-03	07/10/06	Fillet	Common carp	North Shore Channel	5	3.04	17.3	0.017	Detect
HCCA-03	07/10/06	Fillet	Common carp	North Shore Channel	4	8.15	22.5	0.053	Detect
HCCA-03	07/21/05	Fillet	Largemouth bass	North Shore Channel	5	1.4	13.5	0.11	Detect
HCCA-03	07/10/06	Fillet	Largemouth bass	North Shore Channel	5	1.29	12.8	0.12	Detect
HCCA-03	09/07/00	Fillet	Largemouth bass	North Shore Channel	5	0.45	9.28	0.05	Nondetect
HCCA-03	09/07/00	Fillet	Largemouth bass	North Shore Channel	5	1.6	14.03	0.05	Nondetect
HCCA-03	07/10/06	Fillet	Pumpkinseed	North Shore Channel	5	0.21	6.2	0.11	Detect
HCCA-04	08/23/99	Fillet	Largemouth bass	North Shore Channel	5	1.27	13.2	0.19	Detect
HCCA-04	09/08/05	Fillet	Largemouth bass	North Shore Channel	3	1.67	14.2	0.14	Detect
HCCA-04	08/23/99	Fillet	Largemouth bass	North Shore Channel	5	0.37	8.66	0.05	Nondetect
HCCA-05	09/08/00	Fillet	Pumpkinseed	North Shore Channel	5	0.19	6.19	0.05	Nondetect
RHO	07/18/90	Fillet	Largemouth bass	Lake Calumet	5	1.33	13.4	0.04	Detect
RHO	07/18/90	Fillet	Largemouth bass	Lake Calumet	5	1.12	13	0.04	Detect

RHO	10/11/99	Fillet	Largemouth bass	Lake Calumet	6	2.02	14.8	0.13	Detect
RHO	10/18/06	Fillet	Largemouth bass	Lake Calumet	4	2.05	15.2	0.051	Detect
RHO	08/25/00	Fillet	Largemouth bass	Lake Calumet	5	0.77	10.7	0.05	Nondetect
RHO	08/25/00	Fillet	Largemouth bass	Lake Calumet	6	1.2	12.8	0.05	Nondetect
RHO	09/06/02	Fillet	Largemouth bass	Lake Calumet	3	0.32	8.36	0.05	Nondetect
RHO	09/06/02	Fillet	Largemouth bass	Lake Calumet	3	0.93	12.6	0.05	Nondetect

Enclosure 4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HEALTH AND ENVIRONMENTAL EFFECTS
RESEARCH LABORATORY
MID-CONTINENT ECOLOGY DIVISION
6201 CONGDON BOULEVARD $ DULUTH, MINNESOTA 55804-2595

OFFICE OF
RESEARCH AND DEVELOPMENT

April 15, 2014

MEMORANDUM

SUBJECT: Winter Zooplankton Populations in the Chicago Sanitary and Ship Canal

FROM: Michael Sierszen
Research Ecologist, Ecosystem Assessment Research Branch

TO: Candice Bauer
Water Quality Branch, Region 5

These are my comments in response to the question put forward by Region 5, "Are zooplankton, specifically cladocerans, likely to be present in an anthropogenically-warmed river in the Chicago area during the winter? If so, what is the ecological significance of the winter population? Specifically, we were interested in the Chicago Sanitary and Ship Canal near Lockport Lock and Dam". I have four main points to make that I believe are relevant to the question.

First, overwintering is a common and important phenomenon in zooplankton. Winter cladoceran populations typically include both parthenogenic adult females and resting eggs (ephippia), and overwintering by adult females will occur unless prevented by local environmental conditions such as freezing to bottom or anoxia (Lampert et al. 2010, 2012). Reproduction by the overwintering animals is important to the spring population peak, as their young are born into the spring algal bloom sooner than those from resting eggs. Numbers of overwintering cladocerans have a significant effect on the size of the first spring cohort (George and Hewitt 1999).

Second, the Chicago Sanitary and Ship Canal near Lockport Lock and Dam is likely to have winter populations of cladocerans and other zooplankton. I have reviewed the zooplankton data provided by the Illinois Natural History Survey collected from the Canal in 2010, 2011, and 2012 (Illinois Pollution Control Board R08-009 Public Comment #1395), which did not include winter (November-March) samples. However, zooplankton abundance data in the North Temperate Lakes LTER data set maintained by the University of Wisconsin-Madison Center for Limnology (http://lter.limnology.wisc.edu/datacatalog/search), which include winter samples, exhibit typical autumnal declines and persistent winter populations. Because the Chicago Sanitary and Ship Canal is anthropogenically-warmed, there should be larger winter populations in the canal than in north temperate lakes. Winter water temperatures influence abundance of overwintering cladocerans, and small temperature increases (4.0°C vs. 2.5°C, or 40°F vs. 36°F) have been found to result in 10-fold higher abundances (Hulsman et al. 2012). Metropolitan Wastewater Reclamation District data indicate that temperatures downstream of the Lockport Lock and Dam (Site 92) ranged from 4°C to 18°C in the winter months of 2012 (January through Marchand December) (available at: http://www.mwrd.org/pv_obj_cache/pv_obj_id_19F6E1961F5F90C557F22A5DB136214400CE0B00/filename/Waterways_2012.xls). Further, the zooplankton samples collected by Huff & Huff consultants on November 18, 2013 included cladocerans (*Bosmina* sp.) (Pre-Filed Testimony of Roger Klocek, filed with the Illinois Pollution Control Board for R08-009 on November 22, 2013).

Third, although overwintering populations may be low, mortality on those overwintering animals can have large effects on the abundance and the taxonomic composition of spring zooplankton populations (Hanazato and Yasuno 1989).

Fourth, rotifers have reproductive strategies that include parthenogenesis and resting egg production similar to those of cladocerans, and rotifers are similarly found as overwintering individuals (e.g., in the above-referenced LTER data set). The zooplankton samples collected by Huff & Huff consultants on November 18, 2013 did not include rotifers; however, the plankton net that was used had a 153 μm mesh, which is too coarse to efficiently retain rotifers. I would expect that sensitive rotifer populations would be at risk from factors that could impose winter mortality.

George, D.G., and Hewitt, D.P. 1999. The influence of year-to-year variations in winter weather on the dynamics of *Daphnia* and *Eudiaptomus* in Esthwaite Water, Cumbria. Functional Ecology 13 (Suppl. 1):45-54.

Hanazato, T., and Yasuno, M. 1989. Influence of overwintering *Daphnia* on spring zooplankton communities: An experimental study. Ecological Research 4:323–338.

Hulsman, S., Wagner, A., Pitsch, M., Horn, W., Paul, R., Rother, A., and Zeis, B. 2012. Effects of winter conditions on *Daphnia* dynamics and genetic diversity in a dimictic temperate reservoir. Freshwater Biology 57:1458-1470.

Lampert, W., Lampert, K.P., and Larsson, P. 2010. Coexisting overwintering strategies in *Daphnia pulex*: A test of genetic differences and growth responses. Limnology and Oceanography 55:1893-2000.

Lampert, W., Lampert, K.P., and Larsson, P. 2012. Coexisting overwintering strategies in *Daphnia pulex*: Clonal differences in sexual reproduction. Fundamental and Applied Limnology 179:281-291.

Enclosure 5

ENVIRONMENTAL ASSESSMENT

of

WASTEWATER AMMONIA DISCHARGE

from

THE UNO-VEN REFINERY
Lemont, Illinois

Prepared by:

James E. Huff, P.E.
James Paulson, E.I.T.
Sean D. LaDieu, E.I.T.

December, 1992

HUFF & HUFF, INC.
ENVIRONMENTAL CONSULTANTS
LaGRANGE, ILLINOIS

CHAPTER 4

LOCALIZED IMPACTS OF UNO-VEN'S DISCHARGE

4.1 Introduction

In order to assess the impact of UNO-VEN's discharge, both the localized impact as well as the river basin impact must be evaluated. This chapter focuses on the localized impact of the discharge on the Chicago Sanitary & Ship Canal in the vicinity of UNO-VEN's outfall.

To characterize the localized impact, a Mixing Zone study was conducted, measuring ammonia, chlorides, temperature, and conductivity. In addition, benthic samples were collected to describe the biological community upstream and downstream of the outfall. The results of the biological sampling are also compared to the results of a previous benthic study, completed in 1983.

4.2 Site Description

The Ship Canal runs approximately 30 miles from the south branch of the Chicago River to one mile below the Lockport Dam. This segment carries all of the wastewater discharges of the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) as well as stormwater runoff from the Chicago area downstream into the Illinois River system.

When the Ship Canal was constructed, the material collected from the river channel was disposed of in various places, including the river banks. Where the UNO-VEN Refinery is located at river mile 296.5, there is no access to the Ship Canal on the north bank because of the spoil banks which extend 2,800 feet downstream of the discharge point to the Romeo Highway Bridge. Portions of the spoil bank were removed in 1991, but access is still limited. Commonwealth Edison's Will County generating station property extends the ZID providing a minimum of 10:1 dilution, the U.S. EPA policy limiting the CMC at the edge of the ZID will be achieved. In fact, the water quality standard for un-ionized ammonia of 0.1 mg/l will also be achieved at the edge of the ZID based on the effluent quality achieved over the past 3-3/4 years.

4.5 Macroinvertebrate Results

Benthic macroinvertebrate sampling occurred two days following the water sampling for the Mixing Zone delineation. By identifying and classifying organisms present in the canal sediment according to their tolerance value, it is possible to further describe the water quality of the Ship Canal and the impact of UNO-VEN's discharge.

Classification of a waterway may be accomplished by establishing the Macroinvertebrate Biotic Index (MBI). The MBI is a modification of Hisenhoff (1982) index which was developed to rapidly determine the stream quality (IEPA, 1987). MBI values for each sampling location were calculated using the following equation:

$$MBI = \sum \frac{(nt)}{N}$$

Where:

n = Number of individuals in each taxon

t = Tolerance value

N = Total number of specimens

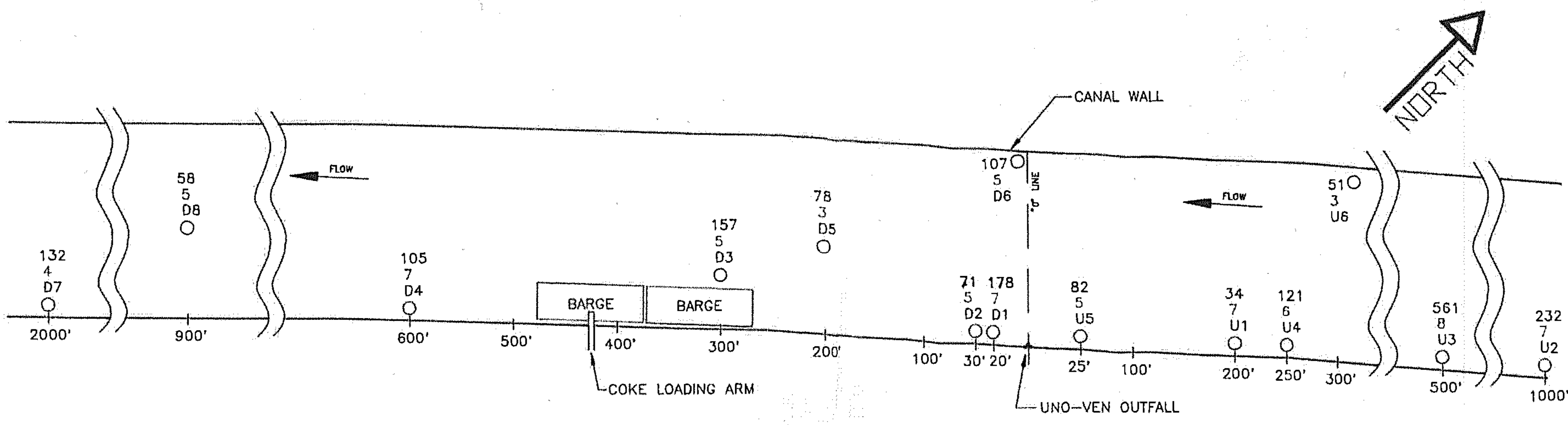
The tolerance value for individual taxons were obtained from the 1987 Field Method Manual prepared by the Illinois Environmental Protection Agency. Tolerance values range from 0 to 11 with 0 assigned to taxa found in unaltered streams with high water quality and 11 assigned to taxa found in severely polluted or disturbed streams. Values in between represent intermediate degrees of pollution.

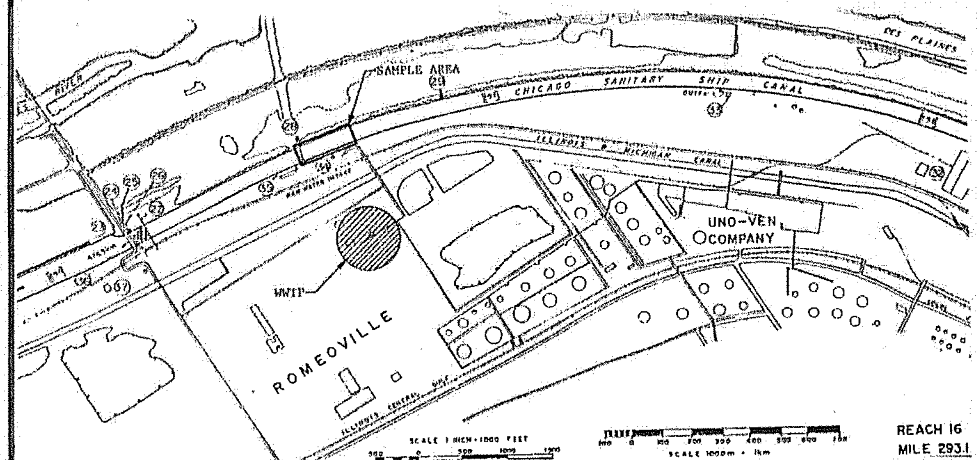
A total of 14 sample locations were examined for macroinvertebrate population on the Ship Canal. Figure 4-5 depicts the upstream and downstream sample locations as well as the number of specimens and total number of species found at each site. Table 4-5 lists the relative distance of each sample site from UNO-VEN's outfall.

The majority of the sample sites are located along the UNO-VEN side of Ship Canal (nearshore). Samples were taken from the center and farshore for comparison but only small amounts of sediment were obtained. In addition, to the flow being faster on the outer wall and center, the barge traffic constantly scours the center of the canal, resuspending any sediment resulting in poor habitat for macroinvertebrates. The macroinvertebrates that were obtained from the center and outer wall of the curve were primarily attached to the rocks that were brought up in the dredge.

The specimens that were identified from the sampling are presented in Table 4-6. Overall, 1,967 specimens were retrieved representing 14 different species. The tolerance values of these specimens ranged from 3 (unaltered stream) to 10 (heavily altered). Macroinvertebrates Biotic Indices were calculated for each sample location. A total of 3,000 feet of the canal was sampled resulting in MBI values of 3 to 9. The average MBI value for the entire sample length is 7, indicating a stream that is moderately polluted.

In order to measure any impact from UNO-VEN's discharge on the aquatic community, the near shore upstream and downstream samples can be compared, as follows:





SAMPLING SITE LOCATION

KEY
● BLUE – TOTAL NUMBER OF ORGANISMS
● RED – TOTAL NUMBER OF SPECIES

FIGURE 4–5
BENTHIC SAMPLING OF THE CHICAGO SANITARY AND SHIP CANAL
UNO–VEN COMPANY, LEMONT IL
SAMPLED JUNE 3, 1992
SCALE: 1:100

TABLE 4-5

BENTHIC COLLECTION DATA
SAMPLING DATE: JUNE 6, 1992

SAMPLE ID#	LOCATION FROM OUTFALL	DISTANCE FROM OUTFALL, ft.	DISTANCE FROM SOUTH BANK, ft.	NUMBER OF DROPS a/
U1	UPSTREAM	200	(near) 10	3
U2	UPSTREAM	1000	(near) 10	1
U3	UPSTREAM	500	(near) 10	2
U4	UPSTREAM	250	(near) 10	2
U5	UPSTREAM	25	(near) 10	2
U6	UPSTREAM	300	(far) 172	1
D1	DOWNSTREAM	20	(near) 10	3
D2	DOWNSTREAM	30	(near) 10	3
D3	DOWNSTREAM	300	(near) 50	3
D4	DOWNSTREAM	600	(near) 10	4
D5	DOWNSTREAM	200	(center) 86	1
D6	DOWNSTREAM	10	(far) 172	2
D7	DOWNSTREAM	2000	(near) 10	3
D8	DOWNSTREAM	900	(center) 86	2

a/ NUMBER OF DROPS WITH ECKMAN DREDGE VARIED DEPENDING ON THE VOLUME OF SEDIMENT COLLECTED

TABLE 4-6

Benthic Macroinvertebrates Counts Collected in the Chicago Sanitary and Ship Canal

TAXA	IEPA TOLERANCE VALUE	COMMON NAME	STATION U-1	U-2	U-3	U-4	U-5	U-6	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	TOTAL
Asellidae *Asellus*	6	Aquatic pillbug													2		2
Gastropoda *Bithynia*	not listed	Bythnia snail (Great Lakes species)	7	1	12		1		5	1		5		5	13		50
Pelecypoda *Dressnia*	not listed	Zebra mussel	1		24	1			1		1	10		6			44
Gammaridae *Gammarus*	3	Scud, Sideswimmer	1		192	9		47	3	1		4	18	12		8	295
Coelenterata *Hydra*	not listed	Hydra		2								14					16
Coleopetera *Laccophilus*	not listed	Predatious diving beetle		1													1
Libellulidae *Libellula*	8	Dragon fly			1												1
Oligchaeta *Naididae* *Tubifex* *Stylaria*	10	Naidid worm Sludge worm Naidid worm	15	145	48	4	71		5	1	3	6			2	1 1	1 300 1
Physidae *Physa*	9	Physa snail	3	73	264	95	3	1	149	58	100	61	4	76	115	41	1043
Rhynchobdellida *Piscicolidae*	7	Leech	2	1	8	2	3		2		8						26
Sphaeriidae *Pisidium* *Spaerium*	 5 5	 Fingernail clam Fingernail clam	5	9	12	10	4	3	13	10	45	5	56	8		7	187
		TOTAL # SPECIES	34 7	232 7	561 8	121 6	82 5	51 3	178 7	71 5	157 5	105 7	78 3	107 5	132 4	58 5	1967 14
MACROINVERTBRATE BIOTIC INDEX			6	9	6	8	9	3	8	8	7	6	5	7	8	8	

	Upstream		Downstream	
	Nearshore Sites [a/]	Standard Deviation	Nearshore Sites [b/]	Standard Deviation
Avg. Density of Organisms (#/m^2)	2,400	2,300	790	301
Avg. No. of Species collected per site	6.6	1.1	5.6	1.3
Mean MBI Value	7.6	1.5	7.4	0.9

a/ U1 through U5
b/ D1, D2, D3, D4, D7

The higher number of organisms upstream reflect the greater quantity of sediment found upstream, requiring fewer drops of the Ekman Dredge to collect a sample. The MBI values and number of species collected per site are statistically similar. Therefore, no measurable impact from UNO-VEN's discharge on the benthic organisms within the Mixing Zone could be discerned.

In 1983, a similar study of benthic organisms was conducted by Huff & Huff, Inc. In 1983, the pollution tolerant organisms Tubifex tubifex (sludge worm, tolerance value of 10), with Chironomidae (midges) and Helobdella fusca (leeches), both pollution tolerant, were found. The MBI index upstream and downstream in 1983 would be approximately 10, because of the sludge worm domination. The 1992 results show a dramatic improvement, with sludge worms present at most sites, but no longer dominating (15% of all organisms recovered). Gammaridae gammarus (sideswimmer scud, tolerance value 3, 15%) Physidae physa (snail, tolerance value 9, 53%) and Sphaeridae pisidium (fingernail clam, tolerance value 5, 10%) were also found in large quantities.

The zebra mussel was also found at 7 of the 14 sites. A total of 14 species were collected, compared to the three species in 1983. The 1983 to 1992 average MBI values (from 10 to 7) also show the overall improvement in water quality.

As part of Ruling R87-27 by the Illinois Pollution Control Board, a comprehensive water quality evaluation including the Ship Canal was conducted by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). As part of this evaluation, benthic invertebrate species and fish surveys were conducted in the Chicago Waterways. The evaluation was conducted from 1989 to mid-1991.

Benthic invertebrates were collected on 84 miles of the Chicago Waterway System. Samples were collected during April, July, and November of 1989 and 1990 and April and June of 1991. The MWRDGC recovered similar macroinvertebrates during their sampling. The predominate species collected each year were the Tubifex worm, which represented an average of 78% over the sample period, and Naidid worms, 17% over the sample period. These are both classified as pollution tolerant species with tolerance values of 10.

The latest benthic sampling round was conducted in June of 1991 by the MWRDGC. This corresponds with the sampling conducted by Huff & Huff in June of 1992, as seasonal variations have been eliminated. The nearest upstream sampling locations were upstream of the Ship Canal and Cal-Sag confluence. These were both located at the Route 83 Bridges on the respective waterways, each 7.5 miles upstream. The nearest downstream sampling location was 16th Street in Lockport, 4.3 miles down the Ship Canal. Sampling occurred in two locations at each site, one in the center and the other along either bank of the Ship Canal.

Macroinvertebrate Biotic Index values were calculated from the MWRDGC Comprehensive Water Quality Evaluation data from each of the referenced locations (Polls, et al., 1991). The MBI values for the stations are presented in Table 4-7. The MBI upstream on the Cal Sag was 10.0, while the upstream MBI on the Ship Canal ranged from 5.2 in the center to 8.8 on the right bank. Downstream 4.3 miles from UNO-VEN, MBI values of 9.9 were reported for both the right bank and center stream.

TABLE 4-7

MBI VALUES FROM MWRDGC - June, 1991 - Benthic Data

Sample Location	Location in Ship Canal [a/]	Location From UNO-VEN	MBI Value
Ship Canal at Route 83	Right Bank	Upstream	8.8
	Center	Upstream	5.2
Cal Sag Channel Route 83	Left Bank	Upstream	10
	Center	Upstream	10
Ship Canal at 16th Street	Right Bank	Downstream	9.9
	Center	Downstream	9.9

a/ Facing upstream in waterway.

SOURCE: Polls, et al., 1991

To further define the aquatic community, the MWRDGC conducted an electrofishing survey. The electrofishing survey was made at 20 locations on the Chicago Waterway. The sample stations were at the same stations as the benthic sampling. The classification system used to describe water quality from the electrofishing survey is based on the Index of Biotic Integrity (IBI) (Dennison, et al., 1991). The IBI assesses the health of a fish community using 12 fish community measures or metrics, which fall into three broad categories: Species composition, trophic composition, and fish abundance and condition. The Illinois Department of Conservation (IDOC) and the Illinois Environmental Protection Agency have used the IBI to develop a five tiered stream classification system as shown below:

<u>Index of Biotic Integrity</u>

Class	Waterway Quality	IBI Range
A	Excellent	60-51
B	Good	50-41
C	Fair	40-31
D	Poor	30-21
E	Very Poor	$\leq$ 20

The results of the fish quality survey indicate that the Ship Canal varies between a class D to E Waterway. The IBI average values for each sample site are listed in Table 4-8. Water quality, as measured by the fish quality improves downstream on the Ship Canal. No effect on the fish quality, can be attributed to UNO-VEN's discharge.

In summary, the benthic and fish sampling conducted by the MWRDGC upstream and downstream of UNO-VEN's discharge revealed similar biological quality. A significant improvement in the benthic community has occurred when comparing the 1983 and 1992 results on the Ship Canal near the refinery, both upstream and downstream, reflecting the overall improvement in water quality in the Ship Canal. No impact on the biological community could be discerned attributable to UNO-VEN's effluent, from either the present study or from the MWRDGC investigations.